

# The Role of Marketplace Lending in Credit Markets:

## Evidence from Bank Mergers

Panagiotis Avramidis

Assistant Professor of Finance  
ALBA Graduate Business School  
Xenias 6-8, 11528, Athens, Greece  
[pavramidis@alba.acg.edu](mailto:pavramidis@alba.acg.edu)

Nikolaos Mylonopoulos

Associate Professor of Digital Business  
ALBA Graduate Business School  
Xenias 6-8, 11528, Athens, Greece  
[nmylonopoulos@alba.acg.edu](mailto:nmylonopoulos@alba.acg.edu)

George G. Pennacchi

Professor of Finance  
University of Illinois  
515 East Gregory Drive, Champaign, IL 61820, United States  
[gpennacc@illinois.edu](mailto:gpennacc@illinois.edu)

This version: 3 July 2019

### Abstract

We develop a model of competition between traditional banks and a marketplace lender to motivate empirical tests using local market data on U.S. banks and the largest marketplace lending platform. Employing mergers of large, multi-market banks as an exogenous credit supply shock, we find that marketplace lending absorbs unmet demand for consumer credit following a decline in the availability of traditional bank credit. Merger-induced bank branch closings lead to an increase in marketplace lending loan requests and loan acceptance rates, particularly for debt consolidation loans to lower-risk consumers. In addition, by meeting consumer demand for credit, marketplace lending mitigates credit stress in local economies due to mergers.

*JEL-classification:* G21, G29

*Keywords:* marketplace lending, bank mergers, consumer credit, community credit stress.

We are grateful for valuable comments from Aziz Alimov and participants of the 2019 City University of Hong Kong Finance Conference and of the 2019 Conference on Research on Economic Theory and Econometrics.

## 1 Introduction

Access to credit for households and small businesses has undergone a significant transformation recently. One impetus to this change is the consolidation of the banking industry. The number of U.S. commercial banks and savings institutions fell from 15,158 in 1990 to 5,406 in 2018.<sup>1</sup> Mergers between banks may reduce competition and lead to a rise in the cost of retail borrowing and a decline in credit availability. Another factor influencing access is the emergence of alternative sources of retail credit. Marketplace lending, also known as peer-to-peer (P2P) lending, has experienced unprecedented growth in recent years. For example, Lending Club, a leading P2P platform founded in 2006, reported loans issued in 2018 of \$7.9 billion, which was over 30 times larger than its loans issued in 2011.<sup>2</sup>

The simultaneous decrease in credit availability from traditional financial institutions and the increase in credit supply from marketplace lending platforms raise important questions. Do marketplace lenders pick up the unmet demand for retail credit that results from bank consolidation? If so, which types of retail credit do they replace? Are marketplace lenders able to mitigate the adverse economic effects of a shrinkage of banking credit to local communities? Our study provides empirical evidence on these questions and casts more light on the extent to which marketplace lenders are able to substitute for brick and mortar banks.

To motivate our empirical tests, this paper begins by presenting a simple model of competition between traditional banks and a marketplace lender. It shows how an exogenous reduction in the number of a local market's banks, as might occur when two large multi-market banks merge, has the potential to decrease the supply of loans in the local market as well as raise the equilibrium loan rate charged by banks. Consequently, some potential borrowers will be deterred from obtaining credit. But the model also shows that if potential borrowers also have access to an online marketplace lender, the reduction in loans supplied

---

<sup>1</sup> <https://www.fdic.gov/bank/statistical/stats/2018dec/fdic.pdf> .

<sup>2</sup> <https://www.lendingclub.com/info/demand-and-credit-profile.action>.

by banks can be offset by an expansion in marketplace lending that also mitigates the rise in the equilibrium rates charged on bank loans.

Our paper's empirical tests use United States data from the largest marketplace lender, Lending Club, and several other public sources. We construct a cross section – time series of observations on local credit markets at the level of 3-digit zip codes during the years 2009 to 2016. This was a period when marketplace lending was rapidly growing but was not available in some states. By comparing states where Lending Club (hereafter, LC) was licensed to operate versus states where it was not, we are able to isolate its impact on local credit markets.

Using this panel sample, we empirically show that mergers of large multi-market banks lead to a decline in local market bank branches. Our findings confirm earlier studies showing that mergers between banks with overlapping bank branch networks are strongly associated with a decline in offices per capita in that local market (Avery, et al. 1999). Moreover, prior research, including Garmaise and Moskowitz (2006) and Nguyen (2019), find that this decline in branches reduces competition and bank credit supply. Following this literature, we use the merger-induced decline in local market bank branches as an instrument to test whether consumer credit demand shifts to marketplace lending.

Specifically, the results from our two-stage least squares regressions show that an exogenous drop in the number of bank branches due to a large bank merger increases the number of loan requests to LC by 11.5% and the total value of loan requests to LC by 13.6%. Moreover, LC responds positively to this surge in loan requests by reducing its rejection rate by 0.53 percentage points to fund a higher proportion of loan requests. This is a considerable change given that the volume under consideration is in millions of requests. The greater requests and lower rejection rate translate to a 29% increase in the number of accepted applications and a 61.4% increase in the total amount of loans granted.

In particular, we find that borrowers used LC to refinance their outstanding bank debt, presumably at more competitive rates than those offered by banks following the merger-induced decline in local competition. The number and dollar amount of debt consolidation loans made by LC increased by 23.4% and 43.9%, respectively. Moreover, following a bank merger the number of loans made to prime borrowers, i.e. borrowers at the lower-risk grades assigned by LC, increases by 23% and the loan amounts by 53.6%. In contrast, the number and amount of loans to borrowers at the higher-risk grades assigned by LC remain unaffected. This evidence suggests that a significant proportion of LC borrowers are former bank customers with strong credit profiles that use marketplace debt consolidation loans to repay their higher-cost bank loans.

To confirm the role of marketplace lending platforms as absorbers of unmet demand for credit following a shock in bank credit availability, we run a placebo test. This test follows the extant literature by analyzing the effects of bank mergers that are unlikely to have an impact on local bank competition either because they are mergers between banks of the same bank holding company or are mergers of small banks. The placebo test findings confirm that only large, independent bank mergers lead to decline in an affected local market's branches and a subsequent increase in marketplace lending.

In addition, we examine the effect of bank consolidation on the consumer demand for marketplace lending and the growth of LC during different time periods. We find that during the global financial crisis year of 2009, bank mergers increased loan requests to LC but it did not expand its loan portfolio. This may be explained by the fact that these mergers occurred during an economy-wide credit contraction when investor funding for consumer loans was scarce and marketplace lending was still in its infancy. Only following the global financial crisis, during the economic expansion period of 2010-2016, did bank mergers lead to an increase in marketplace lending. These findings match the growth pattern of marketplace

lending platforms shown in Figure 1. They also highlight the boundaries of marketplace lending as an absorber of unmet demand for loans.

Our final empirical analysis explores whether marketplace lending enhances financial welfare by stabilizing a local market's credit stress as measured by the proportion of its population in debt delinquency. We employ a difference in differences quasi-experimental design using a sample of local credit markets that are matched to have a similar propensity for demand-driven changes in bank credit availability. Then, we exploit the exogenous credit supply shock of a large bank merger to examine whether the presence or absence of LC in a local market reduces local credit stress. We do this by comparing local markets in U.S. states where LC was licensed to operate versus local markets in U.S. states where it was not.

The results highlight the risk-mitigating role of marketplace lending. The average proportion of population in credit distress before a bank merger is 14.8% for local markets where LC is absent and 17.4% for local markets where LC is licensed. After a large bank merger, the average percentage of population in credit distress increases to 17.8% for local markets without LC while it remains unchanged at around 17.5% for local markets with LC. The difference in differences estimate is 2.9 percentage points. In other words, the impact of bank mergers on the percentage of population in credit distress is 2.9 percentage points lower for local markets with access to LC compared to local markets without access to LC. Thus, while the presence of LC correlates with a higher proportion of the local population in credit distress, LC's presence seems to absorb the potential disruption from a bank supply shock that would otherwise lead to significantly more credit distress.

We confirm the mitigating role of marketplace lending platforms by running another placebo test: there is no difference between local markets with and without access to LC when tests focus on small or intra-holding company bank mergers that are unlikely to have an impact on local competition. Thus, the evidence confirms that the positive effect of

marketplace lenders on the financial welfare of local markets is conditional on a decline in local bank competition that reduces bank credit availability.

Our paper contributes to a large literature on how market structure affects competition for loans to bank-dependent borrowers. Most of this literature focuses on small business lending. Several studies analyse the relationship between bank size and lending, finding that larger banks are associated with a lower tendency to lend to small businesses compared to smaller banks (Keeton, 1995; Cole et al., 2004). Other studies examine the dynamics of bank lending around mergers. The consensus of these studies is that consolidating large bank organizations tends to reduce small business lending, whereas consolidating small organizations tends to increase it (Berger, Demsetz, and Strahan, 1999; Peek and Rosengren, 1995; 1998; Strahan and Weston 1998). With regard to business loan interest rates, Erel (2009) finds that merging banks decrease (*increase*) their loan rates when their prior market overlap was small (*large*), consistent with mergers generating cost savings but also potentially raising market power.

More recently, research confirms the role of distance in credit allocation by showing that post-merger bank branch consolidation leads to a persistent decline in local small business lending (Nguyen 2019). However, some studies that examine the reactions of other lenders in the same local markets show that rival banks take up profitable loans, thereby offsetting the decline in lending by the merging banks (Berger, Saunders, Scalise, and Udell, 1998; Berger, Demsetz, and Strahan, 1999).

Research specifically on consumer lending is more limited. Most of the work in this area examines credit card lending and finds that high credit card rates are consistent with the market being imperfectly competitive due to consumer switching or search costs (Ausubel, 1991; Calem and Mester, 1995; Stango, 2002). An exception is Kahn, Pennacchi, and Sopranzetti (2005) who analyse interest rates on personal loans and auto loans charged by

banks. They find that greater banking market concentration is associated with higher personal loans rates whereas auto loan rates are unaffected, perhaps because auto loans are available from many nonbank lenders.

While the existing literature has studied the “within market” response of rival banks to bank mergers (Berger, Saunders, Scalise, and Udell 1998), there is little direct evidence on the reaction of nonbank lenders. Our paper contributes to this literature by expanding the scope of bank consolidation effects to study the role of nonbank lending. In particular, we show that the adverse effects from a merger-induced decline in bank branches can be offset by the presence of a marketplace lender.

Most related to our paper is a recent study by Tang (2019) who uses a one-time bank regulatory change, FAS 166/167, as an exogenous shock to bank credit supply. This accounting change, implemented in 2011, required banks to move some off-balance sheet securitized credit, mainly credit card securitizations, onto their balance sheets. The effect was to increase regulatory capital requirements for those banks that previously securitized credit card loans. Examining how this shock to the cost of providing bank credit affected LC’s marketplace lending over the period 2009-2012, she finds that following FAS 166/167 LC made more loans to riskier borrowers and more large loans in those markets where banks that previously securitized credit cards operated.

Our paper differs by examining the effects of bank merger-related shocks that occurred during a time when marketplace lending grew rapidly (Figure 1). During this period, LC became a more serious competitor to banks. Somewhat different from Tang (2019), we find that the vast majority of LC’s loans were to lower-risk borrowers seeking consolidation of their existing debt. Most likely these consumers used LC loans to repay higher interest loans, such as credit card balances owed to traditional banks. Moreover, the merger-related

shocks to bank credit supply that we analyse led to an increase in lower-risk, rather than higher risk, consumers applying for and receiving LC loans.<sup>3</sup>

Furthermore, our paper is novel in analysing how marketplace lenders might help stabilize the financial welfare of local market economies. In particular, we offer evidence that marketplace lending shields against negative externalities in local bank credit availability. This is an important observation, given the scale of consolidation in the traditional banking sector and the strain this may impose on particular local credit markets.

We also contribute to the emerging literature on marketplace (P2P) lending. The vast majority of the studies in this stream focus on early innovations with which marketplace lenders experimented. For example, Iyer et al (2015) show that lending platforms enable investors to screen using soft, non-standard information that increased the risk prediction accuracy of evaluating lower-quality borrowers. They highlight how crowdsourcing soft information about borrowers can enhance lending efficiency. Similarly, marketplace lenders experimented with enabling borrowers to benefit from building social capital on the platform, which eventually became an informational externality that could be monetized (Lin et al. 2012). Other studies find that marketplace platforms can improve credit allocation by allowing the screening of soft information such as the borrower's appearance on a profile photograph. On the dark-side, there is evidence of discrimination biases in the loan-origination process (Pope and Sydnor 2011). While this work is insightful, it should be noted that as marketplace lenders scaled their operations and sought large institutional investors to fund their loan portfolios, they abandoned many of these experimental practices and adopted more mainstream algorithmic screening and selection methods.

---

<sup>3</sup> Another potential difference between our paper and Tang (2019) may be the effects of the different types of shocks to bank credit supply. Shocks due to mergers that reduce local market branches and competition may differ from the shocks due to FAS 166/167 that increased the capital charge of credit card lending. Tian and Zhang (2017) document that FAS 166/167 mostly affected the cost of lending to lower-risk credit card borrowers, since prior to FAS 166/167 the credit card loans that banks securitized had lower risk compared to the credit card loans that banks held directly on balance sheet.

For the most part, the literature has not addressed marketplace lending's role in the overall market for consumer credit (Morse 2015). Our study is the first to offer a more fundamental *raison d'être* for its popularity. We show that as bank consolidation has the potential to leave the credit needs of some consumers unfulfilled, marketplace lending caters to such customers in a way that is substantial and socially beneficial. Moreover, unlike prior studies, we study the more extended period of 2009-2016 when marketplace lending experienced exponential growth.

The remainder of the paper is structured as follows. Section 2 presents a simple model of credit market competition that motivates the hypotheses of our empirical tests. Section 3 describes data sources and the construction of our panel of observations. Section 4 presents the methodology of our tests and their empirical results. We conclude with a discussion of our findings and their implications in Section 5.

## **2 Predictions of a model of bank and marketplace lender competition**

This section motivates our subsequent empirical tests by developing hypotheses consistent with a model of competition between banks and a potential marketplace lender. The model is a variation of the Salop (1979) circular city model adapted to a market for consumer borrowing. All derivations of this section's results are given in the Appendix.

### *2.1 A local market with only banks*

Assume that a continuum of identical borrowers is located uniformly around a circle with unit circumference, and these borrowers have a total desired amount of loans equal to  $L$ . Also symmetrically located around this circle are  $n \geq 2$  lending banks. Each borrower incurs a linear "traveling" cost of  $t_L$  per distance traveled to obtain a loan from any bank around the circle. Let  $r_{L,i}$  be the loan rate offered by Bank  $i$ ,  $i = 1, \dots, n$ . Then if a borrower is at distance  $x$  from this bank, the borrower's net surplus from obtaining this loan is  $\bar{s} - r_{L,i} - xt_L$  where  $\bar{s}$  is a

borrower's gross surplus from obtaining the loan. Borrowers each choose the bank that maximizes their net surplus, but are willing to borrow only if the net surplus is non-negative.

Each bank faces an average cost of funding a loan equal to  $r_F$ , which should be broadly interpreted as a tax-adjusted weighted cost of deposits and equity financing plus any costs of screening and monitoring borrowers. Each bank then chooses its loan rate to maximize its profits while taking account of the competition for borrowers from its neighboring banks. Assuming  $\bar{s} > r_F$ , the symmetric Bertrand-Nash equilibrium for this problem is well known and leads to the following solutions for the equilibrium loan rate,  $r_L^*$ , charged by each bank:

$$r_L^* = \begin{cases} r_F + \frac{t_L}{n} & \text{if } n \geq \frac{3t_L}{2(\bar{s} - r_F)} \\ \frac{1}{2}(r_F + \bar{s}) & \text{if } n < \frac{3t_L}{2(\bar{s} - r_F)} \end{cases} \quad (1)$$

The first line in equation (1) represents the monopolistic competition case in which all consumers receive loans because their equilibrium net surplus is non-negative at the Nash equilibrium loan rate. Note that the equilibrium loan rate equals the cost of funding,  $r_F$ , plus a market power term  $t_L/n$  that is a decreasing in the number of banks,  $n$ . In contrast, the second line in equation (1) represents the pure local monopoly case characterized by a higher loan rate and where only a portion of all consumers closest to individual banks receive loans. This is because consumers furthest from banks have negative net surplus at the equilibrium rate due to their greater traveling distance.

Figure 2 illustrates the difference in market coverage between these two cases. Panel A shows an example with  $n = 5$  banks where all consumers obtain loans because they have non-negative surplus at the monopolistic competition loan rate. Panel B illustrates the second pure monopoly case with  $n = 4$  banks. For example, the fewer number of banks may be the result of a merger between two of the banks in the market. There is now a greater distance

between banks so that, unlike the first case, the consumers furthest from banks do not receive loans because they have negative net surplus. Even the consumers that do receive loans are worse off because they must pay the higher, pure monopoly loan rate.

## 2.2 *A market with banks and a marketplace lender*

Now consider an extension of the previous model where an online marketplace lender also offers loans. Instead of a physical location on the unit circle, we model the marketplace lender as having an “internet travel” distance equal to  $\delta$  from each consumer around the circle.<sup>4</sup> Since a marketplace lender tends to operate across many local markets in several states, it is unlikely that it sets loan rates to account for the competitive conditions in any particular local market. Hence, we assume an exogenously-set marketplace loan rate of  $r_M$ .<sup>5</sup> Moreover, we assume  $\bar{s} > r_M + \delta t_L > r_F$  so that consumers would potentially accept a loan from a marketplace lender but the marketplace lender would not dominate banks for all consumers.

Under these assumptions, each bank’s equilibrium loan rate is given by:

$$r_L^* = \begin{cases} r_F + \frac{t_L}{n} & \text{if } n \geq \frac{3t_L}{2(r_M + \delta t_L - r_F)} \\ \frac{1}{2}(r_F + r_M + \delta t_L) & \text{if } n < \frac{3t_L}{2(r_M + \delta t_L - r_F)} \end{cases} \quad (2)$$

Comparing banks’ equilibrium loan rate in the first line of equation (2) to that in the first line of equation (1), we see that when there is a marketplace lender available, the number of banks in the market,  $n$ , needs to be larger for the monopolistic competition loan rate  $r_F + t_L/n$  to obtain. This is because since  $\bar{s} > r_M + \delta t_L$ , the marketplace lender provides potential

<sup>4</sup> See Martinez-Miera and Schliephake (2016) for a similar modeling of nonbank competition. One can think of this distance as reflecting a consumer’s cost of providing information and negotiating online as opposed to an in person meeting with a banker.

<sup>5</sup> Park and Pennacchi (2009) show that if a multi-market lender is constrained to set a uniform loan rate, the rate is a value-weighted average of what would be its profit-maximizing local market rates. Thus, as the lender’s number of local markets becomes large, its loan rate becomes insensitive to any given market’s competitive conditions.

competition. If the number of banks is large enough, then competition from banks themselves leads all consumers to borrow from only banks as they obtain higher net surplus that would be available from obtaining a marketplace lender loan. However, if the number of banks declines, say from a bank merger, then banks' equilibrium loan rate takes the form of the second line in equation (2), which is unambiguously lower than it would be in the absence of a marketplace lender. This is because the marketplace lender now provides actual competition as some consumers now prefer to switch from banks to the marketplace lender.

Thus, with fewer banks the equilibrium is fundamentally different when a marketplace lender is present. Rather than less banks leading to a monopolistic loan rate, as in the second line of equation (1), and some consumers choosing not to borrow (Figure 2 Panel B), the equilibrium is now one where all consumers continue to borrow but some are served by the marketplace lender. This equilibrium is illustrated in Figure 3. Moreover, comparing the equilibrium loan rate charged by banks in the second line of (2) to that in the second line of (1), we see that even those consumers who continue to borrow from banks are better off when the marketplace lender provides competition.

### 2.3 *Testable Hypotheses*

Note that our model is stylized in that it equates a "bank" to a "bank branch" and a merger that leads to a decline in the number of independent banks is synonymous with a decline in the local market's bank branches. With fewer branches, the distance between a given branch and borrower can raise loan rates because effective "traveling costs" increase which results in greater market power exerted by banks (Degryse and Ongena, 2005). The assumption of a decline in the number of branches might be justified if a merger of two large banks generates economies of scale via cost cutting opportunities. This is a testable hypothesis which forms a preliminary test of the model's assumption, namely, that *bank mergers represent an exogenous shock to a local market that decreases its bank branches.*

Yet even if the reduction in branches is not substantial, the spirit of the model implies that mergers lead to greater concentration and fewer independent competitors in the local market. In particular, Erel (2011) shows that when merging banks' markets overlap, such mergers are likely to lead to a rise in loan rates. Indeed, our model shows that in the absence of a marketplace lender, an exogenous decline in the number of banks raises equilibrium loan rates that can dissuade some consumers from borrowing. With sufficiently few banks, these unattractive loan rates from the brick-and-mortar banks implies that some of the demand for credit is likely to go unmet (Garmaise and Moskowitz, 2006; Nguyen, 2019).

Yet when alternative providers of consumer credit, such as marketplace lenders, are present, the model shows that they will service the demand for loans that would be unmet in their absence. Thus, our second hypothesis for empirical verification is that the *marketplace lender faces greater loan demand following an exogenous shock to credit availability from bank consolidation*.

Our model is simplified in that it does not consider differences in the credit risks of consumers. However, richer models are unlikely to reach an unambiguous prediction as to whether the higher-risk or lower-risk consumers are likely to switch to the marketplace lender following a bank merger. If it is the case that banks can accurately discriminate between high and low risk consumers, when they restrict supply and raise loan rates following a merger they may choose to make fewer loans to marginal, higher-risk, and less profitable borrowers.<sup>6</sup> This is similar to the assumption in Tang (2019). Alternatively, banks may not be able to perfectly ascertain consumers' credit risks. In this case a rise in their loan rate can create incentives for less-risky consumers to choose not to borrow. Thus, similar to Boyd and De

---

<sup>6</sup> It may also be the case that if merging banks reduce branches more in areas that are riskier and less profitable, then with higher traveling costs these riskier borrowers will be least likely to apply to banks for loans.

Nicoló (2005), there would be a positive relationship between bank concentration and the risk of banks' loans.<sup>7</sup>

Suppose this latter case obtains and, as our model assumes, the marketplace lender's loan rate is set uniformly across its local markets irrespective of a merger in a given market. Then the marketplace lender would experience an increase in loan requests from less risky consumers seeking a lower cost of credit. Moreover, assuming that the marketplace lender cannot perfectly ascertain consumers' credit risk, but rationally expects this "advantageous" selection of lower-risk consumers that are leaving banks, it may increase its loan acceptance rate.<sup>8</sup> This leads to a third hypothesis that *following a decline in bank credit supply, primarily lower-risk consumers seeking lower-cost credit will migrate to the marketplace lender, allowing it to increase its rate of loan acceptance.*

If some demand for credit is unmet following a supply shock or borrowers face higher loan rates, one would expect a deterioration of financial welfare in the local market economy. In particular, the inability to refinance or the higher cost of debt could raise credit stress as measured by delayed loan payments or delinquencies. By serving such unmet demand and by offering more attractive rates, a marketplace lender is expected to mitigate borrower credit distress arising from this bank merger shock. Thus, our last hypothesis is that *by supplying some of the unmet demand for consumer credit, the marketplace lender mitigates the adverse effects of the decline in bank credit availability.*

As a prelude to testing these hypotheses, the next section discusses the data used in our empirical work.

---

<sup>7</sup> The model in Boyd and De Nicoló (2005) assumes that a higher loan rate charged by banks leads to greater moral hazard by borrowers such that each choose riskier projects. However, the result would be the same if a higher loan rate leads to greater adverse selection whereby consumers with the safest projects can no longer profit from borrowing from banks. Thus, in equilibrium banks only lend to higher risk consumers.

<sup>8</sup> This assumption may be realistic since institutional investors are the largest source of financing for marketplace lenders such as Lending Club. These investors are relatively sophisticated and may be more eager to accept loan requests from local markets experiencing a decline in bank competition due to mergers.

### **3 Data description**

#### *3.1 Data sources and variables*

We employ seven different databases to build a sample over the period 2009-2016. Marketplace loan data is drawn from publicly available files of Lending Club. Branch data is sourced from the Federal Deposit Insurance Corporation (FDIC) Summary of Deposit dataset while bank merger activity is downloaded from the National Information Center (NIC). Regional economic data are available from the Quarterly Census of Employment and Wages Database, house price data comes from the Federal Housing Finance Agency, and population data from the U.S. Census database. Financial stress data is obtained from the Federal Reserve Bank of New York's Community Credit dataset. Next, we offer more information on each dataset and the corresponding variables.

#### *3.2 Marketplace lending*

Founded in 2006, Lending Club (LC) is today the largest listed marketplace lending platform in the US. It has seen exponential growth in applications and implements a screening process involving a proprietary credit grading algorithm. LC partners with WebBank for handling investor and borrower cash accounts. Loan amounts to individuals range from \$1,000 to \$40,000, and the loan maturity is either 36 or 60 months. All loans are fully amortized and the interest charged is fixed during the term of the loan and varies depending on the credit grade of the applicant.

We focus on the number of loan requests and amount requested received by LC, as well as the number and loan amount of requests accepted by LC. We also examine the requests intended for debt consolidation, which comprise borrowers who state explicitly that the purpose of the loan is to re-finance existing debt. The vast majority of these outstanding obligations are credit cards, other revolving credit, and consumer loans that are likely to represent credit owed to traditional banks. This information helps us distinguish loan

applications explicitly intended for servicing outstanding debt versus loans intended for consumption. Nonetheless, we acknowledge that the purpose of each loan is the declared intention of the borrower and that the actual use of the funds is unobserved.

We summarize the descriptive statistics of LC's loan data in Table 1. Consistent with Figure 1, one sees that both the number of loan applications to LC and applications accepted by LC grew dramatically during the sample period. Applications and acceptances grew from 62 thousand and 5 thousand, respectively, in 2009 to 5,204 thousand and 434 thousand, respectively in 2016. The average loan amount requested across all years is \$12,935, and the average loan amount accepted for funding is \$14,762. The rejection rate is 89.4% on average, which suggests that LC performs a rigorous screening process. LC accepts borrowers with a minimum FICO score of 640 while the average LC borrower has a score of nearly 700. Moreover, 81% of funded applications were seeking to consolidate outstanding debt. These figures suggest that LC caters to relatively high credit quality applicants who seek improved terms on the cost of servicing their outstanding debts.

### *3.3 Bank branches and merger activity*

The FDIC publishes Summary of Deposits data for every bank branch as of the end of June of each year. We focus on brick and mortar branches providing full service (i.e., branches of type BRSERTYP= 11 or 12).

Data on mergers among banks is collected from the Federal Reserve and are available through the National Information Center (NIC). We use inclusion criteria to identify those bank mergers that are unlikely to be driven by concerns over local demand factors.

Following Garmaise and Moskowitz (2006), first we include only bank mergers (i.e., combinations in which one FDIC certificate is surrendered) between two banks each with at least \$1 billion in assets as of the year-end preceding the merger. Second, the merger must be classified as "non-failing." Third, we exclude mergers within the same bank holding

company because they are unlikely to have a significant impact on bank branches and lead to an increase in market power. In addition, we consider separately mergers between two small banks (less than the threshold of \$1 billion in assets) or banks owned by the same bank holding company. These mergers are assumed to have no effect on local bank competition and therefore on credit availability (Garmaise and Moskowitz, 2006).

Table 2 summarizes the data on bank branches. Our sample contains 30,601 bank-year observations with an average bank size, measured by total assets, of \$2.909bn and an average network of 20 bank branches. The total number of branch-year observations is 617,096. These observations correspond to 6,199 unique banks with a total network of 97,607 unique branches.

In addition, there are 111 banks involved in mergers fulfilling the above criteria (large and independent banks) that have an average asset size of \$11.4bn and an average of 98 bank branches. The total number of branch-year observations related to these large bank mergers is 10,828. Finally, in the sample of bank branches, we observe 772 banks involved in mergers of small or same-group banks that have an average size of \$0.375bn in assets and an average of 6 bank branches. The total number of branch-year observations related to small scale/same group bank mergers is 4,669.

### *3.4 Regional demographic and economic variables*

Regional population data come from the U.S. Census Bureau. We use the 2010 Census of Population and Housing to get the actual total population count, while for years 2011-2015, we use the 5-yr estimated population count. Since neither actual nor estimated population count is available for years 2009 and 2016, we derive our own estimates by extrapolating the latest population count per five-digit zip code, using the annual growth rate calculated from the period 2010-2015. Finally, we aggregate the five-digit zip code population figures to three-digit zip codes in order to match the sample's regional level.

Regional economic data comes from the Bureau of Labor Statistics (BLS) Quarterly Census of Employment and Wages Database. We focus on the income variable, which, according to the BLS annual bulletin *Employment and Wages*, is the reported total compensation paid during the calendar quarter, regardless of when the services were performed. A few State laws, however, specify that wages be based on the period during which services are performed, rather than for the period during which compensation is paid. Under most State regulations wages include bonuses, stock options, severance pay, the cash value of meals and lodging, tips and other gratuities, and, in some States, employer contributions to certain deferred compensation plans, such as 401(k) plans.

As this data is organized by County (FIPS codes), we use the County-to-Zip crosswalk files to allocate the employment and wage variables to Zip codes. The County-Zip crosswalk files are from the US Department of Housing and Urban Development's Office of Policy Development and Research.<sup>9</sup> They contain the percentage of County residential addresses belonging to each five-digit zip code. We use these percentages to allocate a County-based variable to zip codes. The crosswalk data are quarterly and start in 2010. In the absence of crosswalk data for 2009, we used the 2010 crosswalks for that year. Next, we merged the crosswalks with the BLS data, matching records on year, quarter, and County. We used the address ratio to allocate the wage variables to five-digit zip codes. Finally, we calculated the annual average of each employment and wage variable at the three-digit zip code level weighted by the ratio of population in 5-digit zip code areas within their 3-digit zip code area.

We also use the House Price Index of the Federal Housing Finance Agency compiled using all-transactions, which is estimated using actual sales prices and appraisal data for mortgages bought or guaranteed by Fannie Mae and Freddie Mac. We use the index of the

---

<sup>9</sup> [https://www.huduser.gov/portal/datasets/usps\\_crosswalk.html](https://www.huduser.gov/portal/datasets/usps_crosswalk.html)

fourth quarter of each year at the three-digit zip code.<sup>10</sup>

### 3.5 *Consumer credit conditions*

The Federal Reserve Bank of New York (FRBNY) publishes credit stress data by county and state.<sup>11</sup> This Consumer Credit Panel/Equifax (CCP) consists of detailed Equifax credit report data for a unique longitudinal quarterly panel of individuals and households. The panel is a five percent nationally representative sample of all individuals with a social security number and a credit report. The FRBNY has created a 5-tier scale that measures the severity of community credit stress based on the last four quarter payment histories of residents. The first 3 tiers are: the percentage of individuals with more than 60 days overdue for all four quarters (Weak); the percentage of individuals with more than 60 days overdue for one to three quarters (Struggling); and the percentage of individuals that deteriorated from less than 60 days overdue to more than 60 days (Declining). The remaining two tiers include the percentage of individuals with stable or improved credit.

We allocate the credit stress data from County FIPS codes to three-digit zip codes using the previously mentioned County-Zip crosswalk files. We averaged the quarterly crosswalk ratios annually and then merged the credit stress data with the crosswalk data, matching the records on year and County (FIPS code). Then each of the five credit stress variables (tiers) were multiplied with the corresponding residential address percentage from the crosswalk files. These credit stress variables at the five-digit zip codes were aggregated to three-digit zip codes by weighting them by population as was done with the employment and wage data. In our empirical analysis, we examine two measures of community credit distress. One variable sums the percentage of individuals in the three worst tiers (Weak, Struggling and Declining) while the second equals the percentage of individuals in the two worst tiers.

---

<sup>10</sup> <https://www.fhfa.gov/DataTools/Downloads/Pages/House-Price-Index-Datasets.aspx>

<sup>11</sup> <https://www.newyorkfed.org/data-and-statistics/data-visualization/community-credit-profiles/index.html#stress/counties> .

### 3.6 *Sample summary statistics*

Our definition of a “local market” is the area of a three-digit zip code prefix. After eliminating three-digit zip codes that correspond to military zones, government buildings, or territories outside the United States mainland, we are left with a panel of 7,056 region-year observations, corresponding to 882 unique local markets.

Table 3 provides local economic and demographic summary statistics. Our local markets have, on average, a population of 352,755, a weekly wage of \$804, and 17.4% of the population suffering credit distress. These local markets have an average of 95 bank branches, which declined from an average of 97 in 2009 to an average of 93 in 2016, which is consistent with consolidation reducing local bank branches (Avery, et al. 1999).

Table 4 reports summary statistics on LC loan applications per local market. These statistics are based on the subset of local markets where LC was licensed to operate and received at least 1 loan request.<sup>12</sup> Per local market, the average annual number of LC applications is 1,930 and the average annual total amount requested is \$25 million. On average LC accepts 206 requests and originates approximately \$3 million in loans per local market. Of these loans, on average 167 out of 206 and \$2.6 million out of \$3 million are loans for debt consolidation purposes. These statistics are for the entire observation period, but the annual averages display significant variation over time, with a large surge in loan requests and loans originated during the last three years. Moreover, the number of local markets with LC loans varies over time as increasingly LC was licensed in more states.

Table 5 presents summary statistics of bank merger activities at the local market level. Mergers between large independent banks involve 1,123 out of 7,056 local market-year

---

<sup>12</sup> Based on Lending Club’s 10K annual statements, in year 2009 the platform was not licensed to make loans to residents in Iowa, Idaho, Indiana, Maine, Mississippi, Nebraska, North Carolina, North Dakota and Tennessee. LC obtained a license for North Carolina in 2010, for Tennessee and Indiana in 2013, for Mississippi in 2014, for North Dakota and Nebraska in 2015, and for Idaho in 2016. Iowa remains the only state whose residents are still not permitted to apply for LC loans.

observations and correspond to 621 out of the 882 unique local markets. Thus, mergers are not geographically concentrated, and they have an impact on the vast majority of our sample's local markets. Mergers between large independent banks lead to an average reduction of 1.02 bank branches per local market, which is statistically different from the 0.36 average bank branch decline among local markets not affected by these mergers. In contrast, mergers of small or same-group banks lead to an average reduction of 0.41 bank branches per market, which is not statistically different from the bank branch decline among local markets not affected by these mergers.

## 4 Empirical Analysis

This section presents empirical tests of our model's hypotheses. We begin by examining whether the evidence on bank branch closings supports our assumption that mergers between large independent banks are a shock to bank credit supply in a local market where these banks operated.

### 4.1 *Bank merger activity and the effect on bank branches*

In principle, one could test whether a merger of large banks operating in the same local market reduces the quantity of their consumer loans in that market. Unfortunately, data on a U.S. bank's consumer lending is available only for the entire bank and is not broken down by each local market where the large bank lends. Hence, it is not possible to directly examine whether a merger of large multi-market banks reduces their consumer lending in markets where they have overlap. Instead, we focus on whether mergers lead to a reduction in bank branches in the banks' overlapping markets. Our justification for this indirect measure of bank consumer credit availability is based on evidence from a similar type of bank credit.

U.S. banks with assets exceeding \$1 billion are required by the Community Reinvestment Act (CRA) to report their small business lending by census tract. Using this more detailed CRA data, Nguyen (2019) shows that merger-induced branch closings lead to a

persistent decline small business lending. Moreover, her evidence suggests a causal relationship because a comparison of different census tracts within the same U.S. county indicates that the reduced lending is highly localized to the tracts where bank branches closed. Because consumers are likely to be affected similarly to small business owners, we focus on bank branch closings as our measure of a decline in consumer lending by banks.<sup>13</sup>

Change in a local market's number of bank branches can be "supply-driven" if it is motivated by banks' decisions that are unrelated to conditions in the local market as would be the case when merging banks choose to re-organize their overlapping branch networks. Yet a decision to change the number of branches may also be "demand-driven" if it is due to variation in the local market's underlying economic or demographic conditions.

We begin by estimating a relationship that captures the demand-driven change in branches. Let  $\Delta BB_{z,t+1}$  be the change in the number of bank branches in local market  $z$  from year  $t$  to  $t+1$ . It is assumed to depend on the proportional changes from year  $t-1$  to  $t$  in the local market's income ( $\Delta I_{zt}$ ), house prices ( $\Delta H_{zt}$ ), and population ( $\Delta P_{zt}$ ), as well as year fixed effects ( $T$ ), local market-specific fixed effects ( $f_z$ ), and an error term ( $\varepsilon_{z,t+1}$ ):<sup>14</sup>

$$\Delta BB_{z,t+1} = \beta_0 + \beta_1 \Delta I_{zt} + \beta_2 \Delta H_{zt} + \beta_3 \Delta P_{zt} + T + f_z + \varepsilon_{z,t+1} \quad (3)$$

Table 6 column 1 presents the results of estimating equation (3). This relationship is fitted excluding observations of local markets affected by bank merger activity in a particular year in order to isolate the effect of demand-driven from the supply-driven changes on the number of bank branches. The results show that changes in income have a positive effect on

---

<sup>13</sup> Note that as our model predicts, the decline in consumer lending can be a result of higher consumer loan rates due to less banking competition. Garmaise and Moskowitz (2006) provided related evidence that merger-induced bank closings lead to a rise in interest rates on the local market's commercial real estate transactions.

<sup>14</sup> By looking at within-area variation, the fixed effects model controls for time-invariant characteristics that are likely to affect the changes in branches (e.g., state regulation) which helps us to identify the local economic and demographic drivers of the change in the number of branches. We also ran a similar model with random local market effects, and the results are nearly equivalent. However, the fixed effects model is more appropriate because our dataset contains all local markets rather than a sample of areas. In addition, the Hausman test of the random effects (generalized least square) estimator yields a p-value < 1% so we reject the hypothesis that random effects provides consistent estimates in favor of the fixed effects (within OLS estimator).

bank branches while changes in house prices and population have negative effects.<sup>15</sup> We use the estimated regression (3) to calculate the date  $t$  predicted demand-driven change in the number of bank branches from dates  $t$  to  $t+1$ ,  $\widehat{DD}_{zt} = E_t[\Delta BB_{z,t+1}]$ , i.e. the expected change in the number of branches due to changes in the local economic and demographic conditions.

Next, we consider the independent effect on a local market by a merger between large independent banks. Let  $BM_{zt}$  denote an indicator variable that takes the value of 1, zero otherwise, if local market  $z$  is affected by such a merger from years  $t-1$  to  $t$ . Using the entire sample of local markets, we run the following regression:

$$\Delta BB_{z,t+1} = \beta_0 + \beta_1 BM_{zt} + \beta_2 \widehat{DD}_{zt} + T + f_z + \varepsilon_{z,t+1} \quad (4)$$

The estimated coefficients of equation (4) are reported in Table 6 column 2. They show that bank mergers decrease the number of local bank branches in the first year by -0.2, on average, and the effect is statistically significant at 5% level.

Earlier changes in the number of bank branches could have an effect on current changes in the number of bank branches due to slow adjustments. Thus, as an additional empirical test, we add the lagged effect of the dependent variable and calculate the Arellano-Bond estimator of the following dynamic (autoregressive) model of bank branch changes:

$$\Delta BB_{z,t+1} = \beta_0 + \beta_1 \Delta BB_{z,t} + \beta_2 BM_{zt} + \beta_3 \widehat{DD}_{zt} + T + \varepsilon_{z,t+1} \quad (5)$$

Results for the dynamic equation (5) are given in Table 6 column 3 and show that bank mergers decrease the number of local bank branches by -0.34, on average, and the effect is statistically significant at 1% level.

#### 4.2 Bank merger activity and the effect on marketplace lending

Given that merger-induced branch closings are likely to reduce the availability of

---

<sup>15</sup> Perhaps population growth proxies for an inflow of younger individuals who tend to use bank branches less than older individuals.

bank credit and raise its cost, we now consider whether consumers respond by seeking more credit from an online lending platform.<sup>16</sup> Thus, we now examine whether LC receives and services consumers' credit needs that are unmet by banks by investigating whether a merger-induced decline in bank branches leads to changes in various actions involving LC. These actions include the number and amount of loan requests and acceptances, as well as the loan acceptance rates, for various types of loans. Thus, define  $\Delta LC_{z,t+1}$  as the percentage change in a generic action involving LC relating to local market  $z$  from years  $t$  to  $t+1$ . To mitigate concerns over the role of extreme values in the outcome variables, especially for local markets with a small number of LC requests or LC accepted loans, we winsorize all of the  $LC_{z,t}$  variables at the 1% tails of their distributions.

We run a two stage least squares regression where the first stage uses equation (4) to estimate the expected reduction in local market  $z$ 's bank branches from bank merger activity after controlling for the expected demand-driven bank branch change  $\widehat{DD}_{z,t}$ . The first stage instrument for this merger-induced expectation at year  $t$  of the branch decline for local market  $z$  from years  $t$  to  $t+1$  is denoted as  $\widehat{\Delta BB}_{z,t} |_{BM}$ . The second stage then regresses  $\Delta LC_{z,t+1}$  on this instrumented supply-driven branch change, as well as the demand-driven branch change and time and local market fixed effects:<sup>17</sup>

$$\Delta LC_{z,t+1} = \beta_0 + \beta_1 \widehat{\Delta BB}_{z,t} |_{BM} + \beta_2 \widehat{DD}_{z,t} + T + f_z + \varepsilon_{z,t+1}. \quad (6)$$

Results of this second stage regression (6) are reported in Table 7 for various specifications of the dependent variable,  $\Delta LC_{z,t+1}$ . In column 1, this dependent variable is the percentage change in loan applications from local market  $z$ . The estimates indicate that a

<sup>16</sup> Choi and Loh (2019) provide related evidence that when DBS Bank, the largest bank in Singapore, closed an automated teller machine (ATM), DBS customers who reside near the closed ATM become more frequent users of the bank's online platform.

<sup>17</sup> We conducted tests on the adequacy of our instrument. Evidence from under-identification and weak identification tests (Kleibergen-Paap rk LM statistic/F-statistic) reject the hypothesis that the instrument is weak.

merger-induced drop in the number of bank branches leads to a statistically significant 11.5% rise in the number of loan requests to LC. Changing the dependent variable to loan amounts requested, column 2 indicates the merger-induced decline in branches raises the amount of loans requested by 13.6%.

Recall that our third hypothesis in Section 2 was that a decline in bank credit supply that raises bank loan rates causes lower-risk borrowers seeking lower-cost credit to migrate to LC, allowing it to decrease its loan request rejection rate. In Table 7 column 3, the dependent variable is the change in LC's loan request rejection rate. Consistent with this hypothesis, the results show that LC's rejection (*acceptance*) rate decreases (*increases*) by 0.53 percentage points following a merger-induced reduction in bank branches. Note that due to the large volume of requests, even small changes in the rejection rate can translate to large volumes of additional loans. This is indicated in columns 4 and 5 where the dependent variables are the accepted number of loans and loan amounts, respectively. Their results show that a merger induced decline in branches leads to a 29% increase in accepted loans and a 61.4% increase in the amount of accepted loans.

We test other aspects of this third hypothesis by examining whether credit cost reduction motivates lower-risk borrowers to seek new marketplace loans. The dependent variables in columns 6 and 7 of Table 7 are the number and amounts of loans accepted by LC for debt consolidation purposes. Consistent with borrowers migrating to LC to reduce their cost of bank debt, LC's response to accepting debt consolidation loans is about twice the overall magnitude. The merger-induced decline in branches raises the debt consolidation loan numbers and amounts by 23.4% and by 43.9%, respectively. Finally, columns 8 to 11 of Table 7 use dependent variables on loans accepted categorized by the applicant's credit rating. Here, the evidence shows that a merger-induced branch closing has its main impact on loans to lower-risk borrowers (LC grades A-C), with loan numbers and loan amounts to these

borrowers increasing by 23% and 53.6%, respectively. In contrast, the number and amount of accepted applications from the relatively riskier borrowers (LC grades D-G) shows no significant change.

As a robustness test, we consider small or within-group bank mergers that, according to the literature, are not likely to yield a significant change in bank competition and credit availability. Specifically, we repeat the two stage instrumental variable regressions that were reported in Table 7 but now use the merger-induced branch reductions from these small or within-group bank mergers. The results of this “placebo” test are reported in Table 8 and show that these mergers lead to no significant changes in requests to, or responses by, LC. Consequently, the evidence is consistent with only large, independent bank mergers generating a reduction in competition that results in a surge of new marketplace lending.

#### 4.3 *The role of marketplace lending during the financial crisis*

Figure 1 and Table 1 show that marketplace lending was at its infancy during the global financial crisis but grew rapidly ever since. This section examines whether merger-induced credit supply shocks had different effects on LC loan requests and acceptances during versus after the crisis. We do so by augmenting the two-stage least squares regression in equation (6) with a financial crisis indicator variable interacted with the merger-induced expected branch reduction,  $\widehat{\Delta BB}_{zt} |_{BM}$ . The results are shown in Table 9 where the variable *Crisis* indicates mergers in year 2009 while the variable *Post-Crisis* indicates mergers in 2010 to 2015.

Table 9 columns 1 and 2 indicate that 2009 bank merger activity generated greater increases in the number and amounts of loan requests to LC compared to bank merger activity in subsequent years. This result may be unsurprising as the mergers during the crisis coincided with a severe credit contraction by weakened banks that reduced credit supply independent of any changes in local bank competition. However, Table 9 column 3 shows

that, unlike its response to 2010 to 2015 merger-induced credit shocks, LC did not respond to 2009 merger-induced credit shocks by reducing its loan application rejection rate.

Similarly, Table 9 columns 4 and 5 report that LC did not accept greater numbers or amounts of loans in response to 2009 merger-induced shocks while it did for post-crisis merger shocks. Moreover, Table 9 columns 6 and 7 show that LC decreased the number of accepted requests for debt consolidation due to 2009 merger-induced shocks and increased the amount of its debt consolidation loans only in response to post-crisis merger-induced shocks. In addition, columns 8 and 9 provide evidence that merger-induced branch closings led to an increase in the number and amount of loans made by LC to prime borrowers only during 2010 to 2015. Finally, columns 10 and 11 indicate that merger-induced shocks never led LC to respond positively to relatively higher risk borrowers.

Clearly, 2009 was a year of severe bank credit contraction which would be expected to increase the demand for LC loans, particularly in markets where mergers were often motivated to save distressed banks. Yet LC's ability to meet this demand was likely to be restricted during the crisis. At the margin, LC depends on market investors for new financing. Particularly during the crisis, LC's investor base was primarily retail investors who may have been reluctant to fund consumer credit because they faced liquidity constraints themselves. Only afterwards did LC's investor base expand to comprise mainly institutional investors who are likely to be less constrained. Together with the macro-economic recovery taking hold in 2010 and thereafter, this expansion in LC's investor base may have allowed it to better serve the reduction in credit availability due to bank consolidation.<sup>18</sup>

---

<sup>18</sup> LC's June 2010 10-K report states: "We have a limited operating history and have incurred net losses since our inception. Our net loss was \$10,255,136 for the fiscal year ended March 31, 2010. At this stage of our development, we have funded our operations primarily with proceeds from our venture capital financings, our credit facilities and debt and equity issuances. Over time, we expect that the number of borrower and investor members and the volume of member loans originated through our platform will increase, and that we will generate increased revenue from borrower origination fees and investor service charges."

#### 4.4 Bank merger activity, marketplace lending, and consumer credit stress

This final section examines the hypothesis that the presence of a marketplace lender alleviates consumer credit stress resulting from a merger-induced decline in bank credit availability. We test this hypothesis using a difference-in-difference approach. Denote the level of consumer credit stress in local market  $z$  in year  $t+1$  as  $CCS_{z,t+1}$ . It is assumed to be a function of whether a merger occurred in market  $z$  in year  $t$ ,  $BM_{zt}$ , the year  $t$  expected change in branches from years  $t$  to  $t+1$  due to economic and demographic factors,  $\widehat{DD}_{zt}$ , and an indicator of whether Lending Club is licensed to operate in the local market  $z$  in year  $t$ , which we denote as  $L_{zt}$ . Specifically, the relationship after inclusion of local market fixed effects is:

$$CCS_{z,t+1} = \beta_0 + \beta_1 L_{zt} + \beta_2 BM_{zt} + \beta_3 L_{zt} \times BM_{zt} + \beta_4 \widehat{DD}_{zt} + f_z + \varepsilon_{z,t+1} \quad (7)$$

Our estimation strategy compares similar local markets where LC was licensed to operate versus local markets where it was not. Therefore, we augment our previous data to include local markets where LC did not operate.

First, we examine local markets where a merger did not occur and match every local market where LC is present with another where LC is not present. We perform a Kernel-based Propensity Score Matching using the expected demand-driven change in bank branches  $\widehat{DD}_{zt} = d_t$ . We adjust the kernel propensity score matching to reflect the fact that our dataset is a repeated cross-section. The epanechnikov kernel is used with a default bandwidth of 0.06. Taking the difference in this matched local market sample's credit stress measures in equation (7), we obtain:

$$(CCS_{L=1,t+1} - CCS_{L=0,t+1})|_{d_t, BM=0} = \beta_1 + (f_{L=1, BM=0} - f_{L=0, BM=0}) + (\varepsilon_{L=1, BM=0, t+1} - \varepsilon_{L=0, BM=0, t+1}) \quad (8)$$

Second, we match local markets that experienced a merger, with one being where LC is present with the other where LC is not licensed. The matching method based on the same  $d_t$  used previously. Again, taking the difference in the local markets' credit stresses gives

$$\left( CCS_{L=1,t+1} - CCS_{L=0,t+1} \right) |_{d_t, BM=1} = \beta_1 + \beta_3 + \left( f_{L=1, BM=1} - f_{L=0, BM=1} \right) + \left( \varepsilon_{L=1, BM=1, t+1} - \varepsilon_{L=0, BM=1, t+1} \right) \quad (9)$$

Identifying how the presence of LC affects a merger-induced decline in credit supply is achieved by differencing the differences in equations (9) and (8). Taking the expectation of this difference, we obtain:

$$\begin{aligned} E \left[ \left( CCS_{L=1,t+1} - CCS_{L=0,t+1} \right) |_{d_t, BM=1} - \left( CCS_{L=1,t+1} - CCS_{L=0,t+1} \right) |_{d_t, BM=0} \right] &= \beta_3 + E \left[ f_{L=1, BM=1} - f_{L=0, BM=1} \right] \\ &- E \left[ f_{L=1, BM=0} - f_{L=0, BM=0} \right] + E \left[ \varepsilon_{L=1, BM=1, t+1} - \varepsilon_{L=0, BM=1, t+1} \right] - E \left[ \varepsilon_{L=1, BM=0, t+1} - \varepsilon_{L=0, BM=0, t+1} \right]. \end{aligned} \quad (10)$$

In equation (10), the expected difference in the fixed effects is zero because the merger-induced change in credit supply is exogenous to the matched local markets, i.e.,

$$E \left[ \left( f_{L=1} - f_{L=0} \right) |_{d_t, BM=1} \right] = E \left[ \left( f_{L=1} - f_{L=0} \right) |_{d_t, BM=0} \right].$$

Now we cannot preclude that there is an unobserved factor related to consumer credit stress in a local market that also correlates with the presence of LC in that market. Thus, if we allow the presence of LC to be endogenous, the error term is correlated with it, i.e.,  $E \left[ \varepsilon_{L=1, t+1} - \varepsilon_{L=0, t+1} |_{d_t} \right] \neq 0$ . However, because large, multi-market bank mergers are unlikely to be driven by local factors, i.e., the merger is exogenous to the local market, the expected difference in errors related to the presence of LC is equal for local markets experiencing a bank merger versus those that are not. Thus,

$$E \left[ \left( \varepsilon_{L=1, BM=1, t+1} - \varepsilon_{L=0, BM=1, t+1} \right) |_{d_t} \right] = E \left[ \left( \varepsilon_{L=1, BM=0, t+1} - \varepsilon_{L=0, BM=0, t+1} \right) |_{d_t} \right].$$

Therefore, the use of bank mergers as an exogenous credit supply shock combined with differencing in the sample of local markets by their propensity to experience a demand-driven change in bank branches allows us to isolate the effect of marketplace lending on local market credit stress, which is the parameter  $\beta_3$  in equation (10).

To address any concern of sample bias or within-cluster error correlation, we perform a bootstrap estimation of coefficients with 1000 repetitions and report robust standard errors.

The results of the difference-in-difference estimate ( $\beta_3$ ) in the matched sample of local

markets is presented in Table 10. Prior to a bank merger, the average percentage of a population in credit distress (FRBNY Tiers 1-3) is 14.8% for local markets without LC and 17.4% for local markets with LC. After a bank merger, the average percentage of population in credit distress increases to 17.8% for local markets without LC while it remains almost unchanged at 17.5% in local markets where LC is present. The difference-in-difference estimate is -2.9% implying that, on average, the availability of loans through marketplace lending mitigates the adverse effect of a bank merger to the percentage of local population in credit distress by 2.9 percentage points. Repeating this analysis for the percentage of population in higher distress (FRBNY Tiers 1-2), the findings are statistically and economically equivalent.

As a placebo test, we repeat this difference-in-differences analysis using small/intrabank mergers. The results reported in Table 11 show that the presence of LC in local markets experiencing bank mergers has no effect on the credit stress of the local population. The average percentage of local population in distress (FRBNY Tiers 1-3) before a placebo bank merger is 15% in the absence of LC and 17.3% in the presence of LC. The average percentage of local population in credit distress is 15.2% after a placebo bank merger when LC is absent and 17.5% when LC is present. The difference-in-difference estimate is -0.01%, which is statistically insignificant. When we examine the results of the average percentage of local population in higher distress (FRBNY Tiers 1-2) the results are again statistically insignificant. Taken together, the results based on large, independent bank mergers given in Table 10 and those based on small/intrabank mergers given in Table 11 confirm that marketplace lending mitigates credit stress deriving from mergers that are reasonably likely to actually reduce banks' credit supply.

## 5 Conclusion

The consolidation of the banking sector has raised concerns over the availability of credit to bank-dependent borrowers. Until now, there has been little evidence of whether marketplace lending can substitute for a loss in consumer credit provided by traditional banks. Our empirical findings show that marketplace lending can replace the reduction in bank credit due to mergers of large, independent banks, thereby hedging against the adverse consequences of such consolidation. First, we showed that these mergers do, indeed, lead to a reduction in the number of bank branches in local markets where the banks operated. Second, we found that such mergers generated an increase in loan requests to a marketplace lender. Third, except during a severe financial crisis, we find that a marketplace lender responds positively to a bank credit shock by increasing the number and total value of accepted applications, especially for prime borrowers seeking to consolidate their debts at lower cost.

Fourth, we show that marketplace lenders reduce credit distress in local markets affected by a bank merger-induced decline in bank credit availability. Local markets with access to marketplace lending experience an insignificant increase in credit distress after a merger while local markets without a marketplace lender experience a substantial increase.

While our study is a first step in exploring the merits of marketplace lending, more research is warranted to establish its role in the growth and development of local market economies. Whether marketplace lending reduces income inequality or unemployment is a key policy-related issue that deserves attention. Moreover, the net effect of marketplace lending on a local economy's welfare should take into account of potential social costs, such as excessive credit provision purely for consumption purposes. Whether our documented positive benefit of market place lending exceeds such costs remains an open question.

## Appendix

This appendix provides derivations for the model results in Section 2. Bank  $i$ 's profit maximization problem is

$$\text{Max}_{r_{L,i}} L_i (r_{L,i} - r_F) \quad (\text{A.1})$$

where  $L_i$  is the demand for its loans by consumers.

**Market with only banks:** First consider a market with  $n$  banks and no marketplace lender where the bank index  $i = 1, \dots, n$  is increasing as we move clockwise around the circle.

Suppose that a consumer is located a distance  $x_- \in [0, 1/n]$  from bank  $i$  and a distance  $(1/n - x_-)$  from bank  $i-1$ . This consumer is indifferent between borrowing from these two banks when

$$r_{L,i} + t_L x_- = r_{L,i-1} + t_L \left( \frac{1}{n} - x_- \right). \quad (\text{A.2})$$

Another consumer that is a distance  $x_+ \in [0, 1/n]$  from bank  $i$  and  $(1/n - x_+)$  from bank  $i+1$  is indifferent between borrowing from these banks when

$$r_{L,i} + t_L x_+ = r_{L,i+1} + t_L \left( \frac{1}{n} - x_+ \right). \quad (\text{A.3})$$

Therefore, assuming consumers at the distances satisfying equations (A.2) and (A.3) obtain non-negative net surplus from borrowing, bank  $i$ 's loan demand is

$$L_i = (x_- + x_+) L = \left( \frac{r_{L,i-1} + r_{L,i+1}}{2} - r_{L,i} \right) \frac{L}{t_L} + \frac{L}{n}. \quad (\text{A.4})$$

Substituting equation (A.4) into (A.1), the first order condition yields

$$r_{L,i} = \frac{1}{2} \left( \frac{r_{L,i-1} + r_{L,i+1}}{2} + r_F + \frac{t_L}{n} \right). \quad (\text{A.5})$$

Assuming a symmetric Bertrand-Nash equilibrium where  $r_{L,i} = r_{L,i-1} = r_{L,i+1} = r_L^*$ , equation

(A.5) becomes  $r_L^* = r_F + t_L / n$ , which is the first line on the right-hand side of equation (1).

Accordingly,  $L_i = L/n$  so that all consumers are served. This equilibrium can only hold when the consumer exactly a distance  $x = 1/(2n)$  midway between two banks still has non-negative surplus

$$\bar{s} - r_L^* - \frac{t_L}{2n} \geq 0 \quad (\text{A.6})$$

Substituting  $r_L^* = r_F + t_L / n$  into (A.6), we obtain the same inequality in the first line of the right-hand side of equation (1).

When (A.6) is not satisfied, some consumers furthest from banks would have negative surplus at the Bertrand-Nash equilibrium loan rate and would choose not to borrow. Hence, the equilibrium would be one where neighboring banks do not compete for borrowers and loan demand reflects consumers' reservation loan rate. On either side of bank  $i$ , consumers up to the distance  $x$  would borrow where

$$r_{L,i} + t_L x = \bar{s} \quad (\text{A.7})$$

Therefore, taking account of consumers on both sides, bank  $i$ 's total loan demand is

$$L_i = 2xL = \frac{2L}{t_L}(\bar{s} - r_{L,i}) \quad (\text{A.8})$$

Substituting equation (A.8) into (A.1), the first order condition implies the equilibrium loan rate  $r_L^* = \frac{1}{2}(\bar{s} + r_F)$ , which is the second line on the right-hand-side of equation (1). Note that when inequality (A.6) does not hold, this monopoly equilibrium loan rate is strictly higher than the Bertrand-Nash equilibrium loan rate.

**Market with banks and a marketplace lender:** Second, consider a market where, in addition to  $n$  banks, there is a marketplace lender that is a distance  $\delta$  from all consumers. We begin by considering the minimum value of  $\delta$  for which the marketplace lender would not affect the previous Bertrand-Nash equilibrium because all consumers would continue to prefer borrowing from banks. The net surplus of a consumer at the midpoint between two banks continues to prefer borrowing from a bank rather than the marketplace lender when

$$r_L^* + \frac{1}{2n}t_L = r_F + \frac{3t_L}{2n} \leq r_M + \delta t_L \quad (\text{A.9})$$

Rearranging inequality (A.9) in terms of a constraint on  $n$  gives the condition in the first line of equation (2) for the Bertrand-Nash equilibrium loan rate.

When condition (A.9) is not satisfied, then a subset of consumers furthest from banks will prefer the marketplace lender. In that case a bank's loan demand is determined from competition with the marketplace lender rather than competition with its neighboring banks. On either side of bank  $i$ , consumers up to the distance  $x$  would borrow from the bank where

$$r_{L,i} + t_L x = r_M + \delta t_L \quad (\text{A.10})$$

Taking account of consumers on both sides, bank  $i$ 's total loan demand is

$$L_i = 2xL = \frac{2L}{t_L}(r_M + \delta t_L - r_{L,i}) \quad (\text{A.11})$$

Substituting equation (A.11) into (A.1) and rearranging the first order condition gives the equilibrium loan rate given in the second line of the right-hand-side of equation (2). Substituting this loan rate in (A.11) gives the share of loans provided by each bank.

## References

- Ausubel, L. (1991). The failure of competition in the credit card market. *American Economic Review* 81, 50-81.
- Avery, R., Bostic, R., Calem, P., and Canner, G. (1999). Consolidation and depositor services. *Journal of Banking and Finance* 23, 497-532.
- Berger, A. N., Demsetz, R. S., and Strahan, P. E. (1999). The consolidation of the financial services industry: Causes, consequences, and implications for the future. *Journal of Banking and Finance* 23, 135-194.
- Berger, A. N., Saunders, A., Scalise, J. M., and Udell, G. F. (1998). The effects of bank mergers and acquisitions on small business lending. *Journal of Financial Economics* 50, 187-229.
- Boyd, J.N., and De Nicoló, G. (2005). The theory of bank risk taking and competition revisited. *Journal of Finance* 60, 1329-1343.
- Calem, P., and Mester, L. (1995). Consumer behavior and the stickiness of credit card interest rates. *American Economic Review* 85, 1327-1336.
- Choi, H.-S., and Loh, R. (2019). Physical frictions and digital banking adoption. KAIST and Singapore Management University working paper.
- Cole, R. A., Goldberg, L. G., and White, L. J. (2004). Cookie cutter vs. character: The micro structure of small business lending by large and small banks. *Journal of Financial and Quantitative Analysis* 39, 227-251.
- Degryse, H., and Ongena, S. (2005). Distance, lending relationships, and competition. *Journal of Finance* 60, 231-266.
- Garmaise, M. J., and Moskowitz, T. J. (2006). Bank mergers and crime: The real and social effects of credit market competition. *Journal of Finance* 61, 495-538.
- Erel, I. (2011). The effect of bank mergers on loan prices: Evidence from the United States. *Review of Financial Studies* 24, 1068-1101.
- Iyer, R., Khwaja, A. I., Luttmer, E. F., and Shue, K. (2015). Screening peers softly: Inferring the quality of small borrowers. *Management Science* 62, 1554-1577.
- Kahn, C., Pennacchi, G., and Sopranzetti, B. (2005). Bank consolidation and the dynamics of consumer loan interest rates. *Journal of Business* 78, 99-134.

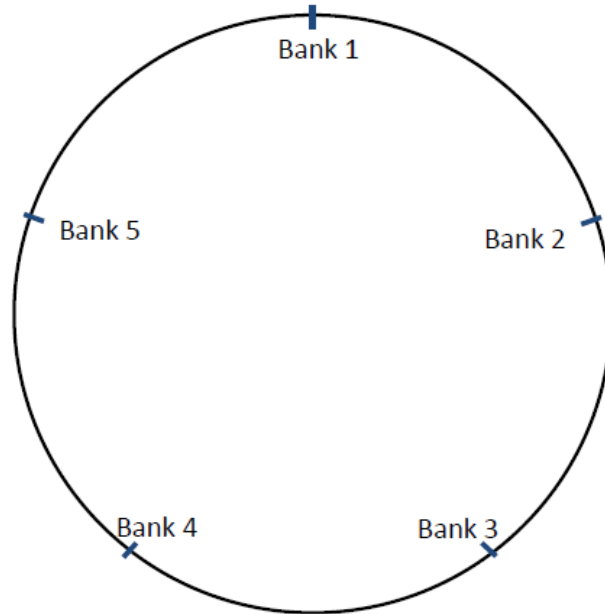
- Keeton, W. R. (1995). Multi-office bank lending to small businesses: Some new evidence. *Federal Reserve Bank of Kansas City Economic Review* 80(2), 45-57.
- Lin, M., N. Prabhala, and S. Viswanathan. 2012. Judging borrowers by the company they keep: Friendship networks and information asymmetry in online peer-to-peer lending. *Management Science* 59, 17-35.
- Martinez-Miera, D. and Schliephake, E. (2016) Bank capital regulation with unregulated competitors. University of Bonn working paper.
- Morse, A. (2015). Peer-to-peer crowdfunding: Information and the potential for disruption in consumer lending. *Annual Review of Financial Economics* 7, 463-482.
- Nguyen, H. L. Q. (2019). Are credit markets still local? Evidence from bank branch closings. *American Economic Journal: Applied Economics* 11, 1-32.
- Park, K., and Pennacchi, G. (2009). Harming depositors and helping borrowers: The disparate impact of bank consolidation. *Review of Financial Studies* 22, 1-40.
- Peek, J., and Rosengren, E. (1995). *Small business credit availability: how important is size of lender?* (No. 95-5). Federal Reserve Bank of Boston.
- Peek, J., and Rosengren, E. S. (1998). Bank consolidation and small business lending: It's not just bank size that matters. *Journal of Banking and Finance* 22, 799-819.
- Pope, D. G., and Sydnor, J. R. (2011). What's in a picture? Evidence of discrimination from Prosper.com. *Journal of Human Resources* 46, 53-92.
- Salop, S.C. (1979) Monopolistic competition with outside goods. *Bell Journal of Economics* 10, 141-156.
- Strahan, P. E., and Weston, J. P. (1998). Small business lending and the changing structure of the banking industry. *Journal of Banking and Finance* 22, 821-845.
- Stango, V. (2002). Pricing with consumer switching costs: Evidence from the credit card market. *Journal of Industrial Economics* 50, 475-492.
- Tang, H. (2019). Peer-to-peer lenders versus banks: substitutes or complements? *Review of Financial Studies* 32, 1900-1938.
- Tian, X. and Zhang, H. (2017). Impact of FAS 166/167 on the Securitization of Credit Card Loans. Available at SSRN: <https://ssrn.com/abstract=2779147>

Figure 1. Marketplace Lending Growth in the United States

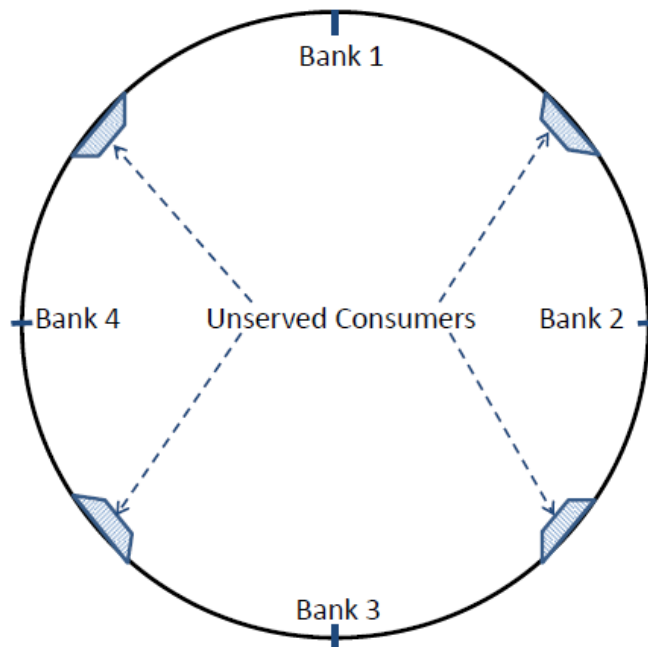


**Figure 2: Market Equilibrium with Only Banks**

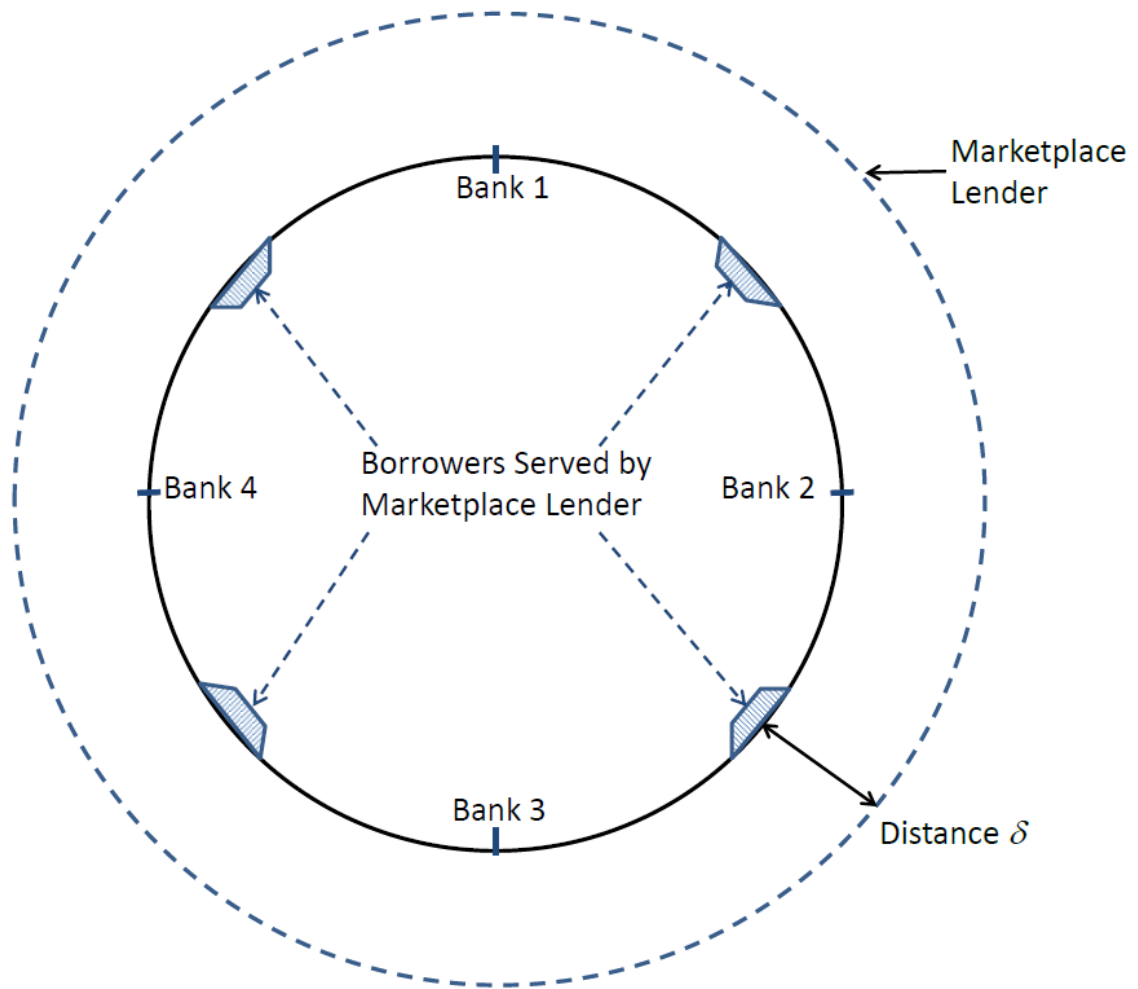
Panel A: Equilibrium Prior to a Merger with Full Market Coverage



Panel B: Equilibrium After a Merger with Partial Market Coverage



**Figure 3: Post-Merger Market Equilibrium with Banks and a Marketplace Lender**



**Table 1. Lending Club data**

<i>Year</i>		<i>All loan applications</i>	<i>Applications accepted</i>	<i>Accepted loan applications for debt consolidation</i>	<i>Rejection rate %</i>	<i>Debt consolidation % accepted</i>
<b>2009</b>	<i>Number</i>	62,270	5,281	2820		
	<i>Total \$M</i>	641	51.9	30.7	91.5%	53.4%
	<i>Mean \$</i>	10,288	9,833	10,898		
<b>2010</b>	<i>Number</i>	125,098	12,537	7274		
	<i>Total \$M</i>	1,380	132	86.9	90.0%	58.0%
	<i>Mean \$</i>	11,005	10,528	11,946		
<b>2011</b>	<i>Number</i>	239,506	21,721	13490		
	<i>Total \$M</i>	3,070	262	179	90.9%	62.1%
	<i>Mean \$</i>	12,814	12,048	13,266		
<b>2012</b>	<i>Number</i>	390,641	53,367	41176		
	<i>Total \$M</i>	5,560	718	581	86.3%	77.2%
	<i>Mean \$</i>	14,229	13,462	14,102		
<b>2013</b>	<i>Number</i>	895,677	134,756	113397		
	<i>Total \$M</i>	12,100	1,980	1,730	85.0%	84.1%
	<i>Mean \$</i>	13,457	14,708	15,289		
<b>2014</b>	<i>Number</i>	2,169,279	235,629	198528		
	<i>Total \$M</i>	26,900	3,500	3,060	89.1%	84.3%
	<i>Mean \$</i>	12,420	14,870	15,400		
<b>2015</b>	<i>Number</i>	3,280,408	421,095	352045		
	<i>Total \$M</i>	43,500	6,420	5,570	87.2%	83.6%
	<i>Mean \$</i>	13,250	15,240	15,813		
<b>2016</b>	<i>Number</i>	5,203,932	434,407	340508		
	<i>Total \$M</i>	66,900	6,400	5,300	91.7%	78.4%
	<i>Mean \$</i>	12,847	14,734	15,559		
<b>All Years</b>	<i>Number</i>	12,400,000	1,318,793	1,069,238		
	<i>Total \$M</i>	160,000	19,500	16,500	89.4%	81.1%
	<i>Mean \$</i>	12,935	14,762	15,462		

**Table 2. Bank branch data**

<i>Year</i>		<i>Assets \$ Mil.</i>	<i>Branches</i>		<i>Assets \$ Mil.</i>	<i>Branches</i>		<i>Assets \$ Mil.</i>	<i>Branches</i>
<b>2009</b>	<i>Mean</i>	2,264	18		82,200	589		457	6
	<i>St.Dev</i>	36,800	156	<i>Merged</i>	173,000	1013	<i>Merged Small/</i>	749	7
	<i>Min</i>	-	1	<i>Large/</i>	1,144	16	<i>Intragroup</i>	30	1
	<i>Max</i>	1,660,000	5812	<i>Indep.</i>	561,000	3150	<i>(N=71)</i>	5,627	48
	<i>Total</i>		77337	<i>(N=10)</i>		5887			425
<b>2010</b>	<i>Mean</i>	2,644	19		4,184	53		360	8
	<i>St.Dev</i>	43,000	178	<i>Merged</i>	3,623	49	<i>Merged Small/</i>	281	18
	<i>Min</i>	10	1	<i>Large/</i>	1,166	14	<i>Intragroup</i>	46	1
	<i>Max</i>	1,570,000	6206	<i>Indep.</i>	11,600	171	<i>(N=82)</i>	1,630	167
	<i>Total</i>		79542	<i>(N=15)</i>		791			617
<b>2011</b>	<i>Mean</i>	2,807	20		8,682	85		352	7
	<i>St.Dev</i>	46,000	181	<i>Merged</i>	13,800	136	<i>Merged Small/</i>	378	9
	<i>Min</i>	9	1	<i>Large/</i>	1,176	2	<i>Intragroup</i>	30	1
	<i>Max</i>	1,790,000	6031	<i>Indep.</i>	45,000	416	<i>(N=73)</i>	2,291	63
	<i>Total</i>		79778	<i>(N=12)</i>		1021			481
<b>2012</b>	<i>Mean</i>	3,005	20		2,911	42		353	6
	<i>St.Dev</i>	48,500	185	<i>Merged</i>	2,454	52	<i>Merged Small/</i>	455	9
	<i>Min</i>	12	1	<i>Large/</i>	1,047	8	<i>Intragroup</i>	12	1
	<i>Max</i>	1,810,000	5982	<i>Indep.</i>	9,392	209	<i>(N=104)</i>	3,808	77
	<i>Total</i>		77951	<i>(N=13)</i>		551			596
<b>2013</b>	<i>Mean</i>	2,707	19		2,766	34		455	6
	<i>St.Dev</i>	39,900	163	<i>Merged</i>	2,359	35	<i>Merged Small/</i>	1,237	14
	<i>Min</i>	6	1	<i>Large/</i>	1,019	7	<i>Intragroup</i>	28	1
	<i>Max</i>	1,430,000	5939	<i>Indep.</i>	9,941	162	<i>(N=116)</i>	12,700	132
	<i>Total</i>		73480	<i>(N=18)</i>		606			750
<b>2014</b>	<i>Mean</i>	3,553	22		1,871	17		388	6
	<i>St.Dev</i>	54,400	187	<i>Merged</i>	1,278	10	<i>Merged Small/</i>	719	14
	<i>Min</i>	7	1	<i>Large/</i>	1,019	5	<i>Intragroup</i>	18	1
	<i>Max</i>	2,000,000	5921	<i>Indep.</i>	5,952	39	<i>(N=147)</i>	8,369	172
	<i>Total</i>		78323	<i>(N=13)</i>		221			941
<b>2015</b>	<i>Mean</i>	3,748	22		5,781	54		303	5
	<i>St.Dev</i>	56,800	184	<i>Merged</i>	8,145	54	<i>Merged Small/</i>	240	4
	<i>Min</i>	16	1	<i>Large/</i>	1,029	1	<i>Intragroup</i>	23	1
	<i>Max</i>	1,970,000	5913	<i>Indep.</i>	35,400	229	<i>(N=123)</i>	1,234	23
	<i>Total</i>		75523	<i>(N=22)</i>		1181			585
<b>2016</b>	<i>Mean</i>	2,734	22		4,557	71		332	5
	<i>St.Dev</i>	37,200	186	<i>Merged</i>	6,746	112	<i>Merged Small/</i>	722	10
	<i>Min</i>	0.5	1	<i>Large/</i>	1,226	4	<i>Intragroup</i>	22	1
	<i>Max</i>	1,200,000	5910	<i>Indep.</i>	21,100	347	<i>(N=56)</i>	5,278	79
	<i>Total</i>		75162	<i>(N=8)</i>		570			274
<b>All Years</b>	<i>Mean</i>	2,909	20		11,400	98		376	6
	<i>St.Dev</i>	45,600	177	<i>Merged</i>	54,800	335	<i>Merged Small/</i>	690	12
	<i>Min</i>	-	1	<i>Large/</i>	1,019	1	<i>Intragroup</i>	12	1
	<i>Max</i>	2,000,000	6206	<i>Indep.</i>	561,000	3150	<i>(N=772)</i>	12,700	172
	<i>Total</i>		617096	<i>(N=111)</i>		10828			4669

**Table 3. Local economic and demographic statistics**

*Annual data per 3-digit US zip code area*

<b>Year (N=882)</b>		<b>Bank branches</b>	<b>Population</b>	<b>House price index</b>	<b>Weekly income (av.)</b>	<b>Credit stress (tier1-3)</b>	<b>Credit stress (tier1-2)</b>
<b>2009</b>	<i>Mean</i>	97	347,749	185.930	740.78	0.192	0.177
	<i>St.Dev</i>	93	370,576	29.579	184.12	0.053	0.049
	<i>Min</i>	2	8,685	116.685	154.91	0.056	0.053
	<i>Max</i>	670	2,876,365	303.338	1762.25	0.369	0.340
<b>2010</b>	<i>Mean</i>	97	349,594	179.944	758.45	0.190	0.175
	<i>St.Dev</i>	93	373,399	28.489	192.90	0.052	0.049
	<i>Min</i>	2	8,637	105.900	157.04	0.053	0.051
	<i>Max</i>	683	2,906,700	302.430	1894.00	0.359	0.336
<b>2011</b>	<i>Mean</i>	97	347,185	174.804	779.41	0.170	0.158
	<i>St.Dev</i>	92	370,479	28.069	199.17	0.048	0.045
	<i>Min</i>	2	8,382	95.735	155.48	0.046	0.040
	<i>Max</i>	669	2,873,899	305.108	1951.75	0.333	0.314
<b>2012</b>	<i>Mean</i>	96	350,037	174.766	798.28	0.178	0.165
	<i>St.Dev</i>	92	374,491	28.566	207.94	0.049	0.046
	<i>Min</i>	2	8,470	94.945	161.95	0.055	0.050
	<i>Max</i>	669	2,913,535	316.363	1975.75	0.335	0.316
<b>2013</b>	<i>Mean</i>	95	352,744	179.626	807.94	0.169	0.156
	<i>St.Dev</i>	92	378,568	31.951	207.80	0.048	0.045
	<i>Min</i>	2	8,545	100.628	182.06	0.044	0.035
	<i>Max</i>	667	2,961,756	344.720	1983.25	0.324	0.303
<b>2014</b>	<i>Mean</i>	94	355,645	186.454	831.39	0.162	0.149
	<i>St.Dev</i>	91	383,318	36.936	215.70	0.048	0.045
	<i>Min</i>	2	8,409	101.673	177.26	0.046	0.039
	<i>Max</i>	663	3,014,722	375.120	2086.25	0.318	0.294
<b>2015</b>	<i>Mean</i>	93	358,377	194.686	854.10	0.164	0.151
	<i>St.Dev</i>	90	387,934	41.093	224.68	0.048	0.045
	<i>Min</i>	2	8,339	109.633	183.21	0.039	0.034
	<i>Max</i>	660	3,061,887	400.588	2188.00	0.327	0.305
<b>2016</b>	<i>Mean</i>	93	360,705	203.568	863.23	0.166	0.153
	<i>St.Dev</i>	89	391,219	45.596	227.92	0.050	0.047
	<i>Min</i>	2	8,346	112.563	184.58	0.044	0.036
	<i>Max</i>	661	3,097,096	429.313	2269.75	0.335	0.313
<b>All Years (N=7056)</b>	<i>Mean</i>	95	352,755	184.972	804.20	0.174	0.161
	<i>St.Dev</i>	92	378,662	35.599	211.93	0.051	0.048
	<i>Min</i>	2	8,339	94.945	154.91	0.039	0.034
	<i>Max</i>	683	3,097,096	429.313	2269.75	0.369	0.340

**Table 4. Lending Club loan requests per local market**

*Annual data per 3-digit US zip code area*

<b>Year</b>		<b>All requests (#)</b>	<b>All requests (\$)</b>	<b>Requests accepted(#)</b>	<b>Requests accepted(\$)</b>	<b>Debt consolidation requests accepted(#)</b>	<b>Debt consolidation requests accepted(\$)</b>
<b>2009</b> <i>(N=749)</i>	<i>Mean</i>	81	832,592	7	68,848	4	40,843
	<i>St.Dev</i>	96	1,040,728	10	108,978	6	68,916
	<i>Min</i>	1	8,000	0	-	0	-
	<i>Max</i>	704	7,693,205	75	988,175	47	646,025
<b>2010</b> <i>(N=770)</i>	<i>Mean</i>	162	1,779,227	16	171,179	9	112,689
	<i>St.Dev</i>	195	2,239,079	25	274,191	15	185,657
	<i>Min</i>	1	17,000	0	-	0	-
	<i>Max</i>	1353	15,100,000	210	2,523,025	137	1,769,800
<b>2011</b> <i>(N=770)</i>	<i>Mean</i>	309	3,962,894	28	339,165	17	232,013
	<i>St.Dev</i>	356	4,693,242	40	493,121	26	344,559
	<i>Min</i>	5	53,000	0	-	0	-
	<i>Max</i>	2434	30,300,000	289	3,653,775	200	2,671,650
<b>2012</b> <i>(N=770)</i>	<i>Mean</i>	504	7,175,888	69	931,113	53	752,660
	<i>St.Dev</i>	607	8,612,540	95	1,292,052	73	1,031,853
	<i>Min</i>	10	127,975	0	-	0	-
	<i>Max</i>	4810	62,300,000	751	10,100,000	568	7,840,275
<b>2013</b> <i>(N=805)</i>	<i>Mean</i>	1108	14,900,000	167	2,457,365	141	2,149,370
	<i>St.Dev</i>	1272	17,100,000	212	3,141,956	177	2,715,398
	<i>Min</i>	25	327,675	1	4,000	1	4,000
	<i>Max</i>	9316	119,000,000	1643	25,000,000	1379	21,700,000
<b>2014</b> <i>(N=817)</i>	<i>Mean</i>	2646	32,900,000	288	4,280,712	243	3,735,455
	<i>St.Dev</i>	3009	37,600,000	357	5,393,800	298	4,653,662
	<i>Min</i>	66	879,550	5	67,775	3	36,225
	<i>Max</i>	23126	280,000,000	2546	42,400,000	2154	37,500,000
<b>2015</b> <i>(N=850)</i>	<i>Mean</i>	3849	51,000,000	494	7,533,903	413	6,534,708
	<i>St.Dev</i>	4600	61,600,000	632	9,825,823	523	8,417,327
	<i>Min</i>	43	610,950	2	31,200	2	31,200
	<i>Max</i>	34116	437,000,000	4466	74,800,000	3664	63,900,000
<b>2016</b> <i>(N=857)</i>	<i>Mean</i>	6058	77,800,000	506	7,453,046	396	6,169,338
	<i>St.Dev</i>	7243	93,900,000	650	9,829,500	504	8,020,099
	<i>Min</i>	84	1,543,425	5	53,550	3	26,450
	<i>Max</i>	52725	673,000,000	4571	74,200,000	3531	60,600,000
<b>All Years</b> <i>(N=6388)</i>	<i>Mean</i>	1930	25,000,000	206	3,041,341	167	2,582,858
	<i>St.Dev</i>	3942	51,200,000	415	6,321,904	336	5,333,118
	<i>Min</i>	1	8,000	0	-	0	-
	<i>Max</i>	52725	673,000,000	4571	74,800,000	3664	63,900,000

**Table 5. Bank mergers per local market**

*Annual data per 3-digit US zip code area. Observations: Local markets × Years.*

*Statistics: Difference in the number of branches in the local market from the year before.*

<b>Panel A: Large independent bank mergers</b>	<b>Obs</b>	<b>Mean</b>	<b>Std.Err.</b>	<b>[95% Conf. Interval]</b>	
<b>No bank merger</b>	5,933	-0.356	0.035	-0.425	-0.288
<b>Bank merger</b>	1,123	-1.020	0.114	-1.243	-0.796
<b>Combined</b>	7,056	-0.462	0.035	-0.530	-0.394
<b>Diff</b>		0.663	0.094	0.478	0.848
					t=7.0289

<b>Panel B: Same-group / small bank mergers</b>	<b>Obs</b>	<b>Mean</b>	<b>Std.Err.</b>	<b>[95% Conf. Interval]</b>	
<b>No bank merger</b>	5,392	-0.479	0.038	-0.554	-0.405
<b>Same group/Small bank merger</b>	1,664	-0.405	0.081	-0.563	-0.247
<b>Combined</b>	7,056	-0.462	0.035	-0.530	-0.394
<b>Diff</b>		-0.074	0.082	-0.234	0.086
					t=-0.9089

**Table 6 – Regressions of bank branch changes**

Column (1) estimates equation (3) which represents demand-driven changes in bank branches due to changes in local economic and demographic. Column (2) is based on equation (4) which incorporates merger-related supply-driven changes in bank branches. Column (3) generalizes the previous regression by estimating an Arellano Bond dynamic autoregressive model specified by equation (5).  $\Delta BB_{z,t+1}$  is the change in the number of bank branches in local market  $z$  from year  $t$  to  $t+1$ .  $BM_{zt}$  equals 1, zero otherwise, if local market  $z$  is affected by a large, independent bank merger from years  $t-1$  to  $t$ .  $\Delta H_{zt}$ ,  $\Delta P_{zt}$ , and  $\Delta I_{zt}$  are proportional changes from year  $t-1$  to  $t$  in local market  $z$ 's house prices, population, and income, respectively.  $\widehat{DD}_{zt} = E_t[\Delta BB_{zt}]$  is the year  $t$  expected change in the number of branches from years  $t$  to  $t+1$  due to changes in local economic and demographic conditions. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% confidence level, respectively.

	(1) $\Delta BB_{z,t+1}$	(2) $\Delta BB_{z,t+1}$	(3) $\Delta BB_{z,t+1}$
$BM_{zt}$		-0.199** (0.0960)	-0.341*** (0.113)
$\Delta H_{zt}$	-0.0156** (0.00629)		
$\Delta P_{zt}$	-0.0587*** (0.0191)		
$\Delta I_{zt}$	0.00402* (0.00243)		
$\widehat{DD}_{zt}$		0.733*** (0.225)	0.931*** (0.214)
$\Delta BB_{zt}$			1.129*** (0.0236)
Constant	0.745*** (0.102)	0.249 (0.195)	-12.26*** (2.256)
Local market fixed effects	yes	yes	-
Year fixed effects	yes	yes	yes
Observations	5,933	7,056	6,174
Number of local markets	882	882	882

**Table 7 – Lending Club loan behavior after large, independent bank mergers**

Reported below are the results of regression specification (6) with each column representing a different dependent variable. Except for Column 3, the dependent variables are expressed in terms of annual percentage changes from years  $t$  to  $t+1$ . The dependent variables are: Column (1) - number of loan applications received by LC; Column (2) - loan amount requested from LC; Column (3) – percentage of applications rejected by LC; Column (4) - number of loan requests accepted by LC; Column (5) - amount of loans accepted by LC; Column (6) - number of loan applications accepted for debt consolidation purposes by LC; Column (7) - amount of loans accepted for debt consolidation purposes by LC; Column (8) - number of loan applications from prime customers accepted by LC; Column (9) - amount of loans to prime customers accepted by LC; Column (10) - number of loan applications from relatively riskier customers accepted LC; Column (11) - amount of loans to relatively riskier customers accepted by LC.  $\widehat{\Delta BB}_{zt} |_{BM}$  is the year  $t$  expected decline in bank branches from years  $t$  to  $t+1$  due to a merger taking place from years  $t-1$  to  $t$  estimated from equation (5).  $\widehat{DD}_{zt}$  is the expected change in the number of branches due to changes in local economic and demographic conditions. Robust, bootstrapped standard errors in parentheses. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% confidence level, respectively.

	(1)	(2)	(3)	(4)	(5)	
$\widehat{\Delta BB}_{zt}  _{BM}$	0.115** (0.0481)	0.136** (0.0621)	-0.00526** (0.00217)	0.290** (0.129)	0.614*** (0.208)	
$\widehat{DD}_{zt}$	-0.159*** (0.0505)	-0.233*** (0.0622)	-0.00910*** (0.00273)	-0.489*** (0.133)	-0.889*** (0.223)	
Constant	0.440*** (0.0362)	0.371*** (0.0464)	0.908*** (0.00198)	0.863*** (0.111)	0.884*** (0.166)	
Local market fixed effects	yes	yes	yes	yes	yes	
Year fixed effects	yes	yes	yes	yes	yes	
Observations	5,639	5,639	5,639	5,560	5,560	
Local markets	857	857	857	857	857	
	(6)	(7)	(8)	(9)	(10)	(11)
$\widehat{\Delta BB}_{zt}  _{BM}$	0.234* (0.131)	0.439* (0.245)	0.230** (0.105)	0.536* (0.290)	0.0625 (0.131)	0.0307 (0.387)
$\widehat{DD}_{zt}$	-0.506*** (0.138)	-0.902*** (0.235)	-0.474*** (0.112)	-0.932*** (0.271)	-0.176 (0.118)	-0.580** (0.282)
Constant	0.732*** (0.117)	0.643*** (0.200)	0.899*** (0.0894)	0.900*** (0.211)	0.644*** (0.105)	0.223 (0.281)
Local market fixed effects	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes
Observations	5,473	5,473	5,524	5,524	5,235	5,235
Local markets	857	857	857	857	857	857

**Table 8 – Lending Club loan behavior after small/intragroup bank mergers (placebo)**

Reported below are the results of regression specification (6) with each column representing a different dependent variable. Except for Column 3, the dependent variables are expressed in terms of annual percentage changes from years  $t$  to  $t+1$ . The dependent variables are: Column (1) - number of loan applications received by LC; Column (2) - loan amount requested from LC; Column (3) - applications rejected by LC; Column (4) - number of loan requests accepted by LC; Column (5) - amount of loans accepted by LC; Column (6) - number of loan applications accepted for debt consolidation purposes by LC; Column (7) - amount of loans accepted for debt consolidation purposes by LC; Column (8) - number of loan applications from prime customers accepted by LC; Column (9) - amount of loans to prime customers accepted by LC; Column (10) - number of loan applications from relatively riskier customers accepted LC; Column (11) - amount of loans to relatively riskier customers accepted by LC.  $\widehat{\Delta BB}_{zt} |_{BM}$  is the year  $t$  expected decline in bank branches from years  $t$  to  $t+1$  due to a merger taking place from years  $t-1$  to  $t$  estimated from equation (5).  $\widehat{DD}_{zt}$  is the expected change in the number of branches due to changes in local economic and demographic conditions. Robust, bootstrapped standard errors in parentheses. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% confidence level, respectively.

	(1)	(2)	(3)	(4)	(5)	
$\widehat{\Delta BB}_{zt}  _{BM}$	-0.133 (0.389)	-0.220 (0.529)	-0.00276 (0.00758)	-0.368 (0.293)	-0.643 (4.725)	
$\widehat{DD}_{zt}$	0.000750 (0.221)	-0.00365 (0.311)	-0.0107* (0.00583)	-0.0753 (0.229)	-0.100 (3.482)	
Constant	0.305 (0.265)	0.177 (0.359)	0.909*** (0.00499)	0.491** (0.211)	0.174 (1.909)	
Local market fixed effects	yes	yes	yes	yes	yes	
Year fixed effects	yes	yes	yes	yes	yes	
Observations	5,639	5,639	5,639	5,560	5,560	
Local markets	857	857	857	857	857	
	(6)	(7)	(8)	(9)	(10)	(11)
$\widehat{\Delta BB}_{zt}  _{BM}$	-0.277 (0.693)	-0.397 (7.416)	-0.213 (1.012)	0.574 (2.622)	0.196 (0.525)	0.657 (4.014)
$\widehat{DD}_{zt}$	-0.196 (0.494)	-0.395 (5.435)	-0.199 (0.978)	-0.956 (1.754)	-0.250 (0.419)	-0.930 (2.727)
Constant	0.432 (0.431)	0.152 (2.907)	0.645 (0.431)	0.922 (1.523)	0.730** (0.285)	0.628 (2.626)
Local market fixed effects	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes
Observations	5,473	5,473	5,524	5,524	5,235	5,235
Local markets	857	857	857	857	857	857

**Table 9 – Lending Club loan behavior after large, independent bank mergers: Time variation**

Reported below are the results of regression specification (6) with *Crisis* being an indicator for mergers in year 2009 and *Post-Crisis* being an indicator for mergers in years 2010 to 2015. Each column representing a different dependent variable. Except for Column 3, the dependent variables are expressed in terms of annual percentage changes from years  $t$  to  $t+1$ . The dependent variables are: Column (1) - number of loan applications received by LC; Column (2) - loan amount requested from LC; Column (3) - applications rejected by LC; Column (4) - number of loan requests accepted by LC; Column (5) - amount of loans accepted by LC; Column (6) - number of loan applications accepted for debt consolidation purposes by LC; Column (7) - amount of loans accepted for debt consolidation purposes by LC; Column (8) - number of loan applications from prime customers accepted by LC; Column (9) - amount of loans to prime customers accepted by LC; Column (10) - number of loan applications from relatively riskier customers accepted LC; Column (11) - amount of loans to relatively riskier customers accepted by LC.  $\widehat{\Delta BB}_{zt} |_{BM}$  is the year  $t$  expected decline in bank branches from years  $t$  to  $t+1$  due to a merger taking place from years  $t-1$  to  $t$  estimated from equation (5).  $\widehat{DD}_{zt}$  is the expected change in the number of branches due to changes in local economic and demographic conditions. Robust, bootstrapped standard errors in parentheses. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% confidence level, respectively.

	(1)	(2)	(3)	(4)	(5)
$\widehat{DD}_{zt}$	-0.310*** (0.0671)	-0.412*** (0.0892)	-0.00596** (0.00263)	-0.710*** (0.156)	-1.330*** (0.387)
$\widehat{\Delta BB}_{zt}  _{BM} \times Crisis$	0.429*** (0.0485)	0.614*** (0.0689)	0.00206 (0.00163)	0.0896 (0.136)	0.483 (0.297)
$\widehat{\Delta BB}_{zt}  _{BM} \times Post-Crisis$	0.239*** (0.0621)	0.285*** (0.0779)	-0.00680*** (0.00193)	0.312*** (0.118)	0.614** (0.298)
Constant	0.537*** (0.0242)	0.724*** (0.0368)	0.920*** (0.00162)	1.703*** (0.106)	2.434*** (0.223)
Local market fixed effects	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes
Observations	5,639	5,639	6,521	5,560	5,560
Local markets	857	857	882	857	857

	(6)	(7)	(8)	(9)	(10)	(11)
$\widehat{DD}_{zt}$	-0.659*** (0.214)	-1.213*** (0.332)	-0.660*** (0.168)	-1.346*** (0.345)	-0.249 (0.208)	-0.624 (0.570)
$\widehat{\Delta BB}_{zt}  _{BM} \times Crisis$	-0.308* (0.163)	0.136 (0.230)	0.0651 (0.135)	0.322 (0.258)	-0.263* (0.156)	0.0181 (0.473)
$\widehat{\Delta BB}_{zt}  _{BM} \times Post-Crisis$	0.191 (0.161)	0.402* (0.226)	0.262** (0.126)	0.579** (0.255)	0.111 (0.167)	0.0661 (0.406)
Constant	2.418*** (0.130)	3.009*** (0.185)	1.703*** (0.0924)	2.458*** (0.237)	1.567*** (0.128)	3.032*** (0.399)
Local market fixed effects	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes
Observations	5,473	5,473	5,524	5,524	5,235	5,235
Local markets	857	857	857	857	857	857

**Table 10. Community credit stress, large independent bank mergers, and marketplace lending**  
Sample of local credit markets matched on the expected demand-driven change in the number of bank branches. Robust, bootstrapped standard errors in parentheses. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% confidence level, respectively.

	<i>Community Credit Stress (Tier 1-3)</i>		<i>Community Credit Stress (Tier 1-2)</i>	
	<i>Before BM (n=5051)</i>	<i>After BM (n=978)</i>	<i>Before BM (n=5051)</i>	<i>After BM (n=978)</i>
<b>No LC</b>	0.148	0.178	0.136	0.164
<b>With LC</b>	0.174	0.175	0.161	0.162
<b>Diff</b>	0.026	-0.003	0.025	-0.002
<b>DiD</b>	-0.029***		-0.027***	
<b>S. Err.</b>	(0.007)		(0.007)	

**Table 11. Community credit stress, small/intragroup bank mergers (placebo), and marketplace lending**

Sample of local credit markets matched on the expected demand-driven change in the number of bank branches. Robust, bootstrapped standard errors in parentheses. \*\*\*, \*\*, and \* denote statistical significance at the 1%, 5%, and 10% confidence level, respectively.

	<i>Community Credit Stress (Tier 1-3)</i>		<i>Community Credit Stress (Tier 1-2)</i>	
	<i>Before BM (n=4816)</i>	<i>After BM (n=1333)</i>	<i>Before BM (n=4816)</i>	<i>After BM (n=1333)</i>
<b>No LC</b>	0.150	0.152	0.139	0.141
<b>With LC</b>	0.173	0.175	0.160	0.163
<b>Diff</b>	0.023	0.023	0.021	0.022
<b>DiD</b>	0.0001		0.0003	
<b>S. Err.</b>	(0.005)		(0.005)	