Communication within Banking Organizations and Small Business Lending

Ross Levine
Haas School of Business, University of California, Berkeley

Chen Lin
University of Hong Kong

Qilin Peng
University of Hong Kong

Wensi Xie
CUHK Business School, Chinese University of Hong Kong

Abstract

We investigate how communication within banks affects small business lending. Using travel times between a bank's headquarters and its branches to proxy for the costs of communicating soft information, we exploit shocks to these travel times—the introduction of new airline routes—to evaluate the impact of within-bank communication costs on small business loans. We find that reducing headquarters-branch travel time boosts small business lending in the branch's county. Several extensions suggest that new airline routes facilitate in-person communications that boost small-firm lending. (*JEL* G21, G30, D83, D20, D22)

We thank Phil Strahan (the editor) and two anonymous referees for constructive and helpful comments. We also thank Philip Bond, Andrew Ellul, Vyacheslav Fos, Ronald Masulis, and Haoxiang Zhu for helpful comments and suggestions. Wenzhi Ding provided excellent research assistance. Send correspondence to Ross Levine, University of California, Haas School of Business, 545 Student Services Building, Berkeley, Berkeley, CA 94720-1900; telephone: (510) 643-1419. E-mail: rosslevine@berkeley.edu.

Small firms play a vital role in the U.S. economy, accounting for over 45% of private, nonfarm gross domestic product (see, e.g., Kobe 2012). Research finds that small banks have a comparative advantage in lending to these small firms and that lending to small businesses falls markedly when large banks acquirer small ones (see, e.g., Berger et al. 1998, 2005, 2017). The rapid reduction in the number of small banks through mergers and acquisitions has spurred research into understanding the particular frictions impeding large banks from financing small firms. In this paper, we contribute to this research by focusing on frictions *within* large banking organizations. We investigate how communication costs within banking organizations affect small business lending.

Two influential lines of research frame our study of how communication costs within banks shape lending to small business. First, research emphasizes that small firms lack quantitative data, audited financial statements, and other types of "hard," easily transmitted information (see, e.g., Petersen and Rajan 1994, 1995; Berger and Udell 1995; Agarwal, Chang, and Yavas 2012). Consequently, lending to small firms relies more on "soft" information, such as the lender's subjective assessment of the borrower's character and the economic prospects of the community, which is garnered and communicated through in-person interactions.

The second line of research stresses that the hierarchical structure of large banks interferes with the flow of soft information, impeding small-firm lending (see, e.g., Berger and Udell 2002; Stein 2002).[1] In particular, the model developed by Stein (2002) suggests that (a) soft information obtained by local loan officers is difficult to transmit to higher-level banking officials, and (b) the costs of communicating soft information within large banking organizations hamper lending that depends on soft information, that is, lending to small firms. Though these insights on the hierarchical structure of banks have been very influential, we are unaware of previous empirical evidence that directly evaluates the impact of changes in the costs of transmitting information within banking organizations on small-firm lending.

[1] This work builds on the organization design literature (see, e.g., Grossman and Hart 1986; Radner 1993; Bolton and Dewatripont 1994).

We evaluate whether reducing in-person communication costs within banking organizations increases small-firm lending. We use the travel time between a bank's headquarters and its branches to proxy for the costs of in-person interactions between headquarters and branch officials. The use of travel time to proxy for the costs of transmitting information relies on the assumption that in-person conversations between headquarters managers and branch officials, local clients, and others in the community are more effective than other modes of communication at transmitting and processing some types of vital information, including soft information about small firms. We assess whether shocks to the travel times between banks' headquarters and branches affect small-firm lending in communities near those branches.

For our identification strategy, we follow Giroud (2013) and use the introduction of new airline routes that reduce the travel time between banks' headquarters and branches. In particular, we compute the minimum travel time between a bank's headquarters and each of its branches, for each bank in a given year. We consider travel by car and plane, where the travel time by air includes travel between headquarters and the airport, waiting time, transfer times, and travel between the airport and each branch. We then determine whether the opening of a new commercial airline route reduces the travel time between banks' headquarters and its branches. To the extent that introducing new airline routes that reduce travel times (a) improves the flow of information between banks' headquarters and branches and (b) is orthogonal to lending opportunities at the branch level, we can use the opening of such airline routes as an exogenous source of variation in communication costs within banking organizations. A large component of our research design, therefore, is addressing the orthogonality condition, that is, addressing concerns that local economic conditions—or other factors—trigger both the opening of airline routes and changes in small-firm lending opportunities.

To conduct our analyses, we match data on the locations of banks' branches and headquarters with data on the locations of banks' small business loans. The Summary of Deposits (SOD) provides branch-level data on deposits and the geographic locations of the headquarters and branches of all FDIC-insured depository institutions on an annual basis.

Data provided under the Community Reinvestment Act (CRA) contain information on each bank's small business loans at the county-year level. Thus, we have bank-county-year information on where each bank is making small business loans and the location of each bank's branches. The CRA data on the dollar amount and number of small business loans are reported in size categories based on the origination loan amount. In our study, we distinguish between small business loans of $100,000 or less and those with original loan amounts that are greater than $100,000 and less than or equal to $1 million.

Methodologically, we begin with a standard difference-in-differences framework. The dependent variable is either the total dollar amount or the total number of CRA loans that a bank makes in a county. The treatment variable is an indicator variable that equals one if a new airline route has reduced the travel time between the bank's headquarters and branches in that county and zero otherwise. Thus, our treatment is uniquely identified by two locations: the branch-county, which is the county in which the bank has branches, and the bank's headquarters. To make the treated and untreated bank more comparable, we employ a nearest neighbor matching approach. In particular, a bank is treated if a new airline route reduces travel time between the bank's headquarters and a branch-county. For each of these treated bank-branch-counties, we find up to five "nearest neighbor" control banks that (1) have lending exposure in the branch-county and (2) are most closely matched on a set of key bank characteristics prior to a treatment: bank assets, capital-asset ratio, profitability, and the number of branches. The treated banks are therefore similar to the nontreated matched banks during the pretreatment period. The treated banks are also similar to the nontreated matched along other, nonmatched dimensions including efficiency, individual loans, real estate loans, commercial and industrial loans, merger and acquisition activity, and total liabilities.

To mitigate omitted variable concerns, we include a full set of bank-county, county-year, and bank-year fixed effects. In this way, we condition out all (1) time-invariant factors that shape lending by each bank in a county, (2) time-varying county characteristics that could influence both the introduction of new airline routes and small business lending, and (3) time-varying bank traits that could alter small business lending by a bank in branch-counties. We can include this full array of fixed effects because not all branches in a county have banks with headquarters in the same location and the introduction of a new airline route does not affect all of a bank's branches in different counties. Thus, our difference-in-differences analyses compare small business loans originated by two or more distinct sets of otherwise similar branches in the same county, except that one set of branches are part of banking organizations in which a new airline route has reduced the travel time to its headquarters, and the other branches are not.

We find that the introduction of a new airline route that reduces travel time between a bank's headquarters and a branch leads to a sharp increase in the total dollar amount and number of small loans ($100,000 or less) that the bank makes in the branch's county. For example, the estimates suggest that introducing a new airline route that reduces headquarters-branch travel times would increase the total dollar amount and number of small loans in the county by 12% and 11%, respectively. These results are consistent with the view that reducing headquarters-branch travel times facilitates information flow, boosting the origination of small business loans that rely heavily on soft information.

Next, we conduct three extensions to address concerns about the link between air travel time and the transmission of information within banking organizations. First, we examine the effect of new time-saving airline routes on large loans. To the extent that (a) loan size reflects the size of the borrowing business, (b) loans to larger firms rely more on hard, easily transmitted information than loans to smaller firms, and (c) reductions in headquarters-branch travel times facilitate the flow of soft information, then we should find that a reduction in headquarters-branch travel time has a bigger effect on smaller firms. The results confirm this hypothesis: reducing headquarters-branch travel times does not induce a significant increase in the total dollar amount or number of large loans, that is, loans with original amounts greater than $100,000. The contrasting results between smaller and larger loans are consistent with the view the introduction of new airline routes facilitates the flow of information between branches and headquarters, enhancing credit supply to small, informationally opaque firms.

Second, we conduct a placebo test. If reducing headquarters-branch travel time boosts small-firm lending by facilitating information flow through in-person interactions, then introducing time-saving cargo routes should not influence small-firm lending through this mechanism. Although cargo routes between the headquarters city and a branch-county could boost small-firm lending through other mechanisms—such as giving firms in the branch-county easier access to growth-enhancing resources in the headquarters city—these cargo routes will not directly facilitate face-to-face interactions between headquarters and branch officers. We discover that the opening of time-saving headquarters-branch cargo routes does not influence small business lending in a branch-county, which is consistent with the view that reductions in headquarters-branch passenger flight times ease in-person communications with positive ramifications on small business lending.

Third, we examine the dynamic effects of introducing new airline routes on small business lending: If the change in small business lending is attributable to the introduction of new airline routes, then we should observe a significant effect only after, and not before, the treatment. The dynamic analyses suggest both that the parallel trend assumption is satisfied and reducing headquarters-branch travel time has an enduring effect on small business lending.

To better identify the impact of improved communication within banks on small business lending, we conduct a series of triple-difference-in-differences analyses. Specifically, we test whether the impact of new airline routes on small-firm lending varies in a theoretically predictable manner across different firms, counties, and banks.

First, we explore whether the effects of new time-reducing airline routes are more profound when small businesses are more reliant on soft information. To differentiate small businesses by the degree to which their access to credit depends on soft information, we exploit distinctions in age and asset tangibility, as well as estimates of industry reliance on soft information (see, e.g., Landier, Nair, and Wulf 2009). For example, to the extent that there is more hard information about older firms than younger ones, banks will rely more on soft information when deciding on loans to younger firms. This suggests that reductions in headquarters-branch travel time that facilitate the flow of information will have a bigger effect on lending to younger firms. Similarly, research suggests that collateral mitigates moral hazard and adverse selection problems in loan contracting (see, e.g., Stiglitz and Weiss 1981).

Thus, we conjecture that the flow of credit to small firms with greater collateral will be less sensitive to the introduction of new airline routes than firms with less collateral. Furthermore, Landier, Nair, and Wulf (2009) derive estimates of the degree to which banks rely on soft information in evaluating firms across different industries.

The results from testing these predictions are consistent with the view that reducing headquarters-branch transportation times boosts small business lending by facilitating the flow of soft information. In particular, we find that the introduction of a new time-saving airline route between a bank's headquarters and its branches has bigger effects on small business lending when the branches are in counties with a higher proportion of (a) young firms, (b) firms with more intangible assets that are a less useful form of collateral, and (c) firms in soft-information-dependent industries.

Second, we evaluate whether the credit-enhancing effects of new airline routes are more pronounced among branches facing more intense competition. Research by Marquez (2002) and Rice and Strahan (2010) suggests that greater competition among banks intensifies the adverse selection problem. Under these conditions, other factors that reduce information asymmetries, such as the introduction of time-saving airline routes that facilitate in-person communications, will trigger an especially large increase in lending in environments where adverse selection was constraining lending, that is, in more competitive environments. Our findings are consistent with this prediction. We find that the introduction of new airline routes is associated with a larger increase in small business lending among branches in more competitive counties.

Finally, we test whether the introduction of time-saving airline routes between headquarters and branches has a bigger effect on small-firm lending among banks in which officials at the bank's headquarters are more time constrained. Because traveling to branches is time consuming and managers have limited time and attention (Berger and Udell 1995), new time-saving airline routes should have a larger impact on banks whose headquarters are more time constrained. Building on Giroud (2013), we construct four proxies for the degree to which bank managers at headquarters are time constrained: (1) the number of branches, (2) the number of branches scaled by the number employees at headquarters, (3) the total distance between a bank's headquarters and its branches, and (4) the total distance between headquarters and its branches scaled by the number of employees at headquarters. To mitigate the concern that these measures of time constrains simply capture bank size, we control for the interaction of the treatment dummy (indicating whether a time-saving airline route has been introduced) and bank assets throughout the analyses. We find that the credit-enhancing effects of introducing new airline routes are more pronounced for headquarters with tighter time constraints.

In sum, we discover that the introduction of a passenger airline route (but not a cargo airline route) that decreases travel time between a bank's headquarters and some of its branches is associated with a sharp increase in the bank's small business lending in those treated branch-counties. Furthermore, we find evidence consistent with the view that the new airline routes facilitate face-to-face interactions between headquarters and branch officials that foster the transmission of information that is especially important for lending to firms that lack hard information. In particular, we show that the introduction of these time-saving airline routes exerts an especially pronounced effect (1) on lending to opaque firms that rely more on the transmission of soft information to obtain bank financing, for example, smaller firms, younger firms, and firms with a higher proportion of intangible assets, (2) among branch-counties with more intense bank competition, and (3) among banks where headquarters' managers are more time constrained, so that easing air travel will tend to boost trips and the in-person conversations that are helpful for small business lending.

Our findings, however, do not suggest that reducing travel times increases small business lending only by giving officials at headquarters access to local borrowers' soft information. Facilitating face-to-face interactions between officials at headquarters and branches can also boost small business lending by enhancing the ability of managers at headquarters to monitor, guide, motivate, and train branch officials. The anticipation of closer monitoring may also encourage greater effort by branch loan officers. Our findings, therefore, are consistent with the view that reducing travel times facilitates the flow of information that is most efficiently transmitted through in-person discussions, with positive repercussions on small business lending.

Our work relates to research examining the effects of proximity on lending (see, e.g., Petersen and Rajan 2002; Degryse and Ongena 2005; Agarwal and Hauswald 2010; Granja, Leuz, and Rajan 2018; Nguyen 2019). Using geographic distance as a proxy for the costs of screening and monitoring borrowers, this work finds that geographic distance is negatively associated with lending to informationally opaque borrowers. Rather than focusing on the geographic distance between banks and borrowers, we focus on "proximity" *within* banks. We find that new airline routes that reduce headquarters-branch travel time materially boost lending to small firms. Thus, we provide novel empirical evidence as to why small business lending falls dramatically when banks become larger and more complex (see, e.g., Berger et al. 1998, 2005, 2017; Sapienza 2002). Our work also contributes to research on information flow within banking organizations. Liberti and Mian (2009) show that soft information is more difficult to communicate across hierarchies within a large Argentine bank than is hard information. They, however, do not examine small-firm lending. We evaluate the impact of shocks to the costs of transmitting information within banks on loans to small firms.

Our work also connects to research on bank-branch autonomy. Using data on Texas commercial banks in 1998, Brickley, Linck, and Clifford (2003) argue that the costs of communicating soft information across the hierarchies of large banking organizations lead large banks to focus on lending to large firms with hard information, obviating the value of granting autonomy to branch managers with soft information about local firms. Agarwal and Hauswald (2012) use data from a major U.S. bank and show that headquarters delegates greater authority to branches farther away due to the costs of communicating soft information, and Canales and Nanda (2012) show that when loan officers in Mexico have more autonomy, they lend more to small firms. Consistent with—though distinct from—these papers, we show that shocks to the costs of in-person communications within banking organizations influence small-firm lending.

1. Data and Variables

1.1 CRA small business loans and bank branch data

We collect annual data on small business lending from the CRA data set provided by the Federal Financial Institutions Examination Council (FFIEC). All banking institutions that are regulated by the Office of the Comptroller of the Currency (OCC), the Federal Reserve System, or the Federal Deposit Insurance Corporation (FDIC) and that meet asset size thresholds established annually by the FFIEC must report information on small business loans. The CRA classifies small business loans as commercial or industrial loans (or loans secured by nonfarm, nonresidential real estate) with an original loan amount that is less than or equal to $1 million.

Under the CRA, each filing institution reports small business loans at the county level, so that we have small business lending at the bank-county-year level.[2] Specifically, the CRA contains information on the aggregate number and dollar value of small business loans that a bank makes in a county. The CRA reports these loans in size categories. In our study, we distinguish between small business loans of $100,000 or less and those with original loan amounts that are greater than $100,000 and less than or equal to $1 million. For each bank in each year, we compute *Loan amount*, which equals the log of one plus the total dollar amount (in thousands) of small business loans originated by each bank in a given county, and *Loan number*, which equals the log of one plus the total number of small businesses loans originated by each bank in a given county. Our initial sample comprises the universe of bank-county-year data recorded in the CRA data set over the period from 2000 through 2016. Our sample starts in 2000 because the county-level lending data are sparse in earlier years.

We match the CRA small business loans data with data on the location of all bank branches, so that we have both county-level information on where each bank is making small business loans and the location of each bank's branches. The Summary of Deposits (SOD) provides branch-level data on deposits and the geographic locations of the headquarters and branches of all FDIC-insured depository institutions on an annual basis. Given the findings in Petersen and Rajan (2002), Berger et al. (2005), Agarwal and Hauswald (2010), Berger,

[2] For a more detailed description, see https://www.ffiec.gov/cra/guide.htm.

Bouwman, and Kim (2017), and Nguyen (2019) that firms, especially small firms, tend to borrow from geographically close bank branches, we assume that a bank's CRA small business loans in a county are linked to the bank's branch(es) in that county. We drop CRA lending filed by banks in counties where the banks do not have a local branch, as these observations do not allow us to infer the location of the loan issuing branch office. Thus, we focus on small business loans originated by banks in counties where they have a brick and mortar presence (i.e., branch-counties). These local loans account for more than 75% of the total CRA dollar lending volume. To ensure comparability of the physical distance between a branch and the bank's headquarters across years, we also exclude bank-year observations for which the location of a bank's headquarters is different from the location of the bank's headquarters in the previous year.[3]

Loans to small businesses represent an economically important fraction of bank loans. Based on the Call Reports since 2000, C&I loans to small businesses account for about 80% of total C&I loans on banks' balance sheets. Among these small business loans, those with origination amounts of $100,000 or less account for 43% of total loans to small businesses. Table 1 provides summary statistics for CRA loans in the sample of matched banks and branches used in our analyses. We describe this matching procedure below.

1.2 Airline data

To identify the introduction of new airline routes, we use data from the T-100 Domestic Segment Database, which covers the universe of all domestic flights in the United States since 1990.[4] The T-100 database contains monthly information reported by U.S. air carriers on nonstop segments (routes) between airports. The data includes the origins, destinations, scheduled departures, departures performed, ramp-to-ramp time (flight duration), available capacity and seats, passengers transported, and aircraft type. As our study focuses

[3] Conditional on a bank having at least one branch in a county, the average bank has two branches in the county, and conditional on a bank having at least two branches in a county, the average distance between a bank's branches in the county is 14 miles.

[4] The U.S. Department of Transportation (DOT) compiles the data, which are provided by the Bureau of Transportation Statistics (BTS). As required by the U.S. Code Title 49 (Transportation), all airlines must report their operating or "traffic" information to the DOT in Form 41 and are subject to fines for misreporting.

on personal travel time, we exclude cargo airline routes that carry freight or mail only from our main analyses and use these cargo flights in placebo tests below.

1.3 Route design and travel time estimation

Using an approach similar to Giroud (2013), we design the itinerary that minimizes the travel time between a bank's headquarters and each of its branches. We consider car and plane as the two potential means of transportation. We first compute the driving time by car between a bank's headquarters and each of its branches using Google Map API. This driving time serves as the benchmark and is then compared with the travel time based on the fastest airline route. Whenever transportation by car takes less time than by plane, we use driving time as the minimum travel time.

We determine the fastest airline route between each pair of headquarters-branch locations by summing the following three components of a plane trip: (1) the driving time between a bank's headquarters and the origin airport; (2) the flight duration, including the average ramp-to-ramp time and estimated time spent at airports; and (3) the driving time between the arrival airport and the branch. With respect to the estimated time spent at airports, we follow Giroud (2013) and add one hour to account for the time spent at the origin and destination airports, plus another one hour for each layover time for indirect flights.[5]

1.4 Airline flights and in-person communications

We use information from interviews, bank disclosures, discussions among bank network members, regulatory guidelines, and international institutions to shed light on (a) the connections between airline flights and in-person meetings and (b) the importance of in-person meetings between headquarters and branch officials. Although we do not have systematic data on headquarters-branch trips before and after the introduction of new airline

[5] New airline routes reduce travel times between a bank's headquarters and a branch in four ways: (1) indirect to indirect, where a new indirect flight using a different route replaces a previously optimal indirect flight; (2) indirect to direct, where a new direct flight connecting a branch with its headquarters replaces a previously optimal indirect flight with stopover(s); (3) direct to direct, where a new direct flight using a different route replaces a previously optimal direct flight; for example, the new route may involve an airport that is closer to the location of the branch or headquarters; and (4) drive to flight, where a new direct or indirect flight replaces driving as the optimal means of transportation.

routes, we have conducted interviews and obtained other information regarding the linkages running from new airline routes to productive in-person meetings.

First, we interviewed officials at five large banks with alumni connections to the Haas School of Business and a medium size bank with branches across Wyoming and Montana. To be concrete, we asked whether the introduction of a direct flight between headquarters and a branch that reduced expected travel time would significantly affect the number of trips. There were two sets of answers. For the bankers at the medium size bank in the Rocky Mountain States and those at the large banks focused on smaller clients, they indicated that more time-saving flights would significantly boost trips. The bankers also noted that these trips were important for those at headquarters to understand local markets and to discuss policies and best practices across the bank. For bankers at the larger banks associated with lending to large corporate clients, they responded that new airline routes would not alter the number of trips. They indicated that these considerations were simply not very relevant to them. These responses are consistent with the presumption underlying our work: time-saving airline routes facilitate in-person communications that are helpful for making small business loans.

Second, banks and regulatory institutions prioritize in-person meetings between headquarters and branch officials. For example, Wells Fargo (2018) stresses the importance of bank directors making personal visits to branches to obtain information about clients (p. 52) and making unannounced on-site visits to branches to assess risks, banker knowledge, and borrower experience (p. 9). In 2017, this included more than 15,000 unannounced visits to improve oversight and compliance with best practices and to identify and address other issues or concerns, 450 unannounced conduct reviews to monitor and assess banker knowledge and services, and branch control review visits to evaluate the functioning of branches. At JP Morgan, the job descriptions of branch examiners stationed at headquarters—ranging from entry level to Vice President—stress that the jobs require the person to travel 30%–40% of the year making on-site visits to foster best practices.[6] A forum of Community Banks and

[6] See, for example, https://lensa.com/corporate-compliance-branch-examiner-vice-president-jobs/new-york/jd/a159b466014e756dc2072060948d0ec9 and https://lensa.com/corporate-compliance-compliance-officer-associate-jobs/tampa/jd/29ccf592a0011c291f3fed0b9fa18cfc.

Credit Unions (CBANC Network),[7] explains that managers from headquarters visit branches several times per year to evaluate branch performance and obtain information about local clients and business conditions. Other institutions also stress the importance of in-person visits by officials at headquarters to branches for obtaining and communicating information, for example, Basel Committee on Banking Supervision (2012), Global Institute of Internal Auditors (2013), and OECD (2017). These bank reports and regulatory guidelines suggest that banks and policy institutions view face-to-face discussions as vital conduits of information between headquarters and branch officers.

1.5 Bank-level and branch-level variables

We also use information on bank- and branch-specific characteristics from the Summary of Deposits and the Reports of Condition and Income ("Call Reports"). For bank-specific traits, we consider: *Bank size* is the log of the book value of total assets; *#Branches* is the total number of branches owned by a bank; *Capital-asset ratio* is the total amount of capital divided by the book value of assets; and *ROA* is the net income divided by total assets. We further account for the size of branches owned by each bank in a county. In particular, *ln(Deposit)* equals the log of the total amount of deposits held at a bank's branches in a given county. We control for *ln(Deposit)* throughout our analyses, but all of the results hold when omitting *ln(Deposit)*.

2. Empirical Methodology

2.1 Identification strategy

We exploit the introduction of new airline routes that reduce travel times between banks' headquarters and their branches as an exogenous shock to communication across hierarchies within banking organizations. This strategy rests on two building blocks. First, travel time is positively related to the costs of a bank's headquarters communicating and collaborating with its branch managers about credit allocation decisions. Second, new time-saving airline routes between a bank's headquarters and its branches facilitate the flow of

[7] See https://www.cbancnetwork.com/.

information within the banking organization. Based on these building blocks, we use the introduction of airline routes that lower travel times between banks' headquarters and branches as an exogenous source of variation in the flow of information within banking institutions. This treatment is likely to be especially pertinent to our study of banking and small business lending, because the information underlying decisions concerning small business loans often cannot be usefully summarized in a "hard" numeric score. Rather, decisions about small business loans often involve discussions about the skills and creditworthiness of the prospective borrower and deliberations about the overall context of the potential loan. To the extent that in-person discussions facilitate communication about and evaluation of such information, airline routes that reduce travel time will enhance small business lending.

We construct our key explanatory variable *Treatment* at the bank-county-year level. This is to accommodate the fact that the small business lending data provided in CRA is available at the bank-county level, and not the branch level. For each bank that has branches in a county in a year, *Treatment* is a dummy variable that equals one if a new airline route reduces the travel time between the bank's headquarters and any of its branches in the county. Otherwise, *Treatment* for that bank-county-year observation equals zero. Specifically, the treatment dummy switches to one in year *t* if a new time-saving airline route is introduced in the first 6 months of the year *t* (i.e., January–June). If the new airline route is introduced in the last 6 months of the year (i.e., July–December), then *Treatment* switches to one in the next year *t* + 1. If this new route is terminated in the future, *Treatment* switches back to zero.[8]

To make the treated and untreated banks more comparable, we further adopt a nearest neighbor matching approach based on the Mahalanobis distance. A bank is treated if a new airline is introduced that reduces the travel time between the bank's headquarters and a county in which the bank has branches. For each such treated bank-branch-county, we find up to five matched control banks that (1) have lending exposure in the branch-county and (2) are most closely matched on a set of four key bank characteristics prior to treatment: size,

[8] As described in Giroud (2013), airlines terminate routes infrequently. We show in robustness checks below that the results hold if we focus on an event window from 5 years before to 5 years after the treatment.

capital-asset ratio, profitability, and the number of branches. The Mahalanobis distance metric captures the distance between the matching covariates of the treated and control banks and accounts for the variances and covariances of these covariates. Similar to the recent literature (see, e.g., Chernenko and Sunderam 2012), we require the distance to be less than one standard deviation of the distance metric to ensure high quality matches, and the size difference between the treated and control is less than fivefold.[9] We then examine small business lending by banks in the matched sample across all counties in our analysis. Our final sample consists of 91,690 bank-county-year observations representing 10,706 bank-branch-counties in 2,322 counties over the 2000–2016 period. As shown in Table 1, for each bank in a county, the average number of small business loans in the $100,000 or less loan-size category equals 32, and the dollar amount equals $914,985. The number and dollar amounts of loans in the greater than $100,000 and less than $1 million loan-size categories equal 10 and $2,165,785, respectively.

Using data during the pretreatment period, panel A of Table 2 compares treated banks and branches with nontreated banks and branches in the matched control sample. As shown, the treated banks are similar to our control sample of nontreated banks during the pretreatment period with respect to the matching variables, namely, bank assets, capital-asset ratio, the number of branches, and profitability. For each of these matching variables, the difference of the mean values in the treated and control samples is not economically or statistically significant.

Moreover, the treated and control banks and branches are similar during the pretreatment period with respect to nonmatching variables. That is, in addition to the matching variables, we consider other bank characteristics including efficiency, individual loans, real estate loans, commercial and industrial (C&I) loans, merger and acquisition activity, and total liabilities. *Bank efficiency* is the total noninterest expense divided by total assets; *Individual loans* is the loans to individuals (such as credit cards, automobile loans) divided by total loans; *Real estate loans* is the loans secured by real estate divided by total

[9] We use the five closest control banks, where there can be less than five for a particular bank-branch-county if fewer than five satisfy the matching criteria.

loans; *C&I loans* is the commercial and industrial loans divided by total loans; *Liabilities* is the total liabilities divided by total assets; and *M&A activity* is the total assets of target bank(s) divided by the total assets of the acquiring bank. Information on bank financial statements and merger and acquisition comes from call reports and FFIEC's National Information Center, respectively. Panel A shows that, for each of these other bank characteristics (i.e., *Bank efficiency*, *Individual loans*, *Real estate loans*, *C&I loans*, *Liabilities*, and *M&A activity*), the differences are not statistically significant. Thus, treated and nontreated matched banks are also balanced along these other, nonmatched dimensions, lending extra confidence to our matching procedure. We also calculate branch characteristics (i.e., *ln(Deposits)* and *Market share*) for treated branches separately from the nontreated branches. As can be seen from panel A, branches have similar characteristics in the matched sample.

Implementing a matching strategy is important, because there exist pretreatment differences between the treated and unmatched control banks. The unmatched controls refer to other banks that have branches in the counties in which the treated bank branches are located. In Table A1 in the Online Appendix, we compare treated banks with a pool of unmatched control banks. As shown, the treated banks differ from the unmatched control banks along several dimensions. These differences motivate the use of the matching strategy. Furthermore, as demonstrated in panel A of Table 2, the matching strategy effectively addresses these differences and yields a comparable set of treated and control banks.

This identification strategy allows us to include a full set of (1) bank-county, (2) county-year, and (3) bank-year fixed effects, which conditions out many potentially confounding factors. For example, one might be concerned that local economic shocks could shape both the introduction of new airline routes to that county and small businesses loans by branches in that county, potentially leading to spurious inferences about the impact of airline flights on lending. To address this concern, we control for county-year fixed effects, which is feasible methodologically because our treatment is uniquely identified by two locations: the branch county and the address of the bank's headquarters. As long as not all branches in a county have their bank headquarters located in the same place, we can distinguish the treatment from county-year effects. One also might be concerned that time-varying bank traits drive the relationship between new airline routes and small business lending. We address this concern by including bank-year fixed effects, a feasible addition, because the introduction of a new airline route does not affect all of a bank's branches. Finally, one also might be concerned that some banks lend persistently more to small firms in some counties in ways that shape the introduction of airline routes. Adding bank-county fixed effects conditions out any time-invariant factors relating banks and counties, which focuses the analyses on within bank-county variations in small business lending following a shock to airline routes that alters travel times.

This initial difference-in-differences analysis compares changes in small business loans originated by two or more distinct sets of otherwise similar branches in the same county. One set of branches experiences the introduction of new airline routes that reduce travel time to their headquarters, and the other set of branches does not. Given the staggered nature of the introduction of new airline routes, the control group includes all branch-counties that have not yet been treated.

We then conduct a series of triple-difference-in-differences evaluations to better identify the impact of improved communication within banking organizations on small business lending. In particular, we test whether the impact of new airline routes on small business lending varies in a theoretically predictable manner across different firms, counties, and banks. We describe this triple-difference-in-differences strategy below.

2.2 Baseline model specification

To assess the impact of new airline routes that reduce the travel time between headquarters and branches on small business lending, we estimate the following regression:

$$Small\ Business\ Lending_{bjt} = \beta \times Treatment_{bjt} + \gamma X_{bj,t-1} + \alpha_{jt} + \alpha_{bj} + \alpha_{bt} + \varepsilon_{bjt}, \quad (1)$$

where b indexes banks, j indexes branch-counties (i.e., counties in which bank b has branches), and t indexes years. $Small\ Business\ Lending_{bjt}$ denotes one of the CRA lending measures for bank b in county j during year t. $Treatment_{bjt}$ is a dummy variable that equals one if a new airline route has been introduced that reduces the travel time between bank b's headquarters and its branches in county *j* in year *t* (i.e., in the first 6 months of year *t* or the last 6 months of year $t-1$) and those years after *t* unless the route is terminated. α_{bj}, α_{jt}, and α_{bt} represent a full set of bank-by-county, county-by-year, and bank-by-year fixed effects, respectively. $X_{bj,t-1}$ denotes the size of branches owned by bank b in county *j* in year $t-1$, *ln(Deposit)*. The coefficient of focus is β, which measures the effect of introducing new airline routes on small business lending. We estimate Equation (1) using ordinary least squares (OLS), with standard errors clustered at the county level.

3. Results

3.1 Main results

As shown in Table 2, panel B, the introduction of new airline routes that reduces the travel time between headquarters and branch-counties leads to a sharp increase in small business lending within the smaller loan-size category (i.e., $100,000 or less). We do not observe such effects for larger loans. As shown in Columns 1–4 for the smaller loan-size category, *Treatment*, enters positively and significantly at the 1% level in the regressions where the dependent variable is either *Loan amount* (Columns 1 and 2) or *Loan number* (columns 3 and 4). In contrast, when examining the larger loan-size category in Columns 5–8, *Treatment* enters insignificantly and with an economically small coefficient estimate in both the loan amount and loan number regressions.[10]

The estimated economic magnitude of the impact of new time-saving airline routes on small business lending is large. For example, using the most conservative coefficient estimates, the results imply that a new time-reducing airline route between a branch-county and its headquarters boosts the total amount and number of small business loans in the $100,000 or less loan-size category by 12% and 11%, respectively. As another way to

[10] We compared branches that are far from the headquarters office with those that are close. We define a branch as "close" to headquarters if the driving time takes less than 2 hours and thus—by construction—cannot be treated by the introduction of a new airline route. All other branches are defined as "far." Although branch deposits are not significantly different at close and far branches, small business lending is significantly larger at branches close to headquarters. This observation is consistent with the view that it is more costly to communicate important information about small firms between headquarters and branches that are farther away. In a sense, this observation is the cross-sectional analogue to our test of whether small business lending increases when a new airline route reduces travel time between headquarters and a branch.

evaluate the economic size of the estimated impact of airline routes on small business lending, consider two otherwise similar branches located in the same county that are affiliated with two different banks, which are headquartered in different places. One branch is treated—a new airline route reduces the travel time to its headquarters—and the other branch is untreated. The Table 2 estimates imply that the bank with the treated branch would increase small business lending (in the $100,000 or less loan-size category) in the branch-county by $109,798 (= 12%*914,985) per annum.

To put this magnitude in perspective, we compare these findings to those in Giroud (2013). Giroud (2013, p. 885) finds that—following the introduction of new airline routes that reduce the travel time between manufacturing plants and their headquarters—capital expenditures increase by about $158,000 to $177,000 per annum. Thus, our finding has a similar order of magnitude to the estimates emerging from Giroud (2013). While capital expenditures reflect "internal lending" from headquarters to a plant, our study focuses on "external lending" from a bank to a borrower. This comparison suggests that the economic magnitudes found in our paper are broadly consistent with other estimates of the economic benefits of better flight connections.

These findings are consistent with the view that the introduction of airline routes that reduce headquarters-branch travel times facilitates the communication of information within a bank, leading to a material increase in small business lending in the branch-county. The effects are statistically and economically significant for loans in the smaller size category, and insignificant for larger loans. To the extent that (a) loan size is positively related to the size of the borrowing firm, and (b) lending to smaller firms requires greater reliance on soft information, these different findings across the loan-size categories offer support for the view that enhancing the communication of soft information within banking organizations facilitates small business lending. Consequently, we now focus exclusively on loans in the smaller size category.

3.2 Dynamics effects

To assess the validity of the identification strategy, we look for pretreatment trends in small business lending. To do this, we employ the specification in Equation (1), while replacing the *Treatment* dummy with a series of dummy variables indicating the number of years relative to the treatment year, namely, $Treatment_{bjt}^{-2}$, $Treatment_{bjt}^{-1}$ $Treatment_{bjt}^{0}$, $Treatment_{bjt}^{1}$, and $Treatment_{bjt}^{2+}$. $Treatment_{bjt}^{k}$ (where *k* = -2, -1, 0, 1, or 2+) equals one if there was a new airline route that reduced travel time between bank *b*'s headquarters and branch-county *j*, *k* years relative to treatment year *t*. For example, $Treatment_{bjt}^{0}$ equals one in year *t* for bank *b*'s branch-county *j* if a new airline route reduced the travel time between bank *b*'s headquarters and its branches in county *j* in the first 6 months of the year *t* (i.e., January–June). If the new airline route is introduced in the last 6 months of the year (i.e., July–December), then $Treatment_0$ switches to one in $t + 1$. $Treatment_{bjt}^{-1}$ ($Treatment_{bjt}^{-2}$) equals one in year $t - 1$ ($t - 2$) for bank *b*'s branch-county *j* that is treated by a new airline route between bank *b*'s headquarters and its branches in county *j* in year *t*; and $Treatment_{bjt}^{2+}$ equals one in year $t + 2$ and after for bank *b*'s branch-county *j* if a new airline route reduced the travel time between bank *b*'s headquarters and its branches in county *j* in year *t*. Besides testing whether changes in local branches' small business lending happen before the treatment, this approach allows us to observe whether new airline routes have an enduring effect on small business lending.

Table 3 shows that (a) neither the dollar amount of small business loans nor the number of small business loans exhibits pretreatment trends, and (b) the positive effects of the treatment on small-firm lending last beyond 2 years. Whether examining the amount or number of small-firm lending by bank *b* in its branch-county *j*, pretreatment dummies ($Treatment_{-1}$ and $Treatment_{-2}$) enter insignificantly and with an economically small coefficient, suggesting that there is not a significant change in small-firm lending in the branch-county before a new airline route reduces the travel time between the branch-county and its headquarters. The coefficients on $Treatment_0$, $Treatment_1$, and $Treatment_{2+}$ are generally positive and statistically significant, suggesting that increases in small business lending in a treated branch-county lasts for at least 2 years. Furthermore, we were concerned that the results could be affected by observations well before or after the introduction of a time-saving airline route. Thus, following Giroud (2013), we repeat the dynamic analysis using the event window of [*t*-5, *t*+5], where *t* denotes the year of the treatment. As reported in Table 3, Columns 5–8, we do not find any pretreated trends within the event window.

3.3 Placebo test—cargo flights—and other robustness tests

Next, we conduct a placebo test and examine the introduction of time-saving cargo flights between a bank's headquarters and its branches. This addresses a key concern: the opening of new airline routes might reflect factors other than facilitating in-person communications between headquarters and branch officials. For example, new airline routes might lower the costs and inconveniences of connecting firms in branch-counties to growth-enhancing resources in headquarter cities, boosting their access to local bank loans. Thus, we examine cargo routes. Although the opening of cargo routes might enhance economic connections between headquarters and branch counties, cargo routes will not facilitate in-person communications between bank officials. If our finding that a reduction in headquarters-branch travel time boosts small-firm lending by facilitating the transmission of information through in-person conversations, then the opening of cargo routes should have no (or less of an) effect on lending.[11]

Our analyses "pass" the placebo test: We confirm in Table 4 that the treatment dummy enters insignificantly in all of the cargo-flight specifications, suggesting that the opening of airline routes that reduce cargo transport times between a bank's headquarters and its branches in a county does not alter lending by the bank in the county.

We conduct another robustness checks to test the sensitivity of our results. In particular, we were concerned that the results might be driven by very small airlines hired by the bank. Consequently, we repeat the analyses while focusing on airline routes operated by carriers classified in T-100 as major carriers, national carriers, or regional carriers. As reported in Columns 3 and 4, all of the results hold.

[11] The changes in the cargo routes are remarkably similar to the changes in passenger routes, making them natural comparisons in a placebo test. For example, 5,371 bank-county-years are eventually treated through the introduction of time-saving cargo routes, whereas the corresponding number for such passenger routes is 4,532. Similarly, whereas 3,556 bank-county-years are eventually treated with the introduction of direct cargo routes, the corresponding number for direct passenger routes is 3,311.

3.4 Heterogeneity in the treatment effect

In this subsection, we conduct a series of triple-difference-in-differences tests to evaluate whether the treatment effect differs across different firms, counties, and banks in theoretically predictable ways. That is, we test whether the impact of time-saving passenger airline routes on small business lending varies across firms, counties, and banks in ways that are consistent with the view that time-saving passenger airline routes facilitate in-person communications and hence the flow of information within banking organizations, and this enhanced in-person information flow is especially important for facilitating lending to small, opaque firms. In particular, we analyze how the effects of new time-reducing airline routes on small business lending vary by (a) the extent of firm opacity and collateral, (b) the intensity of market competition within branch-counties, and (c) the degree to which managers at a bank's headquarters are time constrained with respect to visiting the bank's branches. Conducting these heterogeneous treatment tests helps in drawing sharper inferences about whether the observed changes in small business lending following new airline routes are due to changes in the costs of communicating information across the hierarchies of banking organizations.

3.4.1 Information opacity and collateral.

If the effects of introducing new airline routes on small business lending work through improving the communication of soft information, we should observe stronger effects of time-saving airline routes on lending among businesses that depend more on the ability of banks to obtain and process soft information about their creditworthiness. A business's dependence on transmitting soft information to banks in order to obtain credit is a function of both (a) the availability of hard information on the firm and (b) the firm's collateral, which reduces the degree to which information shapes credit availability.

Focusing first on opacity and the results from Table 2, recall that new, time-saving headquarter-branch airline routes boost loans with original amounts of $100,000 or less in treated branch-counties but does not increase loans with original amounts of greater than $100,000 (i.e., those between $100,000 and $1,000,000). Research suggests that smaller firms are more opaque than larger firms with more hard information (see, e.g., Petersen and Rajan 1994; Berger, Bouwman, and Kim 2017), so these findings are consistent with the view that time-saving airline routes facilitate the flow of soft information that is most effectively communicated through in-person communications, which is especially important for smaller business loans.

Furthermore, the degree of opacity can different across small firms. To the extent that potential lenders have more opportunities to collect information about firms over time, older businesses will be less opaque than otherwise similar younger businesses (Boot 2000). From this perspective, facilitating communication within banks will have a larger impact on lending to young small businesses that rely more on soft information to obtain bank loans.

Next, consider collateral. Collateral mitigates well-known moral hazard and adverse selection problems, reducing the effects of informational asymmetries on credit allocation (see, e.g., Stiglitz and Weiss 1981). To the extent that tangible assets, such as property, plant, or equipment, are more effective forms of collateral than intangible assets, firms with more tangible assets will be less credit constrained than otherwise similar firms with more intangible assets. As such, an improvement in the transmission of soft information within a bank will have a bigger effect on firms with less tangible assets all else equal. Thus, we conjecture that introducing airline routes that reduce headquarters-branch travel times will have a bigger effect on lending to (a) younger small firms and (b) low-collateral small firms.

To test the view that reducing headquarters-branch travel times will have an especially large impact on lending to firms in which banks must rely on soft information when making loan decisions, we begin by constructing proxies for opacity and collateral using the NETS data set, which covers the universe of U.S. businesses. The NETS database provides time-series information on business name, address, industry classification, and the number of employees for about 58.8 million U.S. establishments since 1990. This enables us to construct measures of the characteristics of small businesses within each county. Following the CRA definition, we focus on businesses with annual revenues below $1 million.

First, for each county in each year, we construct two measures of the proportion of young businesses. The first measure, *%young business, emp-weighted*, equals the percentage of small businesses that are less than 3 years old, where each business is weighted by the number of employees. We weight by the number of employees to account for the importance of the business in the economy. To mitigate concerns with this weighting, we check the robustness of the results using a second measure, *%young business*, that does not weight by size. Thus, *%young business* simply equals the percentage of small businesses that are less than 3 years old, where each business is equally weighted. We use the value in the year prior to a treatment to mitigate the concern that the introduction of new airline routes alters the industrial structure of small firms in a county. Our results hold if we use the values over a 3-year window prior to a treatment. Under the assumption that there is less information available about younger firms relative to older firms, our measures of *%young business* serve as a proxy for the degree of informational opacity among small firms in a county. We set *High %young business* (*%young business, emp-weighted*) for a county equal to one if *%young business* (*%young business, emp-weighted*) is above the sample median level, and zero otherwise.

Second, we compute a proxy for the asset tangibility of small firms at the county-year level using the following method: (1) using firm-level data from Compustat over a rolling 10-year window, we calculate the median value of the ratio of tangible assets (property, plant and equipment or PPE) to total assets of firms within each industry and call this ratio the industry asset tangibility ratio; and (2) after assigning this industry asset tangibility ratio to each small firm in the same industry, we compute the asset tangibility ratio among small business in a county-year, where each small business is weighted by its number of employees (*Asset tangibility*).[12] Thus, *Asset tangibility* varies with the industrial composition of small businesses in the county. Under the assumption that greater asset tangibility reduces the

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[12] $Asset\ tangibility_{c,t} = \sum_{i=1}^{N}(Asset\ tangibility\ ratio_i \times \#employees_{i,t})\ /\#employees_{c,t}$,

where *c* and *t* denote county and year. $Asset\ tangibility\ ratio_{i,t}$ is the industry asset tangibility ratio of firm *i* (calculated from Compustat using the PPE data over the [*t*-10, *t*-1] period); $\#employees_{i,t}$ is the number of employees owned by firm *i* in year *t*; and $\#employees_{c,t}$ is the total number of employees owned by all small firms in county *c* in year *t*.

impact of informational frictions on credit allocation, *Asset tangibility* is negatively associated with the degree to which banks rely on soft information to make loans to small firms in a county. We define *High Asset tangibility* as a dummy variable that equals one if *Asset tangibility* is above the sample median value across counties, and zero otherwise.

We then employ the following regression specification,

$$Small\ Business\ Lending_{bjt} = \alpha_{jt} + \alpha_{bj} + \alpha_{bt} + \varphi_1 \times Treatment_{bjt} + \varphi_2 \times Treatment_{bjt} \times Information\ opacity_j + \gamma X_{bjt-1} + \varepsilon_{bjt}, \quad (2)$$

where *b*, *j*, *t* denote bank, branch-county, and year, respectively. Building on the baseline model in Equation (1), we now interact the *Treatment* dummy with $Information\ opacity_j$, which equals one of the measures of *%young business* or *Asset tangibility* in county *j*. Other variables are the same as those in Equation (1) above. The coefficient, φ_2, on the interaction term captures the heterogeneous effect of a new airline route on small business lending across branch-counties with differing degrees of young or collateralized small firms. If the introduction of new airline routes indeed enhances small business lending by facilitating the communication of soft information, we expect the effects to be stronger among branches in counties (a) with more opaque small firms, as measured by *%young business*, and (b) with small firms that have less collateralizable assets, *Asset tangibility*.

The results from estimating Equation (2) confirm these two predictions. As shown in Tables 5 and 6, the positive effects of introducing new airline routes on lending to small business are stronger in branch-counties in which there are a higher proportion of (a) young small firms and (b) small firms in industries with low asset tangibility. From Table 5, Column 1, the coefficient on the interaction term, *Treatment * %young business*, *emp-weighted*, is positive and statistically significant level. The results also hold when using the alternative measure of the proportion of young firms (*%young business* in Column 3) or using a simple high/low indicator of the proportion of young firms in a county (Columns 2 and 4). This suggests that the loan-enhancing effects of new airline routes are significant particularly in *High %young business* branch-counties. The coefficients from Column 2 suggest that following the introduction of new airline routes the amount of small business loans would increase by 17% more in branch-counties with a relatively high proportion of young businesses than in branch-counties with a low proportion of young businesses. We find similar patterns when examining loan number as reported in Columns 5–8.

The results are similar for asset tangibility. As shown in Table 6, the interaction term, *Treatment * Asset tangibility*, enters negatively and statistically significantly, suggesting that the loan-increasing effects are more pronounced for branch-counties where local small businesses have less tangible assets. The results hold whether using the continuous values or the high/low indicators to measure the extent of asset tangibility. In terms of economic magnitudes, the estimates indicate the introduction of a time-saving new airline route will increase the value of small loans by 11% less in *High Asset tangibility* branch-counties relative to *Low Asset tangibility* branch-counties.

Finally, we conduct a different evaluation of the hypothesis that introducing time-saving airline routes will have bigger effects on lending to firms in industries in which banks rely more heavily on soft information when making credit allocation decisions. Following Landier, Nair, and Wulf (2009), we use the National Survey of Small Business Finance in 1987 and 1998, and compute, for each industry, the degree to which information about firms in the industry can easily be transmitted over long distances and classify the industry as a "harder information industry" if such distances are longer. In particular, Landier, Nair, and Wulf (2009) begin from the observations that (a) technological developments have made it easier to systematize and record some information about borrowers, that is, to "harden" information, (b) when there is a hardening of information, banks can rely less on in-person meetings to communicate with borrowers, and (c) when in-person meetings become less important for effective lending, the distance between lenders and borrowers can increase without reducing the quality of loans (Petersen and Rajan 2002). Thus, we measure the change of the mean distance of firms in an industry to their primary lending institution from 1987 to 1998, and categorize an industry as a hard-information environment if the change of distance is above the top quartile value, and soft-information environment otherwise. We then calculate, for each county in a year, the proportion of business classified into hard-information industries. *Hard information* is an indicator of one if the proportion of firms in hard information industries in a county is above the sample median value, and zero otherwise. We then employ the same regression approach used in Table 6.

Consistent with the view that reducing headquarters-branch travel times will trigger a large increase in lending to firms in which banks rely more heavily on soft information in making loan decisions, we find that the impact of time-saving airline routes is weaker for counties with higher values of *Hard information*. These results are reported in Table A2 in the Online Appendix, where we differentiate between the extent of soft and hard information environments among small businesses in a county. Taken together, the results are consistent with the view that the introduction of new airline routes leads to a sharp increase in small business lending by facilitating the transmission of soft information between branches and headquarters.

3.4.2 Market competition.

If the introduction of time-saving airline routes between a bank's headquarters and its branches in a county boosts small business lending by easing the flow of soft information about small firms in that branch-county, then theory suggests that the impact on lending should different systematically by the degree of bank competition across counties. Specifically, the research by Marquez (2002) and Rice and Strahan (2010) suggests that competition intensifies the adverse selection problem. Thus, a reduction in information costs that reduces adverse selection will have an especially large impact on lending where adverse selection stymied small business lending, that is, in more competitive environments.[13] Thus, we test whether the treatment effect is larger in counties with more intense bank competition.

To conduct these analyses, we calculate the degree of banking market competition faced by banks at the branch-county level. *Market concentration* equals the Herfindahl-Hirschman index (HHI) of business exposure in each county, where HHI equals the sum of squared market share of each bank in a county. A higher value of *Market concentration*

13 Relatedly, greater competition among branches in a county might intensify the incentives for bank branches to finance new, small business clients. Thus, improving the flow of information about such clients could trigger a bigger lending response in more competitive markets.

indicates less intense competition. We also define *High Market concentration* as a dummy variable that equals one if *Market concentration* is above the sample median value, and zero otherwise. We estimate the heterogeneous treatment effects across markets with varying degrees of competition using a specification similar to Equation (2), except that we replace the conditional variable with the measure of market competition.

As reported in Table 7, the treatment effect is materially larger in counties with more intense bank competition. That is, the interaction term, *Treatment* × *Market concentration,* enters negatively and statistically significantly at the 1% level in Columns 1 (when examining loan amount) and 3 (when examining loan number), indicating that the introduction of new airline routes increases the amount and number of small loans more in more competitive branch-counties. The results hold when using a high/low indicator of market competition as shown in Columns 2 and 4. The estimated impact is economically large. Introducing an airline route that reduces the branch-headquarters travel time increases the small loan amount and loan number by about 18% and 12% more in high market competition branch-counties than in low competition branch-counties. This corresponds to an increase of $161,037 in loan amount and 4 in loan number in the average branch-county.

3.4.3 Monitoring convenience.

A defining characteristic of soft information is that it is most effectively transmitted through in-person interactions. In our context, this includes managers at headquarters travelling to branches. The marginal benefit of a reduction in headquarter-branch travel time with respect to branch lending, therefore, will be increasing with the value of the manager's time. In this section, we evaluate whether the treatment effects are greater among banks in which managers are more time constrained.

Building on Giroud (2013), we construct four rough proxies for the degree to which bank managers are time constrained. Each of these proxies is constructed to provide information on the burdens facing managers at a bank's headquarters with respect to traveling to branches. The first measure, *1/#branches*, equals the inverse of the total number of branches affiliated with each bank. The second measure, *1/total distance,* equals the inverse of the total geographical distance (in thousand miles) between a bank's headquarters and all of its affiliated branches.[14] The third measure, *emp/#branches*, equals the log number of employees at a bank's headquarters office scaled by the number of branches owned by a bank. The fourth measure, *emp/total distance*, equals the log number of employees at a bank's headquarters office scaled by the total distance between headquarters and all of the bank's branches. We interpret higher values of these ratios as negatively related to the time-constraints for managers at headquarters on conducting in-person visits to all of a bank's branches.

We obtain the number of employees of a headquarters office by matching bank headquarters in the Summary of Deposits data set with establishments in the National Establishment Time-Series (NETS) database, using address and name. Similar to Giroud (2013), we treat all of headquarters' employees as managers due to data limitations, as we cannot distinguish between managers and other employees. Albeit imperfect, these measures allow us to shed some empirical light on whether the impact of introducing a time-saving airline route on small-firm lending are stronger for banks whose headquarters are more likely to be time constrained. We use the Equation (2) regression specification and interact the treatment dummy with each of the four measures of the degree to which bank managers are time constrained. Furthermore, we mitigate the concern that these time-constraint measures simply capture a size effect by controlling for *Treatment* × *Bank Size*.

As shown in Table 8, the effects of new airline routes on the amount and number of small business loans are more pronounced among banks with more time constrained managers at headquarters. From Columns 1–4, we observe that the introduction of new airline routes significantly increases the amount of small business loans for branches whose managers at the headquarters are more time constrained. The results hold using all four proxies. Columns 5–8 exhibit similar patterns when examining loan number. Note that bank size is now less of a concern, as we (a) control for *Treatment* × *Bank Size* throughout the

[14] To compute physical distance (in miles), we use the great-circle distance formula widely used in physics and navigation. The great-circle distance between any two points equals $r \times \arccos(\sin\phi_1 \sin\phi_2 + \cos\phi_1 \cos\phi_2 \cos(\lambda_1 - \lambda_2))$, where ϕ_1, λ_1, and ϕ_2, λ_2 denote the geographical latitude and longitude of points 1 and 2, respectively, and r is the approximate radius for the spherical Earth (3,963 miles).

analysis, and (b) use measures of time-constraints that take into account the number of headquarters' managers. Overall, the results in Table 8 are consistent with our conjecture that the introduction of new airline routes effectively improves within-bank communication by reducing managers' travel time between branches and headquarters.[15]

3.4.4 Models with all heterogeneity effects.

Table 9 reports a model that simultaneously includes each of the four heterogeneous treatment effects. That is, we estimate a model that includes *Treatment* × *%young business*, *Treatment* × *Asset tangibility*, *Treatment* × *Market competition*, and *Treatment* × *Monitoring time constraints*. As shown in Table 9, each of the four interaction terms enters statistically significantly, with the same sign, and similar coefficient estimate as when they were examined separately. This suggests that the conditioning variables we construct capture different sources of heterogeneity, rather than the same factor being proxied by different variables.

3.5 Discussion of the results on heterogeneous effects

The results indicate that the introduction of passenger airline routes that decrease the travel time between a bank's headquarters and some of its branches boosts small business lending by the bank in those treated branch-counties. Because decreases in travel times facilitate in-person interactions, one explanation of these results is that the new airline routes facilitate the flow of information that is most effectively transmitted through in-person discussions, for example, information crucial for offering loans to firms that lack hard information.

[15] One might be concerned that the introduction of new airline routes alters small business lending by reducing marketing costs. To address this concern, we differentiate between older and younger branches. Arguably, branches with a longer history have more established brand names in their local markets, so that the introduction of a new airline route will have less of an influence on lending to small businesses through a marketing-advertising channel. We calculate the age of a branch using the date of establishment from the Summary of Deposit. We then include the interaction between the treatment and the age of the branch when evaluating the impact of the introduction of a new airline route on small business lending. As shown in Online Appendix Table A3, the results are inconsistent with the marketing-advertising channel, as the interaction term enters insignificantly.

To provide empirical evidence on this in-person communication explanation, we test whether—and show that—the introduction of time-saving airline routes between headquarters and branches exerts an especially pronounced effect (1) on lending to firms that rely more on the transmission of soft information to obtain bank financing, for example, smaller firms, younger firms, and firms with a higher proportion of intangible assets, (2) among branch-counties with more bank competition, which is where easing the transmission of soft information is likely to have a bigger effect, and (3) among banks where managers at headquarters are more time constrained, so that easing air travel will tend to boost trips and in-person conversations.

Thus, these findings are consistent with the view that a decrease in headquarters-branch travel time facilitates in-person interactions that can boost small business lending both by (1) giving officials at headquarters access to local borrowers' soft information that is most efficiently communicated through in-person discussions and (2) enhancing the ability of managers at headquarters to monitor, mentor, guide, and train branch loan officers through face-to-face discussions. Indeed, this two-way flow of information might be inseparable and mutually reinforcing: when officials at headquarters and branches meet, headquarters may gain information about opaque borrowers, branch officials might gain training about the banks' best practices, and the reduction in informational asymmetries between headquarters and branches could enhance credit allocation to small businesses. This is fully consistent with the overall message that the introduction of new passenger airline routes facilitates the flow of information that is most efficiently transmitted through in-person discussions with positive effects on small business lending.

4. Conclusion

In this paper, we find that reducing communication costs within banking organizations boosts small business lending. We discover that the introduction of time-saving passenger airline routes between a bank's headquarters and its branches boosts small business lending in the branch-county. Consistent with the view that the new airline routes boost small-firm lending by facilitating the types of face-to-face communications that are essential for making loans to firms that lack hard information, we find that the new routes have bigger effects on more opaque firms that rely heavily on the communication of soft information to obtain bank loans, that is, smaller firms, younger firms, and firms without much tangible assets. Furthermore, we find that the results hold when examining new passenger airline routes, but not when analyzing new cargo flights. Thus, the relationship between time-saving flights and small business loans is tied to the transportation of people. Overall, our findings suggest that new airline routes that reduce headquarters-branch travel times make it easier for headquarters officials to communicate and collaborate with branch officers in-person, facilitating branch lending to small firms.

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Table 1. Summary statistics

	N	Mean	SD	p25	p50	p75
Loan amount, small business loans with loan amount at origination ≤$100k	91,690	6.820	1.793	5.829	6.921	7.971
Loan number, small business loans with loan amount at origination ≤$100k	91,690	3.500	1.538	2.398	3.466	4.522
loan amount, small business loans with loan amount at origination ($100k, $1 million]	91,690	7.681	2.634	6.909	8.146	9.280
loan number, small business loans with loan amount at origination ($100k, $1 million]	91,690	2.454	1.411	1.386	2.398	3.434
Treatment	91,690	0.024	0.153	0	0	0
ln(Deposit)	91,690	11.517	1.602	10.560	11.386	12.374
Bank size	90,880	17.924	1.993	16.358	18.029	19.199
Capital-asset ratio	90,880	0.103	0.026	0.085	0.099	0.118
ROA	90,608	0.010	0.009	0.008	0.011	0.014
%young business	91,478	0.227	0.079	0.169	0.207	0.266
%young business, emp-weighted	91,478	0.187	0.058	0.146	0.178	0.219
Asset tangibility	91,690	0.164	0.023	0.147	0.162	0.176
Market concentration	91,344	0.108	0.112	0.036	0.075	0.138
#branches	91,344	1,755	1,941	226	839	3,222
Total distance (miles)	91,344	1,395	2,079	47	319	1,798

This table reports summary statistics for the key variables used in all subsequent estimation. *Loan amount* is the natural logarithm of one plus the total dollar amount (in thousands) of small business loans originated by each bank in a given county. *Loan number* is the natural logarithm of one plus the total number of small businesses loans originated by each bank in a given county. *Treatment* is a dummy variable that equals one if a new airline route has been introduced that reduces the travel time between the branch county and the bank headquarters. *ln(Deposit)* is the log of the total deposits held by each bank's branches in a given county. *Bank size* is the log of the book value of assets. *Capital-asset ratio* is the total amount of capital divided by the book value of assets. *ROA* is the net income divided by total assets. *%young business*, *emp-weighted* equals the percentage of small businesses aged less than 3 years in a given county, where each business is weighted by the number of employees. *%young business* equals the percentage of small businesses aged less than 3 years in a given county, where each business is equally weighted. *Asset tangibility* is the weighted average of the tangible assets across small businesses in each county. *Market concentration* is the Herfindahl-Hirschman index (*HHI*) of banks' market share in each county. *#branches* equals the total number of branches owned by a bank. *Total distance* equals the total distance between each bank headquarters and its affiliated branches.

Table 2. The effect of introducing new airline routes on small business lending

A. Comparing treated and nontreated banks in the matched sample

	Summary statistics		Test of equality	
Variables	Treated	Control	*t*-stat	*p*-value
Matched bank characteristics				
#Branches	6.287	6.167	-1.216	.224
	(1.675)	(1.748)		
Bank size	17.735	17.630	-0.884	.377
	(1.968)	(2.158)		
Capital-asset ratio	0.102	0.101	-0.263	.793
	(0.023)	(0.027)		
ROA	0.012	0.012	-0.440	.660
	(0.008)	(0.007)		
Branch characteristics				
ln(Deposit)	11.924	11.874	-0.556	.578
	(1.439)	(1.700)		
Market share	0.090	0.094	0.555	.579
	(0.096)	(0.100)		
Other bank characteristics				
Bank efficiency	0.028	0.029	0.513	.608
	(0.007)	(0.007)		
Real estate loans	0.601	0.602	0.187	.852
	(0.145)	(0.152)		
Individual loans	0.105	0.106	0.237	.813
	(0.063)	(0.069)		
C&I loans	0.205	0.202	-0.580	.562
	(0.077)	(0.089)		
M&A activity	0.060	0.048	-1.300	.194
	(0.165)	(0.148)		
Liabilities	0.896	0.897	0.435	.664
	(0.025)	(0.027)		

B. Baseline results

	Small business loans with loan amount at origination ≤$100k				Small business loans with loan amount at origination (100k, $1 million]			
	Amount		Number		Amount		Number	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	0.230***	0.120***	0.273***	0.113***	-0.0533	0.0280	-0.0375	0.0263
	(0.000)	(0.001)	(0.000)	(0.000)	(0.393)	(0.624)	(0.300)	(0.270)
ln(Deposit)	0.246***	0.188***	0.192***	0.164***	0.252***	0.181***	0.188***	0.140***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Bank-by-county FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County-by-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank-by-year FE	No	Yes	No	Yes	No	Yes	No	Yes
Observations	91,690	91,690	91,690	91,690	91,690	91,690	91,690	91,690
R-squared	.892	.936	.903	.967	.881	.897	.941	.960
# of counties	2,322	2,322	2,322	2,322	2,322	2,322	2,322	2,322

Panel A reports the mean value and standard deviation (in parentheses) for matched bank characteristics (bank size, capital-asset ratio, the number of branches, and profitability), branch characteristics (*ln(Deposits)* and *Market share*), and other bank characteristics (bank efficiency, real estate loans, individual loans, commercial and industrial loans, M&A activities, and total liabilities) in the treated banks and the matched nontreated banks. Panel A also reports the test of equality between the two groups of banks for each variable. Panel B reports the effect of introducing new airline routes between a bank's headquarters and its branch-county on its small business lending in each county. In panel B, the dependent variables are *Loan amount* and *Loan number* of a size category. The key explanatory variable *Treatment* is a dummy variable that equals one if a new airline route has been introduced that reduces the travel time between each branch-county and its bank headquarters. For each bank-county, *ln(Deposit)* measures the log total deposits held by each bank's branches in a given county. *p*-values are reported in parentheses and calculated using standard errors clustered at the county level. * $p < .1$; ** $p < .05$; *** $p < .01$.

Table 3
Dynamic effects of introducing new airline routes on small business lending

	Small business loans with loan amount at origination ≤$100k							
	Full sample				Event window [-5, +5]			
	Amount		Number		Amount		Number	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment $_{-2}$		0.0122		-0.0135		0.00829		-0.0164
		(0.798)		(0.691)		(0.861)		(0.600)
Treatment $_{-1}$	0.0389	0.0420	0.0401	0.0367	0.0344	0.0369	0.0405	0.0356
	(0.376)	(0.401)	(0.246)	(0.354)	(0.401)	(0.433)	(0.176)	(0.301)
Treatment $_{0}$	0.0895**	0.0925**	0.0740**	0.0707*	0.0858**	0.0882*	0.0750**	0.0701**
	(0.034)	(0.050)	(0.023)	(0.056)	(0.035)	(0.056)	(0.012)	(0.039)
Treatment $_{+1}$	0.108**	0.111*	0.0754**	0.0722*	0.116**	0.119**	0.0929***	0.0881**
	(0.048)	(0.057)	(0.024)	(0.052)	(0.029)	(0.038)	(0.004)	(0.014)
Treatment $_{2+}$	0.171***	0.173***	0.181***	0.178***	0.159***	0.161***	0.175***	0.170***
	(0.001)	(0.001)	(0.000)	(0.000)	(0.002)	(0.003)	(0.000)	(0.000)
ln(Deposit)	0.188***	0.188***	0.164***	0.164***	0.183***	0.183***	0.159***	0.159***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Bank-by-county FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County-by-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank-by-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	91,690	91,690	91,690	91,690	90,525	90,525	90,525	90,525
R-squared	.936	.936	.967	.967	.937	.937	.968	.968
# of counties	2,322	2,322	2,322	2,322	2,322	2,322	2,322	2,322

This table reports the dynamic effects of introducing new airline routes between a bank's headquarters and its branch-county on its small business lending in each county. The dependent variables are the amount or number of loans originated to small businesses with loan amount at origination less than $100,000. The key explanatory variables, $Treatment_k$, (where k = -2, -1, 0, 1, or 2+) is a set of dummies indicating the number of years relative to the treatment year. $Treatment_{-1}$ ($Treatment_{-2}$) is an indicator corresponding to the 1 (2) year before the treatment. $Treatment_0$ is an indicator corresponding to the year of the treatment. $Treatment_1$ is an indicator corresponding to 1 year after the treatment, and $Treatment_{2+}$ is an indicator corresponding to 2 years and beyond after the treatment. P-values are reported in parentheses and calculated using standard errors clustered at the county level. * $p < .1$; ** $p < .05$; *** $p < .01$.

Table 4
The effect of introducing new airline routes on small business lending, placebo and robustness tests

	Small business loans with loan amount at origination ≤$100k			
	Cargo routes		Routes operated by Major carriers only	
	Amount	Number	Amount	Number
	(1)	(2)	(3)	(4)
Treatment	-0.00488	0.0154	0.106***	0.117***
	(.884)	(.519)	(.007)	(.000)
ln(Deposit)	0.169***	0.150***	0.180***	0.161***
	(.000)	(.000)	(.000)	(.000)
Bank-by-county FE	Yes	Yes	Yes	Yes
County-by-year FE	Yes	Yes	Yes	Yes
Bank-by-year FE	Yes	Yes	Yes	Yes
Observations	83,902	83,902	84,352	84,352
R-squared	.942	.971	.939	.969

This table reports the placebo and robustness test of the effect of introducing new airline routes between a bank's headquarters and its branch-county on its small business lending in each county. Columns 1 and 2 examine the introduction of new cargo routes, and Columns 3 and 4 use airline routes operated by major types of carriers only. The dependent variables are the amount or number of loans originated to small businesses with loan amount at origination less than $100,000. The key explanatory variable *Treatment* is a dummy variable that equals one if a new cargo route (or a route operated by major carrier groups) has been introduced that reduces the transportation time between each branch-county and its bank headquarters. *p*-values are reported in parentheses and calculated using standard errors clustered at the county level. * $p < .1$; ** $p < .05$; *** $p < .01$.

Table 5
Heterogeneous effects of introducing new airline routes on small business lending, by %young business

	Small business loans with loan amount at origination ≤$100k							
	Amount				Number			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment * %young business, emp-weighted	1.085**				1.001**			
	(.039)				(.014)			
Treatment * High %young business, emp-weighted		0.172**				0.128**		
		(.011)				(.011)		
Treatment * %young business			1.187***				0.942***	
			(.002)				(.002)	
Treatment * High %young business				0.192***				0.120**
				(.004)				(.018)
Treatment	-0.144	0.0273	-0.270**	0.0123	-0.130	0.0436	-0.196**	0.0451
	(.263)	(.536)	(0031)	(.782)	(0.178)	(.151)	(.042)	(.135)
ln(Deposit)	0.188***	0.188***	0.188***	0.188***	0.164***	0.164***	0.164***	0.164***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Bank-by-county FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County-by-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank-by-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	91,478	91,478	91,478	91,478	91,478	91,478	91,478	91,478
R-squared	.936	.936	.936	.936	.967	.967	.967	.967
# of counties	2,316	2,316	2,316	2,316	2,316	2,316	2,316	2,316

This table reports the effect of introducing new airline routes between a bank's headquarters and its branch-county on its small business lending in each county, while differentiating counties by the extent of information opacity among its small businesses (with loan amount at origination less than $100,000). *%young business, emp-weighted* equals the percentage of small businesses aged less than 3 years in a given county, where each business is weighted by the number of employees. *%young business* equals the percentage of small businesses aged less than 3 years in a given county, where each business is equally weighted. *High %young business* (*High %young business, emp-weighted*) is an indicator of one if *%young business* (*%young business, emp-weighted*) is above the sample median value, and zero otherwise. The dependent variables are the amount or number of loans originated to small businesses. *Treatment* is a dummy variable that equals one if a new airline route has been introduced that reduces the travel time between each branch-county and its bank headquarters. *p*-values are reported in parentheses and calculated using standard errors clustered at the county level. * $p < .1$; ** $p < .05$; *** $p < .01$.

Table 6
Heterogeneous effects of introducing new airline routes on small business lending, by *Asset tangibility*

	Small business loans with loan amount at origination ≤$100k			
	Amount		Number	
	(1)	(2)	(3)	(4)
Treatment * Asset tangibility	-2.704***		-2.171***	
	(.002)		(.001)	
Treatment * High asset tangibility		-0.110**		-0.0924***
		(.013)		(.003)
Treatment	0.552***	0.144***	0.459***	0.132***
	(.000)	(.000)	(.000)	(.000)
ln(Deposit)	0.188***	0.188***	0.164***	0.164***
	(.000)	(.000)	(.000)	(.000)
Bank-by-county FE	Yes	Yes	Yes	Yes
County-by-year FE	Yes	Yes	Yes	Yes
Bank-by-year FE	Yes	Yes	Yes	Yes
Observations	91,690	91,690	91,690	91,690
R-squared	.936	.936	.967	.967
# of counties	2,322	2,322	2,322	2,322

This table reports the effect of introducing new airline routes between a bank's headquarters and its branch-county on its small business lending in each county, while differentiating counties by the extent of tangible assets among its small businesses (with loan amount at origination less than $100,000). *Asset tangibility* is the weighted average of asset tangibility ratio across industries among small businesses in each county. *High asset tangibility* is an indicator of one if *Asset tangibility* is above the sample median value, and zero otherwise. The dependent variables are the amount or number of loans originated to small businesses. *Treatment* is a dummy variable that equals one if a new airline route has been introduced that reduces the travel time between each branch-county and its bank headquarters. *p*-values are reported in parentheses and calculated using standard errors clustered at the county level. * $p < .1$; ** $p < .05$; *** $p < .01$.

Table 7
Heterogeneous effects of introducing new airline routes on small business lending, by competition

	Small business loans with loan amount at origination ≤$100k			
	Amount		Number	
	(1)	(2)	(3)	(4)
Treatment * Market concentration	-1.082***		-0.674***	
	(.003)		(.004)	
Treatment * High market concentration		-0.176**		-0.117**
		(.026)		(.034)
Treatment	0.190***	0.170***	0.158***	0.148***
	(.000)	(.000)	(.000)	(.000)
ln(Deposit)	0.188***	0.188***	0.164***	0.164***
	(.000)	(.000)	(.000)	(.000)
Bank-by-county FE	Yes	Yes	Yes	Yes
County-by-year FE	Yes	Yes	Yes	Yes
Bank-by-year FE	Yes	Yes	Yes	Yes
Observations	91,344	91,344	91,344	91,344
R-squared	.936	.936	.967	.967
# of counties	2,321	2,321	2,321	2,321

This table reports the effect of introducing new airline routes between a bank's headquarters and its branch-county on its small business lending in each county, while differentiating counties by the intensity of banking market competition. The dependent variables are the amount or number of loans originated to small businesses (with loan amount at origination less than $100,000). *Market concentration* is the Herfindahl-Hirschman index (*HHI*) of banks' market share in each county. *High market concentration* is a dummy variable that equals one if *Market concentration* falls above the sample median value, and zero otherwise. *Treatment* is a dummy variable that equals one if a new airline route has been introduced that reduces the travel time between each branch-county and its bank headquarters. *p*-values are reported in parentheses and calculated using standard errors clustered at the county level. * $p < .1$; ** $p < .05$; *** $p < .01$.

Table 8
Heterogeneous effects of introducing new airline routes on small business lending, by headquarters' monitoring time constraints

	Small business loans with loan amount at origination ≤$100k							
	Amount				Number			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment * 1/#branches	-5.030*				-5.275***			
	(.070)				(.001)			
Treatment * 1/total distance		-0.327***				-0.241***		
		(.001)				(.000)		
Treatment * emp/#branches			-1.703*				-1.308***	
			(.097)				(.004)	
Treatment * emp/total distance				-0.0847***				-0.0590***
				(.004)				(.001)
Treatment * Bank size	-0.0609***	-0.0517**	-0.0737***	-0.0554***	-0.0427***	-0.0294**	-0.0461***	-0.0311**
	(.006)	(.011)	(.009)	(.009)	(.007)	(.026)	(.005)	(.018)
Treatment	1.245***	1.065***	1.500***	1.140***	0.920***	0.661***	0.990***	0.694***
	(.003)	(.005)	(.006)	(.004)	(.002)	(.007)	(.001)	(.004)
ln(Deposit)	0.187***	0.187***	0.187***	0.187***	0.164***	0.164***	0.164***	0.164***
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
Bank-by-county FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County-by-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank-by-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	87,044	87,044	84,395	84,395	87,044	87,044	84,395	84,395
R-squared	.937	.937	.937	.937	.967	.967	.968	.968
# of counties	2,311	2,311	2,307	2,307	2,311	2,311	2,307	2,307

This table reports the effect of introducing new airline routes between a bank's headquarters and its branch-county on its small business lending in each county, while differentiating banks by their headquarters' monitoring time constraints. The dependent variables are the amount or number of loans originated to small businesses (with loan amount at origination less than $100,000). We measure each bank headquarters' monitoring time constraints using four variables. *1/#branches* equals the inverse of the total number of branches affiliated with a bank. *1/total distance* equals the inverse of the total geographical distance (in thousand miles) between each bank headquarters and its affiliated branches. *emp/#branches* equals the log number of employees in the headquarters scaled by the total number of branches owned by a bank. *emp/total distance* equals the log number of employees scaled by the total distance between each bank headquarters and its affiliated branches. *Treatment* is a dummy variable that equals one if a new airline route has been introduced that reduces the travel time between each branch-county and its bank headquarters. *p*-values are reported in parentheses and calculated using standard errors clustered at the county level. * $p < .1$; ** $p < .05$; *** $p < .01$.

Table 9
Heterogeneous effects of introducing new airline routes on small business lending, all interaction terms in one model

	Small business loans with loan amount at origination ≤$100k	
	Amount	Number
	(1)	(2)
Treatment * %young business	0.854**	0.702**
	(.029)	(.028)
Treatment * Asset tangibility	-2.582***	-1.888***
	(.006)	(.003)
Treatment * Market concentration	-0.791**	-0.449**
	(.031)	(.041)
Treatment * Emp/total distance	-0.0886***	-0.0622***
	(.004)	(.002)
Treatment * Bank size	-0.0557***	-0.0312**
	(.010)	(.022)
Treatment	1.333***	0.798**
	(.007)	(.012)
ln(Deposit)	0.187***	0.164***
	(.000)	(.000)
Bank-by-county FE	Yes	Yes
County-by-year FE	Yes	Yes
Bank-by-year FE	Yes	Yes
Observations	84,359	84,359
R-squared	.937	.968
# of counties	2,302	2,302

This table reports the effect of introducing new airline routes between a bank's headquarters and its branch-county on its small business lending in each county, while differentiating banks by (a) %young firms, (b) asset tangibility, (c) competition, and (d) headquarters' monitoring time constraints. The dependent variables are the amount or number of loans originated to small businesses (with loan amount at origination less than $100,000). The key explanatory variable *Treatment* is a dummy variable that equals one if a new airline route has been introduced that reduces the travel time between each branch-county and its bank headquarters, and interaction terms. p-values are reported in parentheses and calculated using standard errors clustered at the county level. * $p < .1$; ** $p < .05$; *** $p < .01$.