The value of in-person banking: evidence from U.S. small businesses

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ORIGINAL RESEARCH

The value of in-person banking: evidence from U.S. small businesses

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Abstract
We produce the first systematic study of the determinants and implications of in-person banking. Using survey data from the U.S., we show that firms which are informationally opaque or operate in rural areas are liable to contact their primary bank in-person. This tendency extends to older, less educated, and female business owners. We find that a relationship based on face-to-face communication, on average, lasts 17.88 months longer, spans a wider range of financial services, and is more likely to be exclusive. The associated loans mature 3.37 months later and bear interest rates which are 11 basis points lower. For good quality firms, in-person communication also relates to less discouraged borrowing. These results are robust to multiple approaches for endogeneity, including recursive bivariate probits, treatment effect models, and instrumental variables regressions. Overall, our findings offer empirical grounding to soft information theory and a note of caution to banks against suppressing channels of interpersonal communication.

Keywords Small business · Relationship banking · Soft information · In-person communication

JEL Classification G20 · G29 · G30

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1 Introduction

Modern technology has revolutionized communication with banking institutions, offering users a high degree of autonomy and geographic liberalization. Everyday examples include online banking (Hernández-Murillo et al. 2010), ATMs in off-site locations (Magnac 2017), and mobile banking (Baptista and Oliveira 2015). Yet, small businesses have never been at the forefront of these innovations. U.S. evidence from the Federal Reserve's Survey of Small Business Finances (SSBF) shows that only a fourth of the participant firms are willing to utilize some impersonal banking channel as a substitute for face-to-face communication with bank officers, raising two main questions. Why are certain firms more likely than others to visit the bank's premises? How do in-person interactions compare with impersonal banking in terms of contribution to financial intermediation efficiency?

Small businesses face considerable difficulty in raising capital from stock markets. Their limited organizational footprint heightens concerns over adverse selection and moral hazard, calling for a level of information production which is disproportionately high to the available resources (Ang 1991). A preferred alternative is bank credit, mainly because it enables the transcendence of informational asymmetries through the repeated borrower-lender interactions (Rosenfeld 2014; D'Aurizio et al. 2015; Beck et al. 2018). As per substantial theoretical work (Boot 2000; Stein 2002; Berger and Udell 2002, 2006; Liberti and Petersen 2019), a distinctive feature of relationship banking is that part of the lending decision is based on *soft information* which, unlike *hard information* (e.g. accounting records, credit scores, history of payments), is neither quantifiable nor in any other manner observable by the market. Importantly, "*with soft information, the context under which the information is collected and the collector of the information are part of the information. It is not possible to separate the two*" (Liberti and Petersen 2019, pp. 3–4).

To disentangle the relative importance of soft and hard information over the course of the bank-firm relationship is unrealistic. However, it is equally unrealistic to assume it constant, given an environment of increasing technological automation and the vast heterogeneity of small firms' characteristics. Relatedly, a shortcoming of the dominant empirical approach is the implicit assumption that a large number of interactions, as over a wide time frame or product range, suffice to enable the relationships effects (Petersen and Rajan 1994, 1995; Berger and Udell 1995; Hernández-Cánovas and Martínez-Solano 2010; Castelli et al. 2012; Karolyi 2018; Mi and Han 2020). By downplaying the importance of how the two parties actually communicate, this approach renders the soft information flow untraceable, obfuscating the sources of the added value of relationship banking. After all, if the main driver of the relationship is still hard data, relationship banking would not be fundamentally different from transactions-based banking technologies (e.g. financial statement or asset-based lending).

Motivated by this disconnect between theory and empirical investigation, we aim to capture more of the role of soft information on small business finance than is currently reflected in the literature. Towards this, the present paper offers, for the first time, a rigorous treatment of the determinants and implications of in-person banking by drawing evidence from a sample of 12,438 firms with less than 500 employees, spanning 9 U.S. regions, and 10 SIC divisions. Central to our approach is a previously overlooked SSBF question which sets the framework of a useful dichotomy: firms choosing to interact with

their primary financial institution[1] in-person vis-à-vis firms mainly relying on impersonal communication methods (internet, post, etc.). Underlying our approach is the recognition that soft information resides within in-person contact, whereas alternative communication channels tend to suppress it. Hence, although we have no way of filtering out hard information, by choosing to focus on the communication mode, we can ensure that every firm within our sample of interest also yields substantial soft information—a condition that prior studies are unable to provide.

Exploiting this property of our dataset, we first seek to enlighten our understanding of the factors invoking face-to-face interactions. Our expectation is that this need surfaces when the hardening of information is: (1) costlier, as when the firm is informationally opaque (Petersen and Rajan 1994, 1995; Schwert 2018); and (2) of limited reusability, as within rural banking markets (Cole et al. 2004; DeYoung et al. 2012). We ascribe much of the remaining variation to owners' characteristics which drive organisational choices to a larger extent in the context of small business (Raymond 1985). Subsequently, we seek to capture the implications. Ceteris paribus, a higher frequency of in-person communication levels the informational playing field more than is attainable via impersonal communication. In turn, a treatment of information asymmetries equates to a treatment of the common root of three major challenges in small business banking: high borrowing costs (Datta et al. 1999), tight lending horizons (Ortiz-Molina and Penas 2008), and discouraged borrowers' propensity to self-ration (Stiglitz and Weiss 1981; Kon and Storey 2003; Han et al. 2009). Accordingly, we hypothesize that credit becomes cheaper and more available for in-person communicators, consolidating their relationship with the bank.

Our findings are in line with the above conjectures. In our determinants tests, we obtain two primary results that are new to the literature. First, banking market conditions, after controlling for potential confounding factors, emerge as a strong driver of in-person contact, which supports the theoretical conjectures of Boot and Thakor (2000) and Hauswald and Marquez (2006) about the link between banking market structure and soft information transmission. Second, we document the incremental significance of small business owners' characteristics on determining the nature of the relationship with the main bank; the inclusion of proxies for demographics and educational attainment not only increases the explanatory power of our probit model but also reveals the high marginal effects of these variables. On this basis, we sketch the profile of owners more liable to steer their firms towards in-person banking as predominantly female, older and less educated individuals.

Next, we test for a causal effect of the communication dichotomy on a variety of banking outcomes. As we find, a preponderance of face-to-face interactions benefits both ends of the relationship: (1) the bank experiences increased loyalty from small firms; and (2) the latter gain access to cheaper credit for an extended period of time. These effects are of high economic significance. A relationship based on in-person communication, on average, lasts 17.88 months longer and is 24.46% more likely to be the firm's sole banking relationship; the associated loans mature 3.37 months later and bear interest rates which are 11 basis points lower. Furthermore, we complement the traditional proxies for relationship strength (e.g. Berger et al. 2005) with a new and comprehensive measure, *services concentration*, defined as the proportion of financial services a firm purchases from the primary bank relative to the total financial services it utilizes. As an outcome variable, this ratio confirms

[1] The relationship with the primary financial institution, being less transaction-oriented and conducive to private information acquisition, serves as a focal point for much of the empirical work in relationship banking (e.g. Berger and Udell 1998; Berger et al. 2001; Ono et al. 2014).

that in-person communication drives not only the credit decision but also the totality of a small firm's banking needs. Finally, we find that the likelihood of discouraged borrowing is smaller for in-person communicators, albeit with a caveat. Because the effect holds for borrowers of good quality only, this finding is indicative of a decrease in screening errors made by the bank rather than a window of opportunity for bad borrowers.

Endogeneity poses a valid concern in our empirical setting. This is mainly due to additional factors which might correlate with the communication decision but lie outside the SSBF scope. For example, Uchida et al. (2012) caution that a high loan officer turnover undermines the bank's ability to act as an information repository and Schoar (2012) finds that bonding (or lack thereof) with the bank's relationship manager explains a portion of the variability in borrowers' delinquency. To address this concern, we conduct a battery of tests, including recursive bivariate probit estimation and treatment effect models, which jointly create a framework for inferences least distorted by selection and / or omitted variables bias.

As a new and refined lens of soft information, our in-person contact approach speaks to a longstanding deficiency in literature: "*existing work falls short in that it has not measured the precise sources of the added value of relationship banking*" Boot (2000 p. 21). The most important contribution of this paper, therefore, is our ability to assign the observed effects to soft information and know that soft information, rather than any other element of the bank-firm relationship, represents the actual cause. In this vein, we provide empirical grounding to the theoretical predictions of the relationship banking literature (Stein 2002; Berger and Udell 2002, 2006; Liberti and Petersen 2019) and demonstrate the salience of soft information with evidence that is both objective and measurable.

Another contribution is to shed light on a hitherto unknown aspect of soft information production. The aim to capture the underlying mechanism which generates soft information is explicit in the studies of Uchida et al. (2012) and Hattori et al. (2015) which debate whether loan officers or the branch manager, respectively, play the leading role in the process; and implicit in studies analysing the characteristics which make a bank most receptive to this type of information (Petersen and Rajan 1995, 2002; Berger et al. 2005, 2014). While this research makes inroads on the bank's ability to capitalize on soft information, we focus on the transmitting end, showing how likely a small firm is to provide critical input in the first place.

Finally, we contribute to two evolving strands of research by offering: (1) a partial remedy, in the form of in-person contact, to the challenge of discouraged borrowing in small business banking (Kon and Storey 2003; Han et al. 2009; Chakravarty and Xiang 2013); and (2) generalizable insight which is of interest to research investigating the efficacy of communication methods in entrepreneurial settings (e.g. Casson and Giusta 2007; Sarapaivanich and Patterson 2015).

Boiled down, this paper is a note of caution for both banks and their small business customers. The former should provide adequate space for subtle, noncontractual information to emerge, or else their unremitting investment in technological automation[2] is likely to eliminate a key value driver. From the small business perspective, impersonal banking channels should be utilized on the understanding that they represent inferior substitutes for relationships built on face-to-face interactions.

[2] The International Data Corporation (IDC) estimates the aggregate investment of U.S. retail banks in information technology at $20.2 billion in 2017, forecasting an increase at an annual growth rate of about 10.5% into 2019.

The remainder of the paper is structured as follows. Section 2 reviews the relevant literature. We develop our hypotheses in Sect. 3 and present the dataset in Sect. 4. The empirical results are in Sect. 5. The paper concludes in Sect. 6.

2 Background literature

Sourcing capital has always been an arduousendeavour for small businesses and indeed a financier has important reasons to shy away from this economic sector. First, small firms typically lack the managerial skills and resources to produce accounting records or other data useful to investors (Ang 1991). Hence, whether the owner has a pipeline of positive NPV projects to invest in (adverse selection problem) or whether she stands willing to channel funds towards these as opposed to subpar investments (moral hazard problem) are warranted concerns. Second and related, future prospects might be linked to owners' characteristics which are either irreplaceable or, in part, unobservable (Bates 2005). Third, organizations of smaller size are vulnerable to environmental factors with a dramatically higher likelihood of failure (Hart and Oulton 1996).[3] Consequently, with the exception of high-growth firms which might be on private equity's radar, financing options for the vast majority of small businesses reduce to bank lending.

Banks are equipped to manage firm-specific uncertainty, the root cause of the above concerns, by their capacity to gather and integrate into the lending decision information generated from the interactions with clients. The greater the frequency of interactions, the more input becomes available and, hence, the greater the value added of the relationship banking (Petersen and Rajan 1994, 1995; Berger and Udell 1995; Hernández-Cánovas and Martínez-Solano 2010; Bharath et al. 2011; Castelli et al. 2012; Karolyi 2018; Tian and Han 2019). In spite of its vast volume, the relevant literature obtains evidence from a limited number of empirical proxies. Degryse and Van Cayseele (2000) and Iturralde et al. (2010) identify the three most popular in the following relationship dimensions: (1) *duration*, i.e. how long the firm has been the bank's client; (2) *breadth* i.e. the range of services that the bank-firm relationship involves; and (3) *concentration* i.e. the firm's total banking relationships.

Yet, unlike what such proxies imply, the informational output of relationship banking is not homogenous. This recognition becomes for first time explicit in Stein (2002) and Berger and Udell (2002) who address theoretically the interplay between organizational structure and financial intermediation, arriving at a common conclusion: flatter bank hierarchies represent better fits for small business lending. As described in Liberti and Petersen (2019), information comprises two distinct types, *hard* and *soft*. The former is quantifiable—think, for example, of financial ratios and credit scores (Udell 2008)—and, hence, transmissible by technology such as internet banking or other mediums (Petersen and Rajan 2002; Berger et al. 2005; Hertzberg et al. 2010). Conversely, soft information neither fits in numbers nor can it be evaluated separately from the physical setting which generates it; for instance, loan officers' conviction that a certain small business owner is liable to deliver because of character and innate aversion to delinquency. Table 1 Panel A summarizes the main characteristics of each information type; Table 1 Panel B illustrates how the

[3] Hart and Oulton come up with an interesting rule of thumb whereby the probability of corporate death declines by 5% for every doubling in size until the firm attains a critical threshold of 1000 employees.

Table 1 Information types and lending technologies

Panel A: Information types (Source: Berger and Udell 2002; Stein 2002; Liberti and Petersen 2019*)*

	Hard information	Soft information
Nature	Quantitative: typically recorded as numbers	Qualitative: communicated in-person
Content	Financial ratios, numbers, etc	Opinions, rumors, market commentary, etc
Collection medium	Could be collected, stored electronically, e.g. by computers, databases, etc. Personal and impersonal transmission is possible	Interpersonal communication is essential
Standardization	Standardized format	Flexible format
Third party	Easily transmitted to a third party	Costly to be transmitted to a third party

Panel B: Lending technologies (Source: Berger and Udell 2006; Udell 2008)

	Descriptor	Nature	Information	Characteristics
Relationship lending	Based on borrower-lender relationship	Relationship-based	Soft	Soft information transmission over time
Financial statement lending	Based on financial statements	Transaction-based	Hard	Should be audited by a CPA; suitable for transparent firms
Asset-based lending	Secured by receivables and inventories	Transaction-based	Hard	High monitoring costs
Factoring	Secured by receivables	Transaction-based	Hard	Lenders' ownership of the receivables
Leasing	Based on assets purchased by the lender	Transaction-based	Hard	Lenders' ownership of the assets
Credit scoring	For micro-businesses	Transaction-based	Hard	Small loan amount
Equipment/real estate—based lending	Collateral	Transaction-based	Hard	Based on collateral value

This table identifies soft information as a unique input of relationship banking and describes its main differences with hard information. Panel A summarizes the distinguishing characteristics of each information type. Panel B presents an overview of the available lending technologies

ability to process soft information differentiates relationship lending from all other lending technologies. The description provided explains why a clean measure of soft information is unattainable. Harder to explain is why, although soft information is exclusive to in-person communication, the empirical literature evaluates relationship effects without taking into account the mode of communication.

We note three studies attentive to the physical setting of the bank-firm interactions,[4] two of which using survey-based evidence from Japan: Uchida et al. (2012) and Hattori et al. (2015). The former study finds that in-person contact improves firms' perceptions about: (i) access to credit and (ii) the extent to which their idiosyncrasy and needs become apprehensible by banks. The latter study documents that face-to-face interactions with clients are among the key factors which enable branch managers to act as information repositories, more so than loan officers do. Taken together, this evidence, while subjective and of limited generalizability due to the special *(keiretsu)* character of the Japanese capital market, supports the capacity of in-person communication to reduce friction in the borrower-lender relationship.

From the Italian setting, Gabbi et al. (2020) document an inverse association between the cost of bank loans and the frequency of face-to-face meetings, especially when these are held at the firm's headquarters. Our research is similar to theirs in that we relate the communication mode to actual banking outcomes rather than firms' perceptions of them, yet different in a number of ways. First, we present the first evidence, to date, from the world's largest economy, the U.S, using the same data that the Federal Reserve collects via a nationwide census and relies upon to form policy. Second, the time period in Gabbi et al. spans from 2009 to 2011, consistent with the study's focus on gauging the effects of credit tightening in the aftermath of the subprime mortgage crisis. By contrast, the recurring nature of the SSBF survey enables us to capture a period extending longer than a decade, including the booming stock market of the 1990s, the subsequent crush, and the recovery in the early 2000s, a through-the-cycle approach which is not exclusively tied to a specific economic environment. Third, our interest lies in developing a symmetric understanding of both the determinants and implications of in-person banking. On the implications side, while borrowing cost is one of our outcome variables, so is an array of other important dimensions including duration, exclusivity, number of financial services purchased, loan maturity, and the phenomenon of discouraged borrowing. The next section delves into the causal mechanism explaining how the communication mode can exert a multifaceted influence on the relationship.

3 Hypothesis development

3.1 In-person banking: determinants

Our first set of hypotheses relates to small firms' incentives to contact their primary bank in-person. We associate these with a quantifiable component, which is the cost of hardening information, and a subjective component, which is the appeal of face-to-face interactions to small business owners.

[4] The lender-firm, as opposed to the bank-firm, method of communication features as a covariate in Petersen and Rajan (2002), where lenders indiscriminately include relationship-oriented primary lenders and transaction-oriented non-primary lenders.

Consider the production of hard information first. Within the small business taxonomy, certain firms are smaller than others, possessing even less resources to commit to it. From a complementary perspective, Lang and Lundholm (1993) view the pertinent cost as an increasing function of informational opacity. Berger et al. (2001) indicate multiple reasons (poor accounting records, lack of skill, a lower public profile) in support of an inverse association between firm size and opacity. Consequently, the smaller a firm, the greater its disadvantage at hardening information for external users, rendering interpersonal communication more probable. Formally, we state our first testable hypothesis as follows:

H.1. In small business, the likelihood of contacting the primary bank in-person is inversely associated with firm size.

When information becomes standardized and available to multiple users, transaction costs decrease (Liberti and Petersen 2019). Scale economies in information production, however, depend on the structure of the local banking market. A smaller number of banks as well as fewer hierarchical layers within the banks limit the scope for information reusability. Rural areas typify both conditions, making interpersonal communication a cost-effective alternative. The converse relates to metropolitan areas. From the perspective of the bank, this distinction has a profound effect on how hard and soft information reflect on customer evaluation. In particular, character is prioritized when the social and civic fabric of the local community can readily supply pertinent information. By contrast, in settings which naturally preclude this possibility, the adherence to formal financial criteria and the cookie cutter approach prevail (Cole et al. 2004; DeYoung et al. 2012). Thus, we formulate our next hypothesis as follows:

H.2. Small businesses are more likely to contact the primary bank in-person in rural areas.

Naturally, the mode of communication may also be subject to individual choices. Prior research affirms that, due to their size, small firms echo owners' human capital and antecedent traits. While plenty could find an application in our context, certain demographics—age, gender, and education—are of particular relevance. Accordingly, the in-person approach is compatible with small business owners who are:

Older Further to the recognition that these individuals have relied on low-tech processes for a longer period of time, aging begets deterioration in cognitive ability as well as in self-efficacy (i.e. the conviction that one is capable of performing a given task). Hence, tradition and simplicity in processes are preferred to innovation and complexity. For example, there is evidence of a negative association between R&D spending and CEO age (Barker III and Mueller 2002).
Female Similar to older individuals, females value simplicity. Venkatesh and Morris (2000), investigating workplace acceptance of information technology, find that the usage decision for female (male) employees depends on the perceived ease of use (functional capabilities). Moreover, females have a natural proclivity to form personal relationships, invoking network-oriented communication with less adherence to social hierarchies (Chai et al. 2011).
Less educated Literature widely uses education as a proxy for cognitive ability, implying a positive relation between academic attainment and the ability to manage complexity (e.g. Miller et al. 2015; King et al. 2016). In addition, Shoda et al. (1990) and Parker

and Fischoff (2005) provide the more subtle insight that a growing intellect holds back impulsive behaviour. Drawing parallels with small business banking, less educated owners appear less likely to embrace technology and prone to visit the bank more often than is necessary.

In sum, we derive the following hypotheses:

H.3.a. In small business, the likelihood of contacting the primary bank in-person is positively associated with the owner's age.

H.3.b. In small business, the likelihood of contacting the primary bank in-person increases when the owner is female.

H.3.c. In small business, the likelihood of contacting the primary bank in-person increases for less educated owners.

3.2 In-person banking: implications

Our remaining hypotheses relate to the impact of in-person banking, which we investigate at three distinct levels.

The first level comprises the breadth and depth of banking relationships which we collectively refer to as 'strength'. As noted earlier, soft information is imparted gradually over multiple (face-to-face) interactions, whereas its nature makes re-verification costly and uncertain (Stein 2002; Liberti and Petersen 2019). Thus, if a small business has already transmitted a large amount of soft information to a bank, it is likely that it will stay within the relationship, as switching to another bank implies the elimination of the value of the accumulated soft information. Formally, we develop the following hypothesis:

H.4. Small firms which contact the primary bank in-person build stronger banking relationships.

The second level of our investigation concerns contractual features of the relationship, i.e. loan interest rate and maturity. Due to acute information asymmetries, these typically entail disadvantageous terms for small businesses. On the cost side, loan rates increase in order to reflect the additional resources committed to monitoring and information acquisition. On the maturity side, a shorter loan duration enables lenders to assess borrower-specific information period by period, which allows for timely interventions should the default risk changes. In support of the conservative stance, Berger and Frame (2007) document a negative association between maturity and information opacity proxied by firm size, age, R&D, and depreciation. For borrowers, however, a shorter maturity begets inflexibility and capital rationing which might preclude investment opportunities with a longer life cycle (Ortiz-Molina and Penas 2008).

Because the in-person approach offers a more complete picture of the small business customer and, hence, a partial treatment to the information asymmetry problem, the contractual terms of the banking relationship should improve. Parallel to this framework, Liberti and Petersen (2019 p. 13) speculate that an auxiliary behavioral mechanism might come into play, whereby "*loan officers can also use their discretion to put a thumb on the scale and influence a loan decision for their own benefit*". Whether involving a fully

rational decision making or not, face-to-face communication is predicted to have an empirically equivalent effect on the cost and availability of credit, supporting our next set of hypotheses:

H.5.a. Small firms which contact the primary bank in-person have access to loans with lower interest rates.

H.5.b. Small firms which contact the primary bank in-person have access to loans with longer maturities.

At a third and final level, we look at the role of in-person banking in efficient capital allocation using the paradigm of discouraged borrowers, i.e. small firms which are in need of funds and yet refrain from submitting a loan application due to fear of rejection. As per the seminal study of Kon and Storey (2003), self-rationing incentives emanate from the double recognition that, under imperfect information, banks are vulnerable to screening errors and applications costs can be considerable. Kon and Storey also acknowledge a non-monetary cost component which relates to entrepreneurs' discomfort about sharing sensitive data about themselves and their enterprises with a third party.

We argue that imparting borrower-specific intelligence in a direct and interpersonal fashion may not only allay the need for expensive hard information but also make entrepreneurs less hesitant to assert their financing needs. Moreover, there should be an asymmetric effect between good and bad quality borrowers as only the former stand to benefit from the leveling of the informational playing field. Hence, we develop our hypotheses as follows:

H.6.a. In-person banking reduces the probability of discouragement for good quality borrowers.

H.6.b. In-person banking does not relate to the probability of discouragement for bad quality borrowers.

4 Data

All data comes from the Federal Reserve's 1993, 1998 and 2003 Survey of Small Business Finances (1993 NSSBF, 1998 SSBF and 2003 SSBF)[5] covering the period 1993–2005. Because of its credibility and thoroughness, the SSBF continues to be a leading data source for a host of recent studies in small business (e.g. Berger et al. 2011; Cassar et al. 2015; Cole and Sokolyk 2016; Dai et al. 2017; Durguner 2017; Han et al. 2017). The survey participants comprise 12,438 enterprises (4637 from 1993 NSSBF, 3561 from 1998 and 4240 SSBF) with less than 500 employees, and represent every U.S. region and industry with the exception of agricultural businesses, non-profit organizations, government entities and subsidiaries. In addition, the SSBF provides sampling weights so that the data correctly represents the population of small businesses, overcoming bias due to disproportionate sampling and nonresponse. Echoing the call in prior literature for research designs attentive to this adjustment, we fully incorporate the sampling weights in all analysis in the study.

[5] Detailed survey information is available at: https://www.federalreserve.gov/pubs/oss/oss3/nssbftoc.htm.

Table 2 Variable definitions and summary statistics

Variable	Definition	Pooled data		1993 NSSBF		1998 SSBF		2003 SSBF	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
In-person	= 1 if the communication with the primary financial institution is most frequently in-person; 0 otherwise	0.7671	0.4227	0.7686	0.4217	0.7933	0.4050	0.7437	0.4367
Firm and owner characteristics									
Female	= 1 if at least 50% of total ownership belongs to a female; 0 otherwise	0.2648	0.4412	0.2323	0.4223	0.2648	0.4413	0.3009	0.4587
Below degree	= 1 if the owner lacks a university (bachelor's) degree; 0 otherwise	0.4892	0.4999	0.4805	0.4997	0.4782	0.4999	0.5083	0.5000
Owner's age[§]	The owner's age in years	51.2949	11.2254	50.1684	11.3525	50.7153	11.2680	53.0378	10.8324
Employees[§]	Total number of employees	29.8134	58.5813	31.5562	61.9421	25.5268	54.6001	31.5076	57.8551
Corporation	= 1 if the firm is a corporation; 0 otherwise	0.5718	0.4949	0.6056	0.4888	0.4933	0.5000	0.5983	0.4903
Startup	= 1 if the firm age is no more than 2 years; 0 otherwise	0.0613	0.2400	0.0410	0.1983	0.0803	0.2718	0.0677	0.2512
Recent failure	= 1 if the firm or the owner declared bankruptcy in the last 7 years or if the firm had a delinquent record lasting longer than 60 days in the last 3 years; 0 otherwise	0.1864	0.3894	0.2137	0.4100	0.1623	0.3688	0.1767	0.3814
Discouragement	= 1 if the firm was in need of finance in the last 3 years but did not apply for finance due to fear of rejection; 0 otherwise	0.2353	0.4477	0.2418	0.4283	0.3573	0.4794	0.1571	0.3640
Business environment characteristics									
In-person environment	The proportion of firms using in-person communication as the main way of contacting their primary financial institution in the same region and business sector	0.7684	0.1151	0.7696	0.1127	0.7945	0.1059	0.7451	0.1201
Rural area	= 1 if the firm locates in a non-metropolitan statistical area; 0 if the firm locates in a metropolitan statistical area	0.2112	0.4082	0.2016	0.4013	0.2252	0.4178	0.2099	0.4073
Relationship characteristics									
Relationship length[#§]	The length of the relationship with the primary financial institution in months	112.7700	106.6947	106.2450	97.4020	94.9499	94.7532	134.7666	121.1491
Banking relations	Total number of banking relationships	2.5441	1.7952	2.4699	1.7507	2.3637	1.7322	2.7769	1.8698

Table 2 (continued)

Variable	Definition	Pooled data		1993 NSSBF		1998 SSBF		2003 SSBF	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Services concentration	=Number of financial services purchased from the primary financial institution/total financial services utilized by the firm	0.6756	0.2748	0.6701	0.2798	0.6931	0.2716	0.6671	0.2713
Commercial Bank	=1 if the primary financial institution is a commercial bank; 0 otherwise	0.8566	0.3505	0.8711	0.3351	0.8558	0.3513	0.8413	0.3654
Exclusivity	=1 if the firm maintains one banking relationship; 0 for multiple banking relationships	0.3105	0.4627	0.3376	0.4729	0.3538	0.4782	0.2446	0.4299
Loan characteristics									
Interest rate[†]	The interest rate (%) on the most recently approved loan	8.2229	2.5149	8.7865	2.0779	10.1962	2.0280	6.7782	2.3614
Prime rate[†]	The U.S. prime rate (%) at the time of the loan application	5.9456	1.4609	6.4676	0.6954	8.1893	0.3366	4.3147	0.5022
Loan amount[§†]	The loan application amount in $US	748,239	3,242,985	887,367	3,895,793	328,115	1,105,050	715,390	2,728,318
Maturity[§†]	The maturity in months of the most recently approved loan	45.4702	59.0269	40.1042	53.8319	56.8688	67.5882	47.7664	60.9292

This table presents definitions and descriptive statistics (mean and standard deviation) for all variables used in the paper. The sample includes 12,438 U.S. firms which participated in the 1993, 1998 and 2003 Federal Reserve's Survey of Small Business Finances (1993 NSSBF, 1998 SSBF and 2003 SSBF)

[§]We use the logarithmic form of Ln(1 + *variable*) in the regression analysis

[#]We winsorize the variable at the 1st and 99th percentiles

[†]For approved loans with a reported interest rate in excess of the prime rate

Table 3 Mean comparisons and univariate analysis

Panel A: Mean proportion of in-person banking by variable (X) category

Variable (X)	Pooled data			1993 NSSBF			1998 SSBF			2003 SSBF		
	X = 0	X = 1	Diff	X = 0	X = 1	Diff	X = 0	X = 1	Diff	X = 0	X = 1	Diff
Rural area	0.7499 (0.0102)	0.8316 (0.0198)	−0.0817***	0.7491 (0.0166)	0.8461 (0.0330)	−0.0969***	0.7787 (0.0193)	0.8437 (0.0359)	−0.0649	0.7273 (0.0174))	0.8055 (0.0339)	−0.0783**
Corporation	0.8145 (0.0141)	0.7334 (0.0119)	0.0811***	0.8247 (0.0239)	0.7335 (0.0189)	0.0911***	0.8307 (0.0244)	0.7578 (0.0240)	0.0730**	0.7864 (0.0249)	0.7164 (0.0199)	0.0699**
Startup	0.7658 (0.0094)	0.7879 (0.0371)	−0.0221	0.7684 (0.0151)	0.7742 (0.0733)	−0.0058	0.7902 (0.0177)	0.8308 (0.0613)	−0.0407	0.7428 (0.0161)	0.7555 (0.0604)	−0.0126
Recent failure	0.7693 (0.0101)	0.7578 (0.0209)	0.0115	0.7704 (0.0167)	0.7621 (0.0320)	0.0084	0.7994 (0.0186)	0.7623 (0.0420)	0.0371	0.7426 (0.0171)	0.7487 (0.0367)	−0.0061
Commercial bank	0.6054 (0.0240)	0.7948 (0.0098)	−0.1894***	0.5538 (0.0413)	0.8020 (0.0159)	−0.2481***	0.6305 (0.0448)	0.8207 (0.0184)	−0.1902***	0.6322 (0.0390)	0.7647 (0.0169)	−0.1325***
Female	0.7524 (0.0106)	0.8133 (0.0178)	−0.0609***	0.7515 (0.0169)	0.8251 (0.0307)	−0.0736**	0.7813 (0.0197)	0.8279 (0.0335)	−0.0466	0.7278 (0.0186)	0.7922 (0.0288)	−0.0644*
Below degree	0.7243 (0.0127)	0.8148 (0.0130)	−0.0904***	0.7272 (0.0205)	0.8140 (0.0215)	−0.0868***	0.7540 (0.0234)	0.8373 (0.0248)	−0.0834**	0.6940 (0.0223)	0.7979 (0.0219)	−0.1039***

Panel B: Mean comparison of variable (Y) by communication mode

Variable (Y)	Pooled data			1993 NSSBF			1998 SSBF			2003 SSBF		
	In-person = 0	In-person = 1	Diff	In-person = 0	In-person = 1	Diff	In-person = 0	In-person = 1	Diff	In-person = 0	In-person = 1	Diff
Employees	53.5534 (1.5509)	23.4593 (0.4945)	30.0941***	57.1516 (2.6386)	24.5628 (0.8655)	32.5888***	50.3809 (3.1157)	19.9733 (0.8232)	30.4076***	52.1232 (2.4145)	25.3058 (0.8552)	26.8175***
Owner's age	51.3963 (0.2060)	51.2025 (0.1171)	0.1938	50.2196 (0.3446)	50.0283 (0.1919)	0.1913	51.2269 (0.3987)	50.5402 (0.2176)	0.6867	52.7092 (0.3313)	53.1412 (0.1965)	−0.4320
Relationship length#	97.8710 (1.8863)	117.2929 (1.1203)	−19.4220***	88.4487 (2.7393)	111.6017 (1.6784)	−23.1531***	80.0406 (3.0891)	98.8350 (1.8593)	−18.7944***	119.1722 (3.5852)	140.1417 (2.1994)	−20.9695***

Table 3 (continued)

Panel B: Mean comparison of variable (Y) by communication mode

Variable (Y)	Pooled data			1993 NSSBF			1998 SSBF			2003 SSBF		
	In-person = 0	In-person = 1	Diff	In-person = 0	In-person = 1	Diff	In-person = 0	In-person = 1	Diff	In-person = 0	In-person = 1	Diff
Banking relations	3.1665 (0.0391)	2.4344 (0.0169)	0.7321***	3.0960 (0.0618)	2.3451 (0.0271)	0.7509***	3.1092 (0.0768)	2.2617 (0.0298)	0.8476***	3.2747 (0.0666)	2.6890 (0.0304)	0.5857***
Exclusivity	0.1966 (0.0188)	0.3450 (0.0104)	−0.1484***	0.1930 (0.0308)	0.3811 (0.0169)	−0.1882***	0.2101 (0.0374)	0.3912 (0.0191)	−0.1812***	0.1911 (0.0307)	0.2631 (0.0180)	−0.0719***
Services concentration	0.5953 (0.0052)	0.6999 (0.0028)	−0.1045***	0.5788 (0.0084)	0.6973 (0.0047)	−0.1185***	0.5923 (0.0103)	0.7193 (0.0051)	−0.1270***	0.6136 (0.0086)	0.6855 (0.0048)	−0.0719***
Interest rate†	8.2868 (0.0842)	8.1975 (0.0516)	0.0893	8.8358 (0.0946)	8.7664 (0.0650)	0.0694	10.2616 (0.1200)	10.1732 (0.1143)	0.0884	6.7918 (0.1508)	6.7727 (0.0706)	0.0474
Maturity†	40.7793 (1.7874)	47.3361 (1.2843)	−6.5569***	38.5023 (2.5189)	40.7582 (1.6681)	−2.2559	50.4380 (5.0380)	59.1308 (3.8449)	−8.6928	40.2515 (2.9183)	50.7972 (2.1737)	−10.5457***
Discouragement	0.2058 (0.0242)	0.2455 (0.0149)	−0.0397	0.2347 (0.0373)	0.2441 (0.0206)	−0.0094	0.2828 (0.0540)	0.3674 (0.0306)	−0.0846	0.1317 (0.0396)	0.1622 (0.0256)	−0.0305

This table univariately compares the mean values of key variables used in subsequent regressions. Panel A compares the proportion of in-person banking for each category of the independent (X) binary variables. Panel B displays the mean comparisons for the dependent (Y) variables based on the communication mode (i.e. in-person vs. impersonal banking). The standard errors are reported in parentheses. All variables are defined in Table 2

#We winsorize the variable at the 1th and 99th percentiles

†For all approved loans with a reported interest rate in excess of the prime rate

Table 2 defines the SSBF variables used in the study and presents key descriptive statistics. Confirming the preponderance of face-to-face interactions in small business finance, 77% of firms are shown to interact with their primary financial institution most frequently in-person. Table 3 Panel A identifies the proportion of in-person banking for each category of the independent binary variables (X) in the subsequent regressions and univariately compares the differences in means. As shown, in-person banking is most prevalent in rural areas, when the primary financial institution is a commercial bank, and for owners who are female or lack a university degree. Table 3 Panel B compares the mean value of each dependent variable (Y) based on the communication dichotomy. The two groups systematically differ along most dimensions. In-person communicators, on average, give rise to longer and more exclusive banking relationships, while they also purchase more services from the primary financial institution. Their loyalty appears to result in longer maturity loans.

5 Empirical analysis

We investigate our hypotheses in a multivariate regression framework using several estimation methods. Central to all subsequent analyses is the variable *in-person*, set equal to 1 if the firm communicates most frequently with the primary financial institution face-to-face, and zero otherwise. The variable coding is based on the respective SSBF question requesting the identification of the main (most frequent) banking method from a list of options that includes in-person and a variety of impersonal ways (e.g. by post, internet, ATM, etc.). Unfortunately, the survey requires no further clarification on the number of bank-firm interactions and it therefore becomes impossible to distinguish firms using in-person communication exclusively from firms which utilize a blend of in-person and impersonal ways of banking. Even so, our research design can ensure not only that soft information transmission has taken place but also that the method which makes this possible, i.e. face-to face interaction, has been used more times than any other mode of communication with the primary financial institution. In line with our study's dual aim, this section proceeds in two steps. First, we use *in-person* as the dependent variable to gauge the key determinants. Subsequently, we place it on the right-hand side to assess its explanatory power over the banking outcomes of relationship strength (i.e. length of relationship, exclusivity, services concentration), loan contracting (i.e. interest rate, maturity of loans), and discouraged borrowing. To fully exploit our dataset, we run each regression using pooled data from 1993 NSSBF, 1998 SSBF, and 2003 SSBF as in Berger et al. (2011), and supplement these results with separate evidence drawn from each individual round as in Cole and Sokolyk (2016).

5.1 The decision to contact the primary bank in-person

Starting from the determinants, our ex ante expectation was that the propensity for face-to-face communication increases with a smaller firm size (H1) and a rural banking market (H2). As a joint test to these hypotheses, we specify the following probit model:

$$\begin{aligned} Probit\left(in\text{-}person_i\right) = {} & \beta_0 + \beta_1 employees_i + \beta_2 rural\ area_i + \beta_3 corporation_i \\ & + \beta_4 startup_i + \beta_5 recent\ failure_i + \beta_6 commercial\ bank_i \\ & + fixed\ effects + \varepsilon_i \end{aligned} \quad (1)$$

where *in-person* is regressed on our firm size proxy *employees* (Wagner 2001; Angelini and Generale 2008) and *rural area* which is coded as 1 if a firm locates in a non-metropolitan statistical area, and 0 otherwise (Berger et al. 2011). Firm-specific variables as well as other factors might exert a confounding influence on selecting the interaction mode with the main bank; we account for this possibility by the inclusion of covariates regularly appearing in studies utilizing the SSBF dataset (see, e.g., Cole and Sokolyk 2016; Dai et al. 2017). Specifically, we employ the dichotomous variables of: *corporation* indicating whether or not the firm has attained a corporate form; *startup* flagging an age of 2 years or younger; *recent failure* evidenced either by a bankruptcy within the last 7 years or firm's delinquent behavior within the last 3 years; and *commercial bank* indicating whether the firm's primary financial provider is a commercial bank or another institution. The fixed effects control for the SIC division and geographic region. Finally, ε denotes the error term.

As predicted by H3, owners' personal attributes are more likely to be discernible in the organizational choices of small businesses, claiming an incremental effect on our dependent variable. To test this hypothesis, we complement the set of covariates in Model 1 with variables capturing the principal owner's gender, education (i.e. whether the owner's highest educational qualification is below the level of a bachelor's degree) and age. Accordingly, we specify Model 2 as follows:

$$\begin{aligned} Probit\left(in\text{-}person_i\right) = {} & \beta_0 + \beta_1 employees_i + \beta_2 rural\ area_i + \beta_3 corporation_i \\ & + \beta_4 startup_i + \beta_5 recent\ failure_i + \beta_6 commercial\ bank_i + \beta_7 female_i \\ & + \beta_8 below\ degree_i + \beta_9 owner's\ age_i + fixed\ effects + \varepsilon_i. \end{aligned} \quad (2)$$

Table 4 presents the results from both models. Model 1 confirms that *employees* and *rural area* reflect on the decision about the physical setting of the communication with the primary bank. The coefficients on the two variables, both statistically significant at the 1% level, display the theoretically predicted signs: smaller firms as well as those operating in rural areas favor the in-person approach supporting H1 and H2, respectively. Based on the pooled data, the marginal effect of *employees* is -6.33%, becoming − 1.06% at the variable's median value (5 employees) estimated as -6.33% / (1 + 5). Simply put, the likelihood of contacting the primary financial institution in-person decreases by 1.06% for every additional employee. The marginal effect of *rural area* indicates that, in a non-metropolitan statistical area, the in-person method is 7.13% more likely than in a metropolitan area. The highest marginal effect, 23.57%, relates to *commercial bank,* which suggests that firms tend to contact banks in-person more often than other financial providers, alluding to the formers' ability to process soft information (Berger and Udell 2006; Liberti and Petersen 2019). Overall, the model yields a pseudo-R^2 of 8.89%.

If in-person banking simply mirrors the personal choice of small business owners, the above results should disappear with the inclusion of the additional variables in Model 2. This, however, is not the case, as all Model 1 findings remain qualitatively similar. Net of firm and banking market characteristics, the evidence in support of owners' fixed effects leads to three main insights. First, owners lacking a bachelor's degree are 6.77% more likely to visit the bank premises compared with university graduates. Second, the resulting coefficient on *female* is significantly positive, indicating that female owners are more likely

Table 4 Determinants of in-person banking

	Pooled data		1993 NSSBF		1998 SSBF		2003 SSBF	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Employees	−0.2180***	−0.2090***	−0.1619***	−0.1543***	−0.1299***	−0.1227***	−0.1280***	−0.1284***
	(0.0107)	(0.0111)	(0.0279)	(0.0284)	(0.0308)	(0.0312)	(0.0302)	(0.0313)
Rural area	0.2617***	0.2314***	0.2104***	0.1893**	0.2488***	0.2254***	0.2789***	0.2330***
	(0.0345)	(0.0349)	(0.0769)	(0.0774)	(0.0793)	(0.0796)	(0.0790)	(0.081)
Corporation	0.0001	0.0230	−0.0778	−0.0570	−0.0906	−0.0721	0.0822	0.0972
	(0.0315)	(0.0318)	(0.0659)	(0.0663)	(0.0691)	(0.0693)	(0.0696)	(0.0698)
Startup	−0.0207	0.0216	0.0149	0.0425	0.0680	0.0837	0.0052	0.1121
	(0.0571)	(0.0584)	(0.1359)	(0.1396)	(0.1146)	(0.1158)	(0.1018)	(0.1069)
Recent failure	0.0166	0.0106	−0.0557	−0.0655	−0.0392	−0.0383	−0.0159	−0.0127
	(0.0336)	(0.0339)	(0.0696)	(0.0701)	(0.0790)	(0.0791)	(0.0804)	(0.0806)
Commercial bank	0.6966***	0.7075***	0.848***	0.8535***	0.6906***	0.7024***	0.4907***	0.5044***
	(0.0357)	(0.0359)	(0.0756)	(0.0762)	(0.0788)	(0.0791)	(0.0746)	(0.0750)
Female		0.0913***		0.0307		0.0718		−0.0197
		(0.0318)		(0.0690)		(0.0738)		(0.0659)
Below degree		0.2357***		0.1908***		0.1652**		0.2625***
		(0.0278)		(0.0600)		(0.0653)		(0.0647)
Owner's age		0.1841***		0.0292		0.1047		0.5655***
		(0.0636)		(0.1350)		(0.1378)		(0.1464)
Year dummies	Yes	Yes	N/A	N/A	N/A	N/A	N/A	N/A
U.S. region dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SIC division dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.5305***	−0.3279	0.6492***	0.4394	0.4451***	−0.0755	0.2585**	−2.0726***
	(0.0541)	(0.2505)	(0.1237)	(0.5272)	(0.1021)	(0.5426)	(0.1029)	(0.5887)
Observations	12,108	12,049	4539	4539	3422	3422	4146	4087
Pseudo R^2	0.0889	0.0949	0.0868	0.0906	0.0652	0.0687	0.0515	0.0638

This table analyzes the factors underlying the firm's decision to communicate with the primary financial provider in-person. Models 1 to 8 present the results from probit regressions where the dependent variable is *in-person*. To correct for nonresponse and disproportionate sampling, the SSBF-provided weights are applied in each survey round. The robust standard errors feature in parentheses. All variables are defined in Table 2 and have variance inflation factors (VIFs) substantially lower than 5. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively

to choose in-person banking with a marginal effect of 2.58%. Third, the older the individual, the stronger the appeal of in-person banking, which highlights the element of simplicity embedded into face-to-face interactions. The marginal effect is 5.30%, implying that the probability of in-person banking increases by 0.10%[6] for each additional year of *owner's age*. Jointly, the variables on the owners' characteristics increase the pseudo-R^2 to 9.49% and sketch a profile for in-person communicators which is compatible with hypotheses H.3.a, H.3.b, and H.3.c. The clear implication of this evidence is that impersonal technologies or other banking automations, if applied indiscriminately, might alienate an important clientele which would otherwise generate considerable soft information.

Extending the above analysis to each individual SSBF round, in Models 3 to 8, the results are largely consistent with the pooled data, particularly with regard to rural area, firm size and owners' education.

5.2 The impact of contacting the primary bank in-person

Because the capacity to inform decisions with soft information remains exclusive to in-person contact, the latter should also entail unique implications. To gauge these, we specify equations which draw the dependent variable from a large pool of banking outcomes but use a common set of independent variables: *in-person* and the covariates which previously entered into the determinants regressions.

In estimating the equations, we are confronted with the problem of endogeneity which might arise from factors potentially correlating with the communication decision but remaining unobservable to the SSBF survey. Indicatively, Uchida et al. (2012) caution that loan officers' turnover undermines the bank's ability to act as an information repository and Schoar (2012) finds that bonding (or lack thereof) with bank relationship managers explains some of the variation in borrowers' delinquency. To allay such concerns, all findings are subjected to a rigorous treatment for endogeneity which is described in detail in the appendices to this paper.

5.2.1 In-person contact and strength of banking relationship

To test H4, we introduce four relationship strength proxies and consider the following associations.

5.2.1.1 In-person contact and length of banking relationship Our first proxy, *relationship length*, is measured by the number of months that the firm has been receiving services from the primary bank, following Berger et al. (2005). We examine the interplay of this variable with the communication dichotomy by means of ordinary least squares (OLS) and treatment effects (TE) estimation ("Appendix 1"). In the latter procedure, our instrument in the 1st-stage regressions is the variable *in-person environment,* defined as the proportion of firms using face-to-face communication with their primary bank within the firm's geographic region and business sector. Intuitively, a preference for this communication mode from the firm's peer group strongly correlates with *in-person*; at the same time, the exogenous nature of the former variable precludes it from exerting a bearing on the dependent variable in the 2nd-stage, which is a necessary condition for satisfying the exclusion restriction.

[6] $0.10\% = \frac{5.30\%}{1+51.00}$, where 51.00 is the median value of *owner's age*.

The results are reported in Table 5. The positive and statistically significant (at 1% level) coefficient on *in-person* affirms that face-to-face interactions enhance the longevity of the relationship. In assessing the magnitude of the effect, we note the statistical significance of both the inverse Mills ratio (IMR) and the χ^2 statistic derived from the Wald test. This evidence substantiates the endogeneity concerns, attaching increased validity to the TE method over OLS (Greene 2012; Guo and Fraser 2015). Based on the endogeneity-corrected estimates (Model 5), the average length of the primary banking relationship for in-person communicators is 76.43 months, decreasing to 58.55 months for the rest of the sample firms. The difference, about one-fifth, is substantial and aligned with the notion that once a significant amount of soft information has been transmitted, the firm typically commits to the incumbent banking relationship due to the high verification cost of this type of information for a third party (Bertomeu and Marinovic 2016). Models 6 to 8 provide separate evidence from each individual round in support of this conclusion.

5.2.1.2 In-person contact and exclusivity of banking relationship A host of studies identify the firm's network of banking relationships by counting the number of different financial services providers (e.g. Han et al. 2008; Iturralde et al. 2010; Castelli et al. 2012; Yu et al. 2015). Other studies focus on whether or not the firm maintains a sole (exclusive) banking relationship (Elsas 2005; Berger et al. 2008). For our purpose, we exploit both proxies to apply two methodologically disparate procedures: (1) a regression with treatment effects (TE) on the count variable of *banking relations*; and (2) a recursive bivariate probit (RBP) on the dummy variable of *exclusivity* ("Appendix 2"). Both methods instrument *in-person* with the exogenous variable *in-person environment,* which does not directly relate to *banking relations* or *exclusivity*.

The results are reported in Tables 6 and 7. As displayed in Table 6, the TE model suggests that firms contacting the primary bank in-person maintain fewer banking ties than firms applying impersonal communication. The RBP model, in Table 7, concludes similarly by showing that—based on the pooled data (Model 5)—in-person communicators are 24.46% more likely to develop an exclusive banking relationship. The regression results from the individual survey rounds (Models 6–8) are consistent with the inferences supported by the pooled data. Overall, the results in Tables 6 and 7 complement the findings on the duration of the bank-firm collaboration, highlighting loyalty as an additional dimension of the relationship.

5.2.1.3 In-person contact and financial services concentration As a fourth and final proxy for banking relationship strength, we introduce a novel measure to the literature, *services concentration*, defined as the ratio of services provided by the primary financial institution to the total number of services the firm utilizes. The descriptive statistics revealed that sample firms, on average, purchase 68% of financial services from the primary institution. We investigate the extent to which this behavior depends on the contacting approach by means of OLS and TE estimation, as in previous analysis.

Table 8 reports the regression results. The positive and statistically significant ($p = 1\%$) coefficient on *in-person* is common in both estimation models. Significant are also the inverse Mills ratio and the χ^2 statistic in the Wald test, underlining, once again, the need to control for endogeneity. This association, surviving in the individual survey rounds,

Table 5 In-person banking and relationship length

	OLS				TE							
	Pooled data	1993 NSSBF	1998 SSBF	2003 SSBF	Pooled data		1993 NSSBF		1998 SSBF		2003 SSBF	
	Model 1	Model 2	Model 3	Model 4	Model 5		Model 6		Model 7		Model 8	
					2nd Stage	1st Stage	2nd Stage	1st Stage	2nd Stage	1st Stage	2nd Stage	1st Stage
In-person	0.2683*** (0.0231)	0.4283*** (0.0602)	0.2268*** (0.0537)	0.2341*** (0.0457)	0.4886*** (0.0985)		0.9072*** (0.2050)		1.1368*** (0.2355)		1.4571*** (0.0945)	
In-person environment						2.3179*** (0.1650)		2.5619*** (0.4667)		2.8683*** (0.5016)		2.0676*** (0.4549)
Rural area	0.2259*** (0.0220)	0.2281*** (0.0473)	0.1617*** (0.0503)	0.1439*** (0.0471)	0.2088*** (0.0230)	0.0832** (0.0366)	0.2065*** (0.0482)	0.0160 (0.0861)	0.1162** (0.0548)	0.0740 (0.0879)	0.0611 (0.0522)	0.0981 (0.0777)
Commercial bank	0.2898*** (0.0290)	0.6366*** (0.0723)	0.0878 (0.0539)	0.1529*** (0.0467)	0.2420*** (0.0334)	0.7105*** (0.0354)	0.5157*** (0.0920)	0.8799*** (0.0761)	−0.0941 (0.0741)	0.6912*** (0.0790)	−0.0315 (0.0568)	0.4839*** (0.0739)
Other firm-aspect characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	3.7346*** (0.0477)	3.2059*** (0.1161)	3.8298*** (0.0731)	4.2861*** (0.0679)	3.5881*** (0.0778)	−1.5059*** (0.1471)	2.8675*** (0.1810)	−1.6857*** (0.4309)	3.2168*** (0.1777)	−1.9352*** (0.4338)	3.5387*** (0.0956)	−6.0768*** (0.5726)
Inverse Mills ratio					−0.1342** (0.0593)		−0.2685** (0.1170)		−0.5711*** (0.1617)		−0.9042*** (0.0833)	
Observations	12,108	4539	3422	4147	12,108		4539		3422		4147	
Wald test of endogeneity (χ^2)					5.61**		5.27**		12.48***		117.92***	

This table presents the regression results of the *relationship length* (dependent variable) with the primary financial institution on *in-person* and other control variables. Models 1 to 4 report the OLS estimates and Models 5 to 8 feature the treatment effects (TE) regression estimates. All regressions include SIC division and U.S. region dummies, Models 1 and 5 also include year fixed effects. To correct for nonresponse and disproportionate sampling, the SSBF-provided weights are applied in each survey round. The robust standard errors are displayed in parentheses. All variables are defined in Table 2 and have variance inflation factors (VIFs) substantially lower than 5. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively

Table 6 In-person banking and number of banking relationships

	OLS				TE							
	Pooled data	1993 NSSBF	1998 SSBF	2003 SSBF	Pooled data		1993 NSSBF		1998 SSBF		2003 SSBF	
	Model 1	Model 2	Model 3	Model 4	Model 5		Model 6		Model 7		**Model 8**	
					2nd Stage	1st Stage	2nd Stage	1st Stage	2nd Stage	1st Stage	2nd Stage	1st Stage
In-person	−0.2961*** (0.0388)	−0.2779*** (0.0664)	−0.3339*** (0.071)	−0.1933*** (0.0708)	−0.5045*** (0.1077)		−1.6341*** (0.3359)		−1.6617*** (0.2117)		−1.3097*** (0.3986)	
In-person environment						2.7917*** (0.1974)		2.4905*** (0.4228)		2.0365*** (0.4659)		2.6482*** (0.5645)
Rural area	0.0394 (0.0355)	−0.083 (0.0541)	0.1005 (0.063)	−0.032 (0.0639)	0.0551 (0.036)	0.0408 (0.0378)	−0.022 (0.06)	0.0253 (0.0787)	0.1669** (0.0666)	0.1863** (0.0819)	0.0414 (0.0720)	0.1679** (0.0806)
Commercial bank	−0.3999*** (0.0411)	−0.4273*** (0.0711)	−0.2389*** (0.0736)	−0.3845*** (0.0737)	−0.3552*** (0.0471)	0.7011*** (0.0354)	−0.0848 (0.1218)	0.8381*** (0.0761)	0.0266 (0.0947)	0.2267*** (0.0855)	−0.2148*** (0.1037)	0.2070*** (0.0800)
Other firm-aspect characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	1.6477*** (0.0656)	1.7135*** (0.114)	1.704*** (0.1063)	1.6029*** (0.1018)	1.7875*** (0.0961)	−1.5371*** (0.3555)	2.6718*** (0.2485)	−1.6704*** (0.3862)	2.5984*** (0.1671)	−1.9761*** (0.4091)	2.2887*** (0.2552)	−2.4191*** (0.4423)
Inverse Mills ratio					0.0779** (0.0392)		0.6375*** (0.1920)		0.6836*** (0.1370)		0.5276*** (0.2051)	
Observations	12,108	4539	3422	4147	12,108		4539		3422		4147	
Wald test of endogeneity (χ^2)					4.25**		5.27**		24.88***		6.62**	

This table analyzes the effect of *in-person* and other control variables on the number of banking relationships. *Banking relations* is the dependent variable in the OLS and treatment effects (TE) estimation presented in Models 1 to 4 and Models 5 to 8, respectively. All regressions include SIC division and U.S. region dummies, Models 1 and 5 also include year fixed effects. To correct for nonresponse and disproportionate sampling, the SSBF-provided weights are applied in each survey round. The robust standard errors are shown in parentheses. All variables are defined in Table 2 and have variance inflation factors (VIFs) substantially lower than 5. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively

Table 7 In-person banking and exclusivity of banking relationships

	Probit				RBP							
	Pooled Data	1993 NSSBF	1998 SSBF	2003 SSBF	Pooled data		1993 NSSBF		1998 SSBF		2003 SSBF	
	Model 1	Model 2	Model 3	Model 4	Model 5		Model 6		Model 7		Model 8	
					2nd Stage	1st Stage	2nd Stage	1st Stage	2nd Stage	1st Stage	2nd Stage	1st Stage
In-person	0.2364*** (0.0337)	0.3362*** (0.0713)	0.2831*** (0.0770)	0.1304* (0.0719)	0.8012*** (0.1805)		1.2330*** (0.3284)		1.1284*** (0.3149)		1.3035*** (0.1392)	
In-person environment						2.2343*** (0.1817)		2.3250*** (0.4794)		2.7937*** (0.5567)		2.8441*** (0.5592)
Rural area	0.0213 (0.0311)	0.1069* (0.0605)	−0.0500 (0.0666)	0.0706 (0.0680)	−0.0165 (0.0331)	0.0808 (0.0367)	0.0589 (0.0627)	0.0526 (0.0834)	−0.0915 (0.0670)	0.0617 (0.0848)	−0.0242 (0.0647)	0.1041 (0.0820)
Commercial bank	0.3227*** (0.0374)	0.4680*** (0.0774)	0.1599** (0.0763)	0.2757*** (0.0741)	0.1894*** (0.0594)	0.7038*** (0.0358)	0.1992 (0.1458)	0.8385*** (0.0751)	−0.0262 (0.1076)	0.6905*** (0.0786)	0.0214 (0.0805)	0.5029*** (0.0749)
Other firm-aspect characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
U.S. region dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SIC division dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	N/A	N/A	N/A	Yes	Yes	N/A	N/A	N/A	N/A	N/A	N/A
Constant	0.0487 (0.0589)	−0.1983*** (0.1257)	0.0539 (0.1101)	0.2408*** (0.1128)	−0.3440*** (0.1371)	−2.6039*** (0.2982)	−0.8289*** (0.2552)	−2.0753*** (0.6502)	−0.5197** (0.2455)	−2.8221*** (0.6687)	−0.5101*** (0.1446)	−4.3819*** (0.6837)

Table 7 (continued)

	Probit				RBP							
	Pooled Data	1993 NSSBF	1998 SSBF	2003 SSBF	Pooled data		1993 NSSBF		1998 SSBF		2003 SSBF	
	Model 1	Model 2	Model 3	Model 4	Model 5		Model 6		Model 7		Model 8	
					2nd Stage	1st Stage	2nd Stage	1st Stage	2nd Stage	1st Stage	2nd Stage	1st Stage
Fisher's z transformed correlation					−0.3516** (0.1239)		−0.5936** (0.2883)		−0.5473** (0.2572)		−0.9471*** (0.2035)	
Observations	12,106	4539	3422	4144	12,106		4539		3422		4145	
Wald test of endogeneity (χ^2)					8.05***		4.24**		4.53**		21.66***	

This table analyzes the effect of *in-person* and other control variables on the exclusivity of banking relationships. *Exclusivity* is the dependent variable in the probit and recursive bivariate probit (RBP) estimation presented in Models 1 to 4 and Models 5 to 8, respectively. To correct for nonresponse and disproportionate sampling, the SSBF-provided weights are applied in each survey round. The robust standard errors are shown in parentheses. All variables are defined in Table 2 and have variance inflation factors (VIFs) substantially lower than 5. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively

Table 8 In-person banking and services concentration

	OLS				TE							
	Pooled data	1993 NSSBF	1998 SSBF	2003 SSBF	Pooled data		1993 NSSBF		1998 SSBF		2003 SSBF	
	Model 1	Model 2	Model 3	Model 4	Model 5		Model 6		Model 7		Model 8	
					2nd Stage	1st Stage	2nd Stage	1st Stage	2nd Stage	1st Stage	2nd Stage	1st Stage
In-person	0.0549*** (0.0059)	0.0811*** (0.0142)	0.0821*** (0.0154)	0.0568*** (0.0151)	0.1488*** (0.0541)		0.4363*** (0.1164)		0.4775*** (0.0315)		0.2753*** (0.1039)	
In-person environment						2.7155*** (0.2183)		1.6944*** (0.5086)		1.1253*** (0.3909)		2.2585*** (0.8107)
Rural area	0.0053 (0.0058)	0.0330*** (0.0122)	−0.0091 (0.0132)	0.0187 (0.0139)	−0.0015 (0.0071)	0.0515 (0.0376)	0.0156 (0.0145)	0.0514 (0.0771)	−0.0286* (0.0147)	0.2304*** (0.0750)	0.0044 (0.0155)	0.1509* (0.0821)
Commercial bank	0.1256*** (0.0073)	0.1334*** (0.0156)	0.0818*** (0.0163)	0.1161*** (0.0162)	0.1049*** (0.0136)	0.6991*** (0.0352)	0.0457 (0.0336)	0.8151*** (0.0797)	0.0024 (0.0191)	0.1576* (0.0884)	0.0829*** (0.0225)	0.4891*** (0.0747)
Other firm-aspect characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
U.S. region dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SIC division dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	N/A	N/A	N/A	Yes	Yes	N/A	N/A	N/A	N/A	N/A	N/A
Constant	0.6530*** (0.0115)	0.6463*** (0.0250)	0.6924*** (0.0234)	0.6979*** (0.0233)	0.5821*** (0.0390)	−1.6147*** (0.3674)	0.3909*** (0.0849)	−1.6475*** (0.6120)	0.4257*** (0.0329)	−1.2799*** (0.3512)	0.5637*** (0.0680)	−1.3682** (0.6172)

Table 8 (continued)

	OLS				TE							
	Pooled data	1993 NSSBF	1998 SSBF	2003 SSBF	Pooled data		1993 NSSBF		1998 SSBF		2003 SSBF	
	Model 1	Model 2	Model 3	Model 4	Model 5		Model 6		Model 7		Model 8	
					2nd Stage	1st Stage	2nd Stage	1st Stage	2nd Stage	1st Stage	2nd Stage	1st Stage
Inverse Mills ratio					−0.2132** (0.1025)		−0.8265*** (0.3102)		−1.0955*** (0.0944)		−0.4815** (0.2377)	
Observations	12,098	4539	3416	4143	12,098		4539		3416		4143	
Wald test of endogeneity (χ^2)					4.05**		7.10***		134.82***		4.10**	

This table analyzes the effect of *in-person* and other control variables on the extent to which a firm's consumption of financial services is concentrated. The dependent variable is *services concentration* defined as the ratio of financial services purchased from the primary financial institution to the total financial services used by the firm. Models 1 to 4 report the OLS estimates and Models 5 to 8 the treatment effects (TE) regression estimates. To correct for nonresponse and disproportionate sampling, the SSBF-provided weights are applied in each survey round. The robust standard errors are shown in parentheses. All variables are defined in Table 2 and have variance inflation factors (VIFs) substantially lower than 5. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively

implies that, when relationships are built on face-to-face communication, the primary bank acts as a one-stop shop for the totality of the small firm's financial needs. In turn, this positively impacts the entire range of available services. Together, the evidence from all four proxies for relationship strength supports H4, elucidating how in-person banking results into loyal customers who generate more revenue—this is clearly valuable from the bank's perspective.

5.2.2 In-person contact and loan contracting

To examine whether value also accrues to the other end of the relationship, as predicted by our fifth hypothesis, we collect additional information on borrowing cost and maturity from individual loan contracts made between the firms and their primary financial institution. This gives rise to the proxy variables of *interest rate*[7] and *maturity* measured in months. In addition, we use *loan amount* and *prime rate*, both measured at the time of the loan application, as the loan-specific controls in the subsequent regressions. We restrict the analysis to the most recently approved loans with interest rates in excess of prime rate, which leaves a total of 3,264 observations (1,497 from NSSBF 1993, 500 from SSBF1998, and 1,267 from SSBF2003).

5.2.2.1 In-person contact and borrowing cost To test H.5.a., we conduct OLS and TE regressions, reporting the results in Table 9. In the TE regressions, we instrument *in-person*, as before, by the exogenous variable *in-person environment*, which does not associate with *interest rate*. According to the pooled data regressions, our evidence suggests that the interest rate on the loans obtained by firms contacting their primary financial institution mainly in-person is, on average, 11 basis points lower than the interest rate on loans issued to the rest of the firms (the difference is 22 basis points according to the OLS estimate which we, however, discard due to endogeneity). The individual survey rounds yield qualitatively similar results. On this basis, in-person communicators' access to cheaper credit proves robust. Furthermore, borrowing cost inversely relates to the loan amount (Degryse and Cayseele 2000; Lian 2018) as well as owners' age and educational attainment (Wu and Chua 2012).

To further strengthen our interpretation that borrowing cost declines because of face-to-face communication mitigating the informational wedge with the primary financial institution, we next focus on two types of firms that have a greater disadvantage at hardening information: young firms, due to limited organizational experience, and firms owned by individuals without a university degree, due to lack in educational capital. For this analysis, we create two augmented forms of the borrowing cost specification: the first includes the interaction term *in-person*×*startup* and the second the interaction *in-person*×*below degree*. Table 10 reports the 2nd-stage results of instrumental variables estimation for both specifications. Models 1 to 4 show that while start-up firms are, in general, associated with a higher borrowing cost, they are able to borrow cheaper when adhering to in-person banking. Analogously, in Models 5 to 8, the borrowing cost is higher for non-university graduate owners, however, cheaper loans are attainable if these owners shift to predominantly in-person communication. Jointly, these results confirm the capacity of in-person communication to compensate for a firm's heightened information opacity.

[7] This represents the marginal borrowing cost, following Wu and Chua (2012).

Table 9 In-person banking and cost of loans

	OLS				TE							
	Pooled Data	1993 NSSBF	1998 SSBF	2003 SSBF	Pooled data		1993 NSSBF		1998 SSBF		2003 SSBF	
	Model 1	Model 2	Model 3	Model 4	Model 5		Model 6		Model 7		Model 8	
					2nd Stage	1st Stage	2nd Stage	1st Stage	2nd Stage	1st Stage	2nd Stage	1st Stage
In-person	−0.2241** (0.0914)	−0.1956** (0.0961)	−0.3055** (0.1501)	−1.0443*** (0.3869)	−2.0474*** (0.1832)		−2.5240*** (0.1679)		−3.2130*** (0.3916)		−2.1857*** (0.6910)	
In-person environment						1.6914*** (0.2670)		1.4176*** (0.3863)		1.8426** (0.7231)		2.8477*** (0.7785)
Rural area	−0.2307*** (0.0791)	0.0222 (0.1756)	−0.7807*** (0.2221)	−0.4613* (0.2468)	−0.0960 (0.0900)	0.1198* (0.0649)	0.0844 (0.1355)	0.1115 (0.0969)	−0.6177** (0.2601)	−0.1227 (0.1547)	−0.4213* (0.2457)	0.0092 (0.1468)
Commercial bank	−0.1952 (0.1274)	−0.5698* (0.3118)	0.0658 (0.3416)	−0.3284 (0.4037)	0.2436** (0.1236)	0.2830*** (0.0835)	0.2366 (0.1872)	0.4147*** (0.1289)	1.3123*** (0.4157)	0.9051*** (0.2102)	−0.0665 (0.4431)	0.3410* (0.1781)
Prime rate	0.7255*** (0.0607)	0.8335*** (0.1529)	0.4116 (0.3266)	0.4859*** (0.1518)	0.7223*** (0.0642)	−0.0067 (0.0428)	0.7392*** (0.0791)	−0.0271 (0.0514)	0.6123 (0.3816)	0.0365 (0.2085)	0.5260*** (0.1523)	0.2042* (0.1113)
Loan amount	−0.2953*** (0.0276)	−0.4058*** (0.0761)	−0.3965*** (0.0759)	−0.6189*** (0.0932)	−0.3601*** (0.0263)	−0.1012*** (0.0168)	−0.3527*** (0.0374)	−0.1066*** (0.0236)	−0.4861*** (0.0946)	−0.2524*** (0.0457)	−0.6444*** (0.0973)	−0.0813* (0.0447)
Female	−0.0582 (0.0916)	−0.2199 (0.1738)	−0.0198 (0.2414)	−0.1708 (0.2693)	−0.0209 (0.0931)	0.0816 (0.0640)	−0.0639 (0.1426)	−0.0482 (0.0945)	0.2440 (0.2999)	0.2940* (0.1772)	−0.1469 (0.2683)	0.0819 (0.3102)
Below degree	0.2173*** (0.0790)	0.1283** (0.0601)	0.4668** (0.2265)	0.7809*** (0.2355)	0.3467*** (0.0817)	0.2399*** (0.0541)	0.3417*** (0.1205)	0.1545* (0.0791)	0.3913** (0.1982)	−0.0377 (0.1526)	0.8693*** (0.2445)	0.3328** (0.1308)
Owner's age	−0.6238*** (0.1817)	−0.3958 (0.4163)	−0.0342 (0.4599)	−1.0751* (0.5567)	−0.5234*** (0.1895)	0.2500** (0.1268)	−0.1666 (0.2775)	0.3203* (0.1822)	−0.1809 (0.5738)	0.0873 (0.0457)	−0.9193* (0.5582)	0.8199*** (0.3102)
Other firm-aspect characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
U.S. region dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 9 (continued)

	OLS				TE							
	Pooled Data	1993 NSSBF	1998 SSBF	2003 SSBF	Pooled data		1993 NSSBF		1998 SSBF		2003 SSBF	
	Model 1	Model 2	Model 3	Model 4	Model 5		Model 6		Model 7		Model 8	
					2nd Stage	1st Stage	2nd Stage	1st Stage	2nd Stage	1st Stage	2nd Stage	1st Stage
SIC division dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	N/A	N/A	N/A	Yes	Yes	N/A	N/A	N/A	N/A	N/A	N/A
Constant	11.0676*** (0.8587)	10.1744*** (1.7036)	12.1716*** (3.0740)	18.4384*** (2.7385)	12.3776*** (0.8866)	−1.6953*** (0.6462)	11.0589*** (1.2453)	−1.1656 (0.8875)	13.4808*** (3.7167)	0.2879 (2.0367)	18.5477*** (2.7694)	−6.5395*** (1.5786)
Inverse Mills ratio					0.6083*** (0.0599)		0.9084*** (0.0609)		1.7944*** (0.2103)		0.2968** (0.1326)	
Observations	3241	1497	498	1246	3241		1497		498		1246	
Wald test of endogeneity (χ^2)					103.03***		222.80***		72.77***		5.00**	

This table presents the regressions results of the *interest rate* on the firm's most recently approved loan (dependent variable) on *in-person* and other control variables. Models 1 to 4 report the OLS regression estimates and Models 5 to 8 report the estimates from the treatment effects (TE) regressions. To correct for nonresponse and disproportionate sampling, the SSBF-provided weights are applied in each survey round. The robust standard errors are presented in parentheses. All variables are defined in Table 2 and have variance inflation factors (VIFs) substantially lower than 5. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively

Table 10 In-person banking and cost of loans under heightened information asymmetry

	Pooled data Model 1	1993 NSSBF Model 2	1998 SSBF Model 3	2003 SSBF Model 4	Pooled data Model 5	1993 NSSBF Model 6	1998 SSBF Model 7	2003 SSBF Model 8
In-person	−0.2060** (0.0886)	−0.1976** (0.0929)	−0.3144** (0.1533)	−0.9662** (0.3869)	−0.2318** (0.0917)	−0.1970** (0.0934)	−0.3027** (0.1521)	−0.9851*** (0.3155)
In-person × startup	−0.4182** (0.1899)	−0.3973** (0.1826)	−0.3893** (0.1768)	−0.7982** (0.4023)				
In-person × below degree					−0.1785** (0.0810)	−0.1363** (0.0691)	−0.3723** (0.1897)	−0.4978** (0.2512)
Startup	0.5470** (0.2471)	0.5386** (0.2566)	0.5985*** (0.2274)	1.3368** (0.6048)	0.2732** (0.1382)	0.2784** (0.1359)	0.3013** (0.1502)	0.5067** (0.2362)
Below degree	0.2166*** (0.0788)	0.1281** (0.0633)	0.4682** (0.2256)	0.7573*** (0.2369)	0.2152*** (0.0763)	0.1262** (0.0608)	0.4597** (0.2162)	0.7518*** (0.2402)
Control variables	Included	Included	Included	Included	Included	Included	Included	Included
U.S. region and SIC division dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	N/A	N/A	N/A	Yes	N/A	N/A	N/A
Observations	3241	1497	498	1246	3241	1497	498	1246
Endogeneity test (LM statistic χ^2)	6.82***	3.93**	5.68**	7.13***	8.52***	4.58**	5.21**	9.08***

This table presents the regressions results of the *interest rate* on the firm's most recently approved loan (dependent variable) on *in-person* and its interaction with variables associated with heightened information asymmetry. Models 1 to 4 use the interaction term *in-person*×*startup* and Models 5 to 8 the interaction term *in-person*×*below degree*. All regressions are based on instrumental variables (IV) estimation and employ the same set of control variables used in Table 9 regressions; in the interest of space, the resulting coefficients on these variables and the 1st-stage regression results are suppressed but remain available upon request. To correct for nonresponse and disproportionate sampling, the SSBF-provided weights are applied in each survey round. The robust standard errors are presented in parentheses. All variables are defined in Table 2 and have variance inflation factors (VIFs) substantially lower than 5. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively

Table 11 In-person banking and maturity of loans

	OLS				TE							
	Pooled Data	1993 NSSBF	1998 SSBF	2003 SSBF	Pooled data		1993 NSSBF		1998 SSBF		2003 SSBF	
	Model 1	Model 2	Model 3	Model 4	Model 5		Model 6		Model 7		Model 8	
					2nd Stage	1st Stage	2nd Stage	1st Stage	2nd Stage	1st Stage	2nd Stage	1st Stage
In-person	0.1389*** (0.0421)	0.1246** (0.0617)	0.3040** (0.1522)	0.2036** (0.1027)	0.9365*** (0.1612)		0.5849*** (0.2135)		1.2474*** (0.4308)		1.0531*** (0.2417)	
In-person environment						1.8024*** (0.2800)		1.8009*** (0.4720)		1.8931* (1.0192)		2.2799*** (0.4537)
Rural area	−0.0093 (0.0440)	0.0385 (0.0797)	−0.1621 (0.1451)	−0.1135 (0.1037)	−0.0678 (0.0465)	0.1616** (0.0664)	−0.0289 (0.0649)	0.1651 (0.1058)	−0.2121 (0.1461)	0.3040 (0.221)	−0.0599 (0.0748)	0.0416 (0.1054)
Commercial bank	−0.1665*** (0.0606)	−0.3397*** (0.1117)	0.1455 (0.1909)	−0.1368 (0.1423)	−0.3579*** (0.0705)	0.7421*** (0.0743)	−0.4655*** (0.1028)	0.3407** (0.1415)	−0.1523 (0.2160)	0.3544 (0.2800)	−0.2624** (0.1070)	0.6161*** (0.1248)
Prime rate	−0.0069 (0.0325)	−0.0633 (0.0562)	0.1531 (0.2050)	0.1612** (0.0660)	−0.0059 (0.0321)	0.0035 (0.0425)	−0.0800** (0.037)	−0.0361 (0.0534)	0.0954 (0.2094)	0.5721** (0.2480)	0.1596*** (0.0614)	0.0186 (0.0844)
Loan amount	0.1052*** (0.0129)	0.1726*** (0.0276)	0.2954*** (0.0490)	0.1462*** (0.0350)	0.1335*** (0.0141)	−0.1060*** (0.0170)	0.1277*** (0.0192)	−0.1103*** (0.0246)	0.3129*** (0.0497)	−0.0662 (0.0586)	0.0925*** (0.0236)	−0.0980*** (0.0289)
Female	0.0944** (0.0463)	0.1511* (0.0869)	0.3266** (0.1460)	0.1360 (0.0944)	0.0824* (0.0473)	0.0303 (0.0649)	0.0667 (0.0668)	−0.0700 (0.0999)	0.2668* (0.1518)	0.2101 (0.2533)	0.0929 (0.0757)	0.0489 (0.1032)
Below degree	−0.0496** (0.0203)	−0.0824** (0.0357)	−0.2483** (0.1147)	−0.1199* (0.0722)	−0.0401** (0.0182)	0.2362*** (0.0547)	−0.0746*** (0.0275)	0.2037** (0.0830)	−0.2013** (0.1017)	0.1515 (0.1871)	−0.1487** (0.0758)	0.3842*** (0.0886)
Owner's age	−0.1887** (0.0951)	−0.5519*** (0.1780)	−0.0077 (0.3394)	−0.0915 (0.2304)	−0.2421** (0.0967)	0.2757** (0.1302)	−0.2415* (0.1307)	0.3261* (0.1926)	−0.0227 (0.3455)	0.2200 (0.4288)	−0.2942* (0.1673)	0.3657 (0.2227)
Other firm-aspect characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
U.S. region dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 11 (continued)

	OLS				TE							
	Pooled Data	1993 NSSBF	1998 SSBF	2003 SSBF	Pooled data		1993 NSSBF		1998 SSBF		2003 SSBF	
	Model 1	Model 2	Model 3	Model 4	Model 5		Model 6		Model 7		Model 8	
					2nd Stage	1st Stage	2nd Stage	1st Stage	2nd Stage	1st Stage	2nd Stage	1st Stage
SIC division dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	N/A	N/A	N/A	Yes	YES	N/A	N/A	N/A	N/A	N/A	N/A
Constant	3.0403*** (0.4391)	4.2952*** (0.8758)	−0.7582 (1.9226)	1.6736* (0.9820)	2.5007*** (0.4572)	−1.3441** (0.6485)	3.3689*** (0.6024)	−1.6740* (0.9657)	−0.8920 (2.0351)	−6.8568** (2.7407)	2.3217*** (0.7526)	−2.2396** (1.0839)
Inverse Mills ratio					−0.4924*** (0.1002)		−0.3159*** (0.1365)		−0.6314** (0.2715)		−0.5660*** (0.1564)	
Observations	3132	1497	463	1172	3132		1497		463		1172	
Wald test of endogeneity (χ^2)					24.14***		5.35**		5.41**		13.10**	

This table presents the regressions results of the *maturity* of the firm's most recently approved loan (dependent variable) on *in-person* and other control variables. Models 1 to 4 report the OLS regression estimates and Models 5 to 8 report the estimates from the treatment effects (TE) regressions. To correct for nonresponse and disproportionate sampling, the SSBF-provided weights are applied in each survey round. The robust standard errors are presented in parentheses. All variables are defined in Table 2 and have variance inflation factors (VIFs) substantially lower than 5. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively

Table 12 In-person banking and maturity of loans under heightened information asymmetry

	Pooled data	1993 NSSBF	1998 SSBF	2003 SSBF	Pooled data	1993 NSSBF	1998 SSBF	2003 SSBF
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
In-person	0.1502*** (0.0425)	0.1708** (0.0801)	0.2197** (0.0950)	0.2793** (0.1200)	0.1369*** (0.0526)	0.1685** (0.0838)	0.2518*** (0.0875)	0.2851** (0.1281)
In-person × startup	0.1172** (0.0582)	0.1698** (0.0821)	0.2281** (0.1081)	0.2392** (0.1213)				
In-person × below degree					0.0491** (0.0212)	0.0566** (0.0278)	0.1379** (0.0698)	0.1839** (0.0891)
Startup	−0.1705*** (0.0606)	−0.1813** (0.0919)	−0.2320** (0.1101)	−0.3033** (0.1521)	−0.0976** (0.0472)	−0.2097*** (0.0751)	−0.2574** (0.1087)	−0.2791** (0.1320)
Below degree	−0.0494*** (0.0181)	−0.0807** (0.0391)	−0.2478** (0.1156)	−0.1379** (0.0702)	−0.0559*** (0.0165)	−0.0792** (0.0352)	−0.1595** (0.0637)	−0.1933** (0.0808)
Control variables	Included	Included	Included	Included	Included	Included	Included	Included
U.S. region dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SIC division dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	N/A	N/A	N/A	Yes	N/A	N/A	N/A
Observations	3132	1497	463	1172	3132	1497	463	1172
Endogeneity test (LM statistic χ^2)	8.31***	7.17***	4.34**	9.25***	9.32***	5.10**	7.29***	8.17***

This table presents the regression results of the *maturity* of the firm's most recently approved loan (dependent variable) on *in-person* and its interaction with variables associated with heightened information asymmetry. Models 1 to 4 use the interaction term *in-person* × *startup* and Models 5 to 8 use the interaction term *in-person* × *below degree*. All regressions are based on instrumental variables (IV) estimation and employ the same set of control variables used in Table 11 regressions; in the interest of space, the resulting coefficients on these variables and the 1st-stage regression results are suppressed but remain available upon request. To correct for nonresponse and disproportionate sampling, the SSBF-provided weights are applied in each survey round. The robust standard errors are presented in parentheses. All variables are defined in Table 2 and have variance inflation factors (VIFs) substantially lower than 5. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively

5.2.2.2 In-person contact and loan maturity We test H.5.b. in an identical procedure with H.5.a. and report the results in Table 11. Again, a highly endogenous relationship between the dependent variable and *in-person* surfaces. The TE model indicates that the maturity of the most recently issued loan to firms contacting their primary financial institution in-person is, according to the pooled data results, on average, 3.37 months longer than the maturity granted to firms opting for impersonal banking. The longer maturity, also evident in each individual SSBF round, substantiates the positive effect of soft information on credit availability.

If firms most severely plagued by information opacity are able to attain lower interest rates by face-to-face communication, we also expect a favorable effect on loan maturity. We, therefore, interact *in-person* with both *start-up* and *below degree* to gauge whether a more level informational playing field can further prolong maturity. Table 12 reports the 2nd-stage regression results of our instrumental variables estimation. Confirming our predictions, the results in Models 1–4 indicate that the maturity for start-up firms is shorter, however, it can be substantially extended by in-person communication. Models 5–8 convey similar insight based on owners' education. Owners lacking a university degree are generally granted a shorter maturity, with credit becoming available for a longer period of time should they choose to address the branch people face-to-face. Combined with our evidence on borrowing cost, we see face-to-face communication influencing two important loan contracting terms[8] in a direction which creates value for the small firm; the higher the information asymmetry with the primary financial institution, the greater the value-added.

5.2.3 In-person contact and discouraged borrowing

A dark side of in-person contact might be that it undermines objectivity in the lending decision as, for example, by being conducive to bonding or manipulation. In such a case, our previous findings on the strength of banking relationships and advantageous contractual terms attained by in-person communicators, could substantiate a market friction whereby banks are incapable of properly filtering the available supply of soft information. In this respect, we test our final hypothesis in the paper about the differential effect of in-person contact on Kon and Storey's (2003) concept of discouraged borrowing based on borrowers' quality. Conceivably, evidence showing less discouragement among good quality borrowers with no such effect on bad quality borrowers would be pivotal in ruling out this alternative interpretation of our results.

We assemble the discoursed borrowing sample in a twofold process. First, we scrutinize our baseline sample for firms which refrained from submitting a loan application when they were actually in need of bank credit. As we find, out of 3604 firms that identified themselves as capital seekers (i.e. pursued financing within the 3-year period preceding the survey), 853 conceded self-rationing due to fear of rejection.[9] We flag such cases with the dummy variable *discouragement.* Second, we follow Han et al. (2009) and factor in differences in prospective borrowers' quality as captured by Dun and Bradstreet's credit scores. Specifically, we classify[10] capital seekers into two (good and bad quality) types of borrowers and draw separate evidence from each subsample. Intuition and some empirical evidence (Ferrando and Mulier 2014; Bhaird et al. 2016) suggest that discouraged borrowers

[8] Loan covenants could yield additional insight, unfortunately the survey questions exclude this feature.

[9] Both numbers are based on the 1998 and 2003 survey rounds, the only rounds for which Dun and Bradstreet's credit score data is available.

[10] In SSBF 1998, the score ranges from 1 (lowest risk) to 5 (highest risk) with a mean value of 2.99. We define as good (bad) borrowers the finance seekers below (above) this average. In SSBF 2003, the score ranges from 1 (highest risk) to 6 (lowest risk) with an average of 3.61. We define as good (bad) borrowers the finance seekers with a credit score above (below) this average.

Table 13 In-person banking and probability of discouragement among good borrowers

	Probit			RBP					
	Pooled data	1998 SSBF	2003 SSBF	Pooled data		1998 SSBF		2003 SSBF	
	Model 1	Model 2	Model 3	Model 4		Model 5		Model 6	
				2nd Stage	1st Stage	2nd Stage	1st Stage	2nd Stage	1st Stage
In-person	−0.1350 (0.1061)	−0.0988 (0.2315)	−0.1952 (0.1690)	−0.4226** (0.2117)		−0.2701** (0.1253)		−0.9708** (0.3965)	
In-person environment					2.5588*** (0.3890)		2.5824** (1.2807)		3.0743*** (0.6831)
Rural area	−0.2286** (0.1095)	−0.3498* (0.2094)	−0.5036*** (0.1680)	−0.2133* (0.1112)	0.0392 (0.0889)	−0.3367 (0.2132)	0.0673 (0.2547)	−0.5548*** (0.1642)	−0.0439 (0.1700)
Commercial bank	−0.1933 (0.1206)	−0.1946 (0.2357)	−0.1748 (0.1897)	−0.1363 (0.1300)	0.1143 (0.1179)	−0.1386 (0.3146)	0.3441 (0.2913)	−0.1282 (0.1998)	0.3867** (0.1638)
Female	0.1288 (0.0949)	0.2966 (0.2117)	0.1402 (0.1466)	0.1433 (0.0958)	0.1609* (0.0875)	0.2990 (0.2119)	−0.0095 (0.2459)	0.1410 (0.1414)	0.0541 (0.1339)
Below degree	0.3827*** (0.0975)	0.4924** (0.1947)	0.3727** (0.1530)	0.4074*** (0.1011)	0.4337*** (0.0729)	0.4966** (0.1954)	0.2740 (0.1878)	0.3084** (0.1555)	0.5337*** (0.1316)
Owner's age	−0.2111 (0.2304)	0.5958 (0.4290)	−0.7779** (0.3692)	−0.1827 (0.2309)	0.4238** (0.1885)	0.6200 (0.4345)	0.5457 (0.4437)	−0.5142 (0.3517)	0.9049*** (0.3264)
Other firm-aspect characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.9670 (0.9075)	−2.3322 (1.6344)	3.5736** (1.4535)	1.0156 (0.9032)	−4.2586*** (0.8391)	−2.3240 (1.6389)	−4.4795** (2.2102)	2.7549** (1.3353)	−5.7521*** (1.4444)
Fisher's z transformed correlation				0.1820** (0.0921)		0.1065** (0.0518)		0.4862** (0.2459)	
Observations	1697	403	1294	1706		405		1301	
Wald test of endogeneity (χ^2)				3.8963**		3.8729**		3.9110**	

This table presents the regressions results of the incidence of discouraged borrowing (dependent variable) on *in-person* and other control variables. The analysis is based on the subsample of good borrowers, i.e. firms in need of finance in the three most recent years with a Dun & Bradstreet credit assessment less risky than average. Models 1 to 3 present the probit coefficients and Models 4 to 6 the recursive bivariate probit (RBP) regression results. All regressions include SIC division and U.S. region dummies, Models 1 and 4 also include year fixed effects. The SSBF-provided weights are applied to correct for nonresponse and disproportionate sampling. The robust standard errors are in parentheses. All variables are defined in Table 2 and have VIFs substantially lower than 5. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively

are usually of higher operating risk, attaching a non-random component to the phenomenon. To account for possible selection bias, we supplement probit estimation with an RBP model where the first-stage instrument, consistent with previous analyses, is the exogenous variable *in-person environment.*

The regression estimates provide empirical validation to our subsampling approach. In Table 13, good borrowers display: (1) a negative coefficient on *in-person* which is statistically significant at 5% level (RBP model); and (2) strong evidence of endogeneity with both the Fisher's z transformed correlation and the χ^2 in the Wald test to attain significance at the 5% level. The effect is economically important with the probability of discouragement to subside by 13.19% (Model 4). Table 14 reports the results obtained from the bad borrowers' sample. Of note is that both the Fisher's z transformed correlation and the χ^2 in the Wald test suggest the exogeneity of *in-person* in the RBP models. Consequently, we rely on probit estimation which generates insignificant coefficients on *in-person.* Based on these results, lower quality firms are shown to lack an apparent incentive to self-select into a certain communication method with the primary bank. Because the effect remains exclusive to good borrowers, i.e. the type of firms which stand to benefit from the leveling of the informational playing field, we infer that the latter function comprises the prime mechanism by which in-person banking influences discouraged borrowing. Han et al. (2009) describe discouragement as an efficient self-rationing process which encourages good borrowers and precludes those of dubious quality. We show that the process can further gain in efficiency from face-to-face communication. More generally, we prove that the positive influence of in-person contact is extensible from the firm-bank system to the economy-wide capital allocation.

6 Summary and concluding remarks

Relationship banking is distinguished by the capacity to operationalize soft information—an impossibility under alternative banking technologies. This capacity is valuable to the extent that soft information adds efficiency to financial processes and, indeed, theory suggests that it does. Absent is, however, the empirical evidence that could put the postulated benefits in perspective, with the extant studies tracing relationship banking effects at an aggregate level only. Addressing this void, our study offers a rigorous analysis of the mechanism that actually generates soft information, in-person communication.

Using data from the Federal Reserve's 1993, 1998 and 2003 Survey of Small Business Finances, we first develop the profile of firms opting for face-to-face interactions with their main bank. This is compatible with informationally opaque organizations and firms operating in rural areas. We also find that small business owners are more likely to visit the bank premises if they are female, older, and less educated. Next, we direct our attention to the implications of in-person communication and document incremental value for both ends of the bank-firm relationship. From the small business perspective, borrowing becomes cheaper and available for a longer period of time, reducing the likelihood of self-imposed rationing among firms of good quality. From the bank perspective, not only client loyalty increases but also firms tend to purchase a wider range of financial services. In light of this evidence, we caution that technological automation in the banking industry should aim to supplement, not obviate, interpersonal communication.

Future research, among other possible directions, can blend our findings with those of previous studies to develop a more symmetrical understanding of soft information

Table 14 In-person banking and probability of discouragement among bad borrowers

	Probit			RBP					
	Pooled data	1998 SSBF	2003 SSBF	Pooled data		1998 SSBF		2003 SSBF	
	Model 1	Model 2	Model 3	Model 4		Model 5		Model 6	
				2nd Stage	1st Stage	2nd Stage	1st Stage	2nd Stage	1st Stage
In-person	0.0221 (0.0822)	0.1009 (0.1298)	0.0559 (0.1560)	0.3235 (1.7975)		1.5646*** (0.2251)		1.2861*** (0.4133)	
In-person environment					2.1317*** (0.5094)		2.7342*** (0.7934)		2.5556** (1.0854)
Rural area	−0.2225*** (0.0833)	−0.2868** (0.1262)	−0.3108* (0.1707)	−0.2386* (0.1232)	0.1494 (0.0957)	−0.3293*** (0.1172)	0.2061 (0.1528)	−0.3615** (0.1533)	0.2287 (0.1794)
Commercial bank	0.0228 (0.0898)	0.0779 (0.1367)	0.0877 (0.1710)	−0.0519 (0.4558)	0.7836*** (0.0868)	−0.3801** (0.1520)	0.8681*** (0.1372)	−0.2476 (0.2145)	0.7464*** (0.1654)
Female	0.1319* (0.0725)	0.1047 (0.1121)	0.4126*** (0.1354)	0.1247 (0.0860)	0.0460 (0.0793)	−0.0049 (0.1083)	0.2295* (0.1266)	0.3403** (0.1451)	−0.0257 (0.1491)
Below degree	0.0104 (0.0699)	−0.0205 (0.1046)	0.0163 (0.1437)	−0.0060 (0.1187)	0.1976*** (0.0718)	−0.0873 (0.0966)	0.1965* (0.1149)	−0.0023 (0.1325)	0.0103 (0.1413)
Owner's age	0.1993 (0.1537)	0.7563*** (0.2316)	−0.5977** (0.2725)	0.2141 (0.1722)	−0.1063 (0.1688)	0.7741*** (0.2108)	−0.1679 (0.2611)	−0.6396** (0.2550)	0.5021 (0.3185)
Other firm-aspect characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	−0.6248 (0.6225)	−2.5498*** (0.9230)	2.3840** (1.1093)	−0.8590 (1.5038)	−1.0951 (0.7844)	−3.4692*** (0.8587)	−1.6536 (1.2035)	1.8425* (1.0546)	−3.5957** (1.4850)
Fisher's z transformed correlation				−0.1801 (1.0969)		−1.5366 (1.0001)		−0.9933 (0.6381)	
Observations	1814	997	815	1814		997		817	

Table 14 (continued)

	Probit			RBP					
	Pooled data	1998 SSBF	2003 SSBF	Pooled data		1998 SSBF		2003 SSBF	
	Model 1	Model 2	Model 3	Model 4		Model 5		Model 6	
				2nd Stage	1st Stage	2nd Stage	1st Stage	2nd Stage	1st Stage
Wald test of endogeneity (χ^2)				0.0270		2.3575		2.4233	

This table presents the regressions results of the incidence of discouraged borrowing (dependent variable) on *in-person* and other control variables. The analysis is based on the subsample of bad borrowers, i.e. firms in need of finance in the three most recent years with a Dun & Bradstreet credit assessment more risky than average. Models 1 to 3 present the probit coefficients and Models 4 to 6 the recursive bivariate probit (RBP) regression results. All regressions include SIC division and U.S. region dummies, Models 1 and 4 also include year fixed effects. The SSBF-provided weights are applied to correct for nonresponse and disproportionate sampling. The robust standard errors feature in parentheses. All variables are defined in Table 2 and have VIFs substantially lower than 5. ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively

production: if loan officers and branch managers impact differently on the recipient end of the process (Berger and Udell 2002; Uchida et al. 2012; Hattori et al. 2015), it is likely that heterogeneity also resides on the transmitting end. Conditional on data availability, it would be interesting to compare the effects of soft information generated by different stakeholders communicating on the firm's behalf (e.g. owner and family, employees, business partners, members of the local community).

Appendix 1: Regression with treatment effects (TE)

The length of the banking relationship (*relationship length*) can be expressed as follows:

$$relationship\ length_i = \alpha + \beta X_i + \gamma\ in\text{-}person_i + \varepsilon_i \tag{3}$$

where X represents a vector of banking market and firm-specific characteristics; *in-person* is a dichotomous variable; and ε stands for the residual term, $\varepsilon \sim [0, \sigma^2]$. $In\text{-}person_i$ itself is determined by a set of variables Z_i which comprise the instrumental variable (*in-person environment*) and the X_i vector. We further assume that there is a continuous variable $in\text{-}person^*_i$, where:

$$in\text{-}person_i^* = \omega\ Z_i + \xi_i \tag{4}$$

and $\xi \sim [0, 1]$.

So that $in\text{-}person_i = \begin{cases} 1, & if\ in\text{-}person_i^* > 0 \\ 0, & if\ in\text{-}person_i^* \le 0 \end{cases}$.

Heckman (1979) suggests that the selection bias in OLS estimates may be rectified with the inclusion of the inverse Mills ratio through the 2-stage procedure described below:

$$\begin{aligned} E(relationship\ length)|in\text{-}person = 1) &= \alpha + X + \gamma + E(\varepsilon|in\text{-}person = 1) \\ &= \alpha + \beta'\ X + \gamma + \rho\sigma_\varepsilon \frac{\varphi(-\omega Z')}{1 - \Phi(-\omega Z')} \\ &= \alpha + \beta'\ X + \gamma + \rho\sigma_\varepsilon \frac{\varphi(\omega Z')}{\Phi(\omega Z')}. \end{aligned} \tag{5}$$

Similarly,

$$\begin{aligned} E(relationship\ length)|in\text{-}person = 0) &= \alpha + \beta'\ X + \gamma + E(\varepsilon|in\text{-}person = 0) \\ &= \alpha + \beta'\ X + \rho\sigma_\varepsilon \frac{-\varphi(-\omega Z')}{\Phi(-\omega Z')} \\ &= \alpha + \beta'\ X + \rho\sigma_\varepsilon \frac{-\varphi(-\omega Z')}{1 - \Phi(-\omega Z')}. \end{aligned} \tag{6}$$

Subtracting Eq. (6) from Eq. (5), the treatment effects (TE) are:

$$\begin{aligned} TE &= E(relationship\ length)|in\text{-}person = 1) - E(relationship\ length)|in\text{-}person = 0) \\ &= \gamma + \rho\sigma_\varepsilon \frac{\varphi(\omega Z')}{\Phi(\omega Z')(1 - \Phi(\omega Z'))} \end{aligned} \tag{7}$$

where $\boldsymbol{\varphi}$ denotes the standard normal density function and $\boldsymbol{\Phi}$ the standard normal cumulative distribution function. Thus, including the inverse Mills ratio (λ) into Eqs. (3) and (4), with $\lambda = \frac{\varphi(\omega Z')}{\Phi(\omega Z')}$ if *in-person* = 1 and $\lambda = \frac{-\varphi(\omega Z')}{1-\Phi(\omega Z')}$ if *in-person* = 0, the resulting coefficients become least affected by selection bias (Greene 2012; Gounopoulos et al. 2017).

Appendix 2: Recursive bivariate probit (RBP) regression

We use the recursive bivariate probit (RBP) method to estimate the regression on the *exclusivity* of banking relationships. In accord with the binary nature of the dependent variable, we specify the following equation:

$$Probit\ (exclusivity_i) = \alpha + \beta X_i + \omega\ in\text{-}person_i + u_i \tag{8}$$

where X represents a vector of banking market and firm-specific characteristics; *in-person* is a dichotomous variable; and u stands for the residual term, $u \sim [0, \sigma^2]$. Let $exclusivity_i^*$ represent a latent continuous variable as follows:

$$\begin{aligned} exclusivity_i &= \begin{cases} 1, & if\ exclusivity_i^* > 0 \\ 0, & if\ exclusivity_i^* \le 0 \end{cases} \\ &\text{where } exclusivity_i^* = \beta' X_i + \omega'\ in\text{-}person + u_i'. \end{aligned} \tag{9}$$

In addition, we specify the $in\text{-}person_i$ equation as:

$$Probit\ (in\text{-}person_i) = \tau + \gamma Z_i + \varepsilon_i \tag{10}$$

where Z includes the X vector of Eq. (8) and the instrumental variable (*in-person environment*).

We further assume a latent continuous variable $in\text{-}person_i^*$ as follows:

$$in\text{-}person_i = \begin{cases} 1, & if\ in\text{-}person_i^* > 0 \\ 0, & if\ in\text{-}person_i^* \le 0 \end{cases}, \text{where } in\text{-}person_i^* = \gamma' Z_i + \varepsilon_i'. \tag{11}$$

Jointly, the error terms of Eqs. (9) and (11) can be expressed as: $\begin{pmatrix} \varepsilon' \\ u' \end{pmatrix} | Z, X \sim \mathrm{N}\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}\begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix}\right]$. Using $F(\cdot,\cdot)$[11] to denote the joint distribution function of (u', ε') and assuming symmetric distributions for the error terms of Eqs. (9) and (11), the expected probability distribution is given below:

$$\begin{aligned} P_{11} &= Prob(exclusivity = 1,\ in\text{-}person = 1) = F\left(\beta' X + \omega', \gamma' Z, \rho\right) \\ P_{10} &= Prob(exclusivity = 1,\ in\text{-}person = 0) = F\left(\beta' X, \gamma' Z, -\rho\right) \\ P_{01} &= Prob(exclusivity = 0,\ in\text{-}person = 1) = F\left(-\beta' X - \omega', \gamma' Z, -\rho\right) \\ P_{00} &= Prob(exclusivity = 0,\ in\text{-}person = 0) = F\left(-\beta' X, -\gamma' Z, \rho\right). \end{aligned} \tag{12}$$

Accordingly, the likelihood function to be maximized is:

[11] Here, $F(Z, X, \rho) = \frac{e^{-0.5*\sqrt{\frac{Z^2+X^2-2\rho ZX}{1-\rho^2}}}}{2\pi\sqrt{1-\rho^2}}$.

$$L(\omega, \gamma, \beta) = \prod \left(P_{11}^{exclusivity*in\text{-}person} P_{10}^{exclusivity*(1-in\text{-}person)} P_{01}^{(1-\text{exclusivity})*\text{in - person}} P_{00}^{(1-\text{exclusivity})*(1-\text{in - person})} \right) \tag{13}$$

Hence, by maximizing the loglikelihood function, least biased estimates are attainable (Maddala 1983, pp. 122–124; Greene 2012, pp 778–789).

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