Credit Supply Shocks and Firm Dynamics: Evidence from Brazil*

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Abstract

This paper explores how financial constraints distort entry decisions among otherwise productive entrepreneurs and limit growth of promising young firms. A model of liquidity-constrained entrepreneurs suggests that the easing of credit constraints can induce more entry of firms with greater long-run growth potential than the easing of conventional entry barriers would bring about. We study this growth mechanism using a large-scale program to expand the supply of credit to small and medium enterprises in Brazil. Local credit supply shocks generate greater firm entry but also greater exit with no effect on short-run employment growth in the formal sector. However, credit expansions increase average capability among entering firms, which enter at larger size, survive longer, and grow faster. These firm dynamics are more pronounced in areas with weaker credit markets ex ante and consistent with local bank branches using cheap targeted credit lines to expand lending more broadly. Our findings provide new evidence on the general equilibrium effects of credit supply expansions.

Keywords: Credit Constraints, Entry Barriers, Growth Barriers, Startups

JEL Codes: D21, D22, D92, L25, L26, M13, O12

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1 Introduction

Barriers to firm entry are pervasive, and numerous policies aim to reduce them. However, researchers have begun to question the importance of such efforts for job creation and economic growth. A study of Portuguese reforms, for example, suggests that a reduction in static entry barriers, such as licensing fees, led to entry of marginal firms with limited growth potential (Branstetter et al., 2014). In this paper, we ask whether reducing barriers to credit access might similarly induce entry of marginal firms or whether alleviating borrowing constraints might imply more dynamic incentives, alter firm growth trajectories, and select entrants with greater capability. We explore this question in the context of a large-scale credit supply shock for small and medium enterprises (SMEs) in Brazil.

Our focus on the entry margin is motivated by recent debates on misallocation and financial access. A growing macro literature argues that distortions to entrepreneurial entry can have implications for aggregate productivity as large as the effects of misallocation among incumbents (Banerjee and Moll, 2010; Buera et al., 2011; Midrigan and Xu, 2014). The micro evidence, however, is mixed. Kerr and Nanda (2009, 2010) show that banking deregulation and subsequent credit expansions in the United States induced substantial entry of small, short-lived firms but also increased the size at entry of longer-lived firms. Meanwhile, in developing countries, access to microfinance increases growth among incumbent microenterprises but rarely leads to entry of productive, new ones (see Banerjee et al., 2015).

The classic Evans and Jovanovic (1989) model of finance-constrained entrepreneurial choice suggests that credit access might act differently than static entry barriers. We combine this model with a general equilibrium framework that builds on Melitz (2003) and allows for feedback effects through local labor markets. We show how relaxing credit constraints (i) selects more high-capability entrants than reducing static barriers can achieve and (ii) generates more employment at incumbent firms. These effects occur because financial constraints cause high-ability entrepreneurs with low initial wealth to be shut out of entry or to enter at less than optimal sizes. The combination of additional entry and an expansion of credit-constrained incumbent firms drives up local wages, inducing exit of marginal incumbents. Our results indicate that, relative to reducing static entry barriers, easing credit constraints increases entry of dynamic firms with greater long-run growth potential but has an ambiguous effect on local employment.

A major policy innovation in Brazil in the early 2000s offers a unique opportunity to identify causal effects of credit supply expansions on firm entry, growth, and lifecycles. In late 2002, the Brazilian Development Bank (*Banco Nacional de Desenvolvimento Econômico e Social* or BNDES) launched a new credit line for formal-sector SMEs, known as the BNDES Card (or *Cartão* BNDES), to finance investment and intermediate inputs on more favorable terms than prevailing credit lines in the market. By 2013, nearly ten percent of formal-sector firms had accessed the credit.

Our empirical analysis leverages variation in access to the credit line over time and space. The main identification challenge is that the credit in a municipality at a point in time may reflect endogenous credit demand conditions rather than a true credit supply shock. Specific features of the *Cartão* BNDES expansion allow us to isolate supply from demand shocks to local credit markets. As part of its piloting process, BNDES only allowed certain banks to intermediate *Cartão* credit beginning in 2003 with other banks becoming eligible in 2008 and in later years. Our strategy relies on predetermined bank branch locations, pre-*Cartão* lending

relationships with BNDES, and a large national expansion in *Cartão* funding in 2008. Our strategy effectively compares municipalities with more versus less exposure to banks eligible to intermediate *Cartão* BNDES before versus after the expansion of *Cartão* lending to intermediating banks. We construct an instrument for municipality-level credit supply based on this combination of prior exposure to *Cartão*-eligible banks and the abrupt expansion of national lending via this intermediated product. For municipalities with weakly developed financial markets, the *Cartão* line constitutes an enormous expansion, reaching as high as 15–20% of total lending locally.

We estimate the impacts of *Cartão*-induced credit supply shocks on local firm dynamics using comprehensive new data on firms and finance. First, we construct firm- and municipality-level outcomes from the Brazilian matched employer–employee database *Relação Anual de Informações Sociais* (RAIS by the Brazilian Ministry of Labor). These data span 1987–2016, cover firms with as few as one employee, and allow us to construct reliable measures of entry and exit as well as employment growth. Second, we observe precise detail on financial transactions using the Credit Information System (*Sistema de Informações de Crédito* or SCR) database maintained by the Central Bank of Brazil. The SCR includes all loan operations with a value of at least R$ 5,000 (roughly US$ 2,500) from 2003–2011 and R$ 1,000 from 2012 to 2016. These data link the financial institution that originates or intermediates a public or private-sector loan to individual borrowing firms in the RAIS data. We supplement the SCR with data from BNDES on the universe of approved indirect lending operations from 2003 to 2013, which allows us to observe smaller *Cartão* BNDES loans.

We identify large local credit multipliers stemming from the *Cartão* BNDES expansion. The *Cartão* BNDES supply shock induced eligible local bank branches to substantially expand lending in other credit products as well. It also prompted the banks to reach new firms with whom they had no prior relationship. Branches with prior experience intermediating other BNDES products before the *Cartão* were responsible for driving the increased borrowing opportunities beyond the immediate targeted credit line. These credit multipliers are important for understanding how the *Cartão* program affects local firm dynamics. While assessing the direct effects of *Cartão* lending on firm dynamics, we also estimate overall effects inclusive of these credit multipliers stemming from targeted SME lending.

We find that the *Cartão*-induced credit supply shock had significant effects on firm turnover and entrant capability. A ten-percent increase in local credit supply led to a six-percent increase in entry of new firms. Moreover, this entry effect seemed to be driven by entirely new firms rather than transitions out of informality (e.g., to gain access to bank credit only available to formal firms). At the same time, we find nearly identical effects on firm exit. These effects on entry and exit offset each other as entrants and exiters are of similar size, and imply no change in overall formal-sector employment at the municipality level. The patterns are consistent with deeper credit markets fostering greater opportunity but also greater competition, the combination of which is associated with limited changes in the size of the formal sector at impact.

Nevertheless, the local credit supply shock does induce entry of higher capability firms, compared to entrants prior to the credit expansion. New firms enter at larger, though still small, scale. Indeed, the entry effects are confined to firms with fewer than 5 employees. Although seemingly small, these firms have the potential to grow and shape aggregate employment patterns over time. While the timing of the credit supply shock and our data on firm outcomes are not suitable for assessing long-run employment effects, we do find important short-run effects. The *Cartão*-induced credit supply shock induces more frequent entry of firms

that survive at least two years. These two-year survivors also enter at larger scale and grow faster than the two-year survivors in municipalities with smaller credit expansions.

We show further that these turnover and capability effects are concentrated in municipalities with *ex ante* weaker credit markets. In fact, in municipalities with above median credit per capita at baseline, local credit expansions have no significant effects on firm entry, exit or capability. There is even suggestive evidence that the direct effect of the *Cartão* supply shock induces entry of relatively smaller firms in these more well-developed credit markets. One interpretation is that, in locales with more mature credit markets, additional, externally-originated cheap credit for SMEs acts much like a reduction in static entry barriers, inducing more marginal firms to enter. By contrast, in places with limited financial development, a larger mass of productive entrepreneurs will be on a margin where the promise of sustained credit lines upon entry may suffice to induce high-capability entry.

Together, these results point to an important role for credit access in shaping firm dynamics in financially immature markets and, especially, the entry of firms with potentially higher long-run productivity. The patterns are in line with our theoretical framework. Consistent with our credit-constraints interpretation, we see that local credit supply shocks lead to greater employment growth among young but not old firms. Older firms, in business for more than ten years, arguably have a stronger internal financing capacity as well as wider access to external credit.

Our paper contributes to a growing literature on credit access and firm dynamics. Several studies on the United States examine entrant and incumbent responses to the credit expansion after banking deregulations in the 1990s (e.g., Cetorelli and Strahan, 2006; Kerr and Nanda, 2010). Cross-country studies use the Rajan and Zingales (1998) measure of financial dependence and find that financial constraints can distort entry decisions of entrepreneurs with high-growth potential (Aghion et al., 2007; Ardagna and Lusardi, 2010). For individual entrepreneurs, Andersen and Nielsen (2012) study a more direct wealth shock due to an unanticipated inheritance and find evidence consistent with a relaxation of financial constraints inducing greater entry of less capable entrepreneurs. McKenzie (2017), in contrast, finds that grants associated with a business competition successfully induce entry of higher capability entrepreneurs in Nigeria. Our study tests the marginal-entrants hypothesis using a direct policy shock and combines a microeconomic perspective on individual firms and their banks with an equilibrium perspective on outcomes within municipalities. We can distinguish the effects of credit supply shocks across localities that vary in financial development. Our contribution highlights a conditional effect: marginal entrants are more likely in well-developed credit markets, whereas the opposite holds for less-developed markets where credit expansions induce entry of higher capability, longer-lived firms.

We offer a unique window into the consequences of policy-induced credit expansion at scale. It is rarely possible to estimate causal effects of a targeted credit supply shock that reaches one-tenth of firms in a country as large as Brazil. Several studies explore large-scale credit contractions (e.g., Breza and Kinnan, 2021; Chodorow-Reich, 2014; Greenstone et al., 2020), and we rely on a similar identification strategy that combines predetermined local exposure to national supply shocks. Unlike those earlier studies, we examine a credit supply *expansion* that can have distinct effects on the entry and growth margins of interest. In concurrent work using a similar identification strategy, Gutierrez et al. (forthcoming) show that a generalized expansion in credit increased SME employment in local labor markets across Mexico, but they do not explore firm

dynamics or the marginal entrants hypothesis as we do here.[1] In other recent work, Fonseca and Matray (2023) use a matching strategy to show that an expansion in the number of local bank branches increased employment and wage growth across Brazilian cities. In contrast to these studies, we identify large credit multiplier effects of *targeted* SME lending through the existing bank branch network, thus offering a new perspective on constrained lending in emerging markets, which has been studied at length in prior research (e.g., Ayyagari et al., 2021; Banerjee and Duflo, 2014; Khwaja and Mian, 2008; Paravisini, 2008).

Finally, we provide the first causal estimates of the impact of one of the world's largest SME credit programs. Others have explored the effects of commodity booms (Bustos et al., 2020; Bernstein et al., 2022) and improved court systems (Fonseca and Van Doornik, 2022; Ponticelli and Alencar, 2016) on financial constraints and firm dynamics in Brazil. Our findings complement those studies by identifying the role for financial policy innovations to shape firm dynamics.

The remainder of the paper proceeds as follows. Section 2 develops a model to guide our empirical analysis. Section 3 provides background on the *Cartão* BNDES credit program. Section 4 describes the data and Section 5 the identification strategy. Section 6 presents the core results, and Section 7 concludes.

2 A Model of Credit Supply and Firm Dynamics

We combine a model of entrepreneurial choice under financial constraints following Evans and Jovanovic (1989) with a framework of heterogeneous firms similar to Melitz (2003) to study the impacts of financial constraints on entry and firm size. This setup delivers novel implications for credit supply shocks under financing constraints and the effects on firm entry, performance, and exit.

2.1 Setup

There are M municipalities in the economy with varying capital-market conditions that result in different financial constraints. There is a continuum L_m of residents in each municipality m and wage rates w_m clear the local labor market in municipality m. Residents are endowed with personal wealth z, and they have a choice to be entrepreneurs or workers.

Every resident is endowed with one entrepreneurial idea. An entrepreneurial idea for a variety ν is a pair of characteristics (ϕ, z), where ϕ is the Hicks neutral productivity of the entrepreneur's production function upon entry ("entrepreneurial ability" in Evans and Jovanovic's words) and z is the entrepreneur's personal wealth. We remove uncertainty from the Evans and Jovanovic (1989) model, but an extension to risk-neutral entrepreneurs with Hicks-neutral shocks to productivity would be straightforward to implement. We drop the assumption of decreasing returns to scale, and instead add employment under constant returns to scale so we can study employment and financial capital jointly. We model the product market structure explicitly and obtain relationships for selection into entrepreneurship under monopolistic competition and CES preferences in the product market. The factor markets for capital k and labor ℓ are perfectly competitive, paying a gross return r on capital and a wage w_m for labor in each local labor market. Following Evans and Jovanovic

[1] Although similar in spirit, our identification strategies differ slightly. In particular, we exploit variation in the timing and scale of local intermediation by eligible banks of a national credit supply shock whereas Gutierrez et al. (forthcoming), like others in prior work, rely on regularly occurring variation in countrywide bank lending passed through to the local branch network.

and heterogeneous firm modelling as in Melitz (2003), we assume specific functional forms for expositional convenience. We follow Chaney (2008) and assume that there is a fixed amount of ideas in the economy.

Product Market. Under CES preferences, total demand $y(\nu)$ for a variety ν is

$$y(\nu) = A\, p(\nu)^{-\sigma} \qquad \text{with} \quad A \equiv \frac{\sum_m w_m L_{\ell m} + \int_\nu \pi(\nu)\mathrm{d}\nu + rZ}{P^{-(\sigma-1)}}, \tag{1}$$

where A is market size (an equilibrium outcome), $\sigma > 1$ is the elasticity of substitution between varieties, $p(\nu)$ is the price of variety ν, $L_{\ell m}$ the measure of residents who choose to be workers in municipality m, $\pi(\nu)$ the net income (beyond the capital return) for entrepreneurs with variety ν, and Z the total wealth of residents that they rent out as capital to other firms (if they are workers) or their own firm (if they are entrepreneurs) at a gross return r, and P is the price index with $P^{-(\sigma-1)} = \int_\nu p(\nu)^{-(\sigma-1)}\mathrm{d}\nu$. We denote revenues with $x(\nu)$ and, using the above demand function $y(\nu)$ in $x(\nu) = p(\nu)\, y(\nu)$, observe for CES preferences that revenues equal

$$x(\nu) = p(\nu)\, y(\nu) = A^{1/\sigma} y(\nu)^{(\sigma-1)/\sigma}. \tag{2}$$

Under CES preferences and monopolistic competition, a firm optimally chooses a markup factor $\mu \equiv \sigma/(\sigma-1) > 1$ of price over marginal cost (the price markup is $\mu - 1$). See Appendix A.1 for a step-by-step derivation of this and subsequent results.

Entrepreneurial Choice. A firm's production function—the production function associated with an entrepreneurial idea for a variety—is Cobb-Douglas with

$$q = f(k, \ell) = \phi\, k^\alpha \ell^{1-\alpha}, \tag{3}$$

where α is the capital intensity and common to all entrepreneurial ideas. In equilibrium with monopolistic competition, supply of a variety equals its total demand $y(\nu) = q$. Using (3) in (2), we can therefore restate revenues in terms of factor inputs as

$$x(k, \ell) = A^{1/\sigma} \left[\phi\, k^\alpha \ell^{1-\alpha}\right]^{(\sigma-1)/\sigma}. \tag{4}$$

If a resident chooses to be a worker, then she inelastically supplies one unit of labor and her total income is $w_m + rz$. The income rz results from renting out her wealth to residents who are entrepreneurs.

If the resident chooses to be an entrepreneur, then her total income is $\pi + rz$ at the gross rental rate r (including principal repayment and interest). An entrepreneur rents out z, either to her own firm or other firms, or some of both. Her net income π from producing variety ν, associated with idea (ϕ, z), is

$$\pi = x - rk - w_m \ell, \tag{5}$$

where x is revenue (a function of ϕ by (3)), k is the optimal capital stock rented from the market or herself, or both, and $w_m \ell$ is the wage bill for optimally employing ℓ workers. The entrepreneur receives π but no wage. If $z < k$ so that the entrepreneur's initial wealth does not suffice to cover the optimal capital stock, then the

entrepreneur is a net borrower and repays $r(z-k)$ out of revenues. Similar to Evans and Jovanovic, we assume that parameters, including the financial constraint, are such that no entrepreneur defaults in equilibrium: $x - w_m\ell > r(k-z)$ for all varieties and local labor markets.[2] The borrowing rate is equal to the lending rate r and is the same across municipalities, but a resident is confined to obtain financing under her municipality's financial-market conditions.

Every resident can borrow up to an amount proportional to her initial wealth, with a factor of proportionality $\lambda_m - 1 > 0$ that varies by municipality m. The borrowed amount cannot exceed $(\lambda_m - 1)z$. An entrepreneur with initial wealth z can therefore at most invest $z+(\lambda_m-1)z = \lambda_m z$, with a resulting constraint on the capital stock

$$0 \leq k \leq \lambda_m z. \tag{6}$$

2.2 Optimal Factor Choice and Firm Size

Conditional on choosing entrepreneurship, a resident of municipality m maximizes net income (5) for her idea of a variety

$$\max_{k\in[0,\lambda_m z],\ell} x(k,\ell) - rk - w_m\ell, \tag{7}$$

given the revenue function (4) and her initial wealth z. We discern the cases of an interior solution for $k < \lambda_m z$ and a boundary solution with $k = \lambda_m z$, when the financial constraint is binding. At the boundary, the entrepreneur can maximize net income only with respect to employment. There are no fixed costs of firm operation, as opposed to the conventional Melitz (2003) model. Instead, the resident's option to be a worker serves as the selection mechanism by which an idea does not become a firm ($k = \ell = 0$).

Interior Solution. At an interior solution, the first-order conditions for the optimal capital stock and employment imply factor demands

$$k_m = \left(\tfrac{\alpha}{\mu}\right)^{\sigma} A \left[\phi \left(\tfrac{1-\alpha}{\alpha}\tfrac{r}{w_m}\right)^{1-\alpha} r^{-\mu}\right]^{\sigma-1}, \tag{8a}$$

$$\ell_m = \left(\tfrac{1-\alpha}{\mu}\right)^{\sigma} A \left[\phi \left(\tfrac{\alpha}{1-\alpha}\tfrac{w_m}{r}\right)^{\alpha} w_m^{-\mu}\right]^{\sigma-1}. \tag{8b}$$

Under the financial constraint (6), the right-hand side of (8a) is less than $\lambda_m z$, which is equivalent to

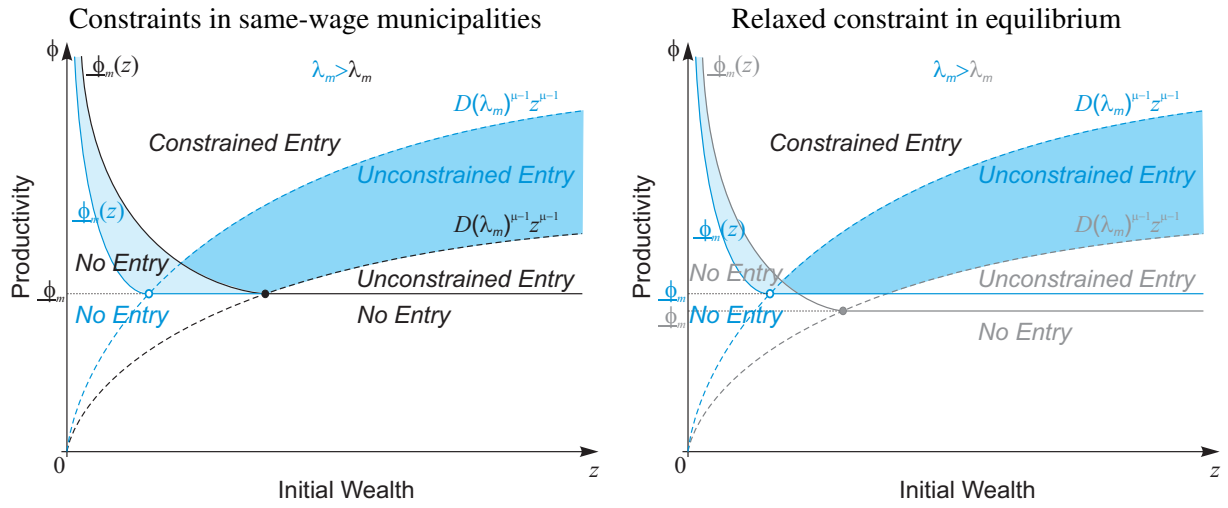
$$\phi \leq D_m \left(\lambda_m\right)^{\mu-1} \cdot z^{\mu-1} \qquad \text{for} \quad D_m \equiv A^{-(\mu-1)} \mu^{\mu}\, r^{\alpha} w_m^{1-\alpha} \left(\tfrac{r}{\alpha}\right)^{\mu-1} / B \tag{9}$$

with $B \equiv \alpha^{\alpha}(1-\alpha)^{1-\alpha}$. In (ϕ, z) idea space, this condition separates unconstrained from constrained ideas. The condition is shown with the concave dashed curves in Figure 1 for $\sigma > 2$ so that $\mu - 1 < 1$.[3]

[2] In a comprehensive framework as in Melitz (2003), allowing for upfront investment into sampling ideas and not fixing the amount of ideas as we do here following Chaney (2008), we could allow for anticipated losses (default) under complete foresight for a measure of unsuccessful ideas.

[3] Broda and Weinstein (2006) report median estimates of σ for U.S. imports and varying levels of industry aggregates between 2.2 and 3.1, with means between 4.0 and 13.1. In industries with $\sigma \leq 2$, the curve that separates financially unconstrained from constrained entrepreneurs would be convex but key insights on the alleviation of financial constraints and its consequence for firm entry would remain unaltered.

Figure 1: Selection into Entrepreneurship and Firm Entry



Notes: Dashed curves show the financial constraint condition (9) for two levels of the financial constraint λ_m, where the higher blue constraint is less binding. The elasticity of substitution is $\sigma > 2$ so that the price markup over marginal cost $\mu - 1 < 1$. Solid schedules, with their two parts given by (15) and (16), show a resident's condition of indifference between entrepreneurship and worker status, determining firm entry. In the **left panel**, we consider an asymmetric case where different labor supplies happen to equalize wages between the municipalities despite different λ_m. The dark-blue shaded area depicts the entrepreneurial ideas (ϕ, z) that are financially unconstrained in a municipality with the blue level of the financial constraint but constrained in a municipality with the black level; and the light-blue area depicts the ideas for which entry occurs in a municipality with the blue level of the financial constraint but not in a municipality with the black level. In the **right panel**, we consider a symmetric case where labor supplies are the same in the blue municipality before and after the change in λ_m. The gray schedules show the blue municipality prior to alleviation of its financial constraint. A less binding financial constraint in the blue municipality raises local labor demand and, for given labor supply, the entry threshold $\underline{\phi}_m$.

These dashed curves in Figure 1 resemble a similar curve in Evans and Jovanovic (1989) where the degree of concavity depended on α under decreasing returns to scale and perfect competition. The area below the dashed curves contains the financially unconstrained entrepreneurial ideas. The blue dashed curve exceeds the black (or gray) dashed curves in Figure 1 under the assumption that the blue level of λ_m exceeds the black (or gray) level.

For a non-binding financial constraint—when condition (9) holds—under CES demand and monopolistic competition, net income is a constant fraction of revenues $\pi = x/\sigma$ and revenues are proportional to employment with $x = [\mu/(1-\alpha)]w_m\ell_m$ so that

$$\pi_m = \frac{\mu\, w_m}{\sigma(1-\alpha)}\,\ell_m \tag{10}$$

(see Appendix A.1 for derivations). Employment ℓ_m is a power function of productivity ϕ by (8b). This result clarifies that, for empirical work, we can use employment as a linearly related proxy to revenues and net income.

Boundary Solution. If condition (9) is strictly violated, the optimal capital stock is at the upper bound, and the first-order condition for optimal employment determines labor demand

$$k_{mz} = \lambda_m z, \tag{11a}$$

$$\ell_{mz} = \left\{ \left(\tfrac{1-\alpha}{\mu}\right)^{\sigma} A \left[\phi \left(\lambda_m z\right)^{\alpha} w_m^{-\mu}\right]^{\sigma-1} \right\}^{\frac{\mu/\sigma}{\alpha+\mu/\sigma}}. \tag{11b}$$

We use the subscript mz for firm outcomes in the financially constrained case to highlight that the outcomes depend on credit market conditions in municipality m (through λ_m) and the entrepreneur's initial wealth z.

When the financial constraint is binding under CES demand and monopolistic competition, revenues are proportional to employment with $x_{mz} = [\mu/(1-\alpha)]w_m\ell_{mz}$, as before, but variable net income is a larger fraction of revenues $\{[\mu-(1-\alpha)]/\mu\}x_{mz}$, and net income is variable net income less the fixed cost for installed capital at the constraint, so that

$$\pi_{mz} = \frac{[\mu-(1-\alpha)]\, w_m}{1-\alpha}\, \ell_{mz} - r\, \lambda_m\, z \tag{12}$$

(see Appendix A.1 for derivations). Employment ℓ_{mz} is a power function of productivity ϕ by (11b). Similar to financially unconstrained firms above, for financially constrained firms we can use employment as a linear proxy to revenues and as a linear affine proxy to net income.

A financially constrained firm with the same productivity ϕ as a financially unconstrained firm is smaller in size, including in employment. We can therefore use employment as a proxy for size also in comparisons between financially constrained and unconstrained firms that are otherwise identical (the only difference is their owner's personal wealth z). However, a financially constrained firm with productivity ϕ optimally chooses a higher labor-to-capital ratio to partially compensate for the lacking capital stock compared to a financially unconstrained firm with the same productivity. To establish these relationships, divide employment at the constrained firm (11b) by employment at the unconstrained firm (8b) with the same productivity ϕ and in the same municipality m (at the same wage w_m):

$$\frac{\ell_{mz}}{\ell_m} = \left(\frac{\lambda_m z}{k_m}\right)^{\frac{\alpha}{\alpha+\mu/\sigma}} < 1 \quad \text{and} \quad \frac{\ell_{mz}/k_{mz}}{\ell_m/k_m} = \left(\frac{\lambda_m z}{k_m}\right)^{-\frac{\mu/\sigma}{\alpha+\mu/\sigma}} > 1, \tag{13}$$

where k_m is the optimal capital stock at the unconstrained firm (8a).

2.3 Firm Entry and Exit

Depending on whether an entrepreneur is financially constrained or not, entrepreneurial net income for a resident in municipality m with idea (ϕ, z) for a variety is

$$\pi_m(\phi, z; \lambda_m) = \begin{cases} \dfrac{\mu\, w_m}{\sigma(1-\alpha)}\, \ell_m(\phi) & \text{if } (\phi, z) \text{ satisfies (9) under } \lambda_m \\ \dfrac{[\mu-(1-\alpha)]\, w_m}{1-\alpha}\, \ell_{mz}(\phi, z; \lambda_m) - r\, \lambda_m\, z & \text{otherwise} \end{cases}, \tag{14}$$

where $\ell_m(\phi)$ is given by (8b) in the financially unconstrained case and $\ell_{mz}(\phi, z; \lambda_m)$ by (11b) in the financially constrained case. A resident in municipality m with idea (ϕ, z) becomes an entrepreneur iff

$$\pi_m(\phi, z; \lambda_m) \geq w_m,$$

and a worker otherwise.

Consider the financially unconstrained residents in municipality m (for them condition (9) is satisfied under λ_m). For these residents, the condition of indifference between entry with the idea (ϕ, z) as an entrepreneur and becoming a worker is implicitly given by

$$\ell_m(\underline{\phi}_m) = \frac{\sigma(1-\alpha)}{\mu}$$

by (14). The condition places a lower bound $\underline{\phi}_m$ on productivity similar to the firm entry threshold in Melitz (2003). Solving out for $\underline{\phi}_m$ using (8b) establishes the lower productivity bound for financially unconstrained residents to enter with their idea:

$$\underline{\phi}_m \quad = \quad \mu \left(\frac{\sigma}{A}\right)^{\mu-1} \frac{r^{\alpha} w_m^{\mu-\alpha}}{B}. \tag{15}$$

When they are not financially constrained, residents accept a lower productivity threshold to enter as entrepreneurs when market size is large or factor prices are low.

Now turn to financially constrained residents (for them condition (9) is violated under λ_m). Their entry threshold is an indifference curve that depends on both productivity $\underline{\phi}_m(z)$ and the resident's initial wealth z. The indifference curve is implicitly given by the condition

$$\ell_{mz}\left(\underline{\phi}_m(z), z; \lambda_m\right) - \frac{(1-\alpha)(r\,\lambda_m\,z + w_m)}{[\mu - (1-\alpha)]\,w_m} = 0,$$

restating (14). The productivity threshold $\underline{\phi}_m(z)$ is specific to a municipality and varies in the resident's initial wealth z. The slope of the indifference curve can be derived using the implicit function theorem:

$$\begin{aligned} \left.\frac{\mathrm{d}\underline{\phi}_m(z)}{\mathrm{d}z}\right|_{\pi(\phi,z;\lambda_m)=w_m} &= -\frac{\partial \ell_{mz}(\cdot)/\partial z - (1-\alpha)\,r\,\lambda_m / \{[\mu-(1-\alpha)]\,w_m\}}{\partial \ell_{mz}(\cdot)/\partial \phi} \\ &= -\frac{\phi}{z}\left[\alpha - (1-\alpha)\frac{r}{w_m}\,\lambda_m z\,\frac{1}{\ell_{mz}(\phi, z; \lambda_m)}\right] < 0. \end{aligned} \tag{16}$$

We show in Appendix A.2 that the slope in (16) is strictly negative iff condition (9) is violated for λ_m (the entrepreneur is strictly financially constrained). This negative relationship means that, when they are financially constrained, residents choose to enter as entrepreneurs at a lower productivity threshold when their wealth increases. The threshold continues to fall with a resident's wealth until it reaches the level for unconstrained entrepreneurs.

Discussion. The left panel of Figure 1 compares two municipalities to each other. For clarity of exposition, we assume in the left panel of Figure 1 that local labor supplies happen to be such that the wages w_m are equal

in the two municipalities, so the entry threshold $\underline{\phi}_m$ is equal between the two municipalities.

A resident's schedule of indifference between entry with the idea (ϕ, z) as an entrepreneur and becoming a worker has two parts: a downward sloping arm $\underline{\phi}_m(z)$ with a slope given by (16) for $\phi > \underline{\phi}_m$ and a flat part $\underline{\phi}_m$ given by (15). Figure 1 depicts this indifference schedule with solid curves, one in black for a municipality with a more binding financial constraint (a lower λ_m) and one in blue for a municipality with a more lenient financial constraint (a higher λ_m).

As discussed above, the concave dashed curves in Figure 1 show condition (9), which separates unconstrained from constrained ideas (ϕ, z). The condition is shown for $\sigma > 2$ so that $\mu - 1 < 1$. The area below the dashed curves contains the financially unconstrained entrepreneurial ideas. In the less financially constrained blue municipality, where λ_m exceeds that in the black municipality, more entry occurs of both financially constrained and unconstrained ideas. The dark-blue shaded area shows the ideas (ϕ, z) that enter without a financial constraint in the blue municipality but with a financial constraint in the black municipality. The light-blue shaded area shows the financially constrained ideas (ϕ, z) that enter in the blue municipality but not in the black municipality.

There are two main implications for empirical analysis. First, a larger number of firms will enter in the blue municipality, as represented by the light-blue shaded area. Second, entrants in the blue municipality are likely to be larger, though we cannot make this prediction unambiguously. Note that firms in the dark-blue shaded area are active in both the blue and the black municipality and mostly not entrants with (ϕ, z) combinations around the entry threshold. The additional entrants in the blue municipality, with (ϕ, z) combinations in the light-blue shaded area, have lower productivity ϕ than their counterparts in the black municipality at the same z level of the entrepreneur's wealth. However, for empirical work, their average productivity needs to be compared to the average productivity of all entrants. For the same wage w_m in both the blue and black municipality, the productivity of unconstrained entrants is $\underline{\phi}_m$. The average productivity of all constrained entrants strictly exceeds $\underline{\phi}_m$ (averaging over the left arm of the entry schedule), so the average productivity of all entrants strictly exceeds $\underline{\phi}_m$. Suppose this average productivity of all entrants is only slightly higher than $\underline{\phi}_m$ (under a given (ϕ, z) distribution) in the black municipality. Then, adding an additional mass of constrained entrants (in the light-blue shaded area) with strictly higher ϕ than $\underline{\phi}_m$, can but need not result in higher average productivity among entrants in the blue municipality than in the black municipality. This theoretical ambiguity calls for empirical resolution. We will consider both size at entry and the two-year growth rate of entrants, using the latter to account for the possibility that the size impacts of the relaxed financial constraint are not exhausted in the entry year.

Local and Economy-Wide Equilibrium. Our empirical analysis studies the relaxation of financial constraints in some municipalities (an increase in λ_m in a subset of municipalities). The alleviation of financial constraints in some Brazilian municipalities will trigger additional responses, as depicted in the right panel of Figure 1.

Financially constrained firms in the municipalities where the financial constraints are alleviated (where λ_m increases) scale up their operations and, by (13), raise labor demand closer to optimal employment size (while also raising the capital-labor ratio closer to unconstrained optimum). The added labor demand bids up the local wage w_m. The higher wage rate has several general-equilibrium consequences. First, some workers

in the economy earn higher incomes. Second, higher labor costs reduce optimal firm size in the local labor market and thus make the financial constraint less binding (an increase in D_m in equation (9)). Third, the selection threshold (15) increases under higher factor prices, inducing exit of previously viable firms. Fourth, higher factor prices raise product prices $p(\nu)$ (see Appendix A.1), which in turn tend to raise revenues and thus profits and entrepreneurs' incomes at given firm sizes (see eq. (14)). Fifth, the consumption effect through product market size A is ambiguous because rising product prices counteract rising incomes for consumption by (1).

The exact general-equilibrium effects depend on the specification of the (joint) distribution of $(\phi, z) \sim F(\phi, z)$. We discern two types of responses: local and economy-wide. When it comes to local general-equilibrium responses, labor-market clearing in each municipality m determines the local wage w_m:

$$\int_0^{\bar{z}} \int_{\underline{\phi}_m(z)} \ell_{mz}(w_m|\lambda_m)\, \mathrm{d}F(\phi, z) + \int_{\bar{z}}^{\infty} \int_{\underline{\phi}_m} \ell(w_m)\, \mathrm{d}F(\phi, z) = L_{\ell m}, \tag{17}$$

where $L_{\ell m}$ is the endogenous local labor supply of residents who choose not to be entrepreneurs, $\ell(w_m)$ for unconstrained firms is given by (8b), $\ell_{mz}(w_m|\lambda_m)$ for constrained firms by (11b) and $\bar{z}$ satisfies (9) with equality for $\phi = \underline{\phi}_m$. Both $\ell(w_m)$ and $\ell_{mz}(w_m|\lambda_m)$ strictly fall in w_m because $\mu > 1$. An increase in λ_m raises $\ell_{mz}(w_m|\lambda_m)$ and therefore results in higher local labor cost w_m for given labor supply. In the right panel of Figure 1, incumbent firms in the dark blue area become unconstrained, expand capital and tend to raise employment (poaching from other incumbents or potentially exiting firms). New entrants in the light blue area are mostly capital constrained but still exert new factor demand. These direct effects raise the local wage w_m.

Beyond first impact, in general equilibrium the increase in w_m affects both the financial constraint schedule (9) and the two-part firm entry schedule given by (15) and (16). The w_m increase raises $\underline{\phi}_m$ with an elasticity $(\mu - \alpha)$ directly and reduces the threshold with an elasticity of $(\mu - 1)$ or less, so that $\underline{\phi}_m$ unambiguously increases (because $(\mu - \alpha) - (\mu - 1) = (1 - \alpha) > 0$). While the change of the slope of the left arm of the firm entry schedule (16) is indeterminate, the upward shift is the same as in (15). The entire firm entry schedule shifts upwards as shown in the right panel in Figure 1 with the change from the gray curve to the blue curve. The marginal firms just above the previous gray firm entry schedule now exit. The effect on the financial constraint schedule (9) is ambiguous, and we consequently do not depict it in Figure 1.[4] The labor-market competition from newly unconstrained firms and entrants therefore causes unambiguous exit in a municipality with an alleviated financing constraint. Moreover, in a municipality with an alleviated financial constraint entrants will have a strictly higher productivity than before if the new productivity threshold for unconstrained firms $\underline{\phi}_m$ strictly exceeds the average productivity of entrants before.

Economy-wide general-equilibrium effects can be conditioned out in empirical work using time fixed effects. For nationally integrated product markets and capital markets, firms in all municipalities face the same changes in product prices p, market size A, and interest rate r. Time fixed effects absorb these common economy-wide responses.

[4] The w_m increase raises D_m in (9) with an elasticity $(1 - \alpha)$ directly and reduces the threshold with an elasticity of $(\mu - 1)$ or less, so that D_m increases if $(1 - \alpha) - (\mu - 1) = 2 - \mu - \alpha \geq 0$ and may decrease otherwise.

3 *Cartão* BNDES and Credit Supply

Brazil's National Development Bank (*Banco Nacional de Desenvolvimento Econômico e Social* or BNDES) is among the largest of such institutions in the world. In 2013, BNDES disbursed nearly US$ 73 billion or roughly 3.3 percent of GDP. Although BNDES has a legacy of industrial policy-based direct lending to large firms (Lazzarini et al., 2014), it has also steadily grown its portfolio for small and medium enterprises (SMEs) in recent years. Since 2002, BNDES has targeted around one quarter of total disbursements towards SMEs.[5] A flagship SME lending program is a rotating credit program known as *Cartão* BNDES (hereafter, simply *Cartão*). Piloted in March 2003, this program grew from less than 1 percent of total BNDES lending to nearly 12 percent by 2013. We use this innovative credit product as well as key details of its implementation to identify the effects of credit supply shocks on firm dynamics.

3.1 Background on the Credit Program

The *Cartão* is a rotating credit line for formal firms with tax ID numbers to make input purchases from BNDES-accredited Brazilian suppliers. Firms apply at local branches of banks that BNDES has approved to intermediate *Cartão* loans. The limit on the credit card balance was R$ 50,000 from 2003 to 2008 and R$ 1 million thereafter. These input purchases are for eligible capital and intermediate goods, as well as select services. The available goods and services varied over time, but all of them must be purchased through an online web portal and have 60 percent national content. For example, firms can purchase a forklift produced by the Altmann corporation headquartered in São Paulo state.

Cartão loans are typically smaller and on more favorable terms than other prevailing credit market opportunities for SMEs. According to data from BNDES and the Central Bank of Brazil (detailed in Section 4), the median loan size of *Cartão* BNDES was R$ 19,108 compared to R$ 191,000 for other loans to SMEs. The typical annual interest rates on *Cartão* loans are 5–15% compared to 25–30% for other loans to SMEs.[6] Repayments for *Cartão* loans could be made in up to 48 installments.

Like other BNDES indirect lending operations, the *Cartão* program is intermediated by privately or publicly owned financial institutions accredited with BNDES. Within broad limits pre-specified by BNDES, these intermediating banks have the leeway to set the actual terms of the *Cartão* loans, including collateral requirements, interest rates for the borrower, credit limits, and repayment frequency. In return, intermediaries bear all the risk on such loans. In these regards, the *Cartão* program can be viewed as a capital injection at low interest rates into the banking system to benefit SMEs, while setting loan conditions is left to the capital market. According to BNDES officers involved in the program, *Cartão* appealed to intermediating banks because it helped attract new clients and freed up bank funds to be used for other, relatively more profitable loans and financial products. Data confirm the intermediating banks' use of this product to expand their client base: in 2013, 68 percent of *Cartão* BNDES borrowers had other loans, while less than 3 percent had a prior relationship with the given bank. These characteristics of the *Cartão* program explain the attractiveness for intermediating banks and SMEs. It is the unique manner in which BNDES furnished these credit lines to intermediating banks that informs our empirical strategy.

[5] During our study period, BNDES defined SMEs as firms with gross revenue less than R$ 90 million.
[6] These interest rate estimates come from the SCR over the period 2003–2013.

3.2 Implementation and Identifying Variation

The staggered implementation of *Cartão* BNDES over 15 years allows us to isolate exogenous variation in local credit supply. We turn to the institutional details underlying this variation.

The *Cartão* program was piloted in 2002 with one private sector intermediary, *Bradesco* bank, whose local branches in municipalities spread across much of Brazil. Over the next decade, additional banks would gradually be allowed to access *Cartão* supply lines from BNDES, beginning with the largest government-owned financial institution, *Banco do Brasil*, in late 2003 and followed by the second largest government-owned financial institution, *Caixa Economica*, in 2005. Eight privately and publicly owned banks were eventually made eligible in 2009 and 2011. However, the two early adopters, *Bradesco* and *Banco do Brasil* account for the dominant share of *Cartão* lending as seen in Figure 2, which plots the evolution of new *Cartão* borrowers by intermediary from 2003 to 2013 using data from BNDES detailed in Section 4.

Once BNDES granted eligibility to a given intermediating bank, its branches across the country could apply for *Cartão* credit lines from BNDES. Hence, the primary constraint for non-financial firms in accessing *Cartão* loans was whether or not a BNDES-accredited bank had branches operating in that locality. This would prove binding in some municipalities as seen in Figure 3, which plots the distribution of bank branches for the three top *Cartão* lenders in their initial year of eligibility.[7] Although individual branches do not necessarily interact with BNDES directly, those branches with prior experience intermediating other BNDES financial products arguably have an informational advantage over other branches when it comes to potential access to *Cartão* credit. Figure 3 also shows the subset of municipalities where each of the three banks had branches with some prior experience intermediating BNDES credit before the introduction of the *Cartão* program. These two features of the preexisting financial landscape shaped the extent to which non-financial firms in a given municipality experienced a change in local credit supply as the *Cartão* BNDES was rolled out nationally.

Before formalizing the identification strategy below, we document the expansion of *Cartão* BNDES lending across space through the eligible banking networks. Figure 4 shows the spread of the program across Brazil's 5,570 municipalities from 2003 to 2013. The dark colors show municipalities where a given accredited bank—*Banco do Brasil* (BdB), *Caixa*, and *Bradesco*—is the only one with outstanding *Cartão* loans. The light colors show municipalities where a given accredited bank is the top lender in volume. The maps show the evolution of intermediation from *Bradesco* dominance in the early years to *Banco do Brasil* dominance in later years. By late 2013, *Cartão* loans were being offered in all but 119 municipalities. Yet, even at this point, in a majority of municipalities, multiple banks were providing *Cartão* loans.

These maps highlight the important institutional feature that, from the outset, there was an explicit lack of geographic preferences in targeting. Although all three banks were providing *Cartão* loans in the most economically vibrant south and southeastern regions of the country by 2009, firms in less developed areas were able to access *Cartão* loans early on. As demonstrated more formally below, this diffuse allocation process will help us rule out a typical identification concern with government funded credit programs, namely that they could be preferentially targeted to underdeveloped regions.

Despite the lack of regional preferences, the program architects did encourage early lending in specific

[7] The map for *Bradesco* is for 2003, one year after its pilot year eligibility, as the SCR data does not begin until 2003.

sectors such as leather and footwear production, small supermarkets, and health clinics and labs. However, over time, the allowable products for investment good and intermediate input purchases using *Cartão* financing evolved beyond the needs of these specific sectors and eventually spanned 75 broad product categories and more than 30,000 products. By the end of our sample period in 2013, the distribution of *Cartão* beneficiaries across sectors roughly matched the distribution of firms across sectors.[8]

The accredited input stipulation makes the *Cartão* program unique in terms of the direct scope for spillover effects of credit along the supply chain. Our empirical strategy will capture these and other potential general equilibrium effects on non-financial firms that do not borrow through BNDES products. By tying the credit to specific purchases, the program might also imply more limited scope for moral hazard than traditional, unrestricted loans. Along most other dimensions, however, the *Cartão* program is similar to other lending programs targeted at SMEs in both rich and poor countries.

The *Cartão* program expanded its lending considerably in 2009, driven largely by new borrowers at *Banco do Brasil*. This evolution can be seen in Figure 2 and is due in large part to the stimulus program implemented by the Luiz Inácio ("Lula") da Silva administration in response to the global financial crisis. Much of this stimulus was directed towards public banks and channeled through BNDES loan programs, including the *Cartão*. This expansion in credit supply for SMEs provides us with precisely the sort of national shock that can then have differential regional effects depending on prior program coverage. We turn next to a discussion of the rich administrative data that allow us to relate these shocks to firm dynamics over the sample period.

4 Data: Firms and Finance

Our main interest lies in understanding how changes in credit supply shape firm dynamics in terms of entry, survival, and growth. We marshal several sources of administrative data on firms and financial transactions in order to trace out the effects of positive credit supply shocks on firm dynamics from 2002 to 2013. In this section, we describe the sources, develop key variables for our analysis, and present summary statistics on the types of firms drawing on different sources of credit.

4.1 Administrative Data Sources

We rely on three comprehensive administrative datasets to track financial flows, survival, and employment outcomes at the firm level.

Credit Data. We measure firm-level access not only to *Cartão* BNDES but also to all other sources of credit, including loans from private-sector banks. In particular, the Credit Information System Database (*Sistema de Informações de Crédito* or SCR) from the Brazilian Central Bank provides transactions-level information on all loans of at least R$ 5,000 (≈ US$ 2,700 in December 2011) from 2003–11 and all loans of at least R$ 1,000 (≈ US$ 300 in December 2016) from 2012 to 2016.[9] We can track the full life of the loan and its time-varying terms month-by-month, but our main variable of interest is the value of disbursements to a given firm in a given year.

[8] In particular, we see that the share of total *Cartão* loans across 3-digit CNAE industries—roughly comparable to 3-digit NAICS industries in the United States—is roughly proportional to the share of total firms in any industry in RAIS.

[9] There are over 700 million transaction-level records per month in the SCR data in 2016.

In the SCR, we can distinguish between institutions that originate and intermediate loans. However, given the nature of *Cartão* BNDES in terms of its size and potential for miscoding as non-intermediated finance, not all *Cartão* loans are identifiable as such in the SCR. Hence, our main analysis of this program relies on precise program data on indirect finance approvals by BNDES, including *Cartão* (provided by BNDES to Banco Central do Brasil for this project). The BNDES data capture all indirect finance programs, including a host of agricultural and industrial lending programs, along with the identity of the intermediating bank. Most of those other BNDES programs are more readily identifiable in the SCR. Therefore, we retain the SCR for identifying all BNDES-originated loans, except the *Cartão* program, as well as all private-bank loans.[10]

Together, the SCR and BNDES approvals data allow us to capture nearly the universe of credit inflows at both the firm and municipality level. Our focus lies on the *Cartão* program, for which we can isolate plausibly exogenous variation in local credit supply. However, as detailed below, the *Cartão* program interacts in several important ways with other segments of the credit market. Our rich data allows us to capture any potential multiplier or displacement effects on other credit lines. By observing the full lending and borrowing portfolios across the country, we are able to characterize potential sources of bias and to recover an estimate of the changes in SME dynamics due to plausibly exogenous shifts in local credit supply coming from the expansion of the *Cartão* portfolio.

Matched Employer–Employee Data. We link borrowers in the SCR to firm-level employment records by their unique tax IDs. These employment records come from Brazil's Relação Anual de Informações Sociais (or simply RAIS). The RAIS data offers matched employer-employee records and comprise the universe of all formal firms with at least one employee; it has been widely used in recent work (see, e.g., Menezes-Filho et al., 2008; Helpman et al., 2017; Ulyssea, 2018). Although we observe establishments within firms, our analysis will be at the firm level because this is the level at which credit flows can be traced. Moreover, the relevant unit of analysis for credit extended to SMEs is the firm. We assign each firm to its modal municipality by establishment employment. There are 5,567 municipalities in our sample period. We construct several variables aimed at capturing firm size and capability based on measures of employment and firm age, all of which are based on the December employment records of the given calendar year.

We measure firm entry in two ways, each of which has advantages and disadvantages. First, because the RAIS data extends back to 1986, the first year of appearance in RAIS provides a reasonable measure of a firm's first year of formal-sector activity (with one employee) during our period of interest beginning in the early 2000s.[11] Second, we attempt to capture prior informal-sector activity (and hence formal entry from prior informality) by defining firm entry based on the longest reported tenure across all workers in a firm's first year in RAIS. We might observe a longer maximum tenure than accounted for by the firm's first year in RAIS if some workers were employed at the firm prior to its formalization. However, this measure of true firm age, including a potential spell of informality, could still be downward biased if the original employees of the informal firm separated prior to the first year of the firm's formalization.

[10] One potential concern with the BNDES approvals data is that they do not reveal the actual date of disbursement. However, a detailed analysis of the difference between date of approval and date of disbursement for a subset of identifiable BNDES loans suggests that the extent of miscoding year of credit received based on approvals is negligible.

[11] This may depart from the true formal entry date insomuch as some firms may legally register but not yet pay workers and thereby enter the RAIS records. Using data from the Department of Federal Revenue in 2013 (*Receita Federal*), we can show that this measurement error is neither large nor systematic with respect to the credit supply shock we investigate.

We define firm exit from the formal sector in year t based on absence from RAIS for at least the next three years $t+1$, $t+2$, and $t+3$. This exit measure has limitations but provides a reasonable proxy in the absence of an actual measure of firm exit.

4.2 Descriptive Background

Before investigating how credit supply shocks shape firm dynamics, we describe the financial landscape in Brazil with particular emphasis on the *Cartão* program. Credit access is pervasive in the formal economy with 55 percent of all firms reporting at least one outstanding loan by 2012, an increase of around 12 percentage points relative to 2004, the first year of comprehensive reporting in the SCR. Meanwhile, over that same period, the share of firms with any indirect financing by BNDES grew from 1 percent to 10 percent. Most of that growth is explained by the expansion of *Cartão* BNDES, which reached nearly 8 percent of all formal-sector firms by 2013.

This deepening of credit markets is accompanied by considerable heterogeneity across regions. Figure 5 highlights spatial variation, showing considerable dispersion in the share of *Cartão* BNDES in total credit going to SMEs. Corresponding municipality-level summary statistics in Table 1 quantify this cross-regional variation. Both the maps and this table make clear that, although *Cartão* lending is a small part of the overall credit market for SMEs, it commands a significant share of the market in certain localities. Nationally, the share of *Cartão* loans in total SME loans grew from 0.1 percent in 2008 to 1.2 percent in 2013. By 2013, *Cartão* disbursements comprised more than 5 percent of total credit for SMEs in around 10 percent of municipalities. In the most underdeveloped financial markets, the *Cartão* share reached as high as 25 percent of total lending to all firms. Against the backdrop of the mid-2000s, the growth in *Cartão* lending constituted a dramatic increase in the scope of local credit availability for SMEs.

Table 2 describes the variation in firm age and size across firms by their borrowing profiles. Firms with *Cartão* BNDES loans tend to be significantly larger (in terms of employment) and slightly older than firms with no outstanding loans. They look more similar to other firms with outstanding non-*Cartão* loans but still tend to be older and larger. This hints at the possibility that intermediating banks offer *Cartão* products to less risky firms because the intermediating bank bears the borrower's default risk vis-à-vis BNDES. However, this lending behavior changed over time as the program expanded. Between 2004 and 2013, the median employment size among *Cartão* borrowers fell from 14 to 7, compared to non-*Cartão* borrowers whose median size fell from 5 to 4. While *Cartão* might be associated with relatively unattractive BNDES-dictated terms for the intermediating bank, the *Cartão* product arguably helps the bank attract new clients and frees up bank funds to be used for other loans and financial products.

An important feature of the *Cartão* program lies in its potential to offer a novel source of credit for both firms and regions rationed out of existing credit markets but nevertheless home to potentially productive entrepreneurs. By bringing new firms into the financial system, the program may exert spillover effects that extend beyond its direct impact at the point of lending. Appendix Figure B.1 provides some indication of these possibilities. First, over time, an increasing number of borrowers takes out their first formal financial sector loan during the study period. Initially, around 20 percent of *Cartão* recipients were first-time borrowers, but by 2012, that share grew to 40 percent as the program reached more disadvantaged segments of the formal

firm population. Moreover, the *Cartão* may serve as an important gateway product for SMEs to subsequently access other lines of credit: the share of *Cartão* borrowers at time t with non-*Cartão* loans at a time later than t grew from around 40 to 50 percent over the 2000s. We view these potential second-order effects of the initial *Cartão* loans as important in understanding the overall impact on firm dynamics.

5 Empirical Strategy: Isolating Credit Supply Shocks

Isolating the impact of credit expansions on firm dynamics is afflicted by endogeneity problems. We develop an identification strategy aimed at solving these challenges with an instrument for the local supply of credit available to SMEs. Our approach exploits historical variation in bank branch locations and lending networks coupled with a shock to the national supply of credit for SMEs. This general strategy of relating national shocks to existing local economic conditions is widespread in the applied microeconomic literature beginning with Bartik (1991) and has been introduced into the macroeconomics and finance literature recently (see, e.g., Greenstone et al., 2020; Mian and Sufi, 2014). This section first develops the identification strategy and then validates its key assumptions.

Before formalizing our empirical strategy, it helps to fix ideas about the possible ways in which a local credit supply expansion targeted at SMEs can affect firm dynamics. Consider the process by which an incumbent firm i obtains a *Cartão* loan. Firm i learned about the *Cartão* either through an advertisement at local bank branches (where it was forum shopping for credit) or through one of the many media through which BNDES itself promotes the product, including trade fairs as well as television, radio and internet ads. Firm i happened to be located in a municipality where *Bradesco* had a number of longstanding branches, and hence firm i was able to secure a *Cartão* credit line in its municipality. In addition, firm i might also have had a better chance of obtaining another loan product from a local *Bradesco* branch in its municipality because *Cartão* would free up funds at the branch for other lines of credit as discussed above. However, if *Bradesco* had not had such a local presence, it is unlikely that the national expansion of the *Cartão* program would have affected firm i's financing opportunities directly because bank branches rarely lend to firms in other municipalities according to SCR credit data. Similarly, for firm i' in a nearby municipality without *Bradesco* branches, accessing *Cartão* BNDES would have been considerably more difficult, and the chance of accessing existing lines of credit would not be any different from before.

In thinking about the impacts of expanding *Cartão* access on firm entry, suppose that an entrepreneur is interested in entry with idea ν or in formalizing her existing firm, but can only do so if credit is available to finance some of the desired capital investment. With increasing visibility of *Cartão* BNDES and its sustainable financing possibilities at local bank branches, this entrepreneur is more likely to enter. The empirical strategy below aims to identify the consequences of additional credit for ν's own outcomes as well as the broader consequences of credit supply expansion for other, incumbent firms in the same municipality. Moreover, the availability of additional credit can disproportionately help relatively more capable incumbent firms to expand and therefore cause the exit of relatively less capable firms.

5.1 Estimating Equations

Our main estimating equation relates new *Cartão* loan disbursements to firm outcomes at the locality level. In particular, we estimate municipality-level panel regressions spanning 2003–2013:

$$y_{mrt} = \alpha + \gamma \ln(\text{credit}_{mrt}^{cartao}) + \theta_{rt} + \varepsilon_{mrt} \tag{18}$$

where y_{mrt} is an aggregate measure of firm dynamics in municipality m in region r at time t (e.g., number of new firms) and $\ln(\text{credit}_{mt}^{cartao})$ is the log value in BRL of new *Cartão* loan approvals for firms operating in m in year t. Below, we develop a strategy for incorporating other non-*Cartão* credit, including other indirect finance from BNDES as well as other non-BNDES-originated lending.

As a baseline, we use region×year fixed effects, θ_{rt}, which are meant to capture time-varying changes in regional economic conditions. As regional aggregates, we use the 554 microregions during this period, and every municipality is uniquely mapped to a time-invariant micro region during the sample period. Their boundaries—determined by the Brazilian Statistical Agency (IBGE)—roughly capture integrated economic zones in the form of contiguous municipalities with similar production and geographic features, a distinction akin to commuting zones or local labor markets. It follows that γ identifies differences in y for municipalities that received relatively more *Cartão* credit inflows than other municipalities in the same regional market in the same year. We prioritize this localized within-period, cross-sectional identification strategy given the relatively short time series and fairly concentrated national surge in *Cartão* lending in 2009 (see Section 3.2). In robustness checks, we address concerns about differential trends by including interactions of predetermined, baseline municipality characteristics with year fixed effects. In all specifications, we cluster standard errors at the microregion r level.

The estimated effects of *Cartão* credit could be biased in either direction. First, we may be upward biased if low-wealth borrowers such as an incumbent firm or prospective entrant are already thriving with other credit, and banks are differentially allocating BNDES credit to growing municipalities within regions. On the other hand, we may be downward biased if high-wealth borrowers divert funds unproductively, or if borrowers are concentrated in backwards municipalities within regions or sectors where credit is not a fundamental bottleneck to growth. In order to address these biases, we need to isolate changes in local *Cartão* credit supply that are orthogonal to changes in credit demand.

Our solution is to leverage the unique institutional features of the *Cartão* program outlined in Section 3. We exploit the fact that only certain banks could intermediate the program at certain points in time. In a given year t, BNDES allocates a certain amount of funding nationally for the *Cartão* program. The degree to which this national expansion in credit for SMEs affects credit availability and our outcomes of interest at the local municipality level will depend on the preexisting presence of branches of BNDES-accredited intermediaries and a financial intermediary's BNDES accreditation for *Cartão* in the first place.

In particular, following an approach put forward in Greenstone et al. (2020), we instrument for $\text{credit}_{mt}^{cartao}$ with a weighted average of national bank b-specific credit supply shocks, $\widehat{S}_{bt}$, where the weights capture the relative importance of bank b lending in municipality m in the prior period. To isolate these credit supply

shocks, we estimate bank×municipality panel regressions:

$$\Delta \ln \text{credit}_{bmt}^{cartao} = \alpha + S_{bt} + D_{mt} + \varepsilon_{bmt} \tag{19}$$

where the estimated $\widehat{S}_{bt}$ terms capture the national program expansion in a given year with eligibility restrictions across banks, and the $\widehat{D}_{mt}$ terms capture all municipality-specific factors correlated with credit demand. These fixed effects can be recovered in a series of adjacent-year regressions or in a single panel spanning all years. In a robustness check, we use weights from the initial year (index $m0$) for $t = 0$. Following Greenstone et al. (2020), we weight these regressions by $\text{credit}_{bm,t-1}^{cartao}$ such that the influence of each bank's local credit supply change is proportional to its lending in the preceding year.

Estimates of equation (19) are based on the set of municipality×bank×years with nonzero *Cartão* loans. Hence, our main results exclude the first year in which *Cartão* loans show up in a municipality (an extensive margin that can be seen in the maps in Figure 4). We are interested in relating national credit expansions to local credit supply via the local institutions with the ability to intermediate these loans.

Using the estimates of S_{bt}, we then construct an instrumental variable that effectively allocates the national, bank-specific supply shock to municipality m in proportion to the importance of credit from that bank in the prior period. This credit supply shock in year t is defined as:

$$\widetilde{\text{shock}}_{mt}^{cartao} = \sum_{b} \left(\frac{\text{credit}_{bm,t-1}^{cartao}}{\text{credit}_{m,t-1}^{cartao}} \right) \widehat{S}_{bt}, \tag{20}$$

where the sum includes all banks eligible to intermediate the *Cartão* program in this year.

We also construct an analogous instrument for other sources of indirect finance originating at BNDES and intermediated by eligible financial institutions across the country. Similar to the IV strategy for *Cartão* loans, this approach helps to isolate the portion of local credit supply due to national expansions in programmatic indirect credit lines. These credit lines include a range of programs, some of which have similar institutional underpinnings as the *Cartão* program whereby changes in national credit supply can only reach regional markets through pre-existing arrangements between BNDES and eligible intermediary banks.

Under this approach, our baseline second-stage estimating equation is given by:

$$y_{mrt} = \alpha + \gamma \ln(\text{credit}_{mrt}^{cartao}) + \delta \ln(\text{credit}_{mrt}^{bndes}) + \theta_{rt} + \varepsilon_{mrt} \tag{21}$$

with the corresponding first-stage equations:

$$\begin{aligned} \ln \text{credit}_{mrt}^{cartao} &= \alpha^{c} + \phi^{c} \widetilde{\text{shock}}_{mrt}^{cartao} + \zeta^{c} \widetilde{\text{shock}}_{mrt}^{bndes} + \theta_{rt} + \upsilon_{mrt}^{c} \\ \ln \text{credit}_{mrt}^{bndes} &= \alpha^{nc} + \phi^{nc} \widetilde{\text{shock}}_{mrt}^{bndes} + \zeta^{nc} \widetilde{\text{shock}}_{mrt}^{cartao} + \theta_{rt} + \upsilon_{mrt}^{nc} \end{aligned} \tag{22}$$

where the shocks are as defined above.

We further consider an alternative specification to address the possible interactions of the *Cartão* program

with other local lending. We define a single endogenous variable for total borrowing in m:

$$y_{mrt} = \alpha + \gamma \ln(\text{total credit}_{mrt}) + \theta_{rt} + \varepsilon_{mrt}. \tag{23}$$

We then instrument that total with the $\widetilde{\text{shock}}_{mt}^{cartao}$ and $\widetilde{\text{shock}}_{mt}^{bndes}$ measures. This approach effectively isolates that portion of total credit supply in m that is driven by changes in *Cartão* and other BNDES indirect finance. In other words, the second-stage coefficient then identifies the net effect of changes in credit supply inclusive of any complementary or offsetting changes in non-BNDES lending.

One important assumption underlying our interpretation of γ is that credit supply is local in that firms in municipality m respond to changes in credit in m and not in nearby municipalities (within the same microregion). This assumption seems reasonable given that less than five percent of loans from BNDES-eligible banks are obtained from branches outside a given firm's municipality.[12] In practice, these local responses to non-local changes in credit supply will simply attenuate the estimates of γ towards zero in equation (18) as long as there are no systematic allocations of credit towards nearby municipalities based on firm dynamics in one's own municipality. In the firm-level regressions, there is no concern of dissipation as we use the loan extended to the individual firm by the identified local bank branch.

An important feature of the expansion of the *Cartão* program in the mid- to late-2000s is that it occurred in a generalized manner, driven by prior bank presence. Indeed, much of the public lending during this period was allocated broadly across the country rather than targeting specific regions or industries (Coleman and Feler, 2015). Moreover, unlike much larger industrial lending programs operated by BNDES, which are subject to political capture (Carvalho, 2014), the *Cartão* program is diffuse across sectors. From an identification perspective, we can therefore view the expansion of *Cartão* BNDES as an intermediary-specific shock with no targeted geographic preferences.

5.2 Validating the Identifying Assumptions

Our empirical strategy rests on the key identifying assumption that banks with low or high shocks to their national supply of BNDES-originated credit, S_{bt} in equation (19), have not systematically sorted into municipalities on the basis of shocks to or differential trends in the given outcome of interest y_{mt}. Robustness checks in Section 6.4 directly address concerns about confounding trends in development and firm dynamics. Here, we provide two pieces of upfront evidence against these types of concerns.

First, we confirm that local branches of eventually eligible banks do not arise endogenously in response to the *Cartão* program. Using the SCR and auxiliary data on bank branch locations (see Figure 3 notes), we find that more than 99.999 percent of the more than 1.5 million *Cartão* loans administered through 2013 were provided by bank branches that existed in the municipality in the prior year. More generally, the *Cartão* loan product is viewed as having relatively low returns compared to other sources of inter- and intra-bank finance. Indeed, we can show that the *Cartão* is a minor part of most bank branches' SME portfolios. Hence, it is unlikely that new branches are created in expectation of increases in *Cartão* lending nationally.

[12] We only observe the issuer of *Cartão* BNDES loans in the BNDES records at the national bank level, not at the local branch level. In merely 715 out of 36,679 municipality-year observations (for municipalities with at least one branch of any bank), we find a *Cartão* BNDES client of a bank that has no active branch in the municipality. We assume for all clients with a *Cartão* BNDES loan from a bank that has a local branch that the client has a *Cartão* BNDES from the bank branch in the client's municipality.

Second, we provide direct tests for sorting by regressing our instrument for *Cartão* lending, $\widetilde{\text{shock}}^{cartao}_{m,t+1}$ in equation (20), on lagged growth in measures of firm activity and local economic development. Table 3 demonstrates that lagged shocks to municipality GDP per capita are uncorrelated with subsequent local credit supply shocks captured by the instrument for *Cartão* lending. The same holds for a host of firm-level outcomes capturing the dynamics we are interested in: entry, survival, growth and entrant capability. Furthermore, the *Cartão* instrument is uncorrelated with the lagged change in the number of bank branches operating in the municipality. These results in Table 3 are reassuring. Together, they lend credibility to the identifying assumption that our instrument for the *Cartão* supply shock is uncorrelated with sorting of banks into municipalities that have high loan-growth potential.

6 Results: Credit Supply Shocks and Firm Dynamics

This section presents our core empirical results in several steps. First, we show how local *Cartão* credit expansions lead to growth in other lending unrelated to BNDES. Second, we identify significant effects of *Cartão*-induced credit supply shocks on the entry and exit of SMEs with limited effects on overall formal-sector employment. Third, we delve into these aggregate effects to show how local credit supply expansions lead to differential entry of higher capability firms and exert general equilibrium effects beyond the borrowing firms. Fourth, we establish robustness of the core findings to leading identification concerns. Finally, we identify heterogeneous effects of these credit supply shocks across locations with different initial credit market tightness and firms with different potential internal financing capacity.

6.1 *Cartão* Loans and Credit Multipliers

Understanding the local impact of *Cartão* lending requires first understanding how such lending ripples across local credit markets. There are several ways in which an increase in subsidized credit from BNDES might shape banks' broader lending behavior. Our identification strategy allows us to estimate the aggregate multiplier at the locality level using equation (18) with the dependent variable being total non-*Cartão* lending.

In Table 4, we estimate the *Cartão* credit multiplier using OLS and IV based on the instrument $\widetilde{\text{shock}}^{cartao}_{mt}$ in equation (20). The OLS estimate of 0.25 falls to 0.18 in the IV specification, suggesting a slight upward bias, consistent with an endogenous component of *Cartão* lending piling in to already well-developed credit markets. The IV estimate implies that a 10 percent *Cartão* BNDES credit supply expansion enables additional local credit supply to grow by nearly 2 percent in other product lines.

These results are consistent with the growth in SME credit originating from BNDES leading to further expansions in local credit supply. The patterns are in line with claims by stakeholders at BNDES that the *Cartão* product is often seen by participating banks and branch managers as a means of attracting new clients and also growing their local SME portfolio. If a given bank branch can reliably expect new public funds to come in, it may adjust its other credit lines and offers with that expectation. Local bank branches might even make loans contingent on the arrival of BNDES funds. This credit-market response to the *Cartão* supply shock may be an important part of the general equilibrium effects of the program.

Furthermore, the credit multiplier appears larger in those municipalities where credit is most scarce at the

outset of the program. Columns 3 and 4 of Table 4 report separate IV estimates for municipalities, respectively, below and above median total non-BNDES credit per capita in 2004. We find that a one-percent *Cartão* credit supply expansion induces a 0.2 percent non-*Cartão* credit supply expansion in less developed credit markets but has no significant effect and might even crowd out non-*Cartão* credit in more developed markets. Together, these results highlight the importance of understanding the local capital market conditions for the response to an expansionary credit policy targeting SMEs. We explore these heterogeneous conditions in Section 6.5 but turn now to our baseline results for all of Brazil.

6.2 Entry, Survival and Employment Growth

We begin in Table 5 with a baseline set of results linking *Cartão* lending to increased firm entry. We report OLS and IV estimates of equation (18) with standard errors clustered at the microregion level.[13] Recall that these estimates identify the overall effect of local credit supply shocks on firm-level outcomes at the municipality level. These effects capture many possible responses to increased SME credit from BNDES, including, among others, lending responses by other banks and labor and product market responses by ineligible firms (in both the formal and informal sector). We explore these possible intermediating forces in turn.

Table 5 provides initial evidence of an increase in firm entry due to an expansion of *Cartão* lending. The OLS specification in column 1 delivers an elasticity of 0.18, suggesting that a doubling in the value of *Cartão* disbursements is associated with an 18 percent increase in the number of new firms entering the formal sector. Turning to column 2, we argue that this significant positive effect of SME credit on entry has a causal interpretation. Instrumenting with the *Cartão* supply shock measure in equation (20) delivers a statistically significant elasticity of 0.136, based on a strong first stage, with an F statistic greater than 100.[14] This estimate implies roughly 1 additional firm relative to 9 entering the mean municipality over this period. The effect size is nearly one-third smaller than the OLS estimate, which reflects the potential upward bias of the OLS estimator from targeting of *Cartão* lending as noted above. The instrument helps isolate variation in access to *Cartão* loans arising not from endogenous firm-level demand but from plausibly exogenous shifts in national supply intermediated by eligible local banks. With only 2 percent of newly established firms having outstanding *Cartão* loans in 2011 (at the height of the program), the large elasticities are consistent with a possible multiplier effect coming through local credit markets.

The remaining columns of Table 5 bear out this possibility, showing how the *Cartão* effect is shaped by and shapes other changes in local credit disbursements. Columns 3–4 report estimates of equation (21) and show that other, non-*Cartão* credit originating from BNDES has similarly positive effects on overall entry. Both the OLS and IV specifications reveal effect sizes that are similar in magnitude to the IV estimate for *Cartão* lending in column 2. However, in column 4, we find that the IV estimate for *Cartão* lending falls by half when accounting for these contemporaneous inflows of other BNDES indirect finance. This suggests that part of the increased entry attributed to the local expansion of *Cartão* lending could be due to strategic interactions with other types of BNDES lending.

[13] As a baseline, we add 1 inside the log to account for zero credit municipality×year observations. Alternative transformations such as inverse hyperbolic sine deliver very similar results. We take a similar approach in generating the instruments from equation (19). Hence, the identifying variation in the IV specification lives in the intensive margin of credit supply expansions.

[14] We report first stage regression results in Appendix Table B.1 and the reduced form in Table B.2.

In columns 5–6, we show that shocks to BNDES lending exert even more sizable effects on firm entry by amplifying other sources of credit (as seen in Table 4). We capture these endogenous lending responses by estimating equation (23), instrumenting *total* credit with the exogenous shocks to *Cartão* and other BNDES credit lines. This specification delivers a causal estimate of the overall impact of BNDES-induced credit supply shocks on outcomes for those firms responding to the particular changes in credit market conditions. Column 6 reveals a significantly larger elasticity of firm entry with respect to local credit supply than in previous specifications. The IV coefficient of 0.744 is substantially larger than the corresponding estimates for the individual BNDES credit terms in columns 2 and 4.[15] This finding suggests that access to additional public financing from BNDES may allow local bank branches to expand their other credit lines (see Table 4) in a manner conducive to further entry.

To better understand the increased entry, we re-estimate the key specifications from Table 5 for firms entering at different sizes. The results in Appendix Table B.3 show that the effects of the *Cartão* credit supply shock are concentrated among enterprises with less than five employees, which make up the majority of entrants. This is consistent with the program's goal of expanding credit to SMEs, many of which may enter at small sizes given the expectation of greater financial access thereafter.[16] Although *Cartão* supply shocks do not affect the largest entrants, they are associated with an increase in entry size, as we shall see below.

While novel credit access may incentivize formalization, we find little evidence that the entry effects are driven by shifts out of the informal sector. In particular, the entry effects in Table 5 are similar when defining entry based on the maximum tenure of initially reported employees at the firm, which is an entry measure that should exclude firm switches from informality to formality (as discussed in Section 4.1). For example, the IV coefficient goes from 0.136 to 0.119 in column 2 and from 0.744 to 0.752 in column 6. Overall, these results suggest that the effects of credit supply shocks on formal-sector entry are most likely driven by entrepreneurs that had not previously begun operations in the informal sector.

Despite these significant effects on entry, local credit supply shocks do not lead to overall growth in formal-sector employment as a result of offsetting effects on exit. In Table 6, columns 3 and 4 show firm exit elasticities with respect to instrumented *Cartão* and total credit supply shocks that are only slightly smaller than the entry elasticities from Table 5 reproduced in columns 1 and 2, respectively. While the marginal entering and exiting firms may differ in size, the overall effects on formal employment growth over the short-run (annual time horizon) are statistically indistinguishable from zero as seen in columns 5 and 6. The estimates are effectively unchanged when looking at a slightly longer two- or three-year growth horizon.[17] The lack of an overall effect on municipality-level employment growth suggests sufficiently offsetting effects on employment growth among incumbents. This could be due to credit supply shocks inducing entry of vibrant young

[15] We also estimate a just-identified IV regression instrumenting total credit with only the *Cartão* shock, and in so doing find very similar results. For the entry outcome, the point estimate is 0.747 (0.046)***, suggesting that most of the identifying variation in the entry elasticity comes from the *Cartão* supply shock rather than shocks to other BNDES credit supply.

[16] Moreover, because *Cartão* loans were available to all firms, the uptake was roughly proportional to sectoral firm shares. This pattern implies that the bulk of *Cartão* borrowers can be found in the wholesale and retail sector where firm sizes tend to be considerably smaller than in manufacturing.

[17] We can show that the entry effects are driven by firms with slightly less employment than those driving the exit effects. In particular, we examine the employment differential between new entrants and exiting firms, $\left(\frac{employees_{enter,t}-employees_{exit,t}}{0.5employees_t+0.5employees_{t-1}}\right)$, and find a coefficient of -0.002* for *Cartão* lending and -0.008*** for total lending in the respective IV specifications. These are meaningful effects relative to the mean of 0.05.

firms that compete with less productive incumbents, some of which are induced to shrink or exit.[18] In terms of our model, we see these exiting incumbents as past marginal entrants that wound up between the horizontal blue and gray lines in the right panel of Figure 1. This interpretation is supported by the fact that the median age of exiting firms is 4.8 years.

Going further, Table 8 reports estimates from firm-level regressions in order to clarify the channels by which BNDES credit supply shocks affect firm behavior. We estimate the following specification on an unbalanced panel of firms that receive *Cartão* credit over the study period:

$$y_{imt} = \alpha + \gamma \ln(\text{credit}_{imt}^{cartao}) + \delta \ln(\text{credit}_{imt}^{bndes}) + \theta_i + \theta_t + \varepsilon_{imt}, \tag{24}$$

where θ_i capture firm i fixed effects. We instrument for *Cartão* and other BNDES credit to firm i using the respective municipality-level IVs defined above. We investigate the effects of these credit supply shocks on firm exit and employment growth. Given the presence of firm fixed effects and our primary interest in *Cartão* lending, we restrict the sample to firms that receive any *Cartão* loans over the study period. This implies a quasi-generalized difference-in-differences interpretation of γ, effectively comparing outcomes for firms that receive *Cartão* credit in one year to those that receive *Cartão* credit in other years.

Although noisy, the results suggest that receipt of *Cartão* credit induces firms to survive longer and grow faster. Column 1 implies that a 10 percent increase in *Cartão* credit reduces the likelihood of exiting the formal sector by around 0.7 percentage points (p.p.) relative to the mean exit rate of 3 p.p. among all firms that ever received *Cartão* BNDES during the sample period. Continued survival is also accompanied by greater employment growth. In column 3, a 10 percent increase in *Cartão* in a given year increases employment growth by 2.6 percent relative to a mean of around 8 percent among firms that ever receive *Cartão* credit. These direct effects of *Cartão* credit capture part of the overall effects on municipality-level firm dynamics that we identify in Table 5. Meanwhile, columns 2 and 4 show that other sources of BNDES credit have a more limited effect on *Cartão* borrowers. Ultimately, though, we cannot read too much into these results given that the instruments, which are well-powered at the municipality level, do not have substantial bite at the firm level, and with weak instruments come wide confidence intervals.

Overall, the expansion of *Cartão* and other BNDES-administered indirect lending programs led to significant churning of firms within local labor markets. With deeper credit markets offering a wider array of financial products comes both greater opportunity and greater competition. The implied effects on entry and exit cancel out in aggregate, leading to no change in formal employment over the short-run. However, by changing the composition of firms each period, the BNDES-induced credit supply shocks may lead to changes in the capability of firms operating in the formal sector, which may in turn affect formal-sector employment dynamics in later periods. We investigate these potential changes in firm capability next.

6.3 Changes in Entrant Capability

Despite relatively limited aggregate effects on local employment, credit supply expansions may lead to important changes in the capability of entering firms. We show here that the BNDES-induced credit supply shock changes entrant characteristics in meaningful and beneficial ways.

[18] The finding of offsetting effects of an injection of credit on treated firms and their competitors is echoed by Cai and Szeidl (2022).

Columns 1–2 of Table 9 show that BNDES-induced credit supply shocks have a small but positive effect on the average size of entering firms. With greater access to rotating credit for specific input purchases, credit-constrained entrepreneurs may be able to enter the formal economy at larger scale. On the other hand, the availability of cheap credit may allow less productive entrepreneurs to enter and hence pull down the average size of entrants. Column 1 suggests that these two forces may offset each other in the case of *Cartão* BNDES credit. However, the credit multiplier effects of all BNDES indirect lending shocks seem to increase the size of the average entrant as seen in column 2. This evidence suggests that the overall credit supply expansion induced by BNDES-administered indirect lending may induce entry of relatively larger firms, in line with the credit constraint mechanism in our theory model. The elasticity of 0.1 implies a 10 percent increase in entrant size for every doubling of local credit supply for SMEs. This is a relatively small effect given the mean entrant size of around 2.5 employees. Nevertheless, the lack of a systematic reduction in the average size of entering firms after credit supply shocks stands in contrast to recent work documenting a reduction in entrant capability subsequent to a reduction in entry costs (see, e.g., Amici et al., 2016; Branstetter et al., 2014).

The remaining columns of Table 9 provide further evidence that the BNDES-induced credit supply shocks select higher capability entrants. Columns 3–4 show that among firms surviving more than two years, those entering in municipalities with large credit supply shocks enter at larger scale. Moreover, these longer-lived entrants also tend to grow faster over the first two years after entry.[19] For productive entrepreneurs, the prospect of (continued) credit availability in subsequent years may allow them to make larger capital investments early, which are accompanied by larger employment as shown in our theory model. In other words, faster growth could reflect a gestation period effect. For example, a *Cartão* loan could allow a restaurant to enter with an industrial kitchen instead of as an extension to the owner's home, but it takes time to renovate the separate building where the kitchen is installed, move in, and hire more employees.

Together, the results in this section suggest that deeper credit markets enable entry of more productive entrepreneurs at larger initial size and with greater potential for subsequent job creation, as our model suggests. These municipality-level effects are consistent with direct effects on *Cartão* borrowers and indirect effects on other firms benefiting from potential spillovers of the program. These spillovers might arise through various channels including, for example, input-output relationships with *Cartão* borrowers, competition in product and input markets, or the increase in non-*Cartão* credit supply stemming from the *Cartão*-induced shock.

6.4 Robustness Checks

We subject our core results in Tables 6 and 9 to several identification checks. For each table, we produce a corresponding table—Table 7 for Table 6 and Table 10 for Table 9—with three alternative specifications meant to address confounding explanations for our results.

In Panel A, we interact year fixed effects with the municipality-level GDP per capita and the manufacturing share of employment in 2003, the last year prior to the rollout of *Cartão* lending. This specification allows for differential trends, entered nonparametrically, across municipalities at varying levels of development and with varying industrial structures, which together might shape the evolution of credit market and firm dynamics.

In Panel B, we include twice-lagged shares of total *Cartão* credit disbursed by all branches from each

[19] Note that the sample is more limited here as we lose years 2012 and 2013 when computing two-year survival rates.

eligible bank in the municipality. These are exactly the bank-specific shares at $t-2$ in the parentheses in the IV construction equation (20). Together, these shares help ensure that the IV is isolating innovations to local credit supply rather than slow-moving changes in the financial landscape that might be correlated with underlying firm dynamics.

In Panel C, we interact year fixed effects with the given municipality-level dependent variable in 2003, the last year prior to the rollout of *Cartão* lending. This demanding specification controls for differential trends, entered nonparametrically, across municipalities with varying baseline firm dynamics. This exercise forces each panel year to enter as a differential effect of the credit supply shock relative to the baseline outcome.

Looking across Tables 7 and 10, we find that most core results withstand this battery of demanding specifications. All results on entry and exit in Table 7 remain statistically and economically significant. Relative to the baseline results in Table 6, some of the coefficients fall in magnitude, especially in Panel C, but this is to be expected given the amount of variation absorbed by these nonparametric trends in the outcome. At the same time, the results on entrant capability in Table 10 remain intact as effect sizes remain large even though standard errors sometimes increase. Together, these robustness checks bolster the case for a causal interpretation of our main findings, which are neither an artifact of endogenous takeup of *Cartão* lending by local bank branches nor a confounding trend in firm dynamics associated with different development trajectories across local labor markets.

6.5 Heterogeneous Effects of Credit Supply Shocks

The model in Section 2 suggests that credit access should exert stronger selection and growth effects on firms that are more constrained *ex ante*. We explore this prediction along two plausible dimensions of such constraints: (i) credit market depth before the rollout of the *Cartão* program and (ii) firm age. Given the scale and geographic scope of the *Cartão* program, we can identify subsets of firms and locations where the marginal returns to additional credit are higher. Concretely, our model predicts that expanding credit supply attracts relatively high-capability entrants compared to the previous average capability of entrants (in the light-blue shaded area in Figure 1) and allows previously credit constrained incumbents to expand in size (in the dark-blue shaded area in Figure 1). In an extension of the model to product-market uncertainty, these high-capability entrants and expanding incumbents would also have higher odds of survival. We provide evidence below consistent with such heterogeneity.

Local Credit Market Depth Pre-*Cartão* BNDES. In Table 11, we re-estimate the main specifications from Section 6.2 and 6.3 separately for municipalities with high and low prior credit market access at baseline. For this purpose, we split the sample into municipalities with below (Panel A) and above (Panel B) median non-BNDES credit per capita in 2004 as observed in the SCR for that year.

Looking across outcomes, we find strong evidence that the overall effects of *Cartão*-induced credit supply shocks are concentrated in locations with more limited credit supply in the early 2000s. The differential effects are quite stark. The results reported in Panel A of Table 11 suggest that the entry and exit effects in Table 6 come largely from municipalities where the additional capital from the BNDES-administered loan products was likely to be a substantial addition to local credit markets. The same pattern holds for the effects on entrant capability as captured by the three outcomes—size at entry, two-year survival rates, and two-year

employment growth rates conditional on survival—in columns 7–12 of Table 9. These results provide the most direct evidence that SME-focused lending expansions can reshape economic activity in localities with underdeveloped credit markets.

Moreover, the results in columns 7–12 of Panel B of Table 11, although noisy, suggest that cheap additional credit from BNDES may have no or even negative consequences for firm capability in localities with well-developed credit markets. In column 7, for example, a doubling of *Cartão* BNDES disbursements leads to a 4 percent reduction in the size of the average entering firm. Column 9 shows that this effect is not limited to those entrants that exit within two years, and column 11 shows a fairly precise null effect on employment growth in the first two years for these marginal surviving entrants. It is of course possible that the additional *Cartão* credit allows banks to target additional credit to higher-capability firms in localities with deeper credit markets. However, the results in columns 8, 10, and 12 of Table 11 do not provide consistent evidence for this possible indirect effect of credit multipliers. Together, the patterns in Table 11 suggest that when credit markets are more developed, the added value of the *Cartão* infusion is relatively small arguably because banks already run deeper and more advanced credit lines.

Young versus Old Firms. In many contexts, younger firms tend to be more financially constrained than older ones. Their financial constraints can be due to a reduced ability to generate internal financing as well as to lacking access to external capital. We see firms of all ages using *Cartão* credit (see Table 2), so we can evaluate heterogeneous effects across the age distribution of incumbent firms.

Table 12 shows that *Cartão*-induced credit supply shocks have larger effects on employment growth among younger than older firms. A 10 percent increase in total credit leads to 0.5 percent higher two-year growth among firms aged 1–2 years (column 2), 0.3 percent among firms aged 3–10 (column 4), and zero among firms operating for more than 11 years. While there are of course other interpretations of this pattern, one salient possibility is that SME-targeted credit allows younger firms, many of which are more financially constrained, to expand, as predicted by the dark-blue shaded area of Figure 1. At the same time, older firms, by virtue of incumbency and deeper pockets, are effectively shielded from some of the competition brought on by the credit-induced growth in younger firms.

Overall, the results in this section are suggestive of potential gains to targeting credit towards those firms with the highest potential marginal returns. However, the response by the financial sector to externally subsidized credit depends on existing local capital market conditions and matters for the outcomes both among incumbent non-financial firms and new entrants.

7 Conclusion

This paper provides new evidence on how credit supply expansions shape firm dynamics at the firm and local market level. We show how Brazil's large-scale expansion of subsidized credit for SMEs in the years 2002–2013 induced greater entry but also greater exit with no net effect on local employment at impact. Importantly, however, the expanded credit supply increased average capability among entering firms, which entered at larger size, survived longer, and grew faster. We find that these selection effects were most pronounced in localities with weak credit markets at baseline. We also uncover large credit multiplier effects: the targeted

SME credit program enabled local bank branches to expand lending operations beyond the subsidized credit line itself. Together, these findings provide new evidence on the consequences of positive credit supply shocks in financially immature markets.

Open issues include estimation of competitive effects in the product market, and measures of firm productivity beyond the observable performance measures such as survival and size. For such investigations, we would need sales and input data beyond employment at the firm level. These are important tasks for future research.

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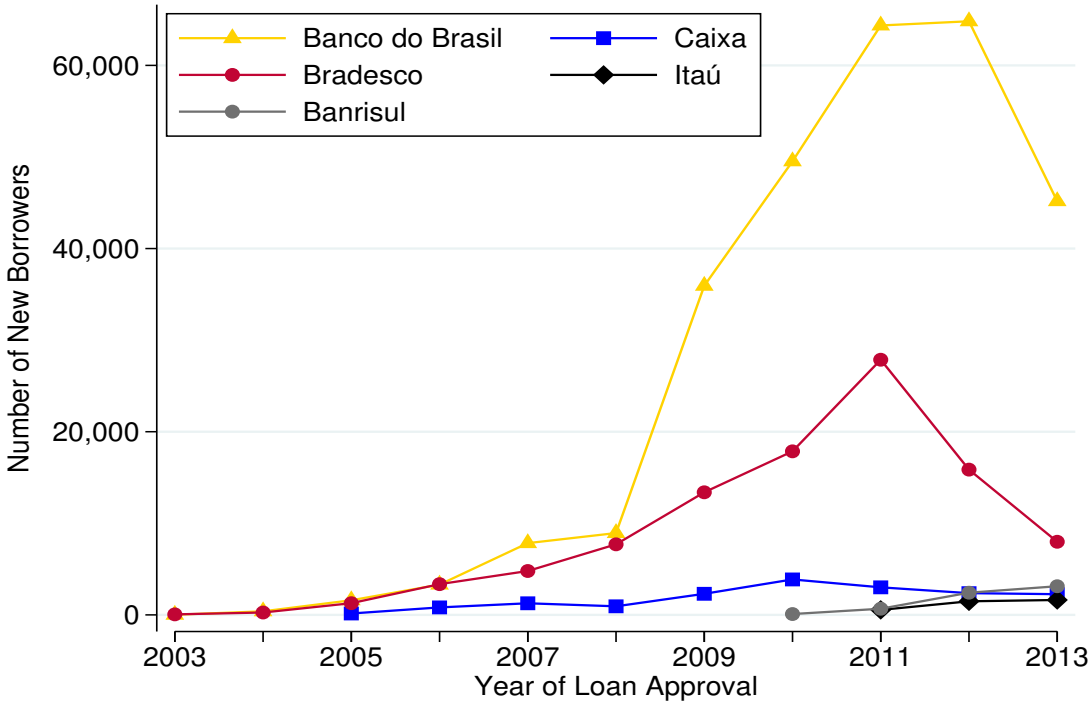
Figures

Figure 2: Expansion of *Cartão* BNDES Lending



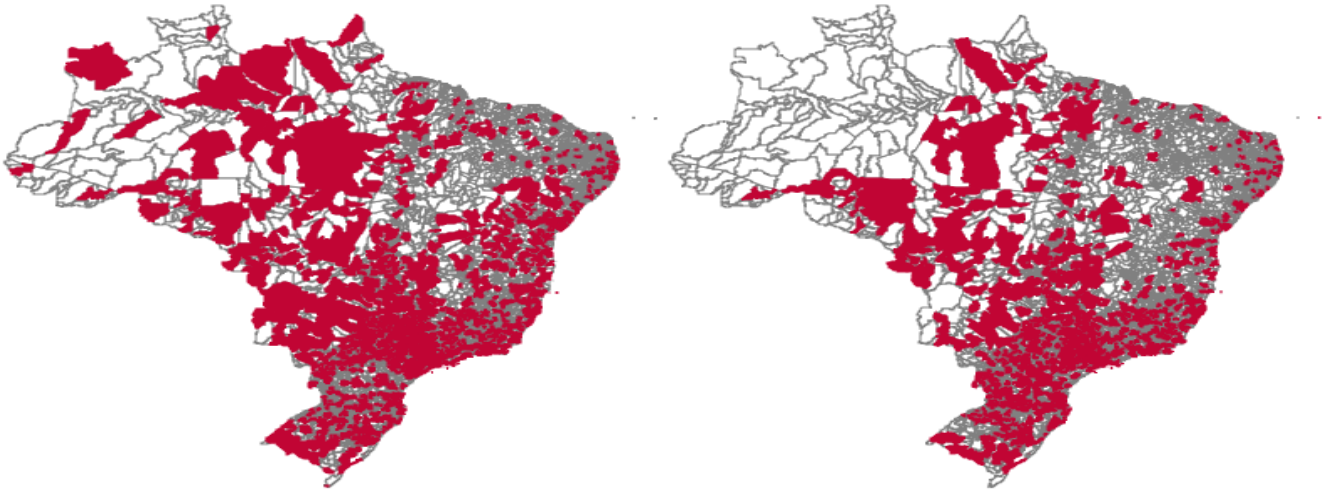
Notes: New borrowers are *Cartão* clients by intermediating bank by year.

Source: BNDES Indirect Finance Approvals Database.

Figure 3: Location of *Cartão*-Eligible Bank Branches

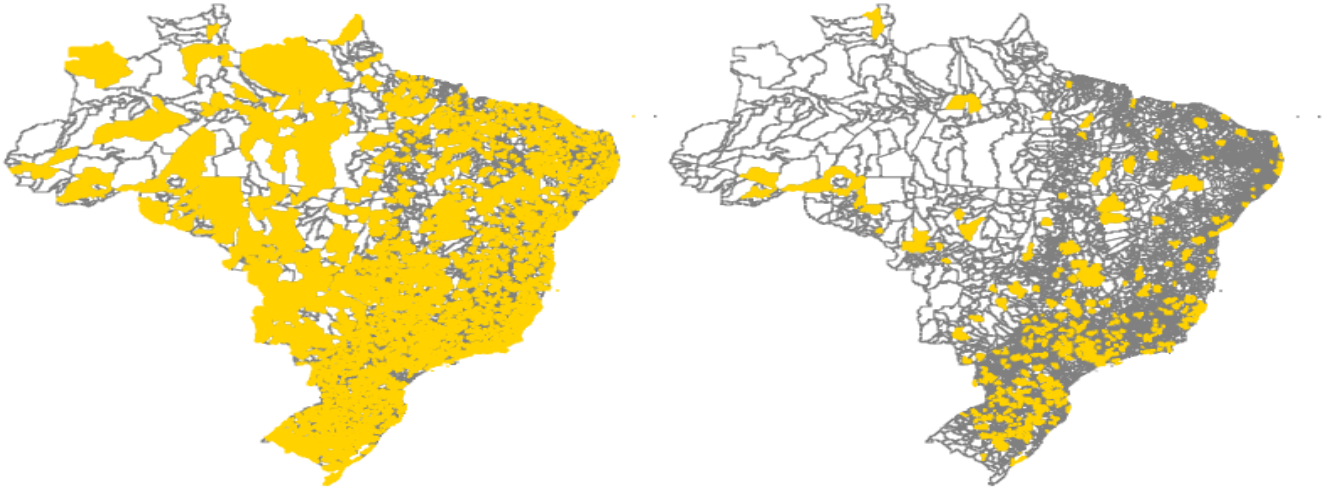
(a) Any Bradesco Branch in 2003

(b) . . . with BNDES tie in 2003



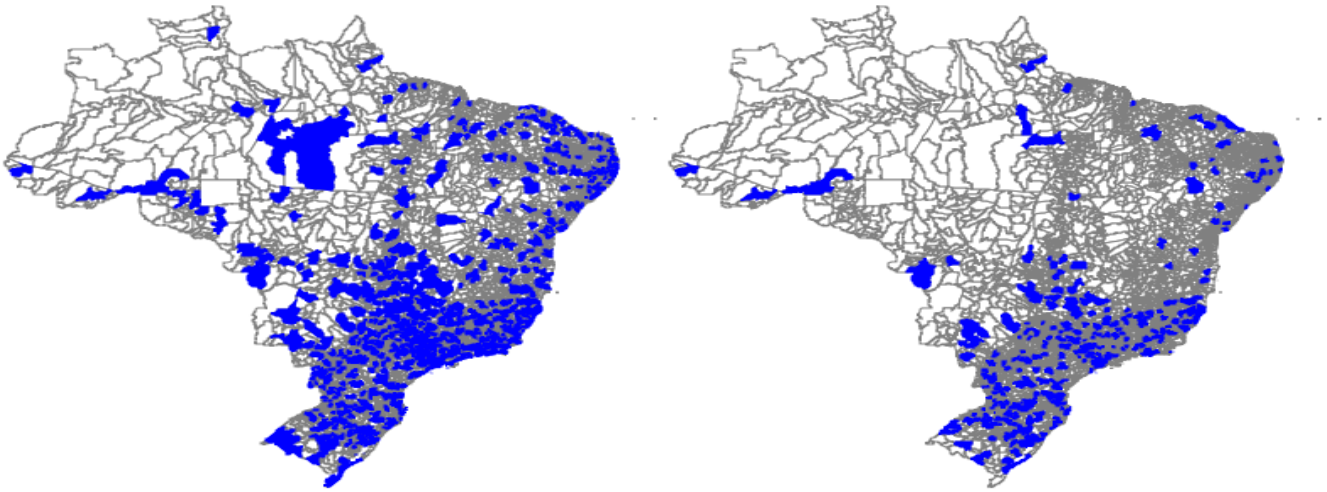
(c) Any Banco do Brasil Branch in 2003

(d) . . . with BNDES tie in 2003



(e) Any Caixa Branch in 2005

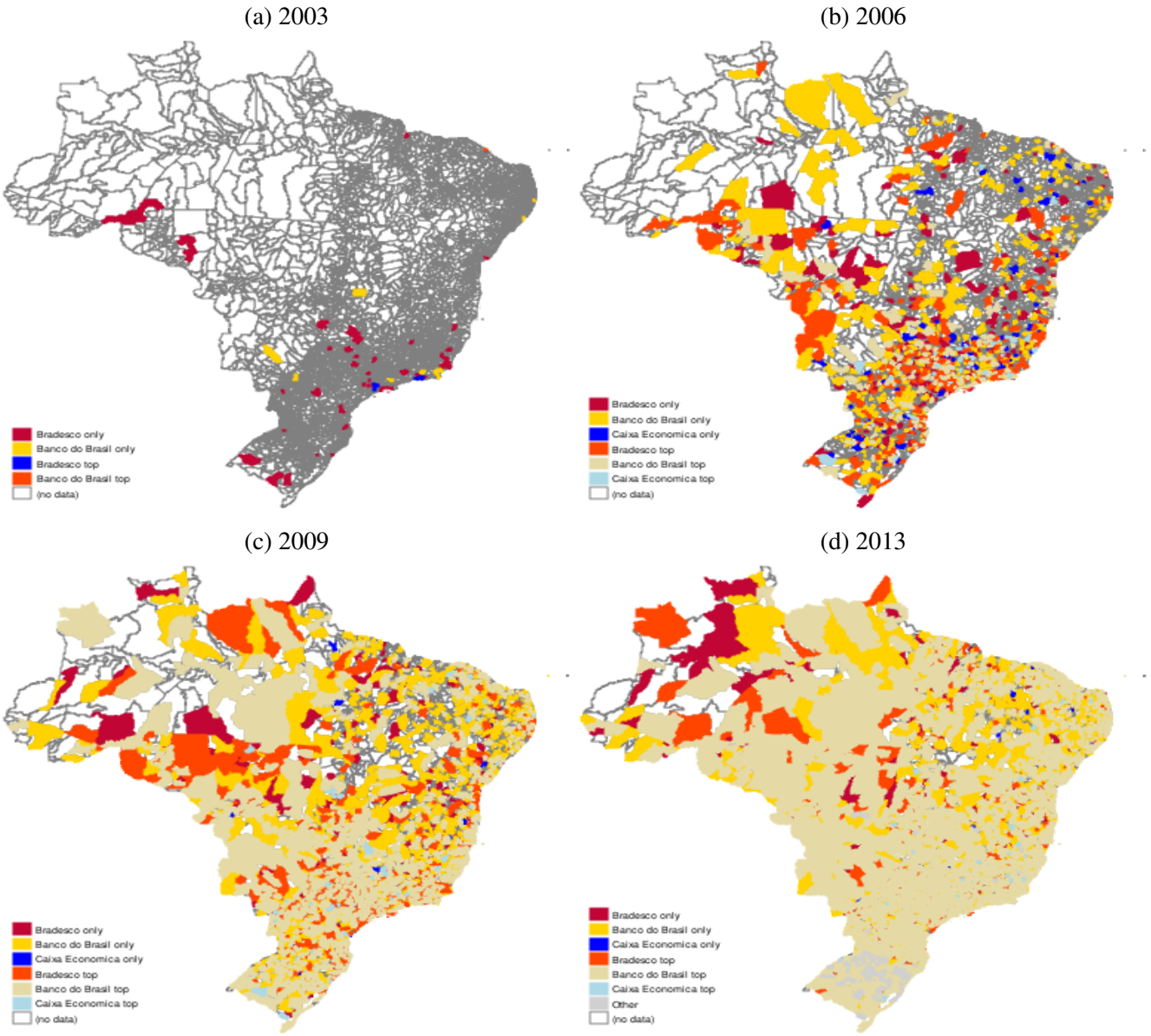
(f) . . . with BNDES tie in 2005



Notes: These maps identify whether a given municipality has any branches of the given bank in the initial year in which the bank became eligible for *Cartão* credit lines. The maps in the second column restrict to those branches with a prior history of intermediating other BNDES credit lines prior to the introduction of the *Cartão* program.

Source: ESTBAN and SCR databases.

Figure 4: Expansion of *Cartão* BNDES Lending Across Municipalities

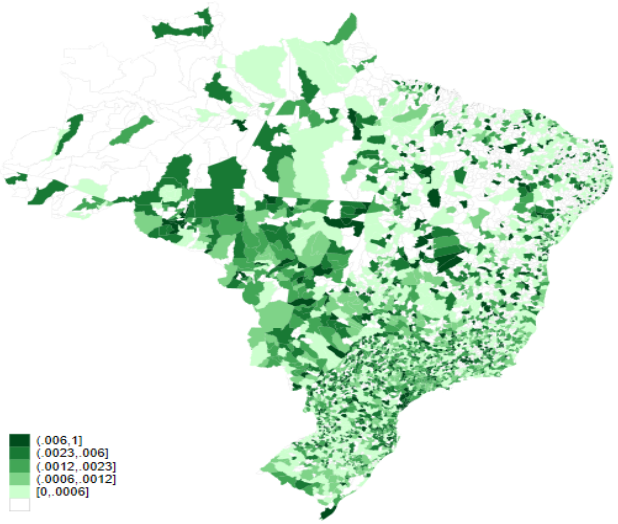


Notes: *Cartão* loans by intermediating banks from 2003 to 2013. The dark colors indicate municipalities with only one of the three eligible banks— Bradesco, Banco do Brasil (BdB), or Caixa—intermediating such loans. The light colors indicate, in cases with more than one bank intermediating, which of the three has the largest outstanding *Cartão* loan value.

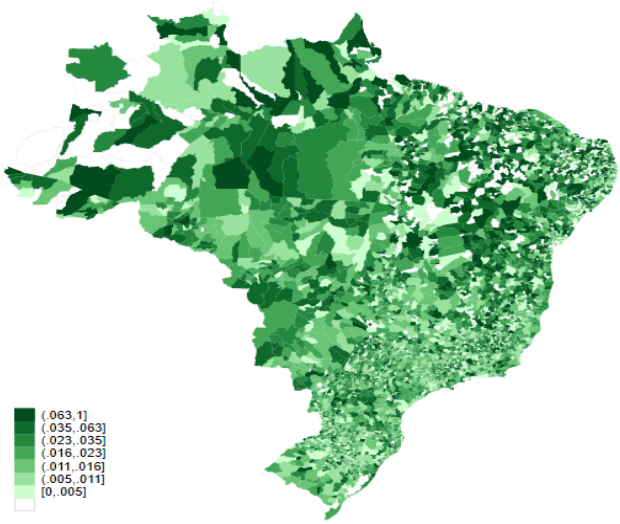
Source: BNDES Indirect Finance Approvals Database.

Figure 5: *Cartão* BNDES Market Share

(a) Overall Credit to SMEs, 2008



(b) Overall Credit to SMEs, 2013



Notes: Share of *Cartão* credit in total credit to SMEs by municipality in 2008 and 2013.

Sources: SCR and BNDES Indirect Finance Approvals Database.

Tables

Table 1: Municipality-Level Summary Statistics

	(1) mean	(2) median	(3) std dev	(4) observations
log total *Cartão* BNDES disbursements	6.0	7.2	6.1	55,646
log total non-*Cartão* BNDES disbursements	8.1	12.0	7.2	55,646
log total non-BNDES disbursements	15.7	15.7	2.9	55,651
log number of new firms	2.2	2.1	1.6	55,646
log number of exiting firms	2.0	1.8	1.5	55,646
log number of employees at new firms that will survive at least 2 years	1.3	1.2	0.8	43,333
log growth in employment for surviving 2 year old firms	0.29	0.29	0.49	43,333
log total formal employment	6.95	6.69	1.53	55,581
log formal employment growth	0.059	0.046	0.391	55,512

Notes: Summary statistics for core regressors and outcomes defined at the municipality–year level.
Sources: RAIS, SCR, and BNDES Indirect Finance Database.

Table 2: Firm-Level Summary Statistics by Credit Access

	(1) mean	(2) median	(3) std. dev.	(4) no. of firm-years
	(a) All Firms			
Number of Employees	18.4	3	483.9	22,011,533
Years in Formal Operation	9.6	6	10.5	22,011,533
	(b) Firms with *Cartão* BNDES Loans			
Number of Employees	24	7	96.7	693,007
Years in Formal Operation	10.6	8	9.6	693,007
	(c) Firms with no *Cartão* but some other Loans			
Number of Employees	25.7	4	590.5	9,825,520
Years in Formal Operation	9.5	6	10.2	9,825,520
	(d) Firms with no Loans			
Number of Employees	11.8	2	387	11,493,006
Years in Formal Operation	9.6	6	10.7	11,493,006

Notes: Summary statistics at the firm–year level.
Sources: RAIS, SCR, and BNDES Indirect Finance Database.

Table 3: Tests for Endogenous Targeting

Regressor	Dep. Var.: $\widehat{\text{shock}}^{cartao}$, $t+1$	
	β (std. err.)	No. of Obs.
GDP/capita growth, t	0.00001	49,968
	(0.002)	
Δ log number of new firms, t	-0.0014*	50,058
	(0.001)	
Δ log average entry size of new firms, t	-0.0004	43,909
	(0.001)	
Δ log average entry size of surviving new firms, t	0.00002	35,571
	(0.001)	
Δ log average growth of surviving new firms, t	0.001	35,571
	(0.001)	
Δ log number of exiting firms, t	0.00003	50,058
	(0.001)	
Δ log employment growth, t	-0.0008*	49,917
	(0.000)	
Δ log employment growth among new firms, t	-0.002	49,917
	(0.002)	
Δ log number of bank branches, t	0.004	50,062
	(0.005)	

Notes: Regressions of instrument, defined in equation (20), on the lagged difference in our core outcomes of interest at the municipality level. Each row is a separate regression, each of which controls for microregion$\times$year fixed effects. The sample size varies across regressions as the outcomes for two-year surviving firms are missing for later years due to the end of our RAIS data coverage. There are also a small number of remote municipalities for which there is no formal sector employment in a given year. Standard errors are clustered at the microregion level.
Significance levels: $*$: 10% $**$: 5% $***$: 1%.

Sources: RAIS, SCR, and BNDES Indirect Finance Database.

Table 4: *Cartão* BNDES and a Credit Multiplier

	Dep. Var.: log Total credit in t excluding *cartão*			
	(1)	(2)	(3)	(4)
	OLS	IV	IV	IV
	All Municipalities		Low Initial Credit/Capita	High Initial Credit/Capita
log *Cartão* BNDES disbursements	0.251***	0.178***	0.211***	-0.137
	(0.004)	(0.019)	(0.012)	(0.089)
Microregion×Year FE	Yes	Yes	Yes	Yes
Dependent Variable mean	15.9	15.9	14.1	17.6
First Stage F Statistic		134.9	127.8	31.4
Observations	55,602	55,566	27,176	27,054

Notes: Estimates of equation (18) relating log Total credit disbursements excluding *cartão* BNDES to the log of *cartão* BNDES disbursements. Columns 1 and 2 include all municipality-years. Column 3 includes municipalities with total non-BNDES credit per capita below the median in 2004, and column 4 includes municipalities above the median. The regressions include microregion×year fixed effects. Standard errors are clustered at the microregion level.
Significance levels: $*$: 10% $**$: 5% $***$: 1%.

Sources: RAIS, SCR, and BNDES Indirect Finance Database.

Table 5: Credit Supply Shocks and Local Firm Entry

Dep. Var.: log number of new firms	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	IV	OLS	IV	OLS	IV
log *Cartão* BNDES disbursements	0.181***	0.136***	0.123***	0.067***		
	(0.003)	(0.015)	(0.002)	(0.020)		
log non-*Cartão* BNDES disbursements			0.093***	0.105***		
			(0.001)	(0.015)		
log total credit disbursements					0.468***	0.744***
					(0.019)	(0.022)
Microregion×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Dependent Variable mean	2.2	2.2	2.2	2.2	2.2	2.2
First Stage F Statistic		134.9		70.9		38.7
Observations	55,646	55,602	55,646	55,602	55,646	55,602

Notes: This table reports estimates for firm entry based on our three alternative estimating equations aimed at capturing local credit supply shocks. Columns 1 and 2 estimate the OLS and IV specification of equation (18), columns 3 and 4 estimate the OLS and IV specification of equation (21), and columns 5 and 6 estimate the OLS and IV specification of equation (23). The regressions include microregion×year fixed effects. Standard errors are clustered at the microregion level. The first-stage F statistics are based on the multivariate Kleibergen and Paap (2006) version. Significance levels: $*$: 10% $**$: 5% $***$: 1%.

Sources: RAIS, SCR, and BNDES Indirect Finance Database.

Table 6: Credit Supply Shocks and Local Firm Dynamics
Instrumental Variables Estimates

	log # entrants		log # of exiters		Δ log employment	
	(1)	(2)	(3)	(4)	(5)	(6)
log *Cartão* disbursements	0.136***		0.107***		-0.002	
	(0.015)		(0.014)		(0.003)	
log total credit disbursements		0.744***		0.613***		-0.007
		(0.022)		(0.021)		(0.006)
Microregion×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Dependent Variable mean	2.2	2.2	2.0	2.0	0.06	0.06
First Stage F Statistic	134.9	38.7	134.9	38.7	134.9	38.7
Observations	55,602	55,602	55,602	55,602	55,471	55,471

Notes: This table uses the same specification as columns 2 and 6 of Table 5 in odd- and even-numbered columns respectively. The dependent variables include the log of the total number of new firms entering in year t (columns 1–2), log of the total number of firms exiting in year t (columns 3–4), and the difference in the log of total employment between year t and $t-1$. See the notes to that table for additional details. Standard errors clustered by microregion. Significance levels: $*$: 10% $**$: 5% $***$: 1%.

Sources: RAIS, SCR, and BNDES Indirect Finance Database.

Table 7: Identification Checks on Table 6

	log # entrants		log # of exiters		Δ log employment	
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: Year FE × Predetermined GDP/capita and Manuf. Shr.					
log *Cartão* disbursements	0.132***		0.103***		-0.002	
	(0.015)		(0.014)		(0.003)	
log total credit disbursements		0.747***		0.610***		-0.007
		(0.024)		(0.023)		(0.007)
First Stage F Statistic	143.9	40.9	143.9	40.9	143.9	40.9
	Panel B: Twice-Lagged Bank-Specific *Cartão* Share					
log *Cartão* disbursements	0.096***		0.071***		-0.002	
	(0.019)		(0.014)		(0.004)	
log total credit disbursements		0.784***		0.600***		-0.012
		(0.024)		(0.042)		(0.013)
First Stage F Statistic	132.1	20.3	132.1	20.3	132.1	20.3
	Panel C: Year FE × Predetermined Outcome Variable					
log *Cartão* disbursements	0.031***		0.042***		-0.002	
	(0.009)		(0.008)		(0.002)	
log total credit disbursements		0.560***		0.387***		-0.005
		(0.102)		(0.050)		(0.006)
First Stage F Statistic	164	10.9	187.4	30.1	134.9	38.1
Microregion×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Dependent Variable mean	2.2	2.2	2.0	2.0	0.06	0.06
Observations	55,602	55,602	55,602	55,602	55,471	55,471

Notes: This table re-estimates Table 6 with different sets of controls. Panel A includes year fixed effects interacted with municipality-level GDP/capita and manufacturing share of employment in 2003, the initial year of the panel prior to the rollout of the *Cartão* BNDES program. Panel B includes the twice-lagged share of total *Cartão* in the municipality by each of the seven banks eligible for intermediating the credit at that point in time. Panel C includes year fixed effects interacted with the given column's municipality-level outcome variables in 2003, the initial year of the panel prior to the rollout of the *Cartão* BNDES program. See the notes to Table 6 for additional details. The three rows at the bottom of the table applies to all three panels. Standard errors clustered by microregion. Significance levels: $*$: 10% $**$: 5% $***$: 1%.

Sources: RAIS, SCR, IBGE, and BNDES Indirect Finance Database.

Table 8: Firm-Level Effects
Instrumental Variables Estimates

	exit in t		Δ log employment	
	(1)	(2)	(3)	(4)
log own-firm *Cartão* BNDES credit	-0.067	-0.079	0.255	0.236
	(0.077)	(0.081)	(0.203)	(0.168)
log own-firm non-*Cartão* BNDES disbursements		0.013		0.023
		(0.037)		(0.066)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Dependent Variable mean	0.030	0.030	0.082	0.082
First Stage F Statistic	1.0	0.7	1.2	0.8
Observations	2,420,120	2,420,120	2,188,110	2,188,110

Notes: This table reports results based on a firm-level panel IV regression. The dependent variables include an indicator for whether the firm exits in year t (columns 1–2) and the difference in the log of total firm employment between year t and $t-1$ Standard errors clustered by microregion. Significance levels: $*$: 10% $**$: 5% $***$: 1%.

Sources: RAIS, SCR, and BNDES Indirect Finance Database.

Table 9: Credit Supply Shocks and Entrant Capability
Instrumental Variables Estimates

	log average size of entrants		log average size of entrants surviving ≥2 yrs		avg. log 2 year employment growth, surviving entrants	
	(1)	(2)	(3)	(4)	(5)	(6)
log *Cartão* BNDES disbursements	0.006		0.020**		0.012**	
	(0.006)		(0.008)		(0.005)	
log total credit disbursements		0.100***		0.169***		0.037**
		(0.019)		(0.028)		(0.014)
Microregion×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Dependent Variable mean	0.9	0.9	1.3	1.3	0.29	0.29
First Stage F Statistic	131	33.8	110	28.5	110	28.5
Observations	51,215	51,215	43,228	43,228	43,228	43,228

Notes: This table uses the same specification as columns 2 and 6 of Table 5 in odd- and even-numbered columns respectively. The dependent variables include the log of the average size of new firms entering in year t (columns 1–2), the log of the average size of new firms entering in year t and surviving at least two years through $t+2$ (columns 3–4), and the difference in the log of total employment between t and $t+2$ among firms that enter in year t and survive until $t+2$ (columns 5–6). See the notes to that table for additional details. Standard errors clustered by microregion. Significance levels: $*$: 10% $**$: 5% $***$: 1%.

Sources: RAIS, SCR, and BNDES Indirect Finance Database.

Table 10: Identification Checks on Table 9

	log average size of entrants		log average size of entrants surviving ≥2 yrs		avg. log 2 year employment growth, surviving entrants	
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: Year FE × Predetermined GDP/capita and Manuf. Shr.					
log *Cartão* BNDES disbursements	0.006		0.020**		0.012**	
	(0.006)		(0.008)		(0.005)	
log total credit disbursements		0.101***		0.171***		0.038**
		(0.021)		(0.030)		(0.016)
First Stage F Statistic	140.4	35.8	118.9	29.4	118.9	29.4
	Panel B: Twice-Lagged Bank-Specific *Cartão* Share					
log *Cartão* BNDES disbursements	0.002		0.017		0.013*	
	(0.008)		(0.011)		(0.007)	
log total credit disbursements		0.123***		0.216***		0.044
		(0.041)		(0.065)		(0.033)
First Stage F Statistic	127	16.8	111.7	14.7	111.7	14.7
	Panel C: Year FE × Predetermined Outcome Variable					
log *Cartão* BNDES disbursements	0.003		0.016		0.010	
	(0.007)		(0.011)		(0.006)	
log total credit disbursements		0.100***		0.158***		0.020
		(0.026)		(0.046)		(0.021)
First Stage F Statistic	124.3	22.9	89.3	15.5	80.8	18.7
Microregion×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Dependent Variable mean	0.9	0.9	1.3	1.3	0.29	0.29
Observations	51,215	51,215	43,228	43,228	43,228	43,228

Notes: This table re-estimates Table 9 with different sets of controls. Panel A includes year fixed effects interacted with municipality-level GDP/capita and manufacturing share of employment in 2003, the initial year of the panel prior to the rollout of the *Cartão* BNDES program. Panel B includes the twice-lagged share of total *Cartão* in the municipality by each of the seven banks eligible for intermediating the credit at that point in time. Panel C includes year fixed effects interacted with the given column's municipality-level outcome variables in 2003, the initial year of the panel prior to the rollout of the *Cartão* BNDES program. See the notes to Table 9 for additional details. Standard errors clustered by microregion. Significance levels: $*$: 10% $**$: 5% $***$: 1%.

Sources: RAIS, SCR, and BNDES Indirect Finance Database.

Table 11: Heterogeneous Effects by Baseline Credit Supply
Instrumental Variables Estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	log number of new firms		log number of exiting firms		Δ log employment		log average size of entrants		log average size of entrants surviving $\geq$2 yrs		avg. log 2 year employment growth, surviving entrants	
	Panel A: Municipalities with Below Median Non-BNDES Credit Per Capita at Baseline											
log total *Cartão* BNDES disbursements	0.141***		0.128***		-0.001		0.017***		0.035***		0.015***	
	(0.009)		(0.008)		(0.004)		(0.006)		(0.009)		(0.005)	
log total credit disbursements		0.640***		0.592***		-0.010		0.115***		0.168***		0.028
		(0.023)		(0.024)		(0.012)		(0.026)		(0.041)		(0.022)
Dependent Variable mean	1.5	1.5	1.1	1.1	0.07	0.07	0.77	0.77	1.07	1.07	0.24	0.24
First Stage F Statistic	127.8	62.9	127.8	62.9	127.9	62.7	129.7	62.5	116.8	52.3	116.8	52.3
Observations	27,176	27,176	27,176	27,176	27,048	27,048	22,992	22,992	18,816	18,816	18,816	18,816
Number of Microregion$\times$Year	4,059	4,059	4,059	4,059	4,056	4,056	3,949	3,949	3,473	3,473	3,473	3,473
	Panel B: Municipalities with Above Median Non-BNDES Credit Per Capita at Baseline											
log total *Cartão* BNDES disbursements	-0.053		-0.050		0.002		-0.038*		-0.038		0.005	
	(0.066)		(0.065)		(0.006)		(0.022)		(0.030)		(0.016)	
log total credit disbursements		0.140		0.169		-0.010		0.201		0.112		-0.072
		(0.370)		(0.360)		(0.044)		(0.135)		(0.124)		(0.088)
Dependent Variable mean	3.3	3.3	3.0	3.0	0.05	0.05	1.0	1.0	1.5	1.5	0.33	0.33
First Stage F Statistic	31.4	1.8	31.4	1.8	31.4	1.8	29.5	2.1	22.0	2.9	22.0	2.9
Observations	27,054	27,054	27,054	27,054	27,054	27,054	26,808	26,808	23,135	23,135	23,135	23,135
Number of Microregion$\times$Year	3,901	3,901	3,901	3,901	3,901	3,901	3,882	3,882	3,424	3,424	3,424	3,424

Notes: This table uses the same specification as columns 2 and 6 of Table 5 in odd- and even-numbered columns respectively. Across panels, we split the sample into municipalities with above versus below median non-BNDES-originated credit per capita in 2004. The dependent variables are as defined in prior tables. See the notes to Table 5 for additional details. Standard errors clustered by microregion. Significance levels: $*$: 10% $**$: 5% $***$: 1%.

Sources: RAIS, SCR, and BNDES Indirect Finance Database.

Table 12: Heterogeneous Effects by Firm Age
Instrumental Variables Estimates

	average log 2 year employment growth among incumbents age... in t					
	1-2 years		3-10 years		11+ years	
	(1)	(2)	(3)	(4)	(5)	(6)
log *Cartão* BNDES disbursements	0.007		0.005*		0.001	
	(0.005)		(0.003)		(0.003)	
log total credit disbursements		0.058***		0.028***		-0.006
		(0.014)		(0.010)		(0.009)
Microregion×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Dependent Variable mean	0.163	0.163	0.111	0.111	0.131	0.131
First Stage F Statistic	118	29.5	121.4	33.4	122.2	34.5
Observations	44,285	44,285	47,396	47,396	48,891	48,891

Notes: This table uses the same specification as columns 2 and 6 of Table 5 in odd- and even-numbered columns respectively. The dependent variable measures the average two-year forward growth rate in employment among incumbent firms that have been in operation 1–2 years (columns 1–2), 3–10 years (column 3–4), and more than 11 years. See the notes to Table 5 for additional details. Standard errors clustered by microregion. Significance levels: $*$: 10% $**$: 5% $***$: 1%.

Sources: RAIS, SCR, and BNDES Indirect Finance Database.

Appendix

A Further Model Details

A.1 Derivation in Steps

For clarity, and comparability of the derivation to Evans and Jovanovic (1989), in this Appendix we proceed in steps rather than maximize the objective function (7) in one.

Interior Solution. Consider an interior solution with $k_m < \lambda_m z$. Then the dual cost function to the production function (3) is

$$C(r, w_m, q) = \frac{r^\alpha w_m^{1-\alpha}}{B\,\phi}\, q \qquad \text{for} \quad B \equiv \alpha^\alpha (1-\alpha)^{1-\alpha} \tag{A.1}$$

and the associated marginal cost is

$$c(r, w_m) = \frac{r^\alpha w_m^{1-\alpha}}{B\,\phi}.$$

By Shepard's lemma, the factor demand functions are

$$k_m = \frac{\partial C(\cdot)}{\partial r} = \alpha\,\frac{c(r, w_m)}{r}\, q, \tag{A.2a}$$

$$\ell_m = \frac{\partial C(\cdot)}{\partial w_m} = (1-\alpha)\,\frac{c(r, w_m)}{w_m}\, q. \tag{A.2b}$$

Using output (A.3) from below in (A.2) and simplifying confirms factor demands (8) in the main text.

Under monopolistic competition, a variety's supply equals demand and satisfies the optimality condition that marginal revenues equal marginal cost:

$$\frac{\partial x(\nu)}{\partial q(\nu)} = \frac{1}{\mu}\, A^{1/\sigma} q(\nu)^{-1/\sigma} = c(r, w_m) = \frac{\partial C(\cdot)}{\partial q(\nu)},$$

where the first equality follows from (2) and $\mu \equiv \sigma/(\sigma-1)$ is the optimal price markup over marginal cost. Under monopolistic competition, optimal output for a financially unconstrained firm therefore is

$$q(\nu) = \mu^{-\sigma} A\, c(\cdot)^{-\sigma} = \left\{ A^{1/\sigma} \mu^{-1}\, \phi\, B\, r^{-\alpha} w_m^{-(1-\alpha)} \right\}^\sigma \tag{A.3}$$

and optimal revenues are

$$\begin{aligned} x(\nu) &= \mu\, c(\cdot)\, q(\nu) = \mu^{-(\sigma-1)} A\, c(\cdot)^{-(\sigma-1)} \\ &= \left\{ A^{\mu-1} \mu^{-1}\, \phi\, B\, r^{-\alpha} w_m^{-(1-\alpha)} \right\}^{\sigma-1}, \end{aligned} \tag{A.4}$$

where $\mu \equiv \sigma/(\sigma-1)$ is the optimal price markup over marginal cost. The financially unconstrained entrepreneur's net income is

$$\pi(\nu) = x(\nu) - C(r, w_m, q) = (\mu - 1)\, c(\cdot)\, q(\nu) = \frac{x(\nu)}{\sigma}. \tag{A.5}$$

Under monopolistic competition and by CES demand (1), the optimal product price for financially uncon-

strained varieties is

$$p(\nu) = \mu\, c(\cdot) = \left(\frac{q(\nu)}{A}\right)^{-1/\sigma} = \left\{\mu^{-1}\,\phi\, B\, r^{-\alpha} w_m^{-(1-\alpha)}\right\}^{-1},$$

where the final equality follows from dividing output (A.3) by A. The price takes the same form for all financially unconstrained varieties. The price varies only with the variety's associated ϕ in equilibrium. Similarly, optimal revenues (A.4) and net income (A.5) vary with the variety's associated ϕ but do not vary with the entrepreneur's wealth z in the financially unconstrained case when condition (9) is satisfied. In contrast, net income does depend on the entrepreneur's wealth z when the financial constraint is binding and condition (9) is violated. We turn to that case.

Boundary Solution. Consider a boundary solution with $k_{mz} = \lambda_m z$ in the financially constrained case when condition (9) is not satisfied. Then the firm's production function (3) becomes

$$q_{mz} = f(\lambda_m z, \ell) = \phi\ (\lambda_m z)^{\alpha}\, \ell^{1-\alpha}. \tag{A.6}$$

and exhibits decreasing returns to scale for a fixed capital input $k_{mz} = \lambda_m z$. The dual cost function to q_{mz} is

$$C_{mz}(r, w_m, q) = \frac{w_m}{\left[\phi\,(\lambda_m z)^{\alpha}\right]^{1/(1-\alpha)}}\, q^{1/(1-\alpha)} + r\,\lambda_m z \tag{A.7}$$

with the associated marginal cost function

$$c_{mz}(w_m, q) = \frac{1}{1-\alpha}\frac{w_m}{\left[\phi\,(\lambda_m z)^{\alpha}\right]^{1/(1-\alpha)}}\, q^{\alpha/(1-\alpha)},$$

which depends on q and is no longer equal to average cost. We can restate the cost function in terms of the marginal cost function as $C_{mz}(r, w_m, q) = (1-\alpha)\, c_{mz}(w_m, q)\, q + r\,\lambda_m z$.

By Shephard's lemma, the labor demand function is

$$\ell_{mz} = \frac{\partial C_{mz}(\cdot)}{\partial w_m} = (1-\alpha)\,\frac{c_{mz}(r, w_m)}{w_m}\, q = \frac{1}{\left[\phi\,(\lambda_m z)^{\alpha}\right]^{1/(1-\alpha)}}\, q^{1/(1-\alpha)}. \tag{A.8}$$

Using output (A.9) from below in (A.8) and simplifying confirms labor demand (11b) in the main text.

Under monopolistic competition, a variety's optimal supply equals demand and satisfies the optimality condition that marginal revenues equal marginal cost:

$$\frac{\partial x(\nu)}{\partial q(\nu)} = \frac{1}{\mu}\, A^{1/\sigma} q(\nu)^{-1/\sigma} = c_{mz}(w_m, q) = \frac{\partial C_{mz}(\cdot)}{\partial q(\nu)},$$

where the first equality follows from (2). So, for a financially constrained firm, optimal output under monopolistic competition satisfies

$$q(\nu) = \mu^{-\sigma} A\, c_{mz}(\cdot)^{-\sigma} = [(1-\alpha)/\mu]^{\sigma} A\ \left[\phi\,(\lambda_m z)^{\alpha}\right]^{\sigma/(1-\alpha)}\ w_m^{-\sigma}\, q(\nu)^{-\alpha\sigma/(1-\alpha)}.$$

Solving out for optimal output yields

$$q(\nu) = \left\{ A^{1/\sigma} \left[(1-\alpha)/\mu \right] \left[\phi \left(\lambda_m z \right)^{\alpha} \right]^{1/(1-\alpha)} w_m^{-1} \right\}^{\frac{\mu(1-\alpha)}{\mu-(1-\alpha)}} \tag{A.9}$$

and optimal revenues

$$\begin{aligned} x(\nu) &= \mu \, c_{mz}(\cdot) \, q(\nu) = \mu^{-(\sigma-1)} A \, c_{mz}(\cdot)^{-(\sigma-1)} \\ &= \left\{ A^{1/[(1-\alpha)(\sigma-1)]} \left[(1-\alpha)/\mu \right] \left[\phi \left(\lambda_m z \right)^{\alpha} \right]^{1/(1-\alpha)} w_m^{-1} \right\}^{\frac{1-\alpha}{\mu-(1-\alpha)}} . \end{aligned} \tag{A.10}$$

The financially unconstrained entrepreneur's net income is

$$\pi(\nu) = x(\nu) - C_{mz}(r, w_m, q) = \left[\mu - (1-\alpha) \right] c_{mz}(\cdot) \, q(\nu) - r \, \lambda_m z = \tfrac{\mu-(1-\alpha)}{\mu} \, x(\nu) - r \, \lambda_m z. \tag{A.11}$$

By (1) and (A.9), the optimal product price is

$$p(\nu) = \mu \, c_{mz}(\cdot) = \left(\frac{q(\nu)}{A} \right)^{-1/\sigma} = \left\{ A^{-\alpha/(1-\alpha)} \left[(1-\alpha)/\mu \right] \left[\phi \left(\lambda_m z \right)^{\alpha} \right]^{1/(1-\alpha)} w_m^{-1} \right\}^{-\frac{\mu(1-\alpha)/\sigma}{\mu-(1-\alpha)}}$$

and takes the same form for all financially constrained varieties under monopolistic competition. In contrast to the case of financially unconstrained varieties, the product price varies not only with the variety's associated ϕ in equilibrium but also with the entrepreneur's initial wealth z. Similarly, optimal revenues (A.10) and net income (A.11) vary not only with the variety's associated ϕ but also with the entrepreneur's wealth z in the financially constrained case when condition (9) is violated.

A.2 Indifference between Entrepreneurship and Worker Status

A resident's indifference between entry as an entrepreneur and becoming a worker can be described with a schedule in (ϕ, z) space. For the financially unconstrained case when condition (9) is satisfied and an interior solution with $k_m < \lambda_m z$ results, the slope of $\underline{\phi}_m = \mu \, (\sigma/A)^{\mu-1} \, r^{\alpha} w_m^{\mu-\alpha}/B$ is zero (equation (15)).

Consider the financially constrained case when condition (9) is violated and a boundary solution with $k_{mz} = \lambda_m z$ results. Then the indifference schedule is implicitly given by

$$\ell_{mz} \left(\underline{\phi}_m(z), z; \lambda_m \right) - \frac{(1-\alpha)(r \, \lambda_m \, z + w_m)}{\left[\mu - (1-\alpha) \right] w_m} = 0$$

and, restating (16), has a slope

$$\left. \frac{\mathrm{d}\underline{\phi}_m(z)}{\mathrm{d}z} \right|_{\pi(\phi,z;\lambda_m)=w_m} = -\frac{\phi}{z} \left[\alpha - (1-\alpha) \frac{r}{w_m} \, \lambda_m z \, \frac{1}{\ell_{mz}(\phi, z; \lambda_m)} \right] . \tag{A.12}$$

We now establish that this slope is strictly negative iff condition (9) is violated for λ_m (that is iff the entrepreneur is strictly financially constrained).

Expression (A.12) is strictly negative iff

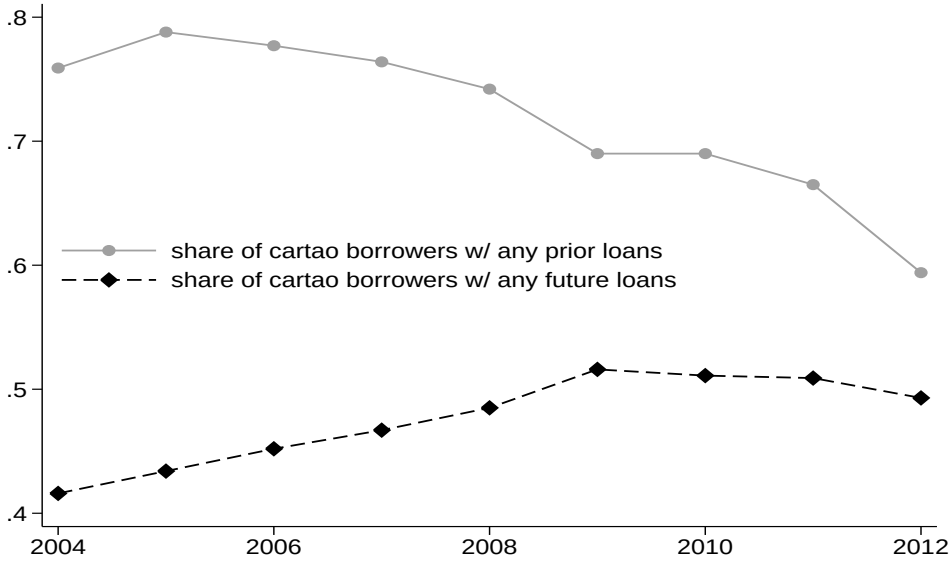
$$\begin{aligned} & & \alpha &> (1-\alpha)\frac{r}{w_m}\,\lambda_m z\,\frac{1}{\ell_{mz}(\phi,z;\lambda_m)} \\ \iff & \ell_{mz}(\phi,z;\lambda_m)\frac{\alpha}{1-\alpha}\frac{w_m}{r}\frac{1}{\lambda_m z} &> 1 \\ & \iff & \phi &> A^{-(\mu-1)}\mu^{\mu}\,\frac{r^{\alpha}w_m^{1-\alpha}}{B}\left(\frac{r}{\alpha}\right)^{\mu-1}(\lambda_m)^{\mu-1}\cdot z^{\mu-1} \\ & \iff & \phi &> D_m\,(\lambda_m)^{\mu-1}\cdot z^{\mu-1}, \end{aligned}$$

where the third restatement follows from using labor demand (11b) for $\ell_{mz}(\phi,z;\lambda_m)$ and collecting terms, and the fourth step follows from the definition of D_m in (9). The final inequality is equivalent to the negation of condition (9).

B Further Empirical Results

Figures

Figure B.1: *Cartão* BNDES, Prior and Future Borrowing



Notes: Share of all firms with *Cartão* loans that have any prior loans and, separately, any future loans.
Sources: SCR and BNDES Indirect Finance Database.

Tables

Table B.1: First Stage

Endogenous Var.:	log . . . disbursements			
	Cartao	*Cartao*	non-*Cartao*	total credit
Column in Table 5	(2)	(4)		(6)
$\widehat{\text{shock}}_{mt}^{cartao}$	4.091***	3.990***	2.475***	0.709***
	(0.352)	(0.348)	(0.345)	(0.119)
$\widehat{\text{shock}}_{mt}^{non-cartao}$		2.225***	4.311***	0.813***
		(0.287)	(0.462)	(0.111)
Microregion × Year FE	Yes	Yes		Yes
Observations	55,602	55,602		55,602

Notes: First-stage regression results corresponding to the IV regressions in Table 5, with the corresponding column numbers from that table listed at the top of the table here. Standard errors clustered by microregion. Significance levels: $*$: 10% $**$: 5% $***$: 1%.

Sources: RAIS, SCR, and BNDES Indirect Finance Database.

Table B.2: Reduced Form: Number of Entrants

Dep. Var.:	log # of new firms	
	(1)	(2)
$\widehat{\text{shock}}_{mt}^{cartao}$	0.557***	0.530***
	(0.092)	(0.091)
$\widehat{\text{shock}}_{mt}^{non-cartao}$		0.604***
		(0.083)
Observations	55,622	55,622

Notes: Reduced-form regression results corresponding to the OLS/IV regressions in Table 5. Standard errors clustered by microregion. Significance levels: $*$: 10% $**$: 5% $***$: 1%.

Sources: RAIS, SCR, and BNDES Indirect Finance Database.

Table B.3: Credit Supply Shocks and Local SME Entry by Size

	Dep. Var.: log number of new firms with [. . .] employee(s)				
	1	2	3–4	5–9	10–19
	(1)	(2)	(3)	(4)	(5)
log *Cartao* BNDES disbursements	0.105***	0.056***	0.027**	0.012	-0.015
	(0.011)	(0.012)	(0.013)	(0.012)	(0.010)
Microregion×Year FE	Yes	Yes	Yes	Yes	Yes
Dependent Variable mean	1.9	1.1	0.9	0.7	0.4
First Stage F Statistic	134.9	134.9	134.9	134.9	134.9
Observations	55,602	55,602	55,602	55,602	55,602

Notes: Baseline specification as in column 2 of Table 5 but for entrants of different size. Standard errors clustered by microregion. Significance levels: $*$: 10% $**$: 5% $***$: 1%.

Sources: RAIS, SCR, and BNDES Indirect Finance Database.