Communication within Banking Organizations and Small Business Lending

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Abstract

We investigate how communication within banks affects small business lending. Using travel time between a bank's headquarters and its branches to proxy for the costs of communicating soft information, we exploit shocks to these travel times to evaluate the impact of within bank communication costs on small business loans. Consistent with Stein's (2002) model of the transmission of soft information across a bank's hierarchies, 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 the transmission of soft information, boosting small firm lending.

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1. Introduction

Small firms play a vital role in the U.S. economy—accounting for over 45% of private, non-farm gross domestic product (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 (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 (e.g., Petersen and Rajan, 1994, 1995; Berger and Udell, 1995; Stein, 2003; Agarwal et al., 2012). Consequently, lending to small firms relies more on "soft" information, such as subjective assessments of the character of the borrower and the economic prospects of the community, that are garnered through in-person interactions, so that soft information is more difficult to verify and communicate than hard information.

The second line of research stresses that the hierarchical structure of large banks interferes with the flow of soft information, impeding small-firm lending (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, which discourages the acquisition and impedes the processing of soft information and (b) the costs of communicating soft information within large banking organizations hamper lending that depends on soft information, i.e., lending to small firms. Though these insights on the hierarchical structure of banks have been very influential, we

[1] This work builds on the organization design literature (e.g., Grossman and Hart, 1986; Sah and Stiglitz; 1986; Hart and Moore, 1990; Radner, 1993; Bolton and Dewatripont, 1994; Hart, 1995; Garicano, 2000).

are unaware of previous empirical evidence that directly evaluates the impact of changes in the costs of transmitting soft information within banking organizations on small-firm lending.

We evaluate whether reducing 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 communicating soft information within a bank. The use of travel time to proxy for the costs of transmitting information relies on the assumption that in-person conversations with local loan officers, potential borrowers, and others in the community are more effective at transferring and processing soft information than other modes of communication. 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 all banks and all years. 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, i.e., 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 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 three categories based on the origination loan amount: (1) $100,000 or less, (2) more than $100,000 but less than or equal to $250,000, and (3) more than $250,000 but less than or equal to $1 million.

We start 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, where we separately examine the three categories of loan origination sizes. 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 and the bank's headquarters. To address concerns that county conditions shape both the opening of airline routes and small-business lending, we include county-year fixed effects throughout the analysis. We can include county-year effects because not all branches in a county have their headquarters located in the same place, which enables us to distinguish the treatment effects from local economic conditions. Furthermore, the findings are robust to controlling for the bank's overall size, capital-asset ratio, and profitability and the size of its branches in each county. We further control for bank-county fixed effects to condition out within-bank variations in small business lending across counties. Thus, our difference-in-differences analysis compares small business loans originated by two (groups of) otherwise similar branches in the same county, except that one branch is part of banking organization in which a new airline route has reduced the travel time to its headquarters, and the other branch is 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 9.6% and 19.5%, 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.

We next engage in three extensions to address concerns about the link between air travel times and the transmission of soft information within banking organizations. First, we examine the connection between the introduction of new airline routes that reduce travel time on large loans. To the extent that (a) loan size reflects the size of the borrowing business, (b) loans to large firms rely more on hard, easily transmitted information than loans to small 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 does not boost large loans. The results confirm this hypothesis: reducing headquarters-branch travel times does not induce an increase in the total dollar amount or number of large loans. The contrasting results between small and large loans is consistent with the view the introduction of new airline routes facilitates the flow of soft information between branches and headquarters, enhancing credit supply to small, informationally opaque firms.

Second, we examine the introduction of cargo flights that reduce travel times between a bank's headquarters and its branches. While the opening of such cargo routes might reflect greater economic connections between the headquarters and branch counties, cargo routes will not facilitate in-person communications. If our finding that a reduction in headquarters-branch travel time boosts small-firm lending by facilitating the transmission of soft information through in-person conversations, then the opening of cargo routes should have no effect on lending. That is what we find. Reducing cargo transport times between a bank's headquarters and its branches in a county does not alter lending by the bank in the county.

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 both confirm this prediction and show that reducing headquarters-branch travel time has an enduring effect on small-business lending.

To better identify the impact of improved communication of soft information 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 (e.g., Beck, 2013). 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 times that facilitate the flow of soft information will have a bigger effect on lending to young small firms. Similarly, research suggests that collateral mitigates moral hazard and adverse selection problems in loan contracting (e.g. Stiglitz and Weiss, 1981; Bester, 1985; Besanko and Thakor, 1987; Aghion and Bolton 1992; Hart, 1995; Berger, et al., 2011). 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. Consistent with both predictions, we find that reductions in travel times between a bank's headquarters and its branches resulting from new airlines routes have bigger effects on small-business lending when the branches are in counties with a higher proportion of (a) young firms and (b) firms with more intangible assets that are a less useful form of collateral. These findings suggest that the impact of new airline routes on small-business lending works through facilitating the transmission of soft information within banking organizations.

Second, we evaluate whether the credit-enhancing effects of new airline routes are more pronounced among branches facing more intense competition. If greater competition increases the incentives for bank branches to finance new, small business clients, improving the flow of soft information about such clients should have a bigger effect in more competitive markets. Our findings are consistent with this view. The economic size of the difference is large. The estimates indicate that introducing new airline routes between branches and headquarters leads to a 19.5% larger increase in the dollar value of small loans in counties with below the median levels of bank concentration, as measured by the Herfindahl index.

Finally, we differentiate banks by the degree to which a bank's headquarters is time constrained with respect to visiting its branches. Since traveling to branches is time-consuming and managers have limited time and attention (Berger and Udell 1995), new timesaving airline routes should have a larger impact on banks whose headquarters are more time-constrained. We construct two proxies for time-constraints. The first measures the number of branches and the second measures the total distance between a bank's headquarters and its branches. We find that the credit-enhancing effects of introducing new airline routes are more pronounced for headquarters with tighter time constraints.

Across different specifications, our work suggests that the costs of communicating soft information across the hierarchical layers of banking organizations shape small-business lending. In this way, our research contributes to research on how the organizational features of large banks influence their financing of small firms and confirms the predictions emerging from Stein's (2002) model of the operation of large banking organizations.

Our work relates to several lines of research. First, extensive research focuses on the effects of proximity on lending (e.g., Petersen and Rajan, 2002; Degryse and Ongena, 2005; Agarwal and Hauswald, 2010; 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 times 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 (e.g., Berger, et al., 1998, 2005, 2017; Sapienza, 2002). Second, focusing on information flow within organizations, Liberti and Mian (2009) show that soft information is more difficult to communicate across hierarchies within a large Argentine bank than hard information, but they do not examine small-firm lending. We evaluate the impact of shocks to the costs of transmitting information within a bank on its loans to small firms. Third, Canales and Nanda

(2012) examine a different feature of organizational design. They show that when local loan officers in Mexico have more autonomy, they lend more to small firms. In turn, we show that the costs of transmitting information within banking organizations influence the allocation of credit to small firms.

The remainder of this paper proceeds as follows. Section II describes the data and variables. Section III introduces the empirical methodology. Section IV discusses the empirical results. Section V concludes.

II. Data and Variable

II.A. CRA Small Business Loans and Bank Branch Data

We collect annual data on small business lending from the Community Reinvestment Act (CRA) dataset 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 non-farm, non-residential 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 three categories: those with origination amounts of (a) $100,000 or less, (b) more than $100,000 but less than or equal to $250,000, and (c) more than $250,000 but less than or equal to $1 million. In our study, we separately examine small business loans in these three categories. 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

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

originated by each bank in a given county. Our initial sample comprises the universe of bank-county-year data recorded in the CRA dataset 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, 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. Our final sample consists of 159,911 bank-county-year observations, including small business loans originated by 2067 banks in 2233 counties over the 2000 – 2016 period.

Table 1 provides summary statistics for the CRA loans, differentiating by the three loan-size categories. As shown, for each bank in a county, the average number of small business loans in the smallest loan-size category (i.e., \$100,000 or less) equals 30 (= $\exp^{3.43} - 1$), and the total dollar amount equals \$887,913 (= $\exp^{6.79} - 1$). The number and dollar amounts of loans in the other two loan-size categories, (\$100,000, \$250,000] and (\$250,000, \$1 million], equal 6 and \$535,464, and 5.8 and \$1,165,776, respectively.

II.B. 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.[3] The T-100 database contains monthly information reported by U.S. air carriers on non-stop 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 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.

II.C. 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.[4]

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

[4] There are four ways in which new airline routes reduce travel times between a bank's headquarters and a branch: (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

II.D. Bank-level Controls

Our analyses account for time-varying bank-county and bank-specific characteristics. We use data from the Summary of Deposits and the Reports of Condition and Income ("Call Reports"). For bank-specific traits, we use the following: *Bank size* is the log of the book value of total assets; *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 using the branch-level deposit data from SOD. 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 note that all of the results hold when omitting *Ln(Deposit)*.

III. Empirical Methodology

III.A. 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 acquiring information and collaborating with its branch managers about credit allocation decisions. Second, new timesaving airline routes between a bank's headquarters and its branches facilitate the flow of soft 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 soft 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 summarized in a "hard" numeric score. Rather, decisions about small business loans often involve discussions about the skills and creditworthiness of

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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; (4) Drive to Flight, where a new direct or indirect flight replaces driving as the optimal means of transportation.

the prospective borrower and deliberations about the overall context of the potential loan. To the extent that in-person discussions facilitate the communication and evaluation of such soft information, airline travel routes that reduce travel time will facilitate 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. If this new route is terminated in the future, *Treatment* switches back to zero.[5] Overall, 6,663 bank-counties in our sample experience a reduction in the travel time between headquarters and counties due to the introduction of new airline routes, representing 4.2% of the sample.

This identification strategy allows us to condition out all time-county influences. For example, one might be concerned that local economic shocks could shape both the introduction of new airline routes and local lending, leading to spurious findings. To address this concern, we control for county-year fixed effects, which is feasible 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.

Furthermore, we control for a full set of bank-county fixed effects to condition out any time-invariant factors across the counties in which each bank has branches. For example, some banks may lend persistently more in some counties. Adding bank-county fixed effects conditions out these differences to focus on within-bank variations in small business lending across different counties 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

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

to their headquarters, and the other set of branches does not. The first difference can be viewed as comparing small business lending in a branch-county before and after the introduction of a new airline route that reduces the travel time between the branch-county and the bank's headquarters. The second difference can be viewed as the difference between branches in a county that are treated with new airline routes and branches in the same county that are not treated with the opening of new airline routes that reduce branch-headquarters travel times (the control group). 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.

III.B. 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:

$$Small\ Business\ Lending_{bjt} = \beta \times Treatment_{bjt} + \boldsymbol{\gamma}'\boldsymbol{X}_{bj,t-1} + \alpha_{jt} + \alpha_{bj} + \varepsilon_{bjt}, \quad (1)$$

where b indexes banks, j indexes branch-counties (i.e., counties in which bank b has branches), and t indexes years. The dependent variable, $Small\ Buisness\ Lending_{bjt}$, denotes one of the CRA lending measures for bank b in county j during year t. That is, we separately examine the three loan-size categories: (1) \$100,000 or less, (2) greater than \$100,000 and less than or equal to \$250,000, and (3) greater than \$250,000 and less than or equal to \$1 million. The key variable of interest, $Treatment_{bjt}$, 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 and those years after t unless the route is terminated. α_{bj} and α_{jt} represent a full set of bank-by-county and county-by-year fixed effects, respectively. $\boldsymbol{X_{bj,t-1}}$ denotes a vector of control variables, namely the size of branches owned by bank *b* in county *j* at the beginning of year *t*, *Ln(Deposit)*, and the time-varying characteristics of bank *b* at the beginning of year *t*, namely *Bank size*, *Capital-asset ratio*, and *ROA*. 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 to account for any correlations of the error terms within each county.

IV. Results

IV.A. Main Results

As shown in Table 2, 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 smallest loan-size category (i.e., \$100,000 or less). We do not observe such effects for larger loans (i.e., loans in two larger loan-size categories \$100,000 – \$250,000 and \$250,000 – \$1 million). As shown in columns 1 – 4 for the smallest 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 categories in columns 5 – 8 and 9 – 12, *Treatment* enters insignificantly and with an economically small coefficient estimate in both the loan amount and loan number regressions.

The estimated economic magnitude of the impact of new timesaving 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 9.6% and 19.5%, respectively. Put differently, 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 branch-county (in the $100,000 or less loan-size category) by $85,239 (= 9.6%*887,913) per annum.

These findings are consistent with the view that the introduction of airline routes that reduce headquarters-branch travel times facilitates the communication of soft 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 smallest size category, and insignificant for loans in larger size categories. 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 smallest size category.

IV.B. Dynamics Effects

To assess the validity of the identification strategy, we examine whether there are pre-treatment tends in small-business lending. To do this, we employ the specification in Equation (1), while replacing the *Treatment* dummy with a set of dummies indicating the number of years relative to the treatment year, namely, $Treatment_{bjt}^{-1}$ $Treatment_{bjt}^{0}$, $Treatment_{bjt}^{1}$, and $Treatment_{bjt}^{2+}$. $Treatment_{bjt}^{k}$ (where k = -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, $Treatment_{bjt}^{-1}$ equals one in year *t-1* 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*; $Treatment_{bjt}^{0}$ 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 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 pre-treatment trends, and (b) the positive effects of the treatment on small-firm lending last beyond two years. Whether examining the amount or number of small-firm lending by bank *b* in its branch-county *j*, $Treatment^{-1}$ enters 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 two years.

IV.C. A Placebo Test—Cargo Flights—and Other Robustness Tests

We next conduct a placebo test and examine the introduction of cargo flights that reduce travel times between a bank's headquarters and its branches. While the opening of such cargo routes might reflect greater economic connections between the headquarters and branch-counties, cargo routes will not facilitate greater in-person communication between headquarters and branch officials. If our finding that a reduction in headquarters-branch travel time boosts small-firm lending reflects the easier transmission of soft information through in-person conversations, then the opening of cargo routes should have no effect on lending. We confirm this in Table 4. As shown, the treatment dummy enters insignificantly in all 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 several robustness checks to test the sensitivity of our results, and report those findings in Table 5. First, we were concerned that single-branch banks, which typically have their headquarters and branch office located in the same place, might distort our results. So, we re-did the baseline analyses while excluding single-branch banks from the sample. This restriction reduces the number of sample banks from 2067 to 1968, and the number of observations drops slightly from 159,911 to 159,301. As shown in columns 1 – 4, the results hold. Second, we were concerned that the results could be affected by observations well before or after the introduction of a timesaving airline route. Following Giroud (2013), therefore, we use an event window of [*t*-5, *t*+5], where *t* denotes the year of the treatment. In this robustness test, we set *Treatment* equal to one after a new airline route reduces the travel time between a branch-county and its headquarters, and zero otherwise. As shown in columns 5 – 8, the results are robust to this alternative definition of the treatment. Third, we were concerned that the results might be driven by very small airlines hired by the bank. Consequently, we repeat our baseline regressions while focusing on airline routes operated by carriers classified in T-100 as major carriers, national carriers, or regional carriers. As reported in columns 9 – 12, all of the results hold.

IV.D. Heterogeneity in the Treatment Effect

In this section, we conduct a series of triple-difference-in-differences tests to evaluate whether the treatment effect differs across different firms, counties, and banks in a theoretically predictable manner. 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 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 soft information across the hierarchies of banking organizations.

IV.D.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 timesaving 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.

While small firms are generally thought to rely more on soft information than large firms (e.g., Petersen and Rajan 1994, Berger, Bouwman, and Kim 2017), small firms differ with respect to opacity and collateral. 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; Bustamante and D'Acunto, 2018). 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 (e.g. Stiglitz and Weiss 1981; Bester 1985; Besanko and Thakor 1987; Aghion and Bolton 1992; Hart 1995; Berger, Frame, and Ioannidou 2011). 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 this, we construct proxies for opacity and collateral using the NETS dataset, which covers the universe of U.S. businesses. In particular, the NETS database provides time-series information on business name, address, industry classification, estimated sales, employees, and year in which a business was born, 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, *%Young business* equals the percentage of small businesses that are less than three years old, where each business is weighted by the number of employees. Under the assumption that there is less information available about younger firms relative to older firms, we use *%Young business* as a proxy for the degree of informational opacity among small firms in a county. We set *High %Young business* for a county equal to one if *%Young business* 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 the 1990s (before the start of our sample period), we calculate the median value of the ratio of tangible assets (property, plant and equipment) to total assets of all 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 weighted asset tangibility ratio among small business in a county-year, where each small business is weighted by its number of employees (*Asset tangibility*).[6] Thus, *Asset tangibility* varies with the industrial composition of small businesses in the county. Under the assumption that greater asset tangibility reduces the 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 intangibility* as a dummy variable that equals one if *Asset tangibility* is below the sample median value across counties, and zero otherwise.

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[6] More specifically,

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

Where c and t denote county and year. Asset tangibility $\text{ratio}_{i,t}$ is the industry asset tangibility ratio of firm i (calculated from Compustat and assigned by industry); $\#employees_{i,t}$ 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.

Thus, we employ the following regression specification:

$$Small\ Buisness\ Lending_{bjt} = \alpha_{jt} + \alpha_{bj} + \varphi_1 \times Treatment_{bjt} + \varphi_2 \times Treatment_{bjt} \times Information\ opacity_j + \boldsymbol{\gamma}'\boldsymbol{X}_{bj,t-1} + \varepsilon_{bjt}, \quad (2)$$

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 either equals *High %Young business* or *High Asset intangibility* in county *j*. For both *%Young business* and *Asset tangibility*, 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. 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 *High %Young business*, and (b) with small firms that have less collateralizable assets, *High Asset intangibility*.

The results from estimating Equation (2) confirm these two predictions. As shown in Tables 6 and 7, 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 6 columns 1 and 2, the coefficient on the interaction term, *Treatment * High %Young business*, is positive and statistically significant at least at the 5% level. The coefficient on the linear term, *Treatment*, is statistically insignificant and economically small. This suggests that the loan-enhancing effects of new airline routes are significant only 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 *High %Young business* branch-counties than in *Low %Young business* branch-counties. We find similar patterns when examining loan number as reported in columns 3 and 4. The results are similar for asset intangibility. As shown in Table 7, the interaction term, *Treatment * High Asset Intangibility*, enters positively and statistically significantly, suggesting that the loan-increasing effects are more pronounced for branch-counties where local small businesses have less tangible assets. 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 17.5% more in *High Asset intangibility* branch-counties relative to *Low Asset intangibility* branch-counties. The results in Tables 6 and 7 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.

IV.D.2. Market Competition

We next evaluate whether the treatment effect is larger in counties with more intense bank competition. To the extent that greater competition increases the incentives for bank branches to finance new, small business clients, we exploit differences in the competitiveness of banking markets to better identify the impact of reducing the costs of transmitting soft information on small-firm lending. In particular, we evaluate the hypothesis that improving the flow of soft information will have a bigger effect on small-firm lending in more competitive markets.

To conduct these analyses, we calculate the degree of banking market competition faced by banks at the branch-county level. In particular, *Market competition* equals one minus the Herfindahl-Hirschman Index (HHI) of small business lending in each county, where HHI equals the sum of squared market share of each bank's small business lending in a county. A higher value of *Market competition* indicates more intense competition. Consistent with previous analyses, we use the value of *Market competition* in a branch-county in the year prior to the treatment to mitigate the concern that the introduction of new airline routes alters the structure of the banking market. We then define *High Market competition* as a dummy variable that equals one if *Market competition* 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 *High Market competition*.

As reported in Table 8, the treatment effect is materially larger in counties with more intense bank competition. That is, the interaction term, *Treatment* × *High Market competition*, enters positively and statistically significantly at the 1% level across all specifications, indicating that the introduction of new airline routes increases the amount and number of small loans more in more competitive branch-counties. 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 19% more in *High Market competition* branch-counties than in other branch-counties. This corresponds to an increase of $168,703 (= 19%*887,913) in loan amount and 6 (= 19%*30) in loan number in the average branch-county.

The results in Table 8 support the view that a reduction in in-person communications costs between local branches and headquarters facilitates the transmission of soft information, boosting lending to small and opaque clients. The effects are stronger for branches facing more intense competition, which is consistent with the view that competition incentivizes banks to seek new growth opportunities, so that branches in more competitive environments react more strongly to reductions in the costs of communicating soft information.

IV.D.3. Monitoring Convenience

A defining characteristic of soft information is that it is most effectively transmitted through in-person interactions. In our context, this means 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 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.

We construct two rough proxies for the degree to which bank managers are time-constrained that build on Giroud (2013). The first measure, *#branches*, equals the log number of branches affiliated with each bank. The second measure, *Total distance*, equals the log total geographical distance (in miles) between a bank's headquarters and all of its affiliated branches.[7] We interpret higher values of *#branches* or *Total distance* as positively related to the time-constraints on conducting in-person visits to all of a bank's branches. We categorize banks as *High #branches* (*High Total distance*) banks if the value of *#branches* (*High Total distance*) is above the sample median value. Using Equation (2) regression specification, we interact the treatment dummy with one of the two measures of monitoring time constraints, i.e., *High #branches* or *High Total distance*.

As shown in Table 9, 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 and number of small business loans for branches whose headquarters have a larger number of affiliated branches. Columns 5 – 8 exhibit similar patterns when measuring headquarter time constraints by *Total distance*. Overall, the results in Table 9 are fully 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.

V. Conclusion

In this paper, we investigate how communication within banking organizations affects small business lending. We use travel time between a bank's headquarters and its branches as a proxy for the costs of communicating soft information within the bank. We exploit the introduction of airline routes that reduce the headquarters-branch travel time as an exogenous source of variation of the costs of communicating soft information across a bank's hierarchies.

We discover that the introduction of airline routes that reduce the travel time between a bank's headquarters and its branches boosts small business lending by the bank in the branch's county. Several extensions suggest that (1) these new airline routes stimulate

[7] To compute physical distance (in miles), we use the great-circle distance formula widely used in physics and navigation. Specifically, 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 approximate radius for the spherical Earth (3963 miles).

lending to small firms by facilitating the transmission of soft information within a bank, and (2) soft information is vital in allocating credit to small firms that tend to lack hard information. For example, the new airline routes trigger an increase in lending to small firms but not larger firms, which is consistent with the time-saving airlines routes lowering the costs of transmitting soft information and smaller firms relying on soft information more than larger firms. Second, the results hold when examining new passenger airline routes but not when analyzing new cargo flights that reduce the time it takes to transport cargo from headquarters to branches. Thus, the relationship between flights and small business loans is linked to the transportation of people, which is essential for communicating soft information. Third, the results are stronger among businesses, counties, and banks suggested by theory. In particular, we find that the introduction of airline routes that reduce the travel time between a bank's headquarters and its branches has a bigger effect in branch-counties when (a) local small businesses are more reliant on soft information and have less collateral, (b) the banking market is more competitive, and (c) the managers at the bank's headquarters are more time constrained. Overall, our findings suggest that the introduction of new airline routes that reduces the travel time between headquarters and branches makes it easier for headquarters to acquire soft information, facilitating branch lending to small, informationally-opaque firms.

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Table 1 Summary Statistics

This table contains 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* is the percentage of small businesses (with gross annual revenues below $1 million) aged less than three years in a given county. *Asset tangibility* is the weighted average of the tangible assets across small businesses in each county. *Market Concentration* equals the Herfindahl-Hirschman Index (HHI) of banks' small business lending in each county, which equals the sum of squared market share of each bank in a county. *Total distance* equals the log total distance between each bank headquarters and its affiliated branches. *#branches* equals the log of the total number of branches owned by a bank.

		N	Mean	SD	p25	p50	p75
Small Business Loans with Loan Amount at Origination <= $100k	Loan amount	159911	6.790	1.846	5.841	6.955	7.979
	Loan number	159911	3.433	1.540	2.398	3.434	4.477
Small Business Loans with Loan Amount at Origination (100k, $250k]	Loan amount	159911	6.285	2.686	5.638	6.909	7.971
	Loan number	159911	1.959	1.276	1.099	1.946	2.833
Small Business Loans with Loan Amount at Origination ($250k, $1million]	Loan amount	159911	7.062	3.164	6.581	7.903	9.031
	Loan number	159911	1.915	1.313	0.693	1.792	2.833
Treatment		159911	0.042	0.200	0	0	0
Ln(Deposit)		159911	11.486	1.583	10.542	11.388	12.397
Bank size		151497	16.649	2.508	14.516	16.358	18.665
Capital-asset ratio		151484	0.102	0.026	0.084	0.097	0.116
ROA		150874	0.010	0.009	0.008	0.011	0.014
%Young business		159268	0.193	0.060	0.151	0.185	0.224
Asset tangibility		159268	0.174	0.021	0.165	0.176	0.186
Market concentration		159313	0.128	0.067	0.088	0.110	0.146
#branches		159313	5.433	2.044	3.738	5.278	7.263
Total distance		159313	10.405	3.439	7.821	10.581	13.090

Table 2 The effect of introducing new airline routes on small business lending, by origination amount

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 loans into three categories by their origination amount, i.e., less than $100k, between $100k and $250k, and between $250k and $1 million. The dependent variables are *Loan amount* and *Loan number* for each of the three categories. 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. *Bank controls* include *Ln(Deposit)*, *Bank size*, *Capital-asset ratio*, and *ROA*. For each bank-county, *Ln(Deposit)* measures the log total deposits held by each bank's branches in a given county. *Bank size* is the log 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. All control variables are one-year-lagged. P-values are reported in parentheses and calculated using standard errors clustered at the county level. *, **, and *** represent significant level at the 10%, 5%, and 1%, respectively.

	Small Business Loans with Loan Amount at Origination <= $100k				Small Business Loans with Loan Amount at Origination (100k, $250k]				Small Business Loans with Loan Amount at Origination ($250k, $1million]			
	Amount		Number		Amount		Number		Amount		Number	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Treatment	0.101***	0.0959***	0.206***	0.195***	0.00159	0.0181	-0.00117	0.00827	-0.0320	-0.0328	-0.0269	-0.0209
	(0.004)	(0.008)	(0.000)	(0.000)	(0.974)	(0.711)	(0.950)	(0.666)	(0.553)	(0.555)	(0.166)	(0.298)
Ln(Deposit)	0.213***	0.193***	0.166***	0.157***	0.241***	0.216***	0.152***	0.139***	0.253***	0.236***	0.149***	0.137***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Bank size		0.220***		0.0738***		0.421***		0.237***		0.387***		0.238***
		(0.000)		(0.001)		(0.000)		(0.000)		(0.000)		(0.000)
Capital-asset ratio		0.399		1.281***		-2.986***		-1.036***		-1.272**		-0.909***
		(0.160)		(0.000)		(0.000)		(0.000)		(0.010)		(0.000)
ROA		1.179**		1.136***		7.325***		4.465***		9.962***		5.085***
		(0.020)		(0.004)		(0.000)		(0.000)		(0.000)		(0.000)
Bank-by-county FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County-by-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	159,911	150,260	159,911	150,260	159,911	150,260	159,911	150,260	159,911	150,260	159,911	150,260
R-squared	0.859	0.865	0.890	0.892	0.786	0.793	0.898	0.903	0.786	0.791	0.904	0.909
# of counties	2233	2206	2233	2206	2233	2206	2233	2206	2233	2206	2233	2206

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

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 *Loan amount* (columns 1 and 2), and *Loan number* (columns 3 and 4) of loans originated to small businesses with loan amount at origination less than \$100k. The key explanatory variables, *Treatment* ^{k}, (where k = -1, 0, 1, or 2+) is a set of dummies indicating the number of years relative to the treatment year. *Treatment* $^{-1}$ is an indicator corresponding to one year before the treatment. *Treatment* ^{0} is an indicator corresponding to the year of the treatment. *Treatment* ^{1} is an indicator corresponding to one year after the treatment, and *Treatment* $^{2+}$ is an indicator corresponding to two years and beyond after the treatment. *Bank controls* include *Ln(Deposit)*, *Bank size*, *Capital-asset ratio*, and *ROA*. All control variables are one-year-lagged. P-values are reported in parentheses and calculated using standard errors clustered at the county level. *, **, and *** represent significant level at the 10%, 5%, and 1%, respectively.

	Small Business Loans with Loan Amount at Origination <= \$100k			
	Loan amount		Loan number	
	(1)	(2)	(3)	(4)
Treatment $^{-1}$	-0.00213	0.0328	0.0161	0.0477
	(0.956)	(0.401)	(0.624)	(0.168)
Treatment ^{0}	0.0702*	0.103**	0.152***	0.170***
	(0.094)	(0.017)	(0.000)	(0.000)
Treatment ^{1}	0.0853*	0.0857*	0.199***	0.192***
	(0.058)	(0.069)	(0.000)	(0.000)
Treatment $^{2+}$	0.127**	0.113**	0.251***	0.234***
	(0.011)	(0.026)	(0.000)	(0.000)
Ln(Deposit)	0.213***	0.193***	0.166***	0.157***
	(0.000)	(0.000)	(0.000)	(0.000)
Bank size		0.220***		0.0739***
		(0.000)		(0.001)
Capital-asset ratio		0.397		1.278***
		(0.162)		(0.000)
ROA		1.180**		1.138***
		(0.020)		(0.004)
Bank controls	No	Yes	No	Yes
Bank-by-county FE	Yes	Yes	Yes	Yes
County-by-year FE	Yes	Yes	Yes	Yes
Observations	159,911	150,260	159,911	150,260
R-squared	0.859	0.865	0.890	0.892
# of counties	2233	2206	2233	2206

Table 4 The effect of introducing new cargo routes on small business lending, Placebo tests

This table reports the effect of introducing new cargo routes between a bank's headquarters and its branch-county on its small business lending in each county. The dependent variables are *Loan amount* (columns 1 and 2), and *Loan number* (columns 3 and 4) of loans originated to small businesses with loan amount at origination less than $100k. The key explanatory variable, *Treatment*, is a dummy variable that equals one if a new cargo route has been introduced that reduces the transportation time between each branch-county and its bank headquarters. *Bank controls* include *Ln(Deposit)*, *Bank size*, *Capital-asset ratio*, and *ROA*. All control variables are one-year-lagged. P-values are reported in parentheses and calculated using standard errors clustered at the county level. *, **, and *** represent significant level at the 10%, 5%, and 1%, respectively.

	Small Business Loans with Loan Amount at Origination <= $100k			
	Amount		Number	
	(1)	(2)	(3)	(4)
Treatment	-0.0111	0.00842	0.00382	0.0154
	(0.707)	(0.780)	(0.886)	(0.583)
Ln(Deposit)	0.212***	0.193***	0.166***	0.157***
	(0.000)	(0.000)	(0.000)	(0.000)
Bank size		0.220***		0.0737***
		(0.000)		(0.001)
Capital-asset ratio		0.413		1.309***
		(0.148)		(0.000)
ROA		1.159**		1.095***
		(0.022)		(0.006)
Bank-by-county FE	Yes	Yes	Yes	Yes
County-by-year FE	Yes	Yes	Yes	Yes
Observations	159,911	150,260	159,911	150,260
R-squared	0.859	0.865	0.890	0.891
# of counties	2233	2206	2233	2206

Table 5 The effect of introducing new airline routes on small business lending, Robustness tests

This table reports the robustness tests on 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 – 4 exclude single-branch banks, and focus only on those multi-branch banks. Columns 5 – 8 use an event window of [*t*-5, *t*+5], where *t* denotes the year of the treatment. Columns 9 – 12 use airline routes operated by major types of carriers only. The dependent variables are *Loan amount* and *Loan number* of loans originated to small businesses with loan amount at origination less than $100k. The key explanatory variable in columns 1 – 4 and 9 – 12, *Treatment,* is a dummy variable that equals one if a new airline route has been introduced and actively operating that reduces the travel time between each branch-county and its bank headquarters. The key explanatory variable in columns 5 – 8, *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. Bank controls include *Ln(Deposit)*, *Bank size*, *Capital-asset ratio*, and *ROA*. All control variables are one-year-lagged. P-values are reported in parentheses and calculated using standard errors clustered at the county level. *, **, and *** represent significant level at the 10%, 5%, and 1%, respectively.

	Small Business Loans with Loan Amount at Origination <= $100k											
	Multi-branch banks only				Event window [-5, +5]				Routes operated by Major carriers only			
	Loan amount		Loan number		Loan amount		Loan number		Loan amount		Loan number	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Treatment	0.101***	0.0962***	0.207***	0.195***	0.112***	0.107***	0.200***	0.189***	0.113***	0.103***	0.221***	0.206***
	(0.004)	(0.008)	(0.000)	(0.000)	(0.001)	(0.002)	(0.000)	(0.000)	(0.002)	(0.006)	(0.000)	(0.000)
Ln(Deposit)	0.213***	0.194***	0.166***	0.159***	0.208***	0.186***	0.164***	0.152***	0.213***	0.193***	0.166***	0.157***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Bank size		0.220***		0.0712***		0.242***		0.110***		0.220***		0.0736***
		(0.000)		(0.001)		(0.000)		(0.000)		(0.000)		(0.001)
Capital-asset ratio		0.378		1.276***		0.0144		0.860***		0.397		1.277***
		(0.183)		(0.000)		(0.962)		(0.001)		(0.162)		(0.000)
ROA		1.136**		1.142***		1.409***		1.238***		1.180**		1.138***
		(0.025)		(0.004)		(0.008)		(0.003)		(0.020)		(0.004)
Bank-by-county FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County-by-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	159,301	149,716	159,301	149,716	154,562	145,007	154,562	145,007	159,911	150,260	159,911	150,260
R-squared	0.859	0.865	0.890	0.891	0.863	0.869	0.896	0.898	0.859	0.865	0.890	0.892
# of counties	2232	2205	2232	2205	2223	2197	2223	2197	2233	2206	2233	2206

Table 6 Heterogeneous effects of introducing new airline routes on small business lending, by %young business

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 $100k). *%young business* equals the percentage of small businesses (with gross annual revenues below $1 million) aged less than three years in a given county, measured in the year prior to a treatment. *High %young business* is an indicator of one if *%young business* is above the sample median value, and zero otherwise. The dependent variables are *Loan amount* (columns 1 and 2), and *Loan number* (columns 3 and 4) of loans originated to small businesses. The key explanatory variable is *Treatment*, 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 its interaction with the indicator of *High %Young business*. *Bank controls* include *Ln(Deposit)*, *Bank size*, *Capital-asset ratio*, and *ROA*. All control variables are one-year-lagged. P-values are reported in parentheses and calculated using standard errors clustered at the county level. *, **, and *** represent significant level at the 10%, 5%, and 1%, respectively.

	Small Business Loans with Loan Amount at Origination <= $100k			
	Loan amount		Loan number	
	(1)	(2)	(3)	(4)
Treatment	-0.0367	-0.0301	0.0550	0.0523
	(0.521)	(0.616)	(0.249)	(0.309)
Treatment * High %Young business	0.188***	0.170**	0.212***	0.199***
	(0.008)	(0.021)	(0.001)	(0.002)
Ln(Deposit)	0.211***	0.192***	0.166***	0.157***
	(0.000)	(0.000)	(0.000)	(0.000)
Bank size		0.214***		0.0699***
		(0.000)		(0.002)
Capital-asset ratio		0.457		1.313***
		(0.108)		(0.000)
ROA		1.089**		1.070***
		(0.033)		(0.008)
Bank-by-county FE	Yes	Yes	Yes	Yes
County-by-year FE	Yes	Yes	Yes	Yes
Observations	159,208	149,584	159,208	149,584
R-squared	0.859	0.865	0.890	0.892
# of counties	2232	2205	2232	2205

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

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 $100k). *Asset tangibility* is the weighted average of tangible assets across industries among small businesses in each county. *High Asset intangibility* is an indicator of one if *Asset tangibility* is below the sample median value, and zero otherwise. The dependent variables are *Loan amount* (columns 1 and 2), and *Loan number* (columns 3 and 4) of loans originated to small businesses. The key explanatory variable is *Treatment*, 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 its interaction with the indicator of *High Asset intangibility*. *Bank controls* include *Ln(Deposit), Bank size, Capital-asset ratio,* and *ROA*. All control variables are one-year-lagged. P-values are reported in parentheses and calculated using standard errors clustered at the county level. *, **, and *** represent significant level at the 10%, 5%, and 1%, respectively.

	Small Business Loans with Loan Amount at Origination <= $100k			
	Loan amount		Loan number	
	(1)	(2)	(3)	(4)
Treatment	0.0148	0.0231	0.109**	0.109**
	(0.762)	(0.643)	(0.013)	(0.014)
Treatment * High Asset Intangibility	0.206***	0.175**	0.243***	0.217***
	(0.002)	(0.012)	(0.000)	(0.001)
Ln(Deposit)	0.211***	0.192***	0.166***	0.157***
	(0.000)	(0.000)	(0.000)	(0.000)
Bank size		0.214***		0.0702***
		(0.000)		(0.001)
Capital-asset ratio		0.457		1.313***
		(0.109)		(0.000)
ROA		1.073**		1.052***
		(0.036)		(0.009)
Bank-by-county FE	Yes	Yes	Yes	Yes
County-by-year FE	Yes	Yes	Yes	Yes
Observations	159,208	149,584	159,208	149,584
R-squared	0.859	0.865	0.890	0.892
# of counties	2232	2205	2232	2205

Table 8 Heterogeneous effects of introducing new airline routes on small business lending, by Competition

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 local market competition. The dependent variables are *Loan amount* (columns 1 and 2), and *Loan number* (columns 3 and 4) of loans originated to small businesses (with loan amount at origination less than $100k). *Market Concentration* is the Herfindahl-Hirschman Index (*HHI*) of banks' market share in each county, measured in the year prior to the treatment. *High Market Competition* is a dummy variable that equals one if *Market Concentration* falls below the sample median value, and zero otherwise. The key explanatory variable is *Treatment*, 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 its interaction with the indicator of *Low Competition*. *Bank controls* include *Ln(Deposit)*, *Bank size*, *Capital-asset ratio*, and *ROA*. All control variables are one-year-lagged. P-values are reported in parentheses and calculated using standard errors clustered at the county level. *, **, and *** represent significant level at the 10%, 5%, and 1%, respectively.

	Small Business Loans with Loan Amount at Origination <= $100k			
	Loan amount		Loan number	
	(1)	(2)	(3)	(4)
Treatment	0.0120	0.00799	0.122***	0.116**
	(0.814)	(0.876)	(0.008)	(0.013)
Treatment * High Market competition	0.192***	0.195***	0.191***	0.185***
	(0.007)	(0.006)	(0.004)	(0.006)
Ln(Deposit)	0.211***	0.192***	0.166***	0.157***
	(0.000)	(0.000)	(0.000)	(0.000)
Bank size		0.214***		0.0704***
		(0.000)		(0.001)
Capital-asset ratio		0.444		1.303***
		(0.119)		(0.000)
ROA		1.083**		1.059***
		(0.034)		(0.008)
Bank-by-county FE	Yes	Yes	Yes	Yes
County-by-year FE	Yes	Yes	Yes	Yes
Observations	159,253	149,629	159,253	149,629
R-squared	0.859	0.865	0.890	0.892
# of counties	2233	2206	2233	2206

Table 9 Heterogeneous effects of introducing new airline routes on small business lending, by headquarters' monitoring time constraints

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 *Loan amount* and *Loan number* of loans originated to small businesses (with loan amount at origination less than $100k). We measure each bank headquarters' monitoring time constraints using two variables. *#branches* equals the log of the total number of branches owned by a bank. *Total distance* equals the log total distance between each bank headquarters and its affiliated branches. Both are measured in the year prior to a treatment. *High #branches* (*High Total distance*) is a dummy variable that equals one if *#branches* (*Total distance*) is above the sample median value, and zero otherwise. The key explanatory variable is, *Treatment*, 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 its interaction with proxies for monitoring convenience. *Bank controls* include *Ln(Deposit)*, *Bank size*, *Capital-asset ratio*, and *ROA*. All control variables are one-year-lagged. P-values are reported in parentheses and calculated using standard errors clustered at the county level. *, **, and *** represent significant level at the 10%, 5%, and 1%, respectively.

	Small Business Loans with Loan Amount at Origination <= $100k							
	Loan amount		Loan number		Loan amount		Loan number	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	-0.0401	-0.0284	-0.0116	0.000884	0.00278	0.0124	0.0381	0.0521
	(0.447)	(0.609)	(0.755)	(0.982)	(0.955)	(0.809)	(0.276)	(0.165)
Treatment * High #branches	0.243***	0.208***	0.385***	0.336***				
	(0.000)	(0.003)	(0.000)	(0.000)				
Treatment * High Total distance					0.179***	0.148**	0.318***	0.265***
					(0.006)	(0.029)	(0.000)	(0.000)
Ln(Deposit)	0.212***	0.192***	0.166***	0.158***	0.212***	0.192***	0.166***	0.158***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Bank size		0.214***		0.0708***		0.214***		0.0712***
		(0.000)		(0.001)		(0.000)		(0.001)
Capital-asset ratio		0.458		1.319***		0.450		1.304***
		(0.108)		(0.000)		(0.115)		(0.000)
ROA		1.077**		1.051***		1.059**		1.017**
		(0.035)		(0.009)		(0.039)		(0.011)
Bank-by-county FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County-by-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	159,253	149,629	159,253	149,629	159,253	149,629	159,253	149,629
R-squared	0.859	0.865	0.890	0.892	0.859	0.865	0.890	0.892
# of counties	2233	2206	2233	2206	2233	2206	2233	2206