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CREDIT MARKETS, RELATIONSHIP BANKING,  
AND FIRM ENTRY

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# Credit Markets, Relationship Banking, and Firm Entry

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## Abstract

Credit frequently flows to the business sector through information-intensive bank-firm relationships. This paper studies the impact of relationship banking on firm entry. Exploiting Italian data, we document that relationship-oriented local credit markets feature lower firm entry, larger size at entry, and relatively more spin-offs than de novo entrepreneurs' entries. Information spillovers from credit relationships to entrants contribute to these effects. A dynamic general equilibrium model calibrated to the Italian data can match the effects when information spillovers are allowed for. Relationship banks' information on incumbents is transferable to incumbents' spin-offs but crowds out information acquisition on de novo entrants. The buildup of incumbents' business wealth during credit relationships can outweigh the aggregate output effect of reduced entry.

Keywords: Credit Relationships, Firm Entry, Information Spillovers, Spin-offs  
JEL Codes: E44; G21; O16

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# Credit Markets, Relationship Banking, and Firm Entry

## Abstract

Credit frequently flows to the business sector through information-intensive bank-firm relationships. This paper studies the impact of relationship banking on firm entry. Exploiting Italian data, we document that relationship-oriented local credit markets feature lower firm entry, larger size at entry, and relatively more spin-offs than de novo entrepreneurs' entries. Information spillovers from credit relationships to entrants contribute to these effects. A dynamic general equilibrium model calibrated to the Italian data can match the effects when information spillovers are allowed for. Relationship banks' information on incumbents is transferable to incumbents' spin-offs but crowds out information acquisition on de novo entrants. The buildup of incumbents' business wealth during credit relationships can outweigh the aggregate output effect of reduced entry.

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## 1 Introduction

The forces that shape firm entry are of fundamental interest in the analysis of cyclical and long-run economic dynamics. The development of the credit sector is reputed to be important in determining the ease with which new firms can break into markets. An aspect that thus far has received little attention is the way the structure of the credit sector shapes the intensity and modes of firm entry. Yet, the literature has extensively documented that a distinct structural feature of the credit sector is the importance of banks' business models and lending technologies, such as the strength of bank-firm

relationships. In many countries, credit mainly flows to firms through long-term credit relationships over the course of which banks garner information about firms' assets, workforce and human capital (Allen and Gale, 2001; Degryse et al., 2009). Credit relationships are predominant in countries such as Germany, Japan and Italy, but are also pervasive in the U.S. credit system (Boot and Thakor, 2000). While a broad body of works have studied how credit relationships affect incumbent businesses involved in the relationships, less is known about their general equilibrium implications for firms' entry dynamics.

Fundamental questions naturally arise from these observations: how does the importance of bank-firm relationships in the credit sector affect the dynamics of firm entry? Does a relationship-oriented banking structure favor or deter the entry of firms? And does it promote some entry modes more than others? This paper takes a step towards addressing these questions by investigating theoretically and empirically the impact of relationship banking on firm entry in a general equilibrium setting. In the first part of the analysis, we exploit information from the Italian local credit markets (provinces) and document how the importance of credit relationships in the local markets affects firm entry. To this end, we employ granular survey data on the strength of credit relationships in the provinces, as well as business registry data on the intensity of firm entry. We complement these data with unique information on the modes of firm entry, whether through new entrepreneurs' (de novo) entry or through spin-offs created by managers and employees of incumbent businesses.<sup>1</sup> Further, we have access to data on the type of information acquired by relationship banks on incumbent firms and on the reusability of this information in the financing of entrant firms.

We uncover the following empirical patterns. Local credit markets characterized by stronger credit relationships feature a lower entry rate of firms and a larger size of firms at entry. When we break down entrant firms into de novo entrants and spin-offs, we obtain that the importance of spin-offs relative to de novo entrants is stronger in more relationship-oriented local credit markets. We also detect a role for information

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<sup>1</sup>In several countries, a sizeable share of entrant firms consist of spin-offs rather than de novo entrants founded by new entrepreneurs. In our Italian data, spin-offs account for more than 25% of firm entries. Empirical studies document that spin-offs represent from 20% to 35% of new firm entries in the United States, Brazil, Netherlands, Sweden, and Portugal (see, e.g., Klepper and Sleeper, 2005, Andersson and Klepper, 2013, and references therein).

spillovers in these effects. Relationship-oriented credit markets appear to deter firm entry, especially de novo entries, when banks' information on incumbent businesses is not transferable to entrants. By contrast, relationship banking promotes spin-off entries when banks accumulate information that is portable by incumbents' managers and employees to spin-offs. These findings are robust across estimation methods, including IV estimations. In particular, when performing IV estimations, we exploit the historical regulation of the Italian banking sector to assuage possible concerns of endogeneity of the importance of relationship lending in local credit markets.

We then study to what extent a parsimonious general equilibrium model with endogenous credit relationships and firm entry can match the empirical findings qualitatively and quantitatively. Motivated by the empirical evidence, a distinct feature of the model is the presence of positive or negative information spillovers from credit relationships to entrant businesses. The first ("embedded") spillover consists of banks' accumulation of information on employees (managers) of incumbent firms. This naturally favors the creation of spin-offs: managers of incumbent firms may start a business by borrowing from banks with which they accumulated relational capital when employed in parent companies. The second ("non-embedded") spillover captures, in reduced form, information on incumbents that relationship banks can transfer to entrants (e.g., sector- or area-specific information) or, on the negative side, rivalry between information acquisition on incumbents and screening of entrants. Again on the negative side, it can capture strategic decisions of relationship banks to conceal information on incumbents' activities from new businesses.<sup>2</sup>

We calibrate the model to match the Italian data. The model can successfully replicate the negative impact of a relationship-oriented banking structure on firms' entry rate. It can also match the larger size at entry associated with a relationship-oriented banking structure. Further, it can explain the higher spin-off rate (spin-offs to de novo entries) when credit relationships are stronger. The magnitude of the effects is sizeable: a permanent increase of 5% of the average relationship length in the credit market is predicted to reduce firms' entry rate by 5%, hinting at a 1-to-1 negative relation between credit relationship intensity and entry intensity. The average size (investment scale) of firms at entry, on the other hand, is predicted to rise by 12%. As for the relative importance of spin-offs and de novo entries, the model predicts an increase of the spin-off rate

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<sup>2</sup>Later in the paper we provide a detailed discussion and examples of these information spillovers.

of about 3%. These figures are in the ballpark of the empirical estimates on the Italian local credit markets.

The model further suggests that, through the above effects, an increase of 5% of the average length of credit relationships can cause a sizeable increase in the concentration of business wealth in the hands of incumbent entrepreneurs, raising the ratio of incumbents' to entrants' wealth by 40% in the long run. Finally, we evaluate the output effects of the strengthening of credit relationships. The simulation results suggest that in our economy the reinforcement in the position of incumbents, as reflected in their larger business wealth and investments, tends to outweigh the aggregate output effect of the drop in firm entry and of the resulting long-run contraction in the number of active firms.

The remainder of the paper unfolds as follows. In the next section we relate the paper to prior literature. In Sections 3 and 4, we present the empirical evidence. In Sections 5-7, we propose and solve a dynamic general equilibrium model aimed at explaining the empirical patterns. Section 8 presents calibration and simulation results. Section 9 assesses the implications of the analysis for selected macroeconomic indicators. Section 10 concludes. Further details on the empirical analysis and technical proofs of the model are relegated to the online Appendix.

## 2 Prior Literature

**Related studies** The paper relates to three strands of literature. The first strand investigates theoretically and empirically the impact of credit imperfections and credit market development on firm entry (see, e.g., Cooley and Quadrini, 2001; Aghion et al., 2007; Aghion et al., 2019; Angelini and Generale, 2008; Bergin et al., 2018). Some studies show empirically that banking competition and efficiency affect firm entry and firm size distribution (Bertrand et al., 2007; Cetorelli and Gambera, 2001; Cetorelli and Strahan, 2006). Guiso et al. (2004) find that financial development can affect firm entry. Relative to these studies, we stress the role of credit relationships in firm entry. Further, we study the impact of relationship lending on both the intensity and the modes of firm entry (whether de novo firm entry or spin-off creation).

Our analysis points to a relevant role of information spillovers in the link between relationship banking and firm entry. Informational channels are consistent with, and

in fact can complement, other mechanisms. Cetorelli and Strahan (2006) and Aghion et al. (2019) propose mechanisms through which banks with strong market power may have the incentive to hinder the entry of firms or promote the consolidation of existing businesses, reducing the degree of turnover in the business sector. We focus on the relationship structure of the banking sector, rather than its concentration or development, and stress the characterizing feature of credit relationships, lenders' continuous accumulation and reuse of information. In this respect, the mechanisms we highlight are especially suitable to describe a market characterized by diffuse entrepreneurship. Small businesses are inherently informationally opaque and, hence, rely heavily on information-intensive relationships with banks. Further, market power mechanisms are likely to be less relevant in diffuse markets than in concentrated ones.

The second strand of related literature investigates the effects of relationship banking on the real sector (see, e.g., Degryse et al., 2009, and Boot and Thakor, 2000). This literature stresses that, over the course of credit relationships, banks progressively accumulate information on the assets, human capital and employees of borrowing firms and that firm owners and managers establish close, personal relationships with loan officers (relational capital) (Petersen and Rajan, 1994, 2002; Diamond and Rajan, 2001). In Diamond and Rajan (2001), relationship banks acquire information on firm-specific assets which are inherently tied to incumbent firms. Drexler and Schoar (2014) and Uzzi and Lancaster (2003) find that owners and managers of borrowing firms develop personal ties and mutual trust (relational capital) with bank loan officers.<sup>3</sup>

Finally, the paper also relates to a broad strand of literature on information spillovers in credit markets, as we now turn to discuss.

**Theoretical underpinnings** Given our emphasis on positive or negative information spillovers from credit relationships to entrant firms, it is useful to illustrate a variety of examples. As noted, in the analysis we consider two types of information spillovers. "Embedded" spillovers consist of knowledge that lenders have accumulated on managers or employees of incumbent firms and that is portable by managers when they found a spin-off. We can also interpret this knowledge as managers' relational capital.

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<sup>3</sup>A large body of literature on relationship lending has looked at its effects on the investments of incumbent firms (Alessandrini et al., 2010; Degryse et al., 2009; Sette and Gobbi, 2015; Herrera and Minetti, 2007; Beck et al., 2018; Ferri et al., 2019).

“Non-embedded” spillovers, on the other hand, capture a variety of mechanisms through which information accumulated by lenders is transferable to new businesses or crowds out information acquisition on entrants. On the positive side, information accumulated by relationship lenders about the sector or the local market in which incumbent firms operate can be reused by lenders when financing new businesses. Boot and Thakor (2000) build a model in which, during credit relationships, lenders acquire information not only on specific assets of the firm but also on the sector in which the firm operates (see also Padilla and Pagano, 2000). On the negative side, the information acquisition effort of relationship lenders can naturally crowd out the incentives and the ability of loan officers to acquire information on entrants. Hachem (2014) develops a model where banks allocate scarce resources between the monitoring of incumbent borrowers and the screening of new loan applicants. As a result, efforts in monitoring incumbents can reduce banks’ incentives to screen new applicants. Michelacci and Suarez (2004) argue that financiers’ informed capital is in limited supply: for instance, monitoring skills are scarce because they relate to experience which is hard to accumulate or because monitors have limited ability to raise external funds. Relationship lenders may also have an incentive to strategically conceal information from potential entrants, thus hindering entry, in order to preserve the position of incumbent borrowers in the product market. Bhattacharya and Chiesa (1995) and Yosha (1995) study models of R&D races in which a lender has a stronger incentive to inhibit the entry of a new innovator in the market when it has established a longer credit relationship with the incumbent producer.

### **3 Empirical Setting**

We test the link between relationship lending and firm entry dynamics using granular data from the Italian local credit markets. The Italian banking system is segmented across provincial credit markets. As a geographical and administrative unit, a province can be compared with a U.S. county. Provinces constitute the appropriate measure of local credit markets in Italy also according to regulatory authorities. For example, the Italian Antitrust Authority considers the province as the relevant market for banking activities. And, at the time of deregulation of the banking sector in the 1990s, the Bank of Italy defined the local market as the provincial one. In Italy, it is traditionally difficult for firms to borrow in a market other than the local one (Guiso et al., 2003, 2004; De

Bonis et al., 2012).

### 3.1 Institutional background

Italy represents an ideal setting to investigate the role of credit relationships in firm entry. The financial system is dominated by the banking sector, while the stock market has a relatively low capitalization.<sup>4</sup> Moreover, the banking sector is characterized by pronounced heterogeneity in the intensity of credit relationships across local (provincial) credit markets (see Figure 1 and the discussion below). This mostly stems from the historical regulation of the Italian banking sector, which remained in place from 1936 to the early 1990s, effectively freezing the structure of local credit markets for several decades (more on this in Section 3.2.3). We expect that in provinces where the 1936 regulation was more restrictive firms tended to stick to the same banks over time, engaging in longer and more stable credit relationships. By contrast, in provinces where the 1936 regulation was looser, firms had more opportunities to switch banks and, hence, could have been less inclined to engage in long-term credit relationships (see, e.g., Herrera and Minetti, 2007; Guiso et al., 2004).

The 1936 banking regulation can have affected the relative importance of credit relationships also through its impact on the types of banks operating in the provinces. Italian local credit markets feature sharp differences in the importance of local and cooperative banks relative to banks with a national scope. Local and cooperative banks are inclined to establish long-term credit relationships with firms which entail personal ties between loan officers and firm managers (Angelini et al., 1998). Banks with a national scope, instead, tend to resort to transactional lending technologies based on the usage of hard (verifiable and codified) information about firms. The heterogeneous presence of different categories of banks across provinces mostly reflects the impact of the 1936 regulation, which effectively froze local banking markets at their 1936 composition.

Besides exhibiting heterogeneity in the strength of credit relationships, Italian provinces also feature substantial variation in firm entry dynamics (see, e.g., King, 2015; Carree

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<sup>4</sup>At the onset of the 2000s, the mid-point of the time frame of our empirical analysis, the ratio of bank credit to the GDP was 70%, a figure similar to that of France (81), Belgium (77) and Finland (51). The high dependence of Italian firms on banks is analogous to that observed in other countries of continental Europe and in Japan (De Bonis et al., 2012).

et al., 2008; and regional reports of the Bank of Italy). This is evident from our data, as shown in Figure 1 and as discussed below.

## **3.2 Data and measurement**

In this section, we detail data sources and the measurement of the variables used in the baseline estimates. Details on information spillover variables are in Section 4.4.

### **3.2.1 Data sources and variables**

Our main data sources are the “Indagine sulle Imprese Manifatturiere”, a survey carried out by a major Italian banking group, Capitalia; the Register of Firms of the Italian Chambers of Commerce; the Orbis database of Bureau van Dijk; and the “Startup Survey”, a survey of startups conducted by the Italian Ministry of Economic Development. We complement these data sources with other databases, including data of the Italian National Institute of Statistics (ISTAT) on institutional and economic characteristics of the provinces; Bank of Italy data on the structure of Italian provincial banking sectors; and prior studies (detailed below) on industry-level measures of physical and human capital intensity, asset specificity, and product information complexity.

Information on credit relationships is drawn from four waves of the Capitalia survey, which cover three-year periods ending respectively in 1997, 2000, 2003, and 2006. The Capitalia survey, which targets manufacturing firms within Italy, includes a representative sample of manufacturing firms with 10–500 employees (about 94% of the firms in the sample) and the universe of manufacturing firms with more than 500 employees. Approximately 4,500 firms were interviewed in each survey wave, for a total of 18,333 observations. The firms in the survey represent between 10% and 15% of the population in terms of employees and value added. Collected data include details about firms’ balance sheets, demographics, sources of finance, relationships with banks and about mechanisms of information acquisition by banks on borrowing firms.

Information on firm entry in the provinces is drawn predominantly from the Register of Firms of the Italian Chambers of Commerce, which provides details on the number of newly registered firms (entrants) and the number of incumbent firms in a province, sector and year. We also construct alternative indicators of firm entry using the Orbis database of Bureau Van Dick. In all cases, we focus on manufacturing firms.

Finally, to study firms' mode of entry we rely on the aforementioned survey of the Italian Ministry of Economic Development, which is the first national survey on startups based in Italy. The survey was administered in 2016 with the goal of investigating startups that were conceived during the previous decade (roughly from the mid-2000s onwards). The questionnaire was filled in by 2,250 firms that obtained the formal registration at the Chambers of Commerce between 2010 and 2015, 44% of the startups registered in the 2010-2015 period. The information in the survey includes the personal background of startup founders, which will be key for our analysis of entry modes.

### 3.2.2 Credit relationships and firm entry

**Relationship lending** To measure the intensity of relationship lending in a province, we construct two indicators for each survey wave: the average length of credit relationships in the province and, as an inverse measure, the average number of banks from which a firm borrows in the province. These indicators are based on two questions in the Capitalia survey that, respectively, ask each firm the number of years it has been doing business with its main bank; and the number of banks from which the firm borrows. Petersen and Rajan (1994) show that the length of the main credit relationship is a suitable measure of the information accumulated by the main bank (see also Degryse et al., 2009); multiple credit relationships can instead dilute the relationship with the main bank. In what follows, we will primarily focus on the length of credit relationships.

**Firm entry** To capture firms' entry dynamics in a province and (two digit ATECO) manufacturing sector in the time frame of the survey waves, we use the Register of the Italian Chambers of Commerce. We compute the ratio of newly registered firms over incumbent firms in the province and sector, and the ratio of newly registered firms in the province and sector over the provincial population (per 1,000 inhabitants). In both cases, for the time frame of each Capitalia survey wave, we take the average over the years of the survey wave. We complement these indicators of firm entry in local markets with an alternative proxy for the entry rate: using Orbis data, we compute the share of firms in a province and sector with no more than 2 years of activity. Due to data availability in Orbis, when using this alternative proxy we restrict attention to firms that entered during the 2004-2006 period, which corresponds to the time frame of the last Capitalia survey wave.

**Modes of entry** In the analysis, we also look at the modes of firm entry: whether a firm is founded by a new entrepreneur (de novo entrant) or is a spin-off. Using the Capitalia survey, we construct an indicator variable equal to one if a firm declares that a spin-off was created from it in the years covered by the survey. Using the survey on startups of the Italian Ministry of Economic Development, we also compute the share of entrant firms in a province and sector that are founded by former employees of firms operating in the same sector, relative to the total number of entrants. In particular, following Andersson and Klepper (2013), we identify a spin-off as an entrant firm in which the majority of managers and directors previously worked for a firm of the same sector. This information refers to startups that were conceived from the mid-2000s and were formally registered in the 2010-2015 period.

### 3.2.3 Controls and instruments

In the regressions, we insert a broad range of controls that may explain firm entry. We include the unemployment rate as a measure of local economic and labor market conditions, the population growth rate of the province, proxies for the quality of material infrastructures in the province, the degree of trade openness, a proxy for local banking concentration (the Herfindhal-Hirschman index of bank branches), a measure of local financial development (branches over population), and a measure of judicial efficiency. Material infrastructures, trade openness, and judicial efficiency are slow-moving variables and are measured at the mid-point of the sample (2001). The unemployment rate, population growth, local financial development, and banking concentration are computed as the average over the time frame of each Capitalia survey wave. We also experiment with including the average age of firms in the province. We saturate the regressions with a full set of sector and time (survey wave) fixed effects and with broad geographical area (North and Center) dummies. In alternate tests, we drop time-invariant province-level controls and broad geographical area dummies and insert province fixed effects.

In addition to performing estimations with a broad set of controls and fixed effects, we also adopt an instrumental variables approach. To this end, we exploit information on the 1936 Italian regulation of local banking markets. In response to the 1930–1931 banking crisis, in 1936 the Italian government approved a Banking Law with the goal of enhancing bank stability through severe restrictions on bank entry. The Banking Law imposed strict limits on the ability of different types of banking institutions to open

new branches. In particular, from 1938 each credit institution could open branches only in an area of competence (one or multiple provinces) determined on the basis of its presence in 1936. Banks were also required to shut down branches outside their area of competence. While the regulatory prescriptions were uniform across Italy, the constrictiveness of regulation varied across provinces and depended on the relative importance of different types of banks in the local market in 1936. For example, savings banks were less constrained by the regulation, while cooperative banks were more constrained (Guiso et al., 2003, 2004). Provincial banking markets were liberalized during the 1990s, following also the introduction of directives of the European Union. As noted, we expect that the 1936 regulation had a long-lasting impact on the ability and incentive of banks to establish long-term credit relationships with firms, leading to substantial variation in the incidence of credit relationships across Italian provinces. Following Guiso et al. (2003, 2004) and Herrera and Minetti (2007), our set of instruments for the intensity of credit relationships consist of provincial data on the number of savings banks in 1936 (per 100,000 inhabitants) and the number of new branches opened by incumbent banks (per 100,000 inhabitants) during the deregulation period (1991-1998).

## 4 Methodology and Results

### 4.1 The baseline empirical model

The baseline empirical model reads

$$FirmEntry_{ijt} = \alpha_1 + \alpha_2 Relation_{it} + \alpha_3^T \mathbf{Z}_i + \alpha_4^T \mathbf{C}_{it} + \gamma_j + \gamma_t + \varepsilon_{itj} \quad (1)$$

where  $FirmEntry_{ijt}$  is the measure of entry of firms in province  $i$ , sector  $j$ , period  $t$  (where periods are three-year windows based on the survey waves);  $Relation_{it}$  is the measure of credit relationship intensity in province  $i$  and period  $t$ ;  $\mathbf{Z}_i$  is a vector of time-invariant province-level controls measured in year 2001, the sample mid-point, as well as macro-area dummies;  $\mathbf{C}_{it}$  is a vector of time-varying province-level controls;  $\gamma_j$  is a vector of sector fixed effects;  $\gamma_t$  is a vector of time (survey wave) fixed effects; and  $\varepsilon_{itj}$  denotes the residual. In a tighter specification, we saturate the model with province fixed effects ( $\gamma_i$ ) and drop time-invariant province-level controls and macro-area dummies.

Considering the local entities (provinces) of a country reduces the risk of omitted

variable bias and implicitly controls for differences in formal institutions. Further, we saturate the model with a rich set of controls and fixed effects. Nevertheless, there remains the possibility that in a local credit market banking relationships and firm entry are jointly determined and that unobserved factors are correlated with both. To further assuage possible endogeneity concerns, we complement the OLS estimates with an instrumental variable (IV) approach. Let  $\mathbf{I}p_i$  be a vector of instruments that are correlated with the local strength of credit relationships in the province but affect firm dynamics only through the banking channel. The effect of these instruments on  $Relation_{it}$  is captured by  $\beta_3$  in the local banking equation

$$Relation_{it} = \beta_1^T \mathbf{Z}_i + \beta_2^T \mathbf{C}_{it} + \gamma_t' + \beta_3^T \mathbf{I}p_i + u_{it} \quad (2)$$

where  $\mathbf{Z}_i$  and  $\mathbf{C}_{it}$  refer to the control variables in the second stage equation,  $\mathbf{I}p_i$  is the vector of instruments and  $u_{it}$  is the residual. As noted, as instruments we employ the indicators of banking regulation in 1936, namely the number of savings banks in the province in 1936 (per 100,000 inhabitants) and the number of new branches created in the province in the deregulation period (per 100,000 inhabitants).

## 4.2 Summary statistics

Table 1 displays summary statistics for the variables used in the analysis. Over the 1995-2006 period spanned by the four Capitalia survey waves, the average length of credit relationships in a province exceeds 16 years (for almost 60% of firms the length exceeds 10 years). The mean number of banks funding a firm in a province is 5. There is substantial heterogeneity in the intensity of credit relationships across provinces. Figure 1 reveals that on average relationship lending is more pervasive in some northern provinces, especially in the regions of Veneto, Emilia Romagna and Trentino. By contrast, credit relationships appear to be relatively weak in some southern provinces.

On average, the ratio of entrant firms to incumbent firms equals 4.99%. There is substantial heterogeneity in firm entry rates across provinces: over the 1995-2006 period, in an average year the ratio of entrants to incumbents ranges from little more than 2% for some provinces to 10% in other provinces. In 2004-2006, the share of firms with no more than two years of activity is about 17%. In the same years, the probability that a spin-off was created from an incumbent firm equals 3.5%. On average, almost 27% of entrant firms consist of spin-offs.

### 4.3 Baseline estimates

Table 2 displays the baseline results. We regress firms' entry rate in a province and sector on the province-level indicator of the intensity of relationship lending (average length of credit relationships in the province). The OLS estimates suggest that, after controlling for sector and time fixed effects, for macro-area dummies, and for relevant provincial characteristics, in provinces where credit relationships are tighter firms' entry rate is lower. This holds regardless of the entry rate measure (columns 1-4). The results are confirmed when we drop time-invariant province-level controls and macro-area dummies in favor of province fixed effects (columns 5-6).<sup>5</sup> They are also robust to using an IV approach (columns 7-8). In the first stage, the instruments perform well in explaining the intensity of relationship lending in a province (the  $F$ -test statistic is well above the threshold values for weak instruments).<sup>6</sup> The second stage estimates confirm the OLS ones. We will extensively discuss the economic magnitude of the effects when comparing the estimates with the quantitative predictions of the theoretical model.

In Table 3, we conduct robustness checks (see Panel A for the OLS estimates and Panel B for the 2SLS estimates). In columns 1-2, we measure entry with the share of firms with no more than 2 years of age (Orbis data, column 1) and with the probability that a spin-off is created from a firm (column 2).<sup>7</sup> We find again a negative impact of the relationship lending intensity in the local credit market on firm entry. Columns 3-6 show that the results carry through when using alternative measures of relationship lending, namely the average number of banks funding a firm in the province (an inverse measure of the local intensity of relationship lending) and the share of firms in the province with credit relationship length above 10 years. Further, columns 7-8 show that the results are robust to winsorizing observations at the 1% tail of the relationship length distribution

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<sup>5</sup>The results for the controls are overall in line with expectations. Higher unemployment is associated with higher entry, suggesting that self-employment and entrepreneurship might substitute for lower employment. Population growth also appears to positively affect firms' entry rate. Somewhat more surprisingly, material infrastructures appear to drive down firms' entry rates.

<sup>6</sup>The signs of the estimated coefficients on the instruments are in line with expectations. For example, provinces with a higher presence of savings banks in 1936 had a less constrictive regulation. Thus, firms could more easily switch banks and stick less to the same banks over long-term credit relationships.

<sup>7</sup>The regression in column 2 of Table 3 is estimated at the firm level. We use the specification in (1) and replace the dependent variable with the probability that a spin-off is created from a firm.

(the results obtained by trimming the data are virtually identical).

In Table 4, Panel A, we explore the link between entry mode and credit relationships. The results in column 1 indicate that the intensity of credit relationships in the province is positively associated with the ratio of spin-offs to de novo entrants.<sup>8</sup> This result is robust to defining spin-offs as entrants in which all managers and directors (rather than the majority) previously worked for a firm of the same sector (column 2).

In Panel B of Table 4, we consider the impact of credit relationship intensity on the size of entrants, using the firm-level information provided by the survey on startups of the Italian Ministry of Economic Development. We estimate firm-level regressions using the specification in (1) and replacing the dependent variable with the firm’s number of employees at entry. The estimates reveal that, in local markets where credit relationships are more intense, firms have a larger size at entry.

#### 4.4 Information spillovers

In Tables 2-4, we have found that the local strength of credit relationships is negatively associated with the intensity of firm entry, especially de novo entry. In Tables 5A-5B, we explore the role of information spillovers in these effects. Over the course of credit relationships, banks accumulate information on incumbent firms’ technology, market and sector, on the assets of the firms and on (the trustworthiness of) firms’ managers and employees (Diamond and Rajan, 2001; Petersen and Rajan, 1994). The information acquired by banks in credit relationships can be reused when extending credit to entrant firms (positive information spillovers; see, e.g., Boot and Thakor, 2000) or, alternatively, can crowd out the acquisition of information on entrants (negative information spillovers; see, e.g., Michelacci and Suarez, 2004; Hachem, 2014; Bhattacharya and Chiesa, 1995).

The empirical model augmented with the effect of information spillovers reads

$$FirmEntry_{ijt} = \alpha_1 + Relation_{it} \times (\alpha_2 + \alpha_3 Spillover_j) + \alpha_4^T \mathbf{Z}_i + \alpha_5^T \mathbf{C}_{it} + \gamma_j + \gamma_t + \varepsilon_{itj}, \quad (3)$$

where  $Spillover_j$  is a proxy for the type of information spillovers in sector  $j$ . The proxies for information spillovers are drawn from previous studies or from our database.

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<sup>8</sup>As the data on entry modes in Table 4 refer to startups conceived from the mid-2000s and formally registered in the 2010-2015 period, in the regressions of Table 4 the average length of credit relationships is from the last Capitalia survey wave.

**Information types** The last wave of the Capitalia survey asks each firm questions about the way banks acquire and reuse information about firms. Using these questions, we construct a set of indicators for information spillovers. The first is a dummy that takes the value of one if the main bank heavily relies on specific, soft information on the firm’s assets and market of destination that is obtained through frequent contacts between firm and loan officers. We expect this information not to be transferable to entrants and, if anything, to crowd out effort and resources of loan officers in screening entrants (Michelacci and Suarez, 2004; Hachem, 2014). The second indicator is a dummy that takes the value of one if the bank intensely collects information about the innovation capacity of the firm. According to prior literature (e.g., Bhattacharya and Chiesa, 1995; Yosha, 1995) banks acquiring this information are keen to preserve the leadership of the incumbent innovative firm and, hence, inhibit the entry of new competitors. The third indicator (“embedded” information spillover) is a dummy that takes the value of one if the bank heavily relies on information about the ability and trustworthiness of the firm’s managers (Drexler and Schoar, 2014; Uzzi and Lancaster, 2003). We expect that this information is portable to a new firm as relational capital if the managers create a spin-off. In each case, to measure the relative importance of information spillovers in a sector, we compute the average of the variable across the firms in the sector.

The estimates in Table 5A reveal that in sectors where banks’ information on incumbents is less transferable to new firms (e.g., it focuses on incumbents’ specific assets and destination market) and is more likely to crowd out screening of entrants, relationship lending is more likely to depress firm entry (columns 1-2). In addition, relationship lending is more likely to depress entry when banks have the incentive to strategically conceal their information on innovative incumbents from entrants (columns 3-4). Expectedly, we find that this incentive is stronger in sectors where trade secrecy is more important (see the Appendix for a discussion and Appendix Table A2 for details). On the other hand, in sectors where banks’ information on incumbents’ managers is portable to new firms, relationship lending increases both the probability that a spin-off is created from a firm (column 9) and the relative importance of spin-offs among entrants (column 12), although the latter effect is estimated imprecisely.

**Industry characteristics** In Table 5B, we further explore information spillovers by exploiting data on characteristics of the sector. We consider the relative importance

of human and physical capital in the sector as well as the sectoral specificity of assets. We expect the transferability of banks' information to entrant firms to be easier when assets are less specific. Moreover, we expect it to be easier when human capital is relatively more relevant than physical capital, as managers and employees who create spin-offs can exploit information previously acquired by banks on their human capital. Finally, we also consider a measure of sectoral information which banks could reuse when financing entrants. The relevance of human capital in the sector is from Ciccone and Papaioannou (2009). The relevance of physical capital in the sector is from the last wave of the Capitalia survey, which asks the firms whether their banks especially value information about the physical, collateralizable assets of the firms. To capture asset specificity (lack of asset redeployability), as in Guiso and Minetti (2010) and following Shleifer and Vishny (1992), we use the co-movement between the value added of the firm and that of other firms in the same industry (see the Appendix for a discussion). Finally, we capture sectoral information with the generality of the product of the sector, measured as in Nunn (2007) as the proportion of generic investments in the sector.

The estimates in Table 5B suggest that credit relationships especially reduce entry in sectors that exhibit a stronger physical collateral emphasis (columns 1-2), a stronger asset specificity (columns 5-6), and a lower incidence of human capital (columns 3-4).<sup>9</sup> On the other hand, we find no evidence of positive information spillovers associated with sectoral information acquired by banks during credit relationships (columns 7-8).

To summarize, Tables 5A-5B point to negative information spillovers from credit relationships to entrant firms especially when assets and activities of incumbents are specific and rival to those of entrants. Positive information spillovers appear to arise when banks acquire knowledge about incumbents' managers and human capital that is portable to new firms.

## 5 The Model

Motivated by the empirical findings, we study a general equilibrium model with firm entry and credit relationships. Key components of the model are channels through which information accumulated by lenders during credit relationships spills over (negatively or

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<sup>9</sup>The coefficients for asset specificity are however estimated imprecisely.

positively) to entrant firms. Our goal is to determine to what extent this parsimonious model can rationalize the empirical findings qualitatively and quantitatively.

We consider an infinite-horizon, discrete-time economy ( $t = 0, 1, 2, \dots$ ). There is a final good which can be invested and consumed. The economy is populated by entrepreneurs and households. Households comprise lenders and managers. Lenders can finance entrepreneurs in the credit market. Managers can work for entrepreneurs. Agents' discount factor is assumed equal to 1.

## 5.1 Entrepreneurs

In any period  $t$ , entrepreneurs consist of incumbents and entrants (see Figure 2 for an illustration). In each period, a unit measure of new entrepreneurs enter the economy. Moreover, each manager who previously worked for an entrepreneur becomes herself an entrepreneur (has a spin-off opportunity) with probability  $\sigma$ .<sup>10</sup>

In each period of her life, an entrepreneur (indexed by  $i$ ) chooses whether to invest or to retire. If she does not invest, an entrepreneur retires permanently and has access to a storage technology with gross return of 1 until she dies. If she invests, an entrepreneur incurs a fixed utility (effort) cost  $\zeta$  and then chooses the size  $i_{i,t}$  of her investment. An entrepreneur survives with probability  $\pi$ , in which case an investment yields a gross return  $Ri_{i,t}$  ( $R > 1$ ). An entrepreneur dies with probability  $(1 - \pi)$  in each period, in which case she does not consume but bequeaths her wealth, after any repayment obligation. If she has invested and then dies before the investment comes to fruition, the investment is liquidated for  $A_{i,t}i_{i,t}$ , where  $A_{i,t}$  captures the liquidation value of the firm's assets and is an *i.i.d.* process across entrepreneurs and time, distributed according to the distribution function  $G$  over the support  $[\underline{A}, \bar{A}]$  (with  $\bar{A} < R$ ).

To invest an amount  $i_{i,t}$ , an entrepreneur with initial wealth  $w_{i,t-1}$  needs a loan of size  $(i_{i,t} - w_{i,t-1})$  and a manager to work with. An entrant's initial wealth depends on bequests from entrepreneurs who died in the previous period. We posit that all bequests are pooled through a mutual fund and that each entrant receives an equal share of all bequests made in period  $t - 1$ .

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<sup>10</sup>While working for incumbent firms, managers acquire knowledge and experience useful for starting entrepreneurial activities (Klepper and Sleeper, 2005).

Entrepreneurs' lifetime utility function reads

$$U_t = \sum_{j=0}^{\infty} \pi^j [\pi \log(x_{i,t+j}) - 1_{i,t+j}(\text{invest})\zeta], \quad (4)$$

where  $x_{i,t+j}$  denotes consumption in period  $t + j$ . Note that bequests do not enter entrepreneurs' utility.

## 5.2 Lenders and managers

There is a large measure of infinitely-lived risk-neutral households. Households comprise lenders and managers.<sup>11</sup> Lenders are deep pockets and finance entrepreneurs in a competitive credit market. Managers supply their services to entrepreneurs in a competitive managerial market. Lenders and managers have access to the same storage technology as entrepreneurs.

When entering the economy, a new entrepreneur can establish credit relationships with a set of lenders. Credit relationships allow lenders to accumulate information on the entrepreneur and her investments over time, as we describe below. Without loss of generality, we consider the case in which the entrepreneur borrows funds from one of her relationship lenders. In any period  $t$ , the contract between an entrepreneur and a lender specifies the amount  $(i_{i,t} - w_{i,t-1})$  of borrowing from the lender and the amount  $d_{i,t}$  of investment pledged to the lender. In particular, in case of investment success (or entrepreneur's death) the lender can claim the output (respectively, the liquidation value) of  $d_{i,t}$  units of investment.

The credit market features limited pledgeability of investment returns. The returns that the lender can effectively appropriate depend on his information about the firm's entrepreneurial and managerial capital (e.g., the entrepreneur's trustworthiness and the manager's skills) and about the firm's assets. The information on entrepreneur and manager ( $\lambda_{i,t}^H$ ) allows the lender to verify their output in case of success ( $\pi$ ). It also turns into relational capital of the manager that is portable by the manager to any entrepreneurial investment she subsequently starts. The information on the assets of the firm ( $\lambda_{i,t}^A$ ) allows the lender to recover value in case of liquidation ( $1 - \pi$ ) and is specific to the firm's assets, that is, it is not transferable to other firms.

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<sup>11</sup>We allow the measure of managers to grow over time so that the outflow of managers who become entrepreneurs gets replenished by an inflow of new managers.

The gross expected return of a lender is

$$\pi R\lambda_{i,t}^H d_{i,t} + (1 - \pi) A_{i,t} \lambda_{i,t}^A d_{i,t}. \quad (5)$$

$\lambda_{i,t}^A, \lambda_{i,t}^H \in [0, 1]$  can be interpreted as fractions: if the investment succeeds, yielding  $Ri_{i,t}$ , the lender receives  $R\lambda_{i,t}^H d_{i,t}$ ; if it is liquidated at  $A_{i,t}i_{i,t}$ , he receives  $A_{i,t}\lambda_{i,t}^A d_{i,t}$ .<sup>12</sup>

Since his outside option is the storage technology, the lender's participation constraint (LPC) reads

$$\pi R\lambda_{i,t}^H d_{i,t} + (1 - \pi) A_{i,t} \lambda_{i,t}^A d_{i,t} \geq i_{i,t} - w_{i,t-1}. \quad (6)$$

### 5.3 Lenders' information and spillovers

At the beginning of period  $t$ , there are three types of entrepreneurs who can start an investment: (i) entrepreneurs who just entered in period  $t$ . These are de novo entrants (denoted by the superscript  $N$ ); (ii) entrepreneurs who already invested in  $t - 1$ . These are incumbent entrepreneurs ( $I$ ); (iii) spin-off entrants ( $S$ ). These are managers who worked for entrepreneurs in  $t - 1$  and who become themselves entrepreneurs.

The three types of information differ in the information that lenders attain on investment returns (see also Table 6 for a summary). In particular, (i) lenders' information on the entrepreneurial and managerial capital and on the assets of incumbents is potentially higher than that for entrants (whether de novos or spin-offs), as incumbents are already known to lenders. To capture the fact that not all incumbents may immediately benefit from the information accumulated by relationship lenders, we assume that, after an entrepreneur's entry, the lender has a probability  $\rho \in (0, 1]$  of upgrading to higher information in each following period, if the upgrade has not yet occurred; with probability  $1 - \rho$ , instead, the lender retains the same information (which is strictly lower); (ii) for entrants, lenders' information on de novos is lower than that on spin-offs, as spin-offs can rely on the relational capital accumulated by managers during their previous interactions with lenders in incumbent firms.

Formally, we posit  $\lambda_{i,t}^J \equiv \lambda \Psi_t^J$  for  $J = A, H$ , where  $\Psi_t^J$  depends on the type of agent.

(i) *Incumbents*. For incumbents whose lenders have upgraded to high information levels,  $\Psi_t^J = \bar{\Psi} \psi_I$ ,  $J = A, H$ , for any  $t$ .  $\psi_I$  shapes the informational advantage of

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<sup>12</sup>In case of death, the entrepreneur receives 0, and  $A_{i,t}(i_{i,t} - \lambda_{i,t}^A d_{i,t})$  is wasted, which reflects costs that lenders sustain when repossession collateral assets during borrowers' bankruptcies.

lenders on incumbents and, hence, captures the intensity of relationship lending.  $\bar{\Psi}$  is an aggregate shock to the intensity of relationship lending and is normalized to 1 in the initial steady state.

(ii) *Entrants*. We next describe lenders' information on entrants. In our economy, information acquired by relationship lenders on incumbents spills over to entrants through two distinct channels. As noted, the first (embedded spillover) runs through the creation of spin-offs: the stock of information (relational capital) is portable by managers who leave incumbent firms to start entrepreneurial investments. The second mechanism (non-embedded spillover) runs through the reusability or the rivalry between lenders' information on incumbents and their information acquisition on entrants.

Precisely, for de novo entrants,  $\Psi_t^J = F(L_t^I)$ ,  $J = A, H$ , where  $L_t^I$  is the aggregate stock of loans extended by lenders to incumbents;<sup>13</sup> if the non-embedded information spillover is positive (the reusability of information prevails over rivalry and crowding out effects), then  $F'(L_t^I) > 0$ ; if it is negative, then  $F'(L_t^I) < 0$ . In the initial steady state, we normalize  $F(L^I)$  to 1.

For spin-off entrants,  $\Psi_t^A = F(L_t^I)$  and  $\Psi_t^H = \bar{\Psi}\psi_S$ , where  $\psi_S \leq \psi_I$ . In the analysis, we will focus on the case in which  $\bar{\Psi}\psi_S > F(L_t^I)$  so as to reflect the positive spillover embedded in the relational capital of the manager (which is absent for de novo entrants).

## 5.4 Discussion

The embedded information spillover reflects information on managers that is portable to spin-offs. During credit relationships loan officers establish close, interpersonal ties with the entrepreneurs and managers of borrowing firms and acquire information on their skills and trustworthiness (Drexler and Schoar, 2014; Petersen and Rajan, 1994). Managers who subsequently start businesses can exploit this relational capital and resort to the banks with which they interacted when working for incumbent firms. This relational capital consists of a stock of “soft” information, mutual trust and personal ties with banks (Uzzi and Lancaster, 2003). This is hard to verify for third parties, so that managers can exploit it when starting their own business but cannot contractually commit to using it to the benefit of de novo entrepreneurs.

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<sup>13</sup>The dependence on  $L_t^I$  reflects the idea that the stronger the involvement of lenders in credit relationships with incumbents, the stronger the information spillover.

As for the non-embedded information spillover, on the positive side (information reusability) it can capture sectoral information accumulated by lenders while financing incumbents and that can be reused when financing entrants (Boot and Thakor, 2000). On the negative side (crowding out), it can capture limited monitoring capacity of lenders: focusing loan officers on acquiring information about incumbents crowds out their ability to screen and monitor entrants (Hachem, 2014; Michelacci and Suarez, 2004). It may also capture lenders' strategic decisions to keep information on incumbents secret when financing entrants (Bhattacharya and Chiesa, 1995; Yosha, 1995).

We will later show how the information acquisition technology in the credit market compares with the technologies specified in previous macroeconomic models of the credit market (e.g., Goodfriend and McCallum, 2007).

## 6 Agents' Decisions

We study the decisions of incumbents, de novos and spin-offs along both the extensive and intensive margins of investment (the decision whether to invest or to retire and, for those who do invest, the size of investments). In particular, we show that for each type there exists a threshold investment liquidation value ( $A_{i,t}$ ) below which starting an investment is not worthwhile, and we find the optimal level of investment ( $i_{i,t}$ ) and of pledged returns ( $d_{i,t}$ ) for those who do invest.

Conditional on retiring ( $r$ ) and using the storage technology, an entrepreneur with initial wealth  $w_{i,t-1}$  solves the following problem

$$V^r(w_{i,t-1}) = \max_{x_{i,t}, w_{i,t}} \pi [\log(x_{i,t}) + V^r(w_{i,t})], \quad (7)$$

$$\text{s.t. } x_{i,t} + w_{i,t} = w_{i,t-1}. \quad (8)$$

$V^r$  is the value function before the idiosyncratic death shock realizes. It can easily be shown that  $x_{i,t} = (1 - \pi)w_{i,t-1}$  and

$$V^r(w_{i,t-1}) = \frac{\pi \log(w_{i,t-1})}{1 - \pi} + \frac{\pi \log(1 - \pi)}{1 - \pi} + \frac{\pi^2 \log(\pi)}{(1 - \pi)^2}. \quad (9)$$

### 6.1 Incumbents

Recall that with probability  $\rho$  a lender's information about an entrepreneur upgrades to a higher level in the following period. If this has not yet occurred, the decision problem

of an incumbent boils down to that of an entrant (see Section 6.2). If the information upgrade has instead occurred, then, conditional on investing, an incumbent ( $I$ ) with initial wealth  $w_{i,t-1}$  solves

$$V^I(w_{i,t-1}, A_{i,t}) = \max_{x_{i,t}, w_{i,t}, i_{i,t}, d_{i,t}} \pi \left[ \log(x_{i,t}) - \frac{\zeta}{\pi} + \int_{\underline{A}}^{\bar{A}} \max\{V^r(w_{i,t}), V^I(w_{i,t}, A_{i,t+1})\} dG(A_{i,t+1}) \right] \quad (10)$$

$$\text{s.t. } x_{i,t} + w_{i,t} = Ri_{i,t} - \lambda_{i,t}^H R d_{i,t}, \quad (11)$$

$$\pi R \lambda_{i,t}^H d_{i,t} + (1 - \pi) A_{i,t} \lambda_{i,t}^A d_{i,t} \geq i_{i,t} - w_{i,t-1}, \quad (12)$$

$$i_{i,t} \geq d_{i,t} \geq 0, \quad (13)$$

where (11) is the incumbents' budget constraint and (12) is the lender's participation constraint. In the constraints, we use the fact that, since the managerial market is competitive and managers have a zero outside option, managers do not appropriate surplus from investments. Thus, an incumbent retains an amount  $R(i_{i,t} - \lambda_{i,t}^H d_{i,t})$  of output in case of investment success.<sup>14</sup>

Since the lenders with which the incumbent established relationships compete for financing her, constraint (12) binds. Solving for  $d_{i,t}$  and  $i_{i,t}$ , we obtain that investment is bounded (i.e., incumbents need a downpayment to borrow) for any  $A_{i,t}$  as long as

$$\text{Assumption 1: } \pi R \lambda_t^H + (1 - \pi) \bar{A} \lambda_{i,t}^A < 1. \quad (14)$$

We also posit

$$\text{Assumption 2: } \pi R + (1 - \pi) \underline{A} > 1. \quad (15)$$

Under Assumption 2, an entrepreneur strictly prefers investing a positive amount and, recalling that  $\lambda_{i,t}^J \equiv \lambda \bar{\Psi} \psi_I$  for any  $t$  and  $J = A, H$ ,

$$d_{i,t} = i_{i,t} = \frac{w_{i,t-1}}{1 - \lambda \bar{\Psi} \psi_I [\pi R + (1 - \pi) A_{i,t}]}. \quad (16)$$

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<sup>14</sup>While working for an incumbent entrepreneur, a manager does not extract surplus from his relational capital and personal ties with the lender. The incumbent entrepreneur has the same ties and relationships with the lender, so the manager's ties are dispensable. The manager can however exploit his relational capital in any entrepreneurial investment he subsequently starts.

The investment payoff to the incumbent can then be expressed as

$$(1 - \lambda \bar{\Psi} \psi_I) R i_{i,t} = R^I(A_{i,t}) w_{i,t-1}, \quad (17)$$

where

$$R^I(A_{i,t}) \equiv \frac{(1 - \lambda \bar{\Psi} \psi_I) R}{1 - \lambda \bar{\Psi} \psi_I [\pi R + (1 - \pi) A_{i,t}]}. \quad (18)$$

It is immediate that, under Assumption 2,  $R^I(A_{i,t})$  is increasing in  $\lambda \bar{\Psi} \psi_I$  for any  $A_{i,t}$ .

We can now state the following lemma.

**Lemma 1** *Conditional on investing, an incumbent's consumption function and value function satisfy*

$$x_{i,t} = (1 - \pi) R^I(A_{i,t}) w_{i,t-1}, \quad (19)$$

$$V^I(w_{i,t-1}, A_{i,t}) = \frac{\pi \log(w_{i,t-1})}{1 - \pi} + \frac{\pi \log(1 - \pi)}{1 - \pi} + \frac{\pi^2 \log(\pi)}{(1 - \pi)^2} + \Gamma_t^I(A_{i,t}) = V^r(w_{i,t-1}) + \Gamma_t^I(A_{i,t}), \quad (20)$$

where  $\Gamma_t^I(A_{i,t})$  is the difference between incumbent value and retiree value. It follows

$$\Gamma_t^I(A_{i,t}) = \pi \left[ \frac{\log R^I(A_{i,t})}{1 - \pi} - \frac{\zeta}{\pi} + \int_{\hat{A}_{t+1}^I}^{\bar{A}} \Gamma_{t+1}^I(A_{i,t+1}) dG(A_{i,t+1}) \right]. \quad (21)$$

In (21),  $\pi \left( \frac{\log R^I(A_{i,t})}{1 - \pi} - \frac{\zeta}{\pi} \right)$  measures the direct utility gain from investing: an incumbent pays utility cost  $\zeta$  but earns a higher return  $R^I(A_{i,t})$  on her wealth than using storage (which has a gross return of one). The second term  $\int_{\hat{A}_{t+1}^I}^{\bar{A}} \Gamma_{t+1}^I(A_{i,t+1}) dG(A_{i,t+1})$  is the option value of being an incumbent. An incumbent invests if and only if  $V^I(w_{i,t-1}, A_{i,t}) > V^r(w_{i,t-1})$ , that is, if  $\Gamma^I(A_{i,t}) > 0$ . The lemma below solves for incumbents' investment threshold.

**Lemma 2** *The threshold  $\hat{A}_t^I$  above which incumbents invest is determined by the following recursive equation*

$$\frac{\log R^I(\hat{A}_t^I)}{1 - \pi} - \frac{\zeta}{\pi} + \int_{\hat{A}_{t+1}^I}^{\bar{A}} \Gamma_{t+1}^I(A_{i,t+1}) dG(A_{i,t+1}) = 0. \quad (22)$$

Because  $\int_{\hat{A}_{t+1}^I}^{\bar{A}} \Gamma_{t+1}^I(A_{i,t+1}) dG(A_{i,t+1}) \geq 0$ , it must be that  $\frac{\log R^I(\hat{A}_t^I)}{1 - \pi} - \frac{\zeta}{\pi} \leq 0$ .

## 6.2 Entrants

We now consider a de novo entrant with wealth  $w_{i,t-1}$ . Conditional on investing, she solves a problem isomorphic to that of an incumbent with the difference that  $F(L_t^I)$  replaces  $\bar{\Psi}\psi_I$ , that is,  $\lambda_{i,t}^H = \lambda_{i,t}^A = \lambda F(L_t^I)$ . If she invests, in the following period her lender upgrades to a higher information level with probability  $\rho$ , in which case the entrepreneur's continuation value is  $V^I(\cdot)$ .

When the lender's participation constraint (6) binds, we have

$$d_{i,t} = i_{i,t} = \frac{w_{i,t-1}}{1 - \lambda F(L_t^I) [\pi R + (1 - \pi) A_{i,t}]}. \quad (23)$$

Note that incumbents' aggregate stock of loans  $L_t^I$  affects the scale of de novo entrants' investment through the non-embedded information spillover. Moreover, our assumptions on lenders' information and spillovers imply that, for given  $A_{i,t}$  and  $w_{i,t-1}$ , de novo entrants' investment is lower than incumbents'. We can now state the following:

**Lemma 3** *The investment threshold  $\hat{A}_t^N$  for de novo entrants is determined by the following recursive equation:*

$$\frac{\log R_t^N(\hat{A}_t^N)}{1 - \pi} - \frac{\zeta}{\pi} + \rho \int_{\hat{A}_{t+1}^I}^{\bar{A}} \Gamma_{t+1}^I(A_{i,t+1}) dG(A_{i,t+1}) + (1 - \rho) \int_{\hat{A}_{t+1}^N}^{\bar{A}} \Gamma_{t+1}^N(A_{i,t+1}) dG(A_{i,t+1}) = 0 \quad (24)$$

where

$$\Gamma_t^N(A_{i,t}) = \pi \left[ \frac{\log R_t^N(A_{i,t})}{1 - \pi} - \frac{\zeta}{\pi} + \rho \int_{\hat{A}_{t+1}^I}^{\bar{A}} \Gamma_{t+1}^I(A_{i,t+1}) dG(A_{i,t+1}) + (1 - \rho) \int_{\hat{A}_{t+1}^N}^{\bar{A}} \Gamma_{t+1}^N(A_{i,t+1}) dG(A_{i,t+1}) \right],$$

and

$$R^N(A_{i,t}) \equiv \frac{[1 - \lambda F(L_t^I)] R}{1 - \lambda F(L_t^I) [\pi R + (1 - \pi) A_{i,t}]}.$$

Finally, consider a manager who has received the opportunity to start an entrepreneurial investment (create a spin-off).<sup>15</sup> Conditional on retiring, a manager has the same

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<sup>15</sup>Like for a de novo entrant, the wealth  $w_{i,t-1}$  of a spin-off manager comes from bequests. In fact, recall that managers do not appropriate surplus from investments and, hence, do not accumulate wealth when working for incumbent entrepreneurs.

value function as a retiring incumbent. Conditional on investing (creating the spin-off), the manager solves a problem isomorphic to that of an incumbent with the difference that, for the output in case of success,  $\bar{\Psi}\psi_S$  replaces  $\bar{\Psi}\psi_I$  and, for the assets in case of liquidation,  $F(L_t^I)$  replaces  $\bar{\Psi}\psi_I$ .

Conditional on the manager investing, in the following period the lender upgrades to a higher information level with probability  $\rho$ , in which case the continuation value is  $V^I(\cdot)$ . When the lender's participation constraint binds,

$$d_{i,t} = i_{i,t} = \frac{w_{i,t-1}}{1 - \lambda [\pi R \bar{\Psi}\psi_S + (1 - \pi) A_{i,t} F(L_t^I)]}. \quad (25)$$

The following lemma determines spin-offs' threshold for investment.

**Lemma 4** *The investment threshold  $\hat{A}_t^S$  for spin-off entrants is determined by the following recursive equation:*

$$\frac{\log R_t^S(\hat{A}_t^S)}{1 - \pi} - \frac{\zeta}{\pi} + \rho \int_{\hat{A}_{t+1}^I}^{\bar{A}} \Gamma_{t+1}^I(A_{i,t+1}) dG(A_{i,t+1}) + (1 - \rho) \int_{\hat{A}_{t+1}^S}^{\bar{A}} \Gamma_{t+1}^S(A_{i,t+1}) dG(A_{i,t+1}) = 0. \quad (26)$$

The expression for  $\Gamma_t^N(A_{i,t})$  is analogous to that for  $\Gamma_t^N(A_{i,t})$ , with  $R^S(A_{i,t})$  replacing  $R^N(A_{i,t})$  (see the proof of the lemma for details).

## 7 Aggregation and Steady State

For simplicity, we pose  $\rho = 1$  in this section and in Sections 8.1-8.2; robustness for the  $\rho < 1$  case will be shown in Section 8.3. Before solving for the measures of the different types of entrepreneurs and for the steady state equilibrium, it is useful to look at the aggregate stock of loans,  $L_t \equiv L_t^I + L_t^N + L_t^S$ . Using (16), (23) and (25) for, respectively,  $I$ ,  $N$  and  $S$ , this can be written as

$$L_t(W_{t-1}^h, \lambda_{h,t}^H, \lambda_{h,t}^A) = \sum_{h \in \{I, N, S\}} W_{t-1}^h \int_{\hat{A}_t^h}^{\bar{A}} \frac{\pi R \lambda_{h,t}^H + (1 - \pi) A_{i,t} \lambda_{h,t}^A}{1 - \pi R \lambda_{h,t}^H - (1 - \pi) A_{i,t} \lambda_{h,t}^A} dG(A_{i,t}), \quad (27)$$

where  $W_{t-1}^h$  is the aggregate wealth of type  $h$  entrepreneurs. Expression (27) can be interpreted as a "production function" of loans. In Goodfriend and McCallum (2007),

for example, the amount of loans is an increasing function of two inputs, the lenders' information stock (here corresponding to  $\lambda_{h,t}^H, \lambda_{h,t}^A$ ), and the wealth ( $W_{t-1}^h$ ) and collateral ( $A_{i,t}$ ) brought by the borrowers. Key differences from Goodfriend and McCallum (2007) are the differentiation between incumbent firms and entrants and the presence of information spillovers from credit relationships to entrant firms. These information spillovers affect (27) through lenders' information levels.

We can now compare the investment choices of incumbents, de novos and spin-offs and study the aggregate behavior of the economy. For any given  $A_{i,t}$ , it is immediate to show that  $R_t^N(A_{i,t}) < R_t^S(A_{i,t}) < R_t^I(A_{i,t})$ . Comparing Lemma 2, Lemma 3 and Lemma 4, the next lemma then follows directly.

**Lemma 5**  $\hat{A}_t^N > \hat{A}_t^S > \hat{A}_t^I$  for all  $t$ .

Lemma 5 shows that the investment conditions are more restrictive for de novos than for spin-offs, whose investment conditions are in turn more restrictive than those for incumbents. This reflects the different information of lenders about the three categories of entrepreneurs.

We can next characterize the measures of de novos ( $M_t^N$ ), spin-offs ( $M_t^S$ ) and incumbents ( $M_t^I$ ). All the measures are defined before the realization of the entrepreneurs' death shock. Recall that in every period  $t$  there is a unit measure of new entrepreneurs. Thus, the measure of de novo entrants is

$$M_t^N = 1 - G(\hat{A}_t^N). \quad (28)$$

Since each firm employs one manager, in period  $t-1$  the measure of managers equals the measure of firms (de novos, incumbents, and spin-offs),  $(M_{t-1}^I + M_{t-1}^N + M_{t-1}^S)$ . Thus, the measure of spin-offs created by managers is

$$M_t^S = \left[1 - G(\hat{A}_t^S)\right] \sigma (M_{t-1}^I + M_{t-1}^N + M_{t-1}^S). \quad (29)$$

In period  $t-1$ , the measure of surviving entrepreneurs is  $\pi (M_{t-1}^I + M_{t-1}^N + M_{t-1}^S)$ . Thus, the measure of incumbents is

$$M_t^I = \left[1 - G(\hat{A}_t^I)\right] \pi (M_{t-1}^I + M_{t-1}^N + M_{t-1}^S). \quad (30)$$

Guided by the empirical analysis, we especially focus on three aggregate variables: the measure of entrants,  $M^N + M^S$ ; the ratio of entrants to incumbents,  $(M^N + M^S) / M^I$ ; and

the ratio of spin-offs to de novo entrants,  $M^S/M^N$ . In the Appendix, we also present the law of motion for the wealth of the different types of agents and for the amount of bequests.

In steady state the measures of incumbents, de novos and spin-offs are constant. We then obtain

$$M^N = 1 - G(\hat{A}^N), \quad (31)$$

$$M^I = \frac{\pi \left[ 1 - G(\hat{A}^I) \right] \left[ 1 - G(\hat{A}^N) \right]}{1 - \pi \left[ 1 - G(\hat{A}^I) \right] - \sigma \left[ 1 - G(\hat{A}^S) \right]}, \quad (32)$$

$$M^S = \frac{\sigma \left[ 1 - G(\hat{A}^S) \right] \left[ 1 - G(\hat{A}^N) \right]}{1 - \pi \left[ 1 - G(\hat{A}^I) \right] - \sigma \left[ 1 - G(\hat{A}^S) \right]}. \quad (33)$$

The measure of entrants is then

$$M^N + M^S = \frac{\left[ 1 - G(\hat{A}^N) \right] \left\{ 1 - \pi \left[ 1 - G(\hat{A}^I) \right] \right\}}{1 - \pi \left[ 1 - G(\hat{A}^I) \right] - \sigma \left[ 1 - G(\hat{A}^S) \right]}. \quad (34)$$

This is decreasing in the investment thresholds  $\hat{A}^N$  and  $\hat{A}^S$ , which reflects the extensive margin (participation) of de novos and spin-offs in the credit market. As for the effect of  $\hat{A}^I$ , recall that spin-offs originate from incumbent firms. Therefore, a lower measure of incumbents -  $\hat{A}^I \uparrow$  - has the direct effect of lowering the measure of spin-offs. On the other hand, the  $\hat{A}^I$  threshold has also an indirect effect through its impact on  $L_t^I$  and, hence, via  $F(L_t^I)$ , on  $\hat{A}^N$  and  $\hat{A}^S$ . We will elaborate on these mechanisms when discussing the simulation results.

The steady state ratio of entrants to incumbents is

$$\frac{M^N + M^S}{M^I} = \frac{1 - \pi \left[ 1 - G(\hat{A}^I) \right]}{\pi \left[ 1 - G(\hat{A}^I) \right]}. \quad (35)$$

This ratio is increasing in incumbents' threshold  $\hat{A}^I$ .

In steady state, the ratio of spin-offs to de novo entrants equals

$$\frac{M^S}{M^N} = \frac{\sigma \left[ 1 - G(\hat{A}^S) \right]}{1 - \pi \left[ 1 - G(\hat{A}^I) \right] - \sigma \left[ 1 - G(\hat{A}^S) \right]}. \quad (36)$$

This ratio is decreasing in  $\hat{A}^S$ . As we discuss below, it is also affected by  $\hat{A}^I$  directly and through the impact of  $\hat{A}^I$  on  $L_t^I$  and, hence, via  $F(L_t^I)$ , on  $\hat{A}^S$ .

## 8 Model Analysis

We numerically solve for the steady state. We first present the calibration of the model to the Italian data used in Section 3 (Section 8.1). We then perform simulations for the short- and long-run effects of a permanent change in the intensity of relationship lending (Section 8.2). Finally, we present extensions to the baseline calibration (Section 8.3).

### 8.1 Calibration

Parameters are displayed in Table 7; the implied steady state values are in Table 8. We assume that the liquidation value  $A_{i,t}$  of firms' assets follows a truncated normal distribution on  $[\underline{A}, \bar{A}]$ , with a mean of  $1/2$  and a standard deviation of  $1/4$ .  $\underline{A}$  and  $\bar{A}$  are two standard deviations away from the mean. We normalize the aggregate shock to the intensity of relationship lending,  $\bar{\Psi}$ , to 1. Using the data from Italy, we calibrate the parameters of the investment technology  $\{\pi, \zeta, R, \sigma\}$  and of lenders' information on investment returns  $\{\lambda, \psi_I, \psi_S\}$  to match the following targets: the ratio of entrants to incumbents, the ratio of spin-off entrants to de novos, the leverage values of incumbents, de novos and spin-offs, as well as the ratio of the aggregate turnover of entrants over the aggregate turnover of incumbents and the ratio of the per capita turnover of entrants over the per capita turnover of incumbents. We normalize the steady state value of  $F(\cdot)$  to one. In the data, the ratio of entrants to incumbents equals 4.99%. Among entrants, almost 27% are spin-offs, using the definition of spin-offs based on the background of the majority of managers and directors (Section 3). This implies a ratio of spin-offs to de novos of 40%. In the data, incumbents exhibit a higher leverage than entrants: 4.70 vs. 2.01 for spin-offs and 1.80 for de novos.

The function  $F(L_t^I)$  for non-embedded information spillovers is set as a power function,  $F(L_t^I) = (L_t^I)^\gamma$ . The function is chosen so that the model can generate an increase in the stock of relationship loans to incumbents following a strengthening of relationship lending (an increase in  $\bar{\Psi}$ ). Given the above parameterization, this entails  $F'(L_t^I) < 0$ . This negative non-embedded information spillover is also consistent with the empirical estimates of Section 4.

## 8.2 Quantitative analysis

We consider an experiment that permanently increases  $\bar{\Psi}$ , raising the information advantage of lenders on incumbent firms. This shock is interpreted as an increase in the intensity of relationship lending. In particular, a higher  $\bar{\Psi}$  reduces the probability of incumbents' exit (retirement) by lowering their investment threshold  $\hat{A}^I$ ; hence, it increases the length of their credit relationships. We set the magnitude of the increase in  $\bar{\Psi}$  such that the expected duration of credit relationships rises by about 5% (1.2 years) of the pre-shock duration. The last column of Table 8 shows the effects of the shock on the steady state. Figure 3 displays the impulse response functions along the transition.

The shock reduces the measure of entrants as well as the ratio of entrants to incumbents. For example, after 5 years the measure of entrants drops by about 2% of the pre-shock level and the ratio of entrants to incumbents falls from 4.9% to 4.78%. In the long run, the ratio of entrants to incumbents goes down to 4.6% in the new steady state. The ratio of spin-offs to de novo entrants rises after the increase in  $\bar{\Psi}$ , going from 40% to 41.2% from the pre-shock to the post-shock steady state.<sup>16</sup> As for the size (investment scale) of firms at entry, this increases for both de novos and spin-offs. These results are consistent with the empirical findings. In the estimates we found a drop in the ratio of entrants to incumbents and in the ratio of entrants to population following a strengthening of relationship lending. We also estimated an increase in the incidence of spin-offs among entrants and an increase in the size of entrants.<sup>17</sup>

The impulse responses of the economy along the transition yield two additional insights relative to the steady-state effects (see Figure 3). First, there is a short-run undershooting of the entry rate relative to its long-run level. Second, in the short run the ratio of spin-offs to entrants overshoots the long-run increase.

To understand the intuition behind the effects of an increase in  $\bar{\Psi}$  both in the short and in the long run, let us first look at its impact on the total measure of entrants. The increase in  $\bar{\Psi}$  affects the measure of de novos through the non-embedded information spillover: it progressively raises the stock of relationship loans to incumbents,  $L^I$ , imposing a negative spillover on de novos through the crowding out of lenders' information acquisition on their managers and assets. This negative spillover also affects spin-off

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<sup>16</sup>The average leverage increases for incumbents and drops for de novos and spin-offs.

<sup>17</sup>Observe however that, due to data availability, in the empirical analysis we measured entrants' size with the number of employees.

entrants, though it only influences the information that lenders acquire on their assets (recall that spin-off managers are already known to lenders). In the case of spin-offs, two more mechanisms shape the impact of the increase in  $\bar{\Psi}$ . The shock directly increases the amount of information portable by managers to spin-offs (embedded information spillovers), which tends to boost spin-off entry. On the other hand, by reducing the measure of de novo entries, the increase in  $\bar{\Psi}$  progressively lowers the measure of incumbents in the long run. Since spin-offs originate from incumbents, this progressively depresses spin-off creation. In our simulation, the negative effects on de novo and spin-off entry are predominant, thus driving down the total measure of entrants.

When looking at the ratio of entrants to incumbents, one has also to consider the effect of the shock on the denominator of the ratio. The direct effect of the shock is to boost the measure of incumbents by raising the pledgeability of their investment returns, although, as noted above, the reduced entry progressively gains relevance, depressing incumbents' measure in the long run. As Table 8 and Figure 3 show, the net effect on the ratio of entrants to incumbents is negative both in the short and in the long run, in line with the empirical findings.

Let us now turn to the composition of entrants between spin-offs and de novos. The increase in  $\bar{\Psi}$  has a direct depressing effect on the measure of de novos. As noted, the effect on spin-offs is more articulated, reflecting the interplay between the information spillovers and the progressive reduction in the measure of incumbents from which spin-offs originate. In line with the empirical findings, under our calibration the measure of spin-offs drops less than that of de novos, driving up the ratio of spin-offs to de novos.

We can also compare the quantitative effects predicted by the model with those suggested by the empirical estimates. Let us first consider long-run changes. An increase by 5% of the average credit relationship length is predicted to reduce the ratio of entrants to incumbents by about 0.3 percentage points, from 4.9% to 4.6% in the new steady state (almost 5% of the pre-shock ratio). This is roughly in between the impact estimated in the OLS regression of Table 2 (a reduction of the ratio of entrants to incumbents by 0.048 percentage points following an increase by 1.2 years in the credit relationship length) and the impact estimated in the 2SLS regression (a 0.6 percentage points reduction). As for the response of the spin-off rate (spin-offs to de novos), the model predicts an increase by 1.2 percentage points in the long run, from 40% to 41.2%. This is consistent with the effect detected in the empirical analysis. In Table 4, column 1, in fact, we estimated

a 0.84 percentage points increase in the ratio of spin-offs to total entrants following an increase by 1.2 years in the credit relationship length. This corresponds to an increase by about 1.2 percentage points in the ratio of spin-offs to de novos.

In the short run the ratio of spin-offs to entrants overshoots the long-run increase, as noted. Intuitively, the role of embedded information spillovers in promoting the creation of spin-offs plays a large role in the short run. Subsequently, the progressive drop in spin-off creation due to the smaller flow of spin-offs from incumbents gains relevance. The short-run undershooting of the ratio of entrants to incumbents relative to its long-run level is again attributable to the predominance of information spillovers in the short run. In particular, the significant drop in de novo entries plays a relevant role in driving down the ratio of entrants to incumbents in the first portion of the transition.

Table 9 and Figure 3 also display the impact of the shock on firms' average size (investment) at entry. In line with the empirical findings, the average firm size at entry rises, going up by approximately 12% from the pre-shock to the post-shock steady state.

### 8.3 Information accumulation

In the baseline calibration we assumed that with probability  $\rho = 1$ , after an entrepreneur's entry, relationship lenders upgrade to a higher level of information on the entrepreneur and her investments in the following period. In Appendix Table 3 and Appendix Figure 1 we show the robustness of the results to letting  $\rho < 1$ , so that the accumulation of relationship lenders' information on entrepreneurs is more gradual.<sup>18</sup> All the results of the analysis carry through. Expectedly, the effects of the  $\bar{\Psi}$ -shock are slightly attenuated, as incumbents benefit less quickly from the strengthening of their credit relationships. Thus, for example, the decrease in the ratio of entrants to incumbents is slightly smaller than under the baseline calibration.

## 9 Macroeconomic indicators

In this section, we evaluate the effects of a strengthening of relationship lending on a number of key macroeconomic indicators.

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<sup>18</sup>In the Appendix, we also present the law of wealth accumulation and the measure of agents in the setting with  $\rho < 1$ .

**Business wealth concentration** The first question we ask the model regards the impact of the  $\bar{\Psi}$ -shock considered in Section 8 on the concentration of business wealth. As shown in Table 9 and in Figure 3, the shock leads to a significant increase in the concentration of entrepreneurs' wealth in the hands of incumbents. The ratio of the total wealth of entrants over that of incumbents drops by about 45% from the pre-shock to the post-shock steady state. Similarly, the per capita wealth of entrants over that of incumbents drops by 42%. Partly driven by this change in the relative wealth of incumbents and entrants, the average investment scale of incumbents rises more than that of entrants. We discuss this when considering the output effects of the shock.

**Output** Table 9 and Figure 3 also show the short- and long-run effect of the shock on total output and on the output produced by entrants (net of investment outlays). We display both the output including the asset liquidation value not appropriated by entrepreneurs or lenders (i.e., treating this portion of the liquidation value as a transfer to unmodelled "liquidators") and excluding it (i.e., treating it as a deadweight loss for the economy). For both output measures, the shock induces an increase in total output (by 6.2% for the first measure and by 7.6% for the second, from the pre-shock to the post-shock steady state) and a reduction in the output produced by entrants.

To understand this impact on output, it is useful to separate extensive and intensive margin effects. The shock reduces the measure of entrants and, by depressing the dynamism at entry, it also reduces the measure of incumbents in the long run. This extensive margin effect tends to shrink output. On the other hand, the shock increases the investment scale of entrants and, to a significantly larger extent, the investment scale of incumbents. The increase in the average investment of entrants is the result of three forces. There is a tightened selection at entry (the  $\hat{A}^N$  and  $\hat{A}^S$  investment thresholds go up) and also some increase in the bequests received by entrants. In the opposite direction, de novos can leverage their wealth less, as the pledgeability of their investment returns drops. Overall, the net effect of these forces is an increase in the investment scale of entrants, which is however too small to offset the drop in their measure. Thus, the output produced by entrants drops. Incumbents, on the other hand, experience a much larger boost to their investment scale: their wealth increase is much more sizeable than for entrants and they also experience an increase in investment returns pledgeability, due to the  $\bar{\Psi}$ -shock. The increase in incumbents' investment scale outweighs the drop

in their measure, raising their output and overall driving up total output.

The simulation thus suggests that the strengthening in incumbents' position, as reflected in their larger business wealth and investments, tends to outweigh the drop in entry and the resulting long-run contraction in the number of active firms. While insightful, it is important to stress that this conclusion may not necessarily hold in an alternative setting where entrants are inherently more productive (e.g., more likely to introduce new technologies) than incumbents.

## 10 Conclusion

Relationship lending is a fundamental component of the structure of credit markets. This paper has studied the impact of relationship lending on the dynamics of firm entry in a general equilibrium setting. Using data from the Italian local credit markets, we have found that an increase in the intensity of credit relationships reduces firm entry, while increasing the size of firms at entry. Stronger relationship lending also appears to tilt firm entry towards spin-offs (firms created by managers and employees of incumbent businesses) rather than de novo entries. The evidence further suggests that information spillovers from incumbents' credit relationships to entrant firms contribute to the detected effects of relationship lending on firm entry dynamics.

To rationalize these empirical patterns, we have developed a parsimonious general equilibrium model in which information accumulated by lenders over the course of credit relationships is directly transferrable to spin-offs that originate from incumbent firms. On the other hand, stronger accumulation of information in incumbents' credit relationships can also crowd out lenders' screening and monitoring of entrants and result in deliberate information retention by lenders when financing entrants.

When calibrated to the Italian data, the model satisfactorily matches the impact of credit relationships on firms' entry rate and on the relative importance of firms' entry modes (through spin-offs or de novo firm creation). The model also shows that, by stiffening firms' entry margin, an increase in the intensity of relationship lending can progressively lead to a contraction in the number of active firms, while expanding the investment scale of entrants and, to a larger extent, that of incumbents.

The analysis leaves open relevant questions. In the model we have abstracted from technological differences between newborn and incumbent businesses. However, new

firms are often found to feature a higher dynamism in introducing new technologies. Allowing for these technological differences could yield further insights into the output impact of the banking structure through firm entry. We leave this and other issues to future research.

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Table 1: Summary statistics

Variable	Obs	Mean	Std dev
Entrants/Incumbents (%)	9407	4.990	6.705
Entrants/Population (1000 inhab.)	9407	0.032	0.114
Share of firms with $\leq 2$ yrs (%)	2745	17.085	16.792
Spin-offs/Entrants (majority)	2246	0.264	0.441
Spin-offs/Entrants (all)	2246	0.162	0.368
Size (employees) at entry	2246	1.764	3.971
Firm spin-off probability	18176	0.035	0.184
Credit relationship length (yrs)	9384	16.142	4.555
Credit relationship length (over 10 y.)	9384	0.566	0.174
Number of banks	9407	5.325	1.427
Unemployment rate (log)	9407	2.047	0.623
Trade openness (log)	9407	-1.158	0.878
Material infrastructure (log)	9407	4.516	0.409
Population growth	9407	0.003	0.005
Judicial efficiency	9324	3.792	1.400
Bank branches HHI	9407	0.088	0.039
Bank branches/Population (1000 inhab.)	9407	0.522	0.181
Average firm age in province	9407	23.298	6.239

Notes: This table reports summary statistics for the main variables used in the analysis. Share of firms with  $\leq 2$  years is from Orbis database. Spin-offs/Entrants (all and majority) and Size at entry are based on the survey of the Italian Ministry of Economic Development. See Data Appendix and Section 3.2 for further details on the variables.

Table 2: Credit relationships and firm entry. Baseline estimations

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Entrants/ Incumbents	Entrants/ Population	Entrants/ Incumbents	Entrants/ Population	Entrants/ Incumbents	Entrants/ Population	Entrants/ Incumbents	Entrants/ Population
	OLS	OLS	OLS	OLS	OLS	OLS	2SLS	2SLS
Relationship length	-0.042*** (0.015)	-0.001** (0.000)	-0.036*** (0.014)	-0.000** (0.000)	-0.047*** (0.017)	-0.000** (0.000)	-0.524*** (0.091)	-0.003* (0.001)
<i>Provincial economic and banking conditions</i>								
Unemployment rate (log)	2.009*** (0.226)	0.007* (0.004)	2.032*** (0.230)	0.008** (0.004)	0.819** (0.397)	0.016*** (0.006)	1.547*** (0.231)	0.005 (0.003)
Population growth	23.640** (10.156)	0.687*** (0.215)	23.182** (9.991)	0.676*** (0.212)	131.095*** (21.955)	0.855* (0.474)	16.221 (11.300)	0.650*** (0.224)
Bank branches HHI	-8.619*** (1.764)	-0.093*** (0.026)	-8.535*** (1.738)	-0.091*** (0.026)	-61.608*** (6.995)	-0.503*** (0.156)	0.602 (2.384)	-0.048* (0.028)
Branches/population	-0.514 (0.636)	-0.017** (0.008)	-0.505 (0.635)	-0.016** (0.008)	5.544** (2.362)	-0.056 (0.038)	-0.540 (0.685)	-0.017** (0.008)
<i>Structural provincial characteristics</i>								
Trade openness (log)	-0.025 (0.112)	0.002 (0.002)	-0.029 (0.114)	0.002 (0.002)			-0.473*** (0.151)	-0.000 (0.002)
Material infrastructure (log)	-1.990*** (0.242)	-0.016*** (0.004)	-1.984*** (0.241)	-0.016*** (0.004)			-2.558*** (0.281)	-0.019*** (0.005)
Judicial efficiency	0.038 (0.047)	0.001** (0.001)	0.037 (0.047)	0.001* (0.001)			0.076 (0.054)	0.002** (0.001)
Average firm age			-0.009 (0.011)	-0.000 (0.000)				
<i>Instrumental variables</i>								
Saving banks 1936							-0.855*** (0.116)	-0.855*** (0.116)
New branches incumbent							0.027*** (0.003)	0.027*** (0.003)
Area dummies	Y	Y	Y	Y	N	N	Y	Y
Provincial dummies	N	N	N	N	Y	Y	N	N
Time and industry dummies	Y	Y	Y	Y	Y	Y	Y	Y
Observations	9,292	9,292	9,292	9,292	9,384	9,384	9,292	9,292
R-squared	0.158	0.108	0.158	0.108	0.264	0.156	0.067	0.100
F instruments							117.7	117.7
Overid p value							0.505	0.125

Notes: This table reports the effects of the average length of credit relationships in a province on the number of newly registered firms in a province and sector (entrants) scaled by the number of incumbent firms in the same province and sector or the total population in the province. All the columns report the estimated coefficients and robust standard errors in parentheses. All the regressions include geographical area, time and industry fixed effects. In columns (1)-(4) and (7)-(8), geographical fixed effects are macro-area dummies. In columns (5)-(6), geographical fixed effects are provincial dummies. In columns (7) and (8) the provincial average length of credit relationships is instrumented using the number of provincial saving bank branches in 1936 and the number of new branches by incumbent banks in the 1991-1998 period (per 100,000 inhabitants). See Data Appendix and Section 3.2.3 for details on the control variables. The table also reports F-tests on excluded instruments and p-values for overidentification tests. \* Significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

Table 3: Credit relationships and firm entry. Robustness checks

<i>Panel A: OLS Estimations</i>								
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Alternative entry measures		Alternative independent variables				Winsorizing relationship length	
	Share of firms with ≤ 2yrs (Orbis)	Firm spin-off probability	Entrants/ Incumbents	Entrants/ Population	Entrants/ Incumbents	Entrants/ Population	Entrants/ Incumbents	Entrants/ Population
Relationship length	-0.217** (0.103)	-0.003* (0.002)					-0.047*** (0.016)	-0.001** (0.000)
Relationship length (over 10 y.)			-1.226*** (0.398)	-0.011* (0.006)				
Number of banks					0.341*** (0.052)	0.003*** (0.001)		
+ controls	Y	Y	Y	Y	Y	Y	Y	Y
Area and industry dummies	Y	Y	Y	Y	Y	Y	Y	Y
Time dummies	N	Y	Y	Y	Y	Y	Y	Y
Observations	2,688	11,372	9,292	9,292	9,315	9,315	9,292	9,292
R-squared	0.119	0.043	0.158	0.107	0.161	0.108	0.158	0.108
<i>Panel B: 2SLS Estimations</i>								
VARIABLES	Share of firms with ≤ 2yrs (Orbis)	Firm spin-off probability	Entrants/ Incumbents	Entrants/ Population	Entrants/ Incumbents	Entrants/ Population	Entrants/ Incumbents	Entrants/ Population
Relationship length	-0.496 (0.688)	-0.013 (0.018)					-0.517*** (0.089)	-0.003** (0.001)
Relationship length (over 10 y.)			-10.827*** (2.145)	-0.020 (0.021)				
Number of banks					2.218*** (0.493)	0.017* (0.009)		
<i>Instrumental variables</i>								
Saving banks 1936	0.198 (0.184)	-0.461 (0.507)	0.003 (0.005)	0.003 (0.005)	0.309*** (0.028)	0.309*** (0.028)	-0.833*** (0.114)	-0.833*** (0.114)
New branches incumbent	0.032*** (0.004)	-0.002 (0.005)	0.001*** (0.000)	0.001*** (0.000)	-0.003*** (0.001)	-0.003*** (0.001)	0.028*** (0.003)	0.028*** (0.003)
+ controls	Y	Y	Y	Y	Y	Y	Y	Y
Area and industry dummies	Y	Y	Y	Y	Y	Y	Y	Y
Time dummies	N	Y	Y	Y	Y	Y	Y	Y
Observations	2,688	11,399	9,292	9,292	9,315	9,315	9,292	9,292
R-squared	0.115	0.197	0.104	0.107	0.052	0.088	0.083	0.102
F instruments	28.55	2.935	99.81	99.81	89.15	89.15	124	124
Overid p value	0.087	0.829	0.005	0.078	0.245	0.245	0.448	0.122

Notes: This table reports robustness checks for the effects of credit relationships on firm entry dynamics. All the columns report the estimated coefficients and robust standard errors in parentheses. All the regressions include control variables, as well as area and industry fixed effects. Regressions (2)-(8) also include time fixed effects (column 1 has a cross-sectional dimension only). In Panel B our proxies of credit relationships are instrumented using the number of provincial saving bank branches in 1936 and the number of new branches by incumbent banks in the 1991-1998 period (per 100,000 inhabitants). See Data Appendix and Section 3.2.3 for details on the control variables. The table also reports F-tests on excluded instruments and p-values for overidentification tests. \* Significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

Table 4: Credit relationships, modes of entry, and size at entry

VARIABLES	<i>Panel A: Mode of entry</i>		<i>Panel B: Size (no. employees) at entry</i>				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Ratio Spin-offs (majority owners)/ All entrants	Ratio Spin-offs (all owners)/ All entrants	All entrants	Spin-off (majority)	Spin-off (all)	De novo (majority)	De novo (all)
Relationship length	0.007** (0.003)	0.005* (0.003)	0.097** (0.045)	0.234** (0.132)	0.166* (0.097)	0.030 (0.028)	0.075 (0.051)
+ controls	Y	Y	Y	Y	Y	Y	Y
Area and industry dummies	Y	Y	Y	Y	Y	Y	Y
Observations	252	252	1,877	590	362	1,287	1,515
R-squared	0.087	0.156	0.082	0.186	0.273	0.098	0.085

Notes: This table reports the effects of credit relationships on the mode of entry (ratio of spin-offs to total entrants) in a province and sector and the size (number of employees) of a firm at entry. All the columns report the OLS estimated coefficients and robust standard errors in parentheses. All the regressions include fixed effects (as detailed in the table) and control variables. See Data Appendix and Section 3.2.3 for details on the control variables. \* Significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

Table 5A: Information spillovers from credit relationships. Bank information types

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Entrants/ Incumbents	Entrants/ Population	Entrants/ Incumbents	Entrants/ Population	Entrants/ Incumbents	Entrants/ Population	Firm spin-off probability	Firm spin-off probability	Firm spin-off probability	Ratio Spin-offs (all owners)/ All entrants	Ratio Spin-offs (all owners)/ All entrants	Ratio Spin-offs (all owners)/ All entrants
Relationship length	0.023 (0.015)	0.001*** (0.000)	0.034 (0.027)	0.001*** (0.000)	0.012 (0.024)	0.000** (0.000)	0.009 (0.007)	-0.006 (0.013)	-0.010 (0.008)	0.005* (0.003)	-0.005 (0.009)	-0.002 (0.004)
Rel length * Information spillover (specificity and crowding out)	-0.114 (0.124)	-0.002*** (0.001)					-0.279* (0.162)			-0.160*** (0.056)		
Rel length * Information spillover (strategic technological rivalry)			-0.081 (0.134)	-0.004*** (0.001)			0.047 (0.070)			0.037 (0.055)		
Rel length * Embedded information spillover					0.066 (0.247)	0.001 (0.001)			0.116* (0.069)			0.017 (0.014)
+ controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Area and industry dummies	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	2,121	2,121	2,121	2,121	2,121	2,121	1,693	1,693	1,693	252	267	252
R-squared	0.313	0.215	0.313	0.216	0.313	0.215	0.038	0.037	0.039	0.125	0.105	0.107

Notes: This table reports the effects of information spillovers from credit relationships on the number of newly registered firms in a province and sector (entrants) scaled by the number of incumbent firms in the same province and sector or the total population in the province (columns 1-6), on the firm spin-off probability (columns 7-9) and on the ratio between spin-offs and new firm entries in the province (columns 10-12). The regressions in columns (1)-(9) refer to the years 2004-2006 for which the indicator for information spillovers are available. In columns (7)-(9), firm spin-off probability is from the Capitalia survey. In columns (10)-(12) the ratio spin-offs/all entrants is from the "Rilevazione sul sistema delle Start-up innovative" (like in Table 4). See Section 4.4 for the description of all the information spillovers and Data Appendix for a detailed definition of information spillover variables. All the columns report the OLS estimated coefficients and robust standard errors in parentheses. All the regressions include control variables, area and industry fixed effects. See Data Appendix and Section 3.2.3 for details on the control variables. \* Significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%.

Table 5B: Information spillovers from credit relationships. Industry characteristics

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Entrants/ Incumbents	Entrants/ Population	Entrants/ Incumbents	Entrants/ Population	Entrants/ Incumbents	Entrants/ Population	Entrants/ Incumbents	Entrants/ Population
Relationship length	0.095 (0.067)	0.001* (0.001)	-0.403** (0.187)	-0.006* (0.003)	-0.011 (0.043)	-0.000 (0.000)	-0.045 (0.016)	-0.001** (0.000)
Rel length * Collateral emphasis	-0.507** (0.249)	-0.006** (0.003)						
Rel length * Human capital intensity			0.031** (0.016)	0.000* (0.000)				
Rel length * Assets specificity					-0.144 (0.189)	-0.002 (0.002)		
Rel length * Sectoral information							0.045 (0.072)	-0.001 (0.001)
+ controls	Y	Y	Y	Y	Y	Y	Y	Y
Area, time and industry dummies	Y	Y	Y	Y	Y	Y	Y	Y
Observations	8,484	8,484	9,292	9,292	9,292	9,292	9,292	9,292
R-squared	0.158	0.106	0.159	0.108	0.158	0.108	0.158	0.107

Notes: This table reports the effects of information spillovers from credit relationships on the number of newly registered firms in a province and sector (entrants) scaled by the number of incumbent firms in the same province and sector or the total population in the province. In this table information spillovers are captured by industry characteristics; see Section 4.4 for the description of all the information spillovers and Data Appendix for a detailed definition of information spillover variables. All the columns report the OLS estimated coefficients and robust standard errors in parentheses. All the regressions include control variables, area, time and industry fixed effects. See Data Appendix and Section 3.2.3 for details on the control variables. \* Significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

Table 6: Lenders' Information

Firm type	Information levels	
	Human capital	Assets
Incumbents	$\lambda \bar{\Psi} \psi_I$	$\lambda \bar{\Psi} \psi_I$
De novos	$\lambda \underbrace{F(L_t^I)}_{disemb. spill.}$	$\lambda \underbrace{F(L_t^I)}_{disemb. spill.}$
Spin-offs	$\lambda \underbrace{\bar{\Psi} \psi_S}_{emb. spill.}$	$\lambda \underbrace{F(L_t^I)}_{disemb. spill.}$

Table 7: Parameters

Parameter	Symbol	Value
Probability of entrepreneur survival	$\pi$	0.982
Aggregate pledgeability value	$\lambda$	0.480
Distribution of asset liquidation value		$N(1/2, 1/16)$
Upper bound on idiosyncratic liquidation value	$\bar{A}$	1
Lower bound on idiosyncratic liquidation value	$\underline{A}$	0
Investment return if success	$R$	1.021
Relationship lending information advantage	$\bar{\Psi}$	1
Information advantage on incumbents	$\psi_I$	1.573
Embedded information spillover on spin-offs	$\psi_S$	1.280
Elasticity non-embedded spillover $F(\cdot)$	$\gamma$	-1
Probability of spin-off	$\sigma$	0.021
Utility cost of investing	$\zeta$	3.211

Table 8: Steady State

Variable	Symbol	Data	Baseline Model	Higher $\bar{\Psi}$
Entrants/Incumbents	$\frac{M^N + M^S}{M^I}$	4.99%	4.89%	4.61%
Spin-offs/De novos	$\frac{M^S}{M^N}$	39.40%	40.00%	41.21%
Ratio of turnover	$\frac{Sales^N + Sales^S}{Sales^I}$	0.64%	0.59%	0.32%
Ratio of turnover per firm	$\frac{(Sales^N + Sales^S)/(M^N + M^S)}{Sales^I/M^I}$	10.13%	12.03%	6.99%
Average leverage:				
Incumbents		4.70	4.243	4.244
De novo entrants		1.80	1.955	1.843
Spin-offs		2.01	2.644	2.643
Average rel. length		17.18	20.44	21.69

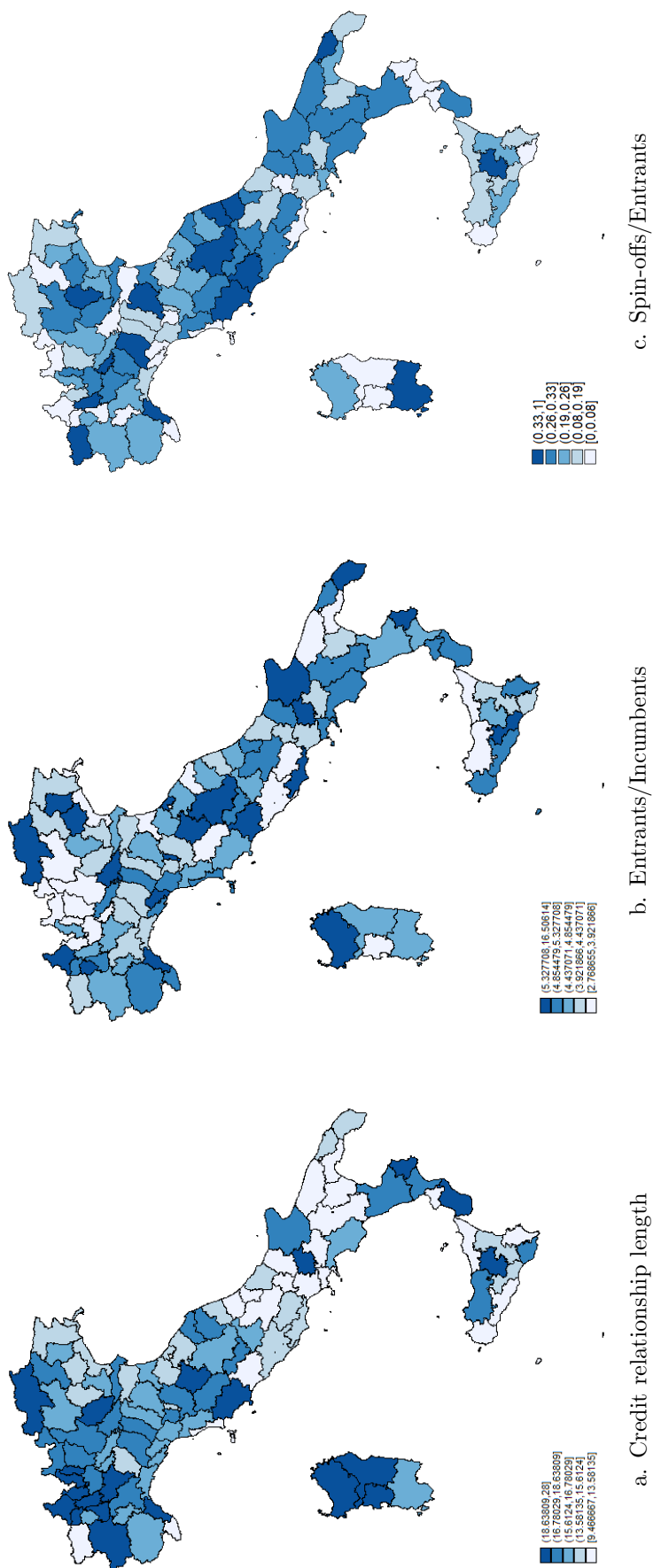
Notes: The higher  $\bar{\Psi}$  of the last column is associated with a relationship length higher by 5%.

Table 9: Macroeconomic Indicators

Variable	Symbol	Baseline Model	Higher $\bar{\Psi}$
Average firm size at entry		0.006	0.007
Ratio of wealth	$\frac{W^N + W^S}{W^I}$	0.60%	0.33%
Ratio of wealth per firm	$\frac{(W^N + W^S)/(M^N + M^S)}{W^I/M^I}$	12.29%	7.15%
Gross output	$Y_{gross}$	0.016	0.017
Net output	$Y_{net}$	0.013	0.014
Gross output entrants	$Y_{gross}^{N+S}$	6.622E-05	3.898E-05
Net output entrants	$Y_{net}^{N+S}$	3.816E-05	2.131E-05

Notes: The higher  $\bar{\Psi}$  of the last column is associated with a relationship length higher by 5%.

Figure 1: Credit relationships and firm entry by province



Notes: This figure plots the average credit relationship length (a), the ratio of entrants over incumbents (b), and the ratio of spin-offs over entrants (c) in the Italian provinces. See Section 4.2 and, for details on sources and definitions, the Data Appendix.

Figure 2: Timeline

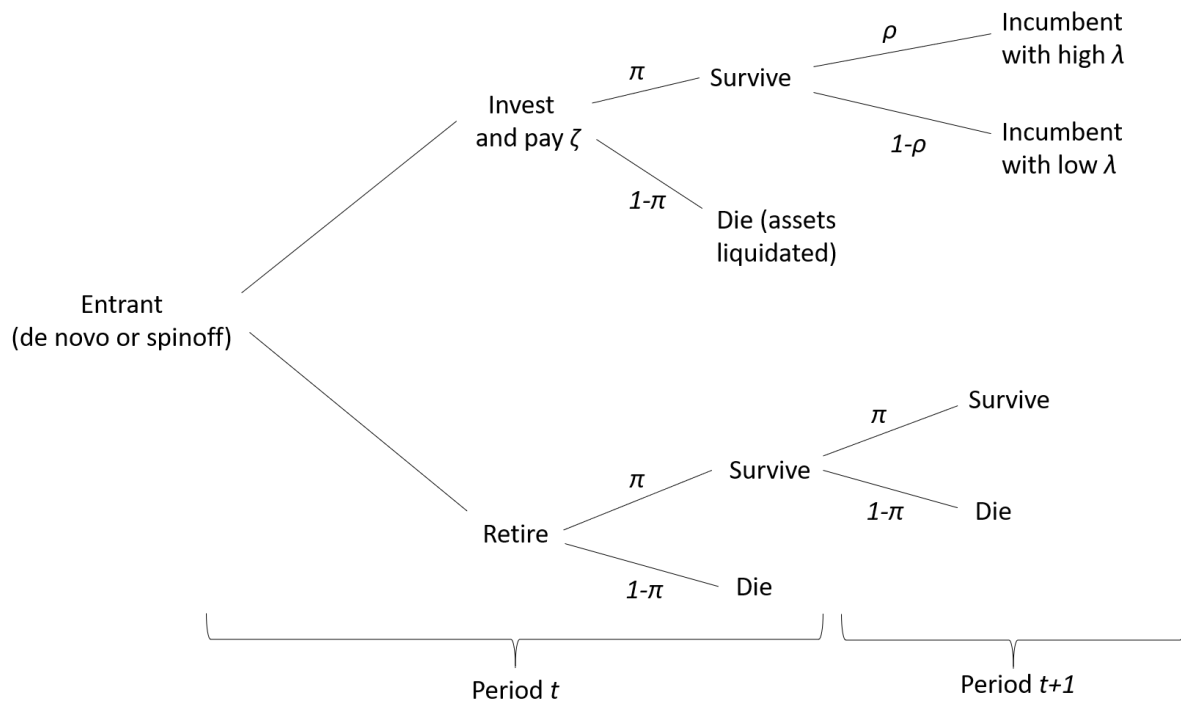
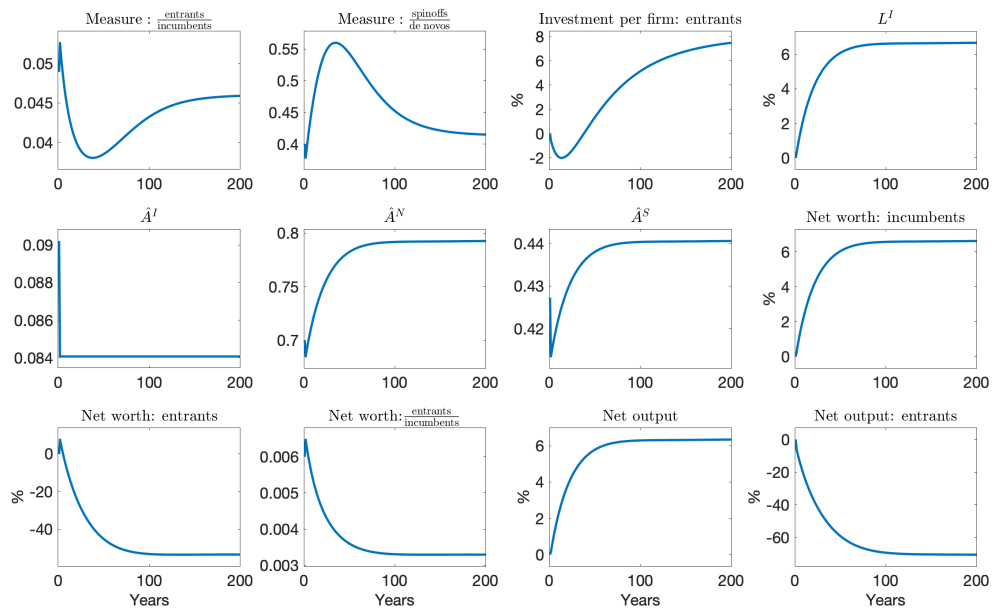


Figure 3: Impulse response functions to relationship lending shock



Notes: The figure shows the impulse response functions of selected variables of the model to an increase in  $\bar{\Psi}$ . The increase in  $\bar{\Psi}$  is set to raise the average credit relationship length by 5%.

# Online Appendix

(not for publication)

This online Appendix contains additional data information and further estimates (A.1) as well as technical proofs and additional details of the model (A.2). Section A.1 provides more information on data sources, measurement of trade secrecy (with related additional tests), and measurement of co-movement. Section A.2 contains technical proofs, laws of motion of agents' wealth and bequests, and robustness for the  $\rho < 1$  case.

## A.1 Additional Data Information and Further Estimates

**Details on data sources (complements Section 3.2)** We draw data from four main sources: the “Indagine sulle Imprese Manifatturiere”, a survey carried out by the Italian banking group Capitalia; the Register of Firms of the Italian Chambers of Commerce; the Orbis database of Bureau van Dijk; and the “Startup Survey”, a survey of startups carried out by the Italian Ministry of Economic Development. Moreover, for control variables and instruments, we use other databases, including data of the Italian National Institute of Statistics (ISTAT) on institutional and economic characteristics of the provinces; Bank of Italy data on the structure of Italian provincial banking sectors; and prior studies on industry-level measures of physical and human capital intensity, asset tangibility, and product information complexity.

In the main text we discussed essential features of the Capitalia Survey. Data in this survey include detailed information about firms' ownership and governance structures, workforce characteristics, bank-firm relationships, export and internationalization activities, investments in innovation and R&D expenditure. Industry codes (ATECO) at different digits are also reported. This survey has been widely used in the empirical literature on firms' financial constraints and relationship banking. Among others, see Herrera and Minetti (2007), Alessandrini et al. (2010) and Angelini and Generale (2008).

Data on firm entry comes predominantly from the Register of the Italian Chambers of Commerce. The Italian Business Register contains information (incorporation, amendments, cessation of trading) for all firms with any legal status and within any sector of economic activity, with headquarters or local branches within Italy, as well as any other subjects as required by law. The Business Register contains all the main information relating to companies (name, statute, management, headquarters, etc.) and all the subsequent events occurred after registration (for example changes to the statute and to company officers, changes in registered address, liquidation, insolvency proceedings, etc.). We also construct an alternative indicator of firm entry using the Orbis database of Bureau Van Dick. Orbis provides information on more than 365 million companies across the globe. This database carefully captures a wide variety of data and standardizes it to make it richer and easier to interrogate. Orbis obtains and treats data from

more than 160 separate providers. As noted in the main text, the data used to construct the alternative measure of firm entry are available for the years 2004-2006.

To study firms' mode of entry we rely on the "Startup Survey", a survey of start-ups carried out by the Italian Ministry of Economic Development (MISE). In March 2016, with a mass mailing to all the innovative startups listed in the Italian Register on Innovative Start-ups on 31 December 2015, ISTAT and MISE launched the "Startup Survey", the first national statistical survey of startups. This survey came from the need to investigate certain aspects of start-ups in Italy, which cannot be obtained from the Register data. The survey questionnaire comprises four sections: 1) Human capital and social mobility, 2) Growth funding, 3) Innovation, and 4) Level of information and satisfaction with policies.

On the survey end date (May 2016), 2,250 innovative startups had completed the questionnaire, over 44% of the total. About 58% of the companies interviewed were located in the North of Italy: 31.2% in the North West and 26.8% in the North East. The other areas of the country were also well represented: 22% were based in the South and 20% in the Centre. Service companies were 79.6% of the total: 29.7% produced software, 16.4% operated in research, 6.9% in data processing and 5.3% in commerce and tourism. 20.3% operated in manufacturing, and, of these, 3.5% produced innovative machinery. Both the territorial distribution and the sector distribution of the respondents reflected the population of startups as a whole. 60.2% of companies recorded a value of production of up to €100,000 in the 2015, 30.1% between 100,000 and 500,000, and 9.6% generated more than €500,000.

We use the book "Struttura funzionale e territoriale del sistema bancario italiano 1936-1974" and the Statistical Bulletin of the Bank of Italy for our instrumental variables and for the control variables about the structure of local banking sectors. The book contains historical data on the regional structure of the Italian banking system, such as the number of financial institutions by type (e.g., savings bank) and province for the 1936-1974 period. The Statistical Bulletin is a quarterly publication that contains a wide range of data on financial intermediaries, interest rates, monetary aggregates, and other information collected by the Bank of Italy. In particular, this data set contains demographic information on banks' branches sorted by province.

**Measurement of trade secrecy use (complements Section 4.4)** In Appendix Table A2, we reestimate the regressions in columns 3-4 of Table 5A differentiating firms according to the importance of trade secrecy in the sector. In line with expectations, we find evidence that the incentive of relationship banks to conceal information from entrants is especially strong in sectors in which trade secrecy is more relevant.

To measure the reliance of incumbent firms on trade secrecy in the industries we refer to the Community Innovation Survey (CIS). The CIS is a survey of innovation activity in European firms. The survey is designed to provide information on the innovativeness of sectors by type of enterprises, on the different types of innovation and on various aspects of the development of an innovation. Using this survey, we compute the share of firms using trade secrets by economic sector. This measure is based on the following

survey question: “How effective were the following methods for maintaining or increasing the competitiveness of product and process innovations introduced during the last two years? Patents; Design registration; Copyright; Trademarks; Lead time advantages; Complexity of goods or services; Secrecy (include non-disclosure agreements).”

**Measurement of co-movement (complements Section 4.4)** As noted in the main text, for the sectoral measure of asset specificity used in Table 5B, we use the degree of co-movement between the value added of the firm and that of other firms in the same industry (Shleifer and Vishny, 1992; Guiso and Minetti, 2010). As Shleifer and Vishny (1992) argue, when the conditions of the firms in an industry are positively correlated, the redeployability of the assets of the firms in that industry is likely to be low. The highest value second-hand users of a firm’s assets are probably its industry peers, since they have the experience and know-how to use these assets most effectively. If these second-hand users themselves face financial problems, they will be willing to buy, if at all, at low prices; otherwise, the firm will have to sell to less efficient, out-of-industry users whose willingness to pay is low. We borrow the measure of the co-movement of sales from Guiso and Minetti (2010), who compute it using data from Compustat firms over the period 1950-2000 for a total of 251,782 firm-year observations.

Guiso and Minetti (2010) classify into 64 industries using a two-digit classification and then, for each industry, regress the standardized annual rate of growth of firms’ sales on a full set of year dummies. If firms within an industry co-move significantly, the year dummies will explain a large part of sales variability. They thus retain the R2 of these regressions and use it as a measure of co-movement of firms in the industry. Industries with high R2 will be high co-movement industries. We then impute this measure to the firms in our sample using the industry code.

## A.2 Technical Proofs and Further Model Details

**Proof of Lemma 1** We guess, and later verify, that the investment decision follows the threshold strategy

$$V^I(w_{i,t-1}, A_{i,t}) > V^r(w_{i,t-1}) \quad \text{if} \quad A_{i,t} > \hat{A}_t^I.$$

Then the maximization problem for incumbents becomes a consumption-saving problem:

$$V^I(w_{i,t-1}, A_{i,t}) = \max_{x_{i,t}, w_{i,t}} \pi \left[ \log(x_{i,t}) - \frac{\zeta}{\pi} + \int_{\underline{A}}^{\hat{A}_{t+1}^I} V^r(w_{i,t}) dG(A_{i,t+1}) + \int_{\hat{A}_{t+1}^I}^{\bar{A}} V^I(w_{i,t}, A_{i,t+1}) dG(A_{i,t+1}) \right],$$

$$\text{s.t.} \quad x_{i,t} + w_{i,t} = R^I(A_{i,t})w_{i,t-1}.$$

Combining the first order conditions of  $x_{i,t}$  and  $w_{i,t}$ , we obtain

$$\frac{1}{x_{i,t}} = \int_{\underline{A}}^{\hat{A}_{t+1}^I} \frac{\partial V^r(w_{i,t})}{\partial w_{i,t}} dG(A_{i,t+1}) + \int_{\hat{A}_{t+1}^I}^{\bar{A}} \frac{\partial V^I(w_{i,t}, A_{i,t+1})}{\partial w_{i,t}} dG(A_{i,t+1}).$$

Using the equation above, the envelope condition

$$\frac{\partial V^I(w_{i,t-1}, A_{i,t})}{\partial w_{i,t-1}} = \frac{\pi R^I(A_{i,t})}{x_{i,t}},$$

and the fact that

$$\frac{\partial V^r(w_{i,t-1})}{\partial w_{i,t-1}} = \frac{\pi}{(1-\pi)w_{i,t-1}},$$

we can derive the Euler equation

$$\frac{1}{x_{i,t}} = \int_{\underline{A}}^{\hat{A}_{t+1}^I} \frac{\pi}{(1-\pi)w_{i,t}} dG(A_{i,t+1}) + \int_{\hat{A}_{t+1}^I}^{\bar{A}} \frac{\pi R^I(A_{i,t+1})}{x_{i,t+1}} dG(A_{i,t+1}). \quad (37)$$

We now use equation (37) to verify that  $x_{i,t} = (1-\pi)R^I(A_{i,t})w_{i,t-1}$  and  $w_{i,t} = \pi R^I(A_{i,t})w_{i,t-1}$  for incumbents. Under this guess, the right-hand-side of equation (37) becomes

$$\begin{aligned} & \int_{\underline{A}}^{\hat{A}_{t+1}^I} \frac{\pi}{(1-\pi)w_{i,t}} dG(A_{i,t+1}) + \int_{\hat{A}_{t+1}^I}^{\bar{A}} \frac{\pi R^I(A_{i,t+1})}{(1-\pi)R^I(A_{i,t+1})w_{i,t}} dG(A_{i,t+1}) \\ &= \frac{\pi}{(1-\pi)w_{i,t}} = \frac{1}{(1-\pi)R^I(A_{i,t})w_{i,t-1}} = \frac{1}{x_{i,t}}, \end{aligned}$$

so the guess is verified.

We then prove the solution to the value function  $V^I(w_{i,t-1}, A_{i,t})$  in Lemma 1. The Bellman equation for incumbents can be written as

$$V^I(w_{i,t-1}, A_{i,t}) = \max_{x_{i,t}, w_{i,t}} \pi \left[ \log(x_{i,t}) - \frac{\zeta}{\pi} + V^r(w_{i,t}) + \int_{\hat{A}_{t+1}^I}^{\bar{A}} V^I(w_{i,t}, A_{i,t+1}) - V^r(w_{i,t}) dG(A_{i,t+1}) \right].$$

Using the verified policy functions  $x_{i,t} = (1-\pi)R^I(A_{i,t})w_{i,t-1}$  and  $w_{i,t} = \pi R^I(A_{i,t})w_{i,t-1}$ , as well as the fact that

$$V^r(w_{i,t-1}) = \frac{\pi \log(w_{i,t-1})}{1-\pi} + \frac{\pi \log(1-\pi)}{1-\pi} + \frac{\pi^2 \log(\pi)}{(1-\pi)^2},$$

we can show that

$$V^I(w_{i,t-1}, A_{i,t}) - V^r(w_{i,t-1}) = \pi \left[ \frac{\log R^I(A_{i,t})}{1 - \pi} - \frac{\zeta}{\pi} + \int_{\hat{A}_{t+1}^I}^{\bar{A}} V^I(w_{i,t}, A_{i,t+1}) - V^r(w_{i,t}) dG(A_{i,t+1}) \right],$$

which completes the proof of Lemma 1.

**Proof of Lemma 3** We can write de novos' investment payoff as

$$[1 - \lambda F(L_t^I)] Ri_{i,t} = R^N(A_{i,t}) w_{i,t-1} \quad (38)$$

where

$$R^N(A_{i,t}) \equiv \frac{[1 - \lambda F(L_t^I)] R}{1 - \lambda F(L_t^I) [\pi R + (1 - \pi) A_{i,t}]}. \quad (39)$$

It is immediate to prove that  $R^N(A_{i,t}) < R^I(A_{i,t})$ . De novo entrants with wealth  $w_{i,t-1}$  solve

$$\begin{aligned} V^N(w_{i,t-1}, A_{i,t}) = & \max_{x_{i,t}, w_{i,t}, i_{i,t}} \pi \left[ \log(x_{i,t}) - \frac{\zeta}{\pi} \right. \\ & + \rho \left( \int_{\underline{A}}^{\hat{A}_{t+1}^I} V^r(w_{i,t}) dG(A_{i,t+1}) + \int_{\hat{A}_{t+1}^I}^{\bar{A}} V^I(w_{i,t}, A_{i,t+1}) dG(A_{i,t+1}) \right) \\ & \left. + (1 - \rho) \left( \int_{\underline{A}}^{\hat{A}_{t+1}^N} V^r(w_{i,t}) dG(A_{i,t+1}) + \int_{\hat{A}_{t+1}^N}^{\bar{A}} V^N(w_{i,t}, A_{i,t+1}) dG(A_{i,t+1}) \right) \right]. \end{aligned} \quad (40)$$

Assumption 1 ensures that de novo entrants need a downpayment to borrow. Conditional on investing, a de novo entrant's consumption function and value function satisfy

$$x_{i,t} = (1 - \pi) R^N(A_{i,t}) w_{i,t-1}, \quad (41)$$

$$V^N(w_{i,t-1}, A_{i,t}) = V^r(w_{i,t-1}) + \Gamma_t^N(A_{i,t}), \quad (42)$$

where  $\Gamma_t^N(A_{i,t})$ , the gap between de novo entrant value and retiree value, equals

$$\Gamma_t^N(A_{i,t}) = \pi \left[ \frac{\log R_t^N(A_{i,t})}{1 - \pi} - \frac{\zeta}{\pi} \right] + \quad (43)$$

$$\pi \rho \int_{\hat{A}_{t+1}^I}^{\bar{A}} \Gamma_{t+1}^I(A_{i,t+1}) dG(A_{i,t+1}) + \pi (1 - \rho) \int_{\hat{A}_{t+1}^N}^{\bar{A}} \Gamma_{t+1}^N(A_{i,t+1}) dG(A_{i,t+1}). \quad (44)$$

A de novo entrant invests if and only if  $V^N(w_{i,t-1}, A_{i,t}) > V^r(w_{i,t-1})$ . The rest of the proof is analogous to that of Lemma 1.

**Proof of Lemma 4** The spin-offs' investment payoff is given by

$$[1 - \lambda \bar{\Psi} \psi_S F(L_t^I)] Ri_{i,t} = R^S(A_{i,t}) w_{i,t-1}, \quad (45)$$

where

$$R^S(A_{i,t}) \equiv \frac{[1 - \lambda \bar{\Psi} \psi_S F(L_t^I)] R}{1 - \lambda [\pi R \bar{\Psi} \psi_S + (1 - \pi) A_{i,t} F(L_t^I)]}. \quad (46)$$

It is immediate to prove that  $R^S(A_{i,t}) < R^I(A_{i,t})$ . The Bellman equation of spin-offs is

$$\begin{aligned} V^S(w_{i,t-1}, A_{i,t}) = & \max_{x_{i,t}, w_{i,t}, v_{i,t}} \pi \left[ \log(x_{i,t}) - \frac{\zeta}{\pi} \right. \\ & + \rho \left( \int_{\underline{A}}^{\hat{A}_{t+1}^I} V^r(w_{i,t}) dG(A_{i,t+1}) + \int_{\hat{A}_{t+1}^I}^{\bar{A}} V^I(w_{i,t}, A_{i,t+1}) dG(A_{i,t+1}) \right) \\ & \left. + (1 - \rho) \left( \int_{\underline{A}}^{\hat{A}_{t+1}^S} V^r(w_{i,t}) dG(A_{i,t+1}) + \int_{\hat{A}_{t+1}^S}^{\bar{A}} V^S(w_{i,t}, A_{i,t+1}) dG(A_{i,t+1}) \right) \right]. \end{aligned}$$

Conditional on investing, a spin-off entrant's value function and consumption function satisfy

$$x_{i,t} = (1 - \pi) R_t^S(A_{i,t}) w_{i,t-1}, \quad (47)$$

$$V^S(w_{i,t-1}, A_{i,t}) = V^r(w_{i,t-1}) + \Gamma_t^S(A_{i,t}), \quad (48)$$

where  $\Gamma_t^S(A_{i,t})$  is the gap between spin-off entrant value and retiree value. It follows

$$\begin{aligned} \Gamma_t^S(A_{i,t}) = & \pi \left[ \frac{\log R_t^S(A_{i,t})}{1 - \pi} - \frac{\zeta}{\pi} \right] + \\ & \pi \rho \int_{\hat{A}_{t+1}^I}^{\bar{A}} \Gamma_{t+1}^I(A_{i,t+1}) dG(A_{i,t+1}) + \pi(1 - \rho) \int_{\hat{A}_{t+1}^S}^{\bar{A}} \Gamma_{t+1}^S(A_{i,t+1}) dG(A_{i,t+1}). \end{aligned} \quad (49)$$

A manager invests if and only if  $V^S(w_{i,t-1}, A_{i,t}) > V^r(w_{i,t-1})$ . The rest of the proof is analogous to that of Lemma 1.

**Laws of Motion of Wealth and Bequests** We here specify the law governing the evolution of wealth over time for incumbents ( $W_t^I$ ), spin-offs ( $W_t^S$ ), de novos ( $W_t^N$ ) and retirees ( $W_t^r$ ). Incumbents' wealth evolves according to

$$W_t^I = \pi^2 \int_{\hat{A}_t^I}^{\bar{A}} R_t^I(A_{i,t}) dG(A_{i,t}) W_{t-1}^I + \pi^2 \rho \int_{\hat{A}_t^N}^{\bar{A}} R_t^N(A_{i,t}) dG(A_{i,t}) W_{t-1}^N + \pi^2 \rho \int_{\hat{A}_t^S}^{\bar{A}} R_t^S(A_{i,t}) dG(A_{i,t}) W_{t-1}^S.$$

Let the total amount of bequest in period  $t$  be

$$B_t = (1 - \pi)W_{t-1}^r + (1 - \pi)G(\hat{A}_t^I)W_{t-1}^I + (1 - \pi)G(\hat{A}_t^N)W_{t-1}^N + (1 - \pi)G(\hat{A}_t^S)W_{t-1}^S. \quad (51)$$

Then we have

$$\begin{aligned} W_t^N &= B_t \frac{1}{1 + \sigma (M_{t-1}^I + M_{t-1}^N + M_{t-1}^S)}, \\ W_t^S &= B_t \frac{\sigma (M_{t-1}^I + M_{t-1}^N + M_{t-1}^S)}{1 + \sigma (M_{t-1}^I + M_{t-1}^N + M_{t-1}^S)}, \\ W_t^r &= \pi^2 W_{t-1}^r + \pi^2 G(\hat{A}_t^I)W_{t-1}^I + \pi^2 G(\hat{A}_t^N)W_{t-1}^N + \pi^2 G(\hat{A}_t^S)W_{t-1}^S. \end{aligned}$$

Note that, once investing incumbents or entrants die, they transfer their entire liquidation value to lenders. Therefore, only retirees who use storage technologies can leave a bequest to de novo entrants. At the beginning of period  $t + 1$ , all available bequests from the previous period amount to  $(1 - \pi)W_{t-1}^r$ . They are shared among all potential entrants (measure of 1) and all potential spin-offs ( $\sigma (M_t^I + M_t^N + M_t^S)$ ).

### Robustness for Information Accumulation ( $\rho < 1$ ) (complements Section 8.3)

In Appendix Table A3 and in Appendix Figure A1, we show the robustness of the results to letting  $\rho = 0.98$ , so that the accumulation of relationship lenders' information on incumbents is more gradual. All the results of the analysis carry through. Below, we also show agents' measures and law of wealth accumulation for the case  $\rho < 1$ .

Recall that with probability  $\rho$  the lender upgrades to higher information in the following period. We then need to distinguish those incumbents who benefit from relationship banking ("relational" incumbents) from those who do not ("non-relational" incumbents). The measures of de novos ( $M_t^N$ ), spin-offs ( $M_t^S$ ), "relational" incumbents ( $M_t^I$ ) and "non-relational" incumbents ( $M_t^{IN}, M_t^{IS}$ ) can then be, respectively, expressed as

$$\begin{aligned} M_t^N &= 1 - G(\hat{A}_t^N), \\ M_t^S &= \left[1 - G(\hat{A}_t^S)\right] \sigma (M_{t-1}^I + M_{t-1}^{IN} + M_{t-1}^{IS} + M_{t-1}^N + M_{t-1}^S), \\ M_t^I &= \left[1 - G(\hat{A}_t^I)\right] \left[\pi\rho (M_{t-1}^{IN} + M_{t-1}^{IS} + M_{t-1}^N + M_{t-1}^S) + \pi M_{t-1}^I\right], \\ M_t^{IN} &= \left[1 - G(\hat{A}_t^N)\right] (1 - \rho) \pi (M_{t-1}^{IN} + M_{t-1}^N), \\ M_t^{IS} &= \left[1 - G(\hat{A}_t^S)\right] (1 - \rho) \pi (M_{t-1}^{IS} + M_{t-1}^S). \end{aligned}$$

We can now state the law governing the evolution of wealth over time for all types of entrepreneurs and for retirees. Relational incumbents' ( $W_t^I$ ) and non-relational incumbents' ( $W_t^{IN}, W_t^{IS}$ ) wealth, respectively, evolves according to

$$W_t^I = \pi^2 \int_{\hat{A}_t^I}^{\bar{A}} R_t^I(A_{i,t}) dG(A_{i,t}) W_{t-1}^I + \pi^2 \rho \int_{\hat{A}_t^N}^{\bar{A}} R_t^N(A_{i,t}) dG(A_{i,t}) (W_{t-1}^N + W_{t-1}^{IN}) + \\ + \pi^2 \rho \int_{\hat{A}_t^S}^{\bar{A}} R_t^S(A_{i,t}) dG(A_{i,t}) (W_{t-1}^S + W_{t-1}^{IS}),$$

$$W_t^{IN} = \pi^2 (1 - \rho) \int_{\hat{A}_t^N}^{\bar{A}} R_t^N(A_{i,t}) dG(A_{i,t}) (W_{t-1}^N + W_{t-1}^{IN}),$$

$$W_t^{IS} = \pi^2 (1 - \rho) \int_{\hat{A}_t^S}^{\bar{A}} R_t^S(A_{i,t}) dG(A_{i,t}) (W_{t-1}^S + W_{t-1}^{IS}),$$

Let the total amount of bequest in period  $t$  be

$$B_t = (1-\pi)W_{t-1}^r + (1-\pi)G(\hat{A}_t^I)W_{t-1}^I + (1-\pi)G(\hat{A}_t^N) (W_{t-1}^N + W_{t-1}^{IN}) + (1-\pi)G(\hat{A}_t^S) (W_{t-1}^S + W_{t-1}^{IS}).$$

We can then finally express the wealth for de novos ( $W_t^N$ ), spin-offs ( $W_t^S$ ) and retirees ( $W_t^r$ ) as

$$W_t^N = B_t \frac{1}{1 + \sigma (M_{t-1}^I + M_{t-1}^N + M_{t-1}^S + M_{t-1}^{IN} + M_{t-1}^{IS})},$$

$$W_t^S = B_{t-1} \frac{\sigma (M_{t-1}^I + M_{t-1}^N + M_{t-1}^S + M_{t-1}^{IN} + M_{t-1}^{IS})}{1 + \sigma (M_{t-1}^I + M_{t-1}^N + M_{t-1}^S + M_{t-1}^{IN} + M_{t-1}^{IS})},$$

$$W_t^r = \pi^2 W_{t-1}^r + \pi^2 G(\hat{A}_t^I) W_{t-1}^I + \pi^2 G(\hat{A}_t^N) (W_{t-1}^N + W_{t-1}^{IN}) + \pi^2 G(\hat{A}_t^S) (W_{t-1}^S + W_{t-1}^{IS}).$$

## Table A1: Data Appendix

Four main data sources are used in the empirical analysis: four waves of the Capitalia Survey of Italian Manufacturing Firms (SIMF), which cover three-year periods ending respectively in 1997, 2000, 2003 and 2006; the Register of the Italian Chambers of Commerce (Register); the Orbis database of Bureau van Dick (Orbis); the “Rilevazione sul sistema delle Start-up innovative”, a survey of start-ups carried out by the Italian Ministry of Economic Development (MED). We complement these data sources with other databases, including Istat data on characteristics of provinces; Bank of Italy data on the structure of Italian banking sectors; data on provincial infrastructures (GEOWEB) and previous studies to construct measures of asset tangibility, human capital intensity and product information complexity, by industries. The variables used in the empirical analysis are:

Variable	Definition and source (in parentheses)
<i>Dependent Variables</i>	
Entrants/Incumbents	The ratio of newly registered firms in a province and sector (entrants) over the number of incumbent firms in the same province and sector. For each survey wave, we take the average over the years of the wave (1995-1997, 1998-2000, 2001-2003 and 2004-2006). (Register)
Entrants/Population	The ratio of newly registered firms in a province and sector (entrants) over the population in the province. For each survey wave, we take the average over the years of the wave (1995-1997, 1998-2000, 2001-2003 and 2004-2006). (Register and ISTAT)
Share of firms with $\leq 2$ yrs	The share of manufacturing firms with no more than 2 years of activity in a province and sector in 2008. (Orbis)
Ratio Spin-offs (majority owners)/All entrants	Ratio in the province between spin-offs (having the majority of the owners with experience in the same industry) and all entrants. (MED)
Ratio Spin-offs (all owners)/All entrants	Ratio in the province between spin-offs (having all the owners with experience in the same industry) and all entrants. (MED)
Size at entry	Number of employees of entrant firms. (MED)
Firm spin-off probability	A dummy equal to one if a spin-off from the firm has occurred in the three years of the survey; zero otherwise. (SIMF)
<i>Main Independent Variables</i>	
Relationship length	The average length of credit relationships in the province, in the survey wave. (SIMF)
Relationship length (over 10 y.)	The share of firms in the province with a length of credit relationships larger than 10 years, in the survey wave. (SIMF)
Number of banks	The average number of banks of a firm in the province, in the survey wave. (SIMF)
Assets specificity	Comovement between the sales of the firm and those of other firms in the same industry. (Guiso and Minetti, 2010)
Human capital intensity	Average years of schooling at the industry level in 1980. (Ciccone and Papaioannou, 2009)
Collateral emphasis	The last survey wave asks each firm: “In your view, which criteria does your bank follow in granting loans to you?” Our measure of collateral emphasis is a dummy variable equal to one if the firms answer collateral, zero otherwise. (SIMF)
Sectoral information	Index that measures the complement of one of the proportion of relationship-specific investments in the sector (Nunn, 2007).
Information spillover (specificity and crowding out)	The last survey wave asks each firm: “Which of these characteristics are key in selecting your main bank?”. We use two of these characteristics: 1) The bank knows your relevant market; 2) Frequent contacts with the credit officer at the bank. For each firm we construct a dummy variable equal to one if the firms answer “very much” for each of these characteristics. Then we construct an average index for each industry. (SIMF)
Information spillover (strategic technological rivalry)	The last survey wave asks each firm: “In your view, which criteria does your bank follow in granting loans to you?” We use the characteristic: Firms’ innovation capacity. For each firm we construct a dummy variable equal to one if the firms answer “very much” to this characteristic. Then we construct an average index for each industry. (SIMF)
Embedded information spillover	The last survey wave asks each firm: “Which of these characteristics are key in selecting your main bank?” and “In your view, which criteria does your bank follow in granting loans to you?” We use two of the characteristics of the first question: 1) The bank knows you and your business; 2) Managerial ability on the part of those running the firm’s business. Moreover, we use two characteristics of the second question: 1) Personal guarantees of firm’s manager or owner; 2) Commercial network of the firm. For each firm we construct a dummy variable equal to one if the firms answer “very much” for each of these characteristics. Then we construct an average index for each industry. (SIMF)
<i>Control Variables</i>	
Unemployment rate (log)	Logarithm of provincial unemployment rate. For each survey wave, we take the average over the years of the wave (1995-1997, 1998-2000, 2001-2003 and 2004-2006). (ISTAT)
Trade openness (log)	Logarithm of the ratio of trade on GDP in the province in 2001. (ISTAT)
Material infrastructure (log)	Synthetic index of material infrastructures in the province. This index includes information about: Road Network, Railways, Ports, Airports, Environmental Energy Networks, Broadband Services, Business Structure. (GEOWEB)
Population growth	Growth rate of the population in the province. For each survey wave, we take the average over the years of the wave (1995-1997, 1998-2000, 2001-2003 and 2004-2006). (ISTAT)
Judicial efficiency	As an inverse measure, we considered the number of civil suits pending in each of the 27 district courts of Italy, scaled by the population of the district. We imputed this variable to the firms according to the districts where they are headquartered. (ISTAT)
Bank branches HHI	Herfindahl-Hirschman index of bank branches in the province. For each survey wave, we take the average over the years of the wave (1995-1997, 1998-2000, 2001-2003 and 2004-2006). (Bank of Italy)
Bank branches/population	Number of bank branches in the province, per 1,000 inhabitants. For each survey wave, we take the average over the years of the wave (1995-1997, 1998-2000, 2001-2003 and 2004-2006). (Bank of Italy)
Average firm age in province	The average age of the firms in the province, in the survey wave. (SIMF)
Center, South	Dummy variables that take the value of one if the firm is located in a central or southern province; zero otherwise. (ISTAT)
Industry dummies	Two-digit Ateco sector dummies. (Register)
<i>Instrumental Variables</i>	
Saving banks in 1936	Number of saving banks in the year 1936 in the province, per 100,000 inhabitants. (Bank of Italy)
New branches incumbent	For each province and year we calculate the number of branches created minus those closed by incumbent banks per 100,000 inhabitants. Then we compute the average over the years 1991-1998. (Bank of Italy)

Table A2: Information spillovers and trade secrecy

VARIABLES	<i>Trade secrecy use &gt; 41.4</i>		<i>Trade secrecy use ≤ 41.4</i>	
	(1)	(2)	(3)	(4)
	Entrants/ Incumbents	Entrants/ Population	Entrants/ Incumbents	Entrants/ Population
Relationship Length	0.029 (0.025)	0.001*** (0.000)	0.002 (0.102)	0.003* (0.002)
Rel length * Information spillover (strategic technological rivalry)	-0.046 (0.116)	-0.003*** (0.001)	0.212 (0.373)	-0.010 (0.007)
+ controls	Y	Y	Y	Y
Area, time and industry dummies	Y	Y	Y	Y
Observations	1,515	1,515	505	505
R-squared	0.305	0.423	0.158	0.115

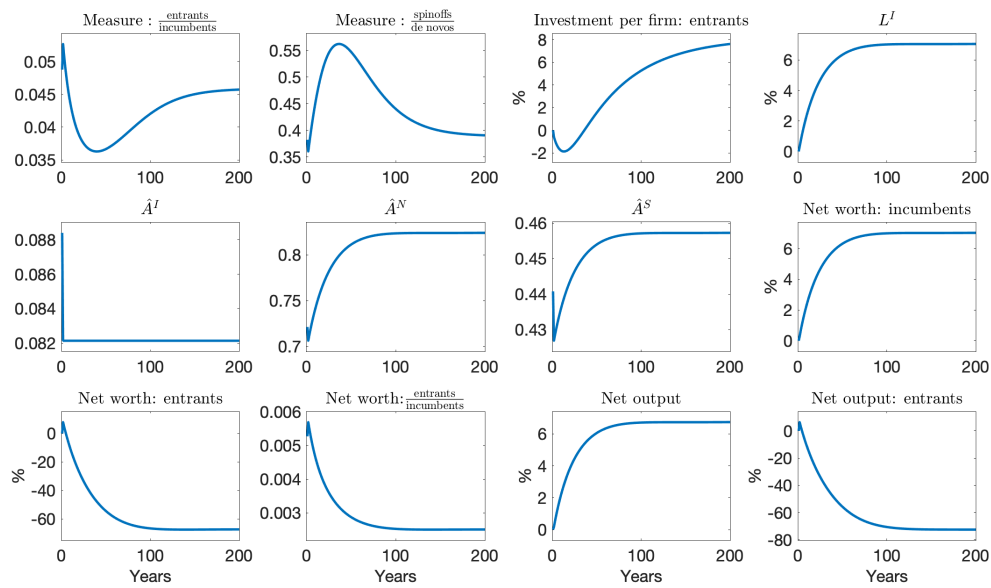
Notes: This table reports the effects of information spillovers from credit relationships on the number of newly registered firms in a province and sector (entrants) scaled by the number of incumbent firms in the same province and sector or the total population in the province. In Columns (1) and (2), the sample includes firms in sectors in which more than 41.1% (first quartile) of the firms rely on trade secrecy. In Columns (3) and (4), the sample includes firms in sectors in which less than 41.1% of the firms rely on trade secrecy. See Section 4.4 for the description of all the information spillovers and Data Appendix for a detailed definition of information spillover variables. All the columns report the OLS estimated coefficients and robust standard errors in parentheses. All the regressions include control variables, area and industry fixed effects. See Data Appendix and Section 3.2.3 for details on the control variables. \* Significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

Table A3: Robustness for information accumulation ( $\rho = 0.98$ )

Variable	Data	Baseline Model	Higher $\bar{\Psi}$
<i>Panel A: Steady State</i>			
Entrants/Incumbents	4.99%	4.88%	4.60%
Spin-offs/De novos	39.40%	38.23%	38.77%
Ratio of turnover	0.64%	0.52%	0.24%
Ratio of turnover per firm	10.13%	10.58%	5.33%
Average leverage:			
Incumbents	4.70	4.243	4.244
De novo entrants	1.80	1.955	1.837
Spin-offs	2.01	2.645	2.643
Average rel. length	17.18	20.79	22.09
<i>Panel B: Macroeconomic Indicators</i>			
Firm size at entry		0.007	0.008
Ratio of wealth		0.53%	0.25%
Ratio of wealth per firm		10.81%	5.45%
Gross output		0.016	0.017
Net output		0.013	0.014
Gross output entrants		5.874E-05	3.016E-05
Net output entrants		3.376E-05	1.639E-05

Notes: This table reports robustness for a probability of information upgrade of lenders  $\rho = 0.98$ . The higher  $\bar{\Psi}$  of the last column is associated with a relationship length higher by 5%.

Figure A1: Impulse response functions to relationship lending shock ( $\rho = 0.98$ )



Notes: The figure shows the impulse response functions of selected variables of the model to an increase in  $\bar{\Psi}$ . In this figure the parameter  $\rho$  is set to 0.98. The increase in  $\bar{\Psi}$  is set to raise the average credit relationship length by 5%.