Marginal Entrepreneurs

Shai Bernstein, Emanuele Colonnelli, Davide Malacrino, and Tim McQuade*

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ABSTRACT

Firm entry plays an important role in the amplification and propagation of aggregate economic shocks. In this paper, we study the characteristics of the actual individuals who drive firm entry response to aggregate shocks, the marginal entrepreneurs. We use employer-employee matched data from Brazil and develop an empirical strategy that links fluctuations in global commodity prices to municipality level agricultural endowments to identify local demand shocks. We find that increases in global commodity prices lead to a significant new firm creation and this effect is almost entirely driven by young individuals. Within the young, we further document that the most responsive individuals are those who are more educated and who work in occupations that require generalist, managerial skills. In contrast, we find no such response among older skilled and educated individuals. Municipalities with better access to finance and higher concentrations of skilled individuals see a stronger entrepreneurial response by the young. These findings shed light on the potential ramifications of aging populations on the entrepreneurial responsiveness of economies to aggregate shocks.

*Shai Bernstein is with Stanford University, Graduate School of Business, and NBER; Emanuele Colonnelli is with Stanford University, Department of Economics; Davide Malacrino is with the IMF, and Tim McQuade is with Stanford Graduate School of Business. The views expressed in this article/presentation are those of the authors and do not necessarily represent the views of the IMF, its Executive Board or IMF management. We are grateful to Nick Bloom, Rebecca Diamond, Callum Jones, Arvind Krishnamurthy, Luigi Pistaferri, as well as seminar participants at Alabama, Brigham Young, Duke, Statistics Norway, and Stanford University. We are grateful to the Stanford Institute for Innovation in Developing Economies (SEED), the Private Enterprise Development in Low-Income Countries (PEDL) Initiative by the Centre for Economic Policy Research (CEPR), the Stanford Center for International Development (SCID), and the Abdul Latif Jameel Poverty Action Lab (J-PAL) Governance Initiative for financial support.

I. Introduction

A variety of macroeconomic studies have emphasized the crucial role new firm creation plays in the propagation of aggregate economic shocks. While some papers highlight how the life-cycle characteristics of new firms can magnify the impact and persistence of these shocks (e.g., Clementi and Palazzo (2016); Sedláček and Sterk (2017)), others argue that entrepreneurial activity increases product variety, which in turns leads to increased investment and amplification of the underlying dynamics (e.g., Bilbiie et al. (2012); Chatterjee and Cooper (2014); Devereux et al. (1996)). Regardless of the mechanism, the important role of the entrepreneurial response is clearly illustrated by Adelino et al. (2017), who find that new and young firms create most jobs following changes in local demand. This literature, however, has abstracted away from the actual individual entrepreneurs who identify and act upon aggregate shocks. In this paper we explore the defining characteristics of these entrepreneurs, who we term *marginal entrepreneurs*.

This issue is particularly salient. If marginal entrepreneurs are concentrated in a particular segment of the population, demographic changes may have significant implications for the entrepreneurial responsiveness of the economy to aggregate shocks. One of the most profound demographic transitions of the past 50 years has been towards aging populations. This trend is widespread, stemming from both declines in fertility rates and increased longevity. We seek to understand the implications of such demographic shift on firm creation following aggregate economic shocks.

The direction of the effect of aging on entrepreneurial responsiveness is theoretically ambiguous, depending crucially on the demographic characteristics of the marginal entrepreneurs. On the one hand, it is possible that aging would have no impact at all. In the classical Lucas (1978) model, the most able individuals sort into entrepreneurship. If this ability is innate and not time varying, one would not expect the aging of the population to have an effect on the entrepreneurial responsiveness of the economy.

On the other hand, the ability to identify new economic opportunities, and start a new firm in response, may require a variety of business and managerial skills which can only be obtained with experience (Evans and Leighton (1989); Lazear (2005)). Individuals could accumulate such requisite skills as well industry-specific knowledge over time as their careers evolve. Moreover, the ability to create new firms in response to new economic opportunities may also hinge on access to finance (Evans and Jovanovic (1989); Hurst and Lusardi (2004)). Wealth required to satisfy downpayment or collateral demands would likely need to be acquired over time. These forces suggest that it would be in fact older individuals, with sufficient wealth and skills, who would be better positioned to take advantage of entrepreneurial opportunities as they arise.

Conversely, younger individuals have been shown to have higher degrees of risk tolerance than older individuals, and thus may be better able to tolerate the risk associated with entrepreneurial activity (Kihlstrom and Laffont (1979b); Miller (1984b); Levesque and Minniti (2006)). Likewise, young individuals may have less constraints in the form of family or looming retirement needs, and may therefore have sufficient flexibility to quickly respond to changes in economic opportunities. Finally, younger individuals, being at the early stage of their career, may have less attractive outside options. The combination of these life cycle forces would suggest that younger individuals would in fact be the the most responsive in the face of new economic opportunities.

Given such considerations, the relationship between entrepreneurial responsiveness and population demographics must ultimately be resolved empirically. Such an exercise poses two important challenges. First, typically there is little information on the actual characteristics of individual entrepreneurs, as most papers rely on survey evidence or specific samples that do not reflect the composition of entrepreneurs in the economy as a whole. Second, in order to study the entrepreneurial response of individuals, we need to identify plausibly exogenous variation in aggregate economic shocks.

For these reasons, we focus on the Brazilian economy, which allows us to address both issues. First, we have access to administrative employer-employee matched data from the Brazilian Ministry of Labor that captures all the employees in the formal sector, and includes information on their work history, wages, education, gender and occupation. Information on individual occupations allows us to shed light on the set of skills acquired by individuals. Such data allow us the compare the characteristics of the marginal entrepreneurs, who start a business in response to aggregate economic shocks, to the overall population of entrepreneurs and that of all other workers.

Second, the large agribusiness sector in the Brazilian economy allows us to identify exogenous demand shocks arising from global commodity price fluctuations. Brazil is among the largest producers in the world of coffee, sugarcane, orange juice, soybean, corn and ethanol, among others. These crops provide the basis for the large agribusiness industry in Brazil, which represents 22% of Brazil's GDP, a third of its employment, and almost 40% of its export (PwC, 2013). The agribusiness industry includes not only farming production, but also the supply of farming inputs such as machinery, the selling, exporting and marketing the products, warehousing facilities, wholesalers, processors, and retailers, among others.

Our empirical strategy identifies exogenous demand shocks by interacting municipality level historical production endowments of agricultural crops with contemporaneous changes in global commodity prices. These historical concentrations of agricultural crops are persistent due to the accumulation of expertise and economic activity over long time periods, as well as physical characteristics of the regions such as climate and soil. When global commodity prices of local crop endowments rise, the profitability of the local agribusiness sector increases. Hence, such movements in global commodity prices, interacted with local endowments, generate plausibly exogenous variation in local income and local demand.

We find that, in affected municipalities, increases in commodity prices lead to a significant increase in local employment, income and new business creation. Our estimated effects are economically meaningful. At the top 10% of commodity price increases, municipalities experience a 4.1% increase in local employment and 2.9% increase in aggregate income. Importantly, the local demand shock triggers significant firm entry, with the number of local firms increasing by 3.7%. The rise in employment is most pronounced in the agricultural sector, but is also significant in the manufacturing and non-tradable sectors. In contrast, new firm creation is concentrated entirely in the non-tradable sector.[1] Using various proxies of firm performance, we further demonstrate that new firms created as a response to the local demand shock are not worse than other new firms. Specifically, we find that following the shock, new firms are more likely to survive, and conditional on survivorship, they hire more employees. We also find that these firms are more likely to be incorporated, which can be viewed as a proxy for future growth plans of the business (Levine and Rubinstein, 2017).

We then turn to our main question, and explore the characteristics of those individuals who generate the entrepreneurial response to these aggregate demand shocks. To do so, we shift the analysis to individual level data and explore the differential response of individuals that reside in the same municipality at the time of the shock and who are therefore subject to the same change in local economic conditions. We model the decision to start a new (non-tradable) business using a linear probability model. We define a binary shock to be a year with a top 10th percentile change in the value of the municipality endowment relative to the municipality mean. In this framework, under a monotonicity assumption, the treatment effect reveals not only the increase in the probability to become an entrepreneur, but also the (proportional) size of the marginal entrepreneurs group. We show that the relative size of the marginal entrepreneurs population in our analysis is sizable, roughly equivalent to 6.2% of the size of the total entrepreneurial population in the economy.

We additionally find that marginal entrepreneurs are concentrated among the youngest individuals within a municipality, while there is almost no response to the commodity price shock among the older population. Specifically, we find that the commodity price shock increases entrepreneurship among individuals below the age of 30 by almost 10 percent, while there is essentially a zero response for older individuals. These results are robust to the inclusion of industry fixed effects and a variety of covariates controlling for other demographic characteristics which may be correlated with age, as well as education and type of occupation. These results are consistent with the idea that lifecycle considerations strongly influence the individual entrepreneurial response to the shock.

[1] Allcott and Keniston (forthcoming) document similar findings in a US setting, examining the local economic impact of oil and gas booms.

In particular, younger individuals are likely to be more flexible and tolerant of risks than older individuals, and are thus better able to quickly take advantage of economic opportunities when they arise.

Interestingly, we find that while the average entrepreneur in the economy also tends to be young, this trait is significantly more pronounced among marginal entrepreneurs. For instance, the share of people aged less than 30 is 30% in the general population, 50% among new entrepreneurs, and more than 75% among marginal entrepreneurs. This is again consistent with the idea that the ability to rapidly respond to new opportunities requires a degree of flexibility and risk tolerance that is uniquely possessed by the young.

The results so far suggest that lifecycle considerations are important, leading to a lack of response among the older population. This is somewhat surprising given that young individuals had less time to accumulate either wealth or skill over their life time. To further explore the importance of skill and wealth, we examine the heterogeneity of the firm creation response within the young, restricting our analysis to individuals at the bottom quartile of the age distribution. We first find that, within the young population, it is those individuals who have the most industry experience, those that are more educated, and those that work in white-collar and managerial occupations who are most responsive to new economic opportunities.

Next, we classify individuals into generalists and specialists according to their previous occupation, following a procedure described in Muendler et al. (2004). Specifically, individuals classified as generalists are those working in occupations that require multiple abilities and involve leadership, monitoring, and supervisory tasks. Again within the young population, we find that individuals in the generalist category are highly responsive to aggregate shocks when they arise, relative to the specialists. This finding is consistent with Lazear (2005). Finally, we follow Autor et al. (2003) and use the occupational data to classify occupations that are non-routine and require cognitive skills. Such occupations require tasks that demand creativity, generalized problem-solving, and complex communications, such as selling, managing, legal writing, among others. We find that young individuals who engage in cognitive non-routine tasks are significantly more responsive than those who do not.

Overall, these results do highlight the importance of experience and skill in explaining entrepreneurial responsiveness to aggregate economic shocks. However, these traits are only contributing factors within the young, i.e within those likely to be sufficiently flexible and tolerant of the risks associated with entrepreneurship. When we repeat the analysis for older individuals, we do not find such results. Among the older population, even the skilled and educated individuals remain unresponsive to the local demand shock.

Finally, we explore cross-municipality variation motivated by two hypotheses that may explain the entrepreneurial responsiveness of the young. First, given that young individuals have less time to accumulate wealth, we posit that in municipalities with better access to finance, we are likely to find stronger responsiveness of the young to aggregate economic shocks. Second, following Lucas (1988) and Gennaioli et al. (2012), we hypothesize that in areas with more skilled individuals, young individuals will respond more aggressively to economic shocks due to human capital externalities and opportunities to learn. We find support for both hypotheses. Municipalities with better access to finance at the beginning of the sample, proxied by number of banks, or total value of credit to small businesses, experience a greater entrepreneurial responsive to the local demand shock. Moreover, younger individuals are more responsive in municipalities where the overall population is younger and endowed with more generalist skills, suggesting that changes in demographic structure have both direct and indirect equilibrium effects.

Our work relates to several strands of literature. First, as mentioned above, a variety of macroeconomic studies have emphasized the crucial role that new firm creation plays in the amplification and propagation of aggregate economic shocks.[2] We contribute to these studies by investigating

[2]General equilibrium models of monopolistic competition linking firm entry and exit to aggregate fluctuations indicate the presence of various channels. Devereux et al. (1996), Chatterjee and Cooper (2014), and Bilbiie et al. (2012) are examples of models where entry of new firms generates greater product variety, while in Jaimovich and Floetotto (2008) entry works through increased competition and lower markups. In related recent work, Clementi and Palazzo (2016) argue that increases in firm entry in response to aggregate shocks lead to large and persistent expansions because of lifecycle considerations. Sedlácek (2014) suggest the lack of startups during a downturn can lead to persistent employment declines in the economy, and Sedlacek et al. (2017) show that firm heterogeneity, and particularly the presence of high-growth startups, are key for aggregate gains. Several empirical studies further highlight how new and young firms act as important sources of job creation and employment (Haltiwanger et al. (2013b); Pugsley and Sahin (2015)). In particular, Adelino et al. (2017) use US Census micro-data and regional

the characteristics of the entrepreneurs who respond to aggregate shocks by creating new firms. Our micro-level evidence highlights the importance of individual level heterogeneity, and of demographic characteristics of the population, in explaining the entrepreneurial response of economies to aggregate fluctuations.

Second, our paper contributes to a long-lasting literature on the nature and characteristics of entrepreneurs.[3] In particular, little is known about the specific individuals who select into entrepreneurship in response to aggregate economic shocks. Using individual-level evidence, we illustrate that these marginal entrepreneurs are different compared to the average entrepreneurs in the population. Our evidence also highlights the importance of life-cycle considerations as important drivers of entrepreneurial dynamics. Indeed, we find that wealth, access to finance, as well as skills do affect entrepreneurial responsiveness, but only when individuals are young, and thus likely to be more flexible and tolerant to risks.

Finally, our paper rleates to a growing strand of literature that seeks to understand how demographic changes affect macroeconomic patterns and labor market dynamics.[4] Our focus is on relationship between demographic changes and entrepreneurial responsiveness to aggregate shocks. In that regard, our paper is also related to Liang et al. (2014) and Kopecky (2017), who explore the relationship between aging populations and entrepreneurship across and within countries.

The remainder of the paper proceeds as follows. Section 2 illustrates the various data sources used in the analysis, while Section 3 discusses the construction of our local endowment value shocks. Section 4 presents municipality-level aggregate results. Section 5 describes the individual-level analysis and reports the key results of the paper. Section 6 provides evidence on cross-municipality differences in the entrepreneurial responsiveness to aggregate fluctuations. Section 7 concludes.

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variation in investment opportunities through Bartik shocks to show that it is the young and new firms that create the most jobs in response to positive local demand shocks.

[3]See, for example, Kihlstrom and Laffont 1979b; Blanchflower and Oswald 1998; Hamilton 2000; Moskowitz and Vissing-Jorgensen 2002; Hurst and Lusardi 2004; Hombert, Schoar, Sraer and Thesmar 2014, and Humphries, 2016.

[4]For example, see Jaimovich and Siu (2009); Jones (2010); Backus et al. (2014); Gagnon et al. (2016); Engbom (2017).

II. Data

In this section we discuss the main datasets used in our analysis. We start by describing the RAIS dataset, which provides matched employer-employee information on all employees in the formal sector in Brazil. We supplement this data with aggregate municipality-level data on loans and firm credit. We further employ data on municipal agricultural crop endowments in Brazil, as well as data on global commodity prices.

A. Employer-Employee Data

The RAIS database (Relacao Anual de Informacoes Sociais) is an administrative database from the Brazilian Ministry of Labor (MTE) which provides individual level data on the universe of formal sector employees in Brazil. RAIS is widely considered a high quality Census of the Brazilian formal labor market (Dix-Carneiro (2014)). The database, created in 1976, is used by several Brazilian government agencies (such as the Brazilian Central Bank) to generate statistics for the Brazilian economy. The RAIS database also forms the basis for national unemployment insurance payments and other worker benefits programs. As a result, ensuring the accuracy of the information is in the interest of both firms (who would otherwise be subject to monetary fines) and individuals (who want to be eligible to receive government benefits), as well as the central government.

RAIS contains information on the firm and the establishment of each employee.[5] Firm and establishment level data include tax identifiers, locations, industry, and legal status. At the individual level, the RAIS includes employee-specific identifiers, called PIS, which allows for individuals to be tracked over time and across firms (as well as across establishments of the same firm).[6] Similar to other employer-employee matched data, for each employee we observe payroll, tenure in the firm, and hiring and firing dates. RAIS additionally has rich personal data on gender, nationality, age and education, as well as a few less commonly available variables such as hours worked, reasons

[5]Individuals with multiple jobs in a given year therefore appear multiple times. Following standard practice in the literature (Menezes-Filho, Muendler and Ramey, 2008), we keep only the highest paying job of the individual in a given year. If there are two or more such "highest paying" jobs, we break ties by keeping the earlier job.

[6]RAIS naturally covers only the formal sector. The informal sector certainly represent a larger "unobservable" part of the economy in Brazil compared to the United States. Estimates of its size vary widely.

for hiring and firing, and contract details. Finally, each employee is assigned to an occupational category specific to her current job. There are more than 2,000 such categories, which follow the detailed Brazilian's classification of jobs (Classificacao Brasileira de Ocupacoes - CBO) that is similar to the International Standard Classification of Occupations (ISCO-88).

Using data on occupations we are able to identify individuals that are managers or CEOs of a firm, as well as lower ranked workers, such as blue and white collar workers. Following standard practice in the entrepreneurship literature (e.g. Kerr et al. (2015); Babina (2015)), we define an entrepreneur as the CEO or the top paid manager of a new firm in the year of birth. If no worker is classified as CEO or manager, we use the highest paid worker in the firm.[7]

Furthermore, the detailed data on occupations allow us to classify workers based on skills. Following Muendler et al. (2004), we classify individuals into *generalists*, i.e. those working in occupations that require multiple abilities and that involve leadership, monitoring, and supervisory tasks, and *specialists*, i.e. those working on specialized tasks and occupations. Additionally, following Autor et al. (2003) and Gathmann and Schönberg (2010), we distinguish between workers who perform different types of tasks. *Non-routine cognitive* tasks require creativity and problem-solving ability, as well as negotiation and coordination skills. *Non-routine manual* tasks require physical work together with the ability to adapt to different situations. Finally, *routine* tasks are all other tasks based on well-specified processes and activities.

We focus on individuals that are within the age range of 18 and 65 and have wage data for at least 3 years, during the 1998-2014 period. We restrict our focus to this time period due to the availability of information on agricultural resources at the municipality level. Under these restrictions, the sample includes roughly 69 million individuals. Since we are interested in understanding how changes in local economic shocks affect the decision of individuals to become entrepreneurs, we focus on individuals that are already in the region rather than individuals that migrate from a different region. Our final sample includes 45 million individuals.[8]

[7]Results are robust to various definition of "entrepreneur."

[8]In the municipality-level analysis, we aggregate data using all individuals in this sample. When we move to the individual-level analysis, for computational reasons, we extract a random sample of 5% of all individuals on which

In Panel A of Table 1 we provide summary information on the relative importance of Brazilian industries. The two largest industries in the economy are the non-tradable and services sectors, which capture 54% and 20% of the annual number of firms, and 27% and 20% of annual employment respectively. Panel A also documents the annual creation of new firms across industries, with most new firms being created in the non-tradable and services sectors.

In the empirical analysis, we focus on municipalities as the local economic unit and explore how local municipalities respond to economic shocks triggered by fluctuations in global commodity prices. Panel B of Table 1 provides municipality level summary statistics. The average municipality in the sample has a population of 24,122 and the GDP per capita is 3,093 (USD 2000).[9] In our sample period, there is an average (median) of 237 (47) firms and an average (median) total number of formal private sector employees of 3143 (342) per municipality, with significant dispersion in size across regions. The average (median) number of new businesses created in a given municipality in a given year is 32 (7). Once again, there is significant heterogeneity across municipalities. The RAIS data allow us to explore the characteristics of the newly created firms in the economy. In Panel C of Table 1 we find that on average, a newly created firm survives 6.8 years (median is 5) and, conditional on survivorship, employs 14 workers two years after its birth and 18 workers after five years.

Panel D of Table 1 provides summary statistics on all individual formal sector employees in our sample, excluding the set of entrepreneurs. On average, 61% percent of the workers are men. Workers have an average of 11.45 years of education and the median level of education is high school (12 years). Based on the occupational status of the workers, we find that most workers can be characterized as either Blue Collar (48%) or White Collar (41.6%), while only a small fraction consists of Managers and CEOs (3.6%). We do not observe occupational status for the remaining workers in the data.[10] Finally, when we classify individuals according to their previous occupation

we perform the analysis.

[9] All summary statistics on the municipalities are computed using the full aggregate municipality-level panel data from 1998 to 2014.

[10] We match the CBO classification to the International Standard Classification of Occupations (ISCO-88) using the procedure outlined in Muendler et al. (2004). This correspondence allows us to categorize workers into four organizational layers, following a framework close to Caliendo and Rossi-Hansberg (2012). From bottom to top layers

into generalists and specialists, we find that 19.3% of the workers are in a job which entails a generalist skill set.

In Panel E of Table 1, we provide summary statistics on the the population of entrepreneurs in our sample. We find that entrepreneurs are relatively more likely to be female and to have a higher educational level (12.11 years of education on average). The distribution also appears skewed towards higher hierarchical jobs in the organization in the year before founding a new firm, with 40.2% Blue Collar and 50% White Collar workers, and 4.5% Managers and CEOs.

B. Loans and Banking Sector

We supplement the RAIS data with municipal level data on the number and dollar amount of all loans to local businesses, as well as information on the location of bank branches in Brazil. These data are obtained from the Brazilian Central Bank datasets (Banco Central do Brasil, BCB). We also obtain confidential loan-level data from the BNDES, which represents the second largest national development bank in the world (after the Chinese Development Bank), and is a major lender of Brazilian companies. BNDES provides a significant share of long-term bank lending in Brazil and is amongst the largest sources of investment in industry and infrastructure (Colby, 2012). For each loan, we have information on the loan amount, the interest rate (and type), and tax identifier of the firm receiving the loan.

Panel B of Table 1 reports summary statistics on the financial characteristics of municipalities. We report information on both total volume of credit from private banks and the BNDES, expressed in millions of USD 2000, and total number of BNDES government loans. The data shows significant variation across municipalities, with an average of 20.794 millions USD going to local business from private financial institutions (median is 4.129), and an average of additional 2.75 millions USD coming from the BNDES (median is 0.228)

they are: Blue Collar, White Collar, Managers, CEOs. Please see Colonnelli and Prem (2017) for more details on the data construction.

C. Agricultural Crops in Brazil

The Brazilian economy relies heavily on agriculture. For example, Brazil is among the largest producers in the world of coffee, sugarcanes, orange juice, soybean, corn and ethanol. These crops, and others, provide the basis for the large agribusiness industry in Brazil, which represents 22% of Brazil's GDP, a third of its employment, and almost 40% of its export (**PwC** (**2013**)). The agribusiness industry captures not only farming production, but also the supply of farming inputs such as machinery and seeds, as well as the selling and marketing of farm products, such as warehouses, wholesalers, processors, and retailers.

The empirical strategy in this paper relies on local economic shocks caused by fluctuations in the value of local agricultural endowments. We obtain information on agricultural crops from the Brazilian Institute of Geography and Statistics (IBGE), which is responsible for the Brazilian census as well as most of the statistical analyses of the Brazilian economy. The data provides the annual production of all 66 different agricultural crops at the municipality level for the period 1993-2014. We standardize the different crops to the same unit measure (i.e., tons) to construct a panel dataset of the universe of agricultural crops production by Brazilian municipalities. We construct proxies for the agricultural endowment of crops by municipality by averaging production quantities in the five years from 1993 to 1997.

Panel B of Table 1 illustrates that the average aggregate value of local crops in a municipality is equal to approximately 89% of local GDP, with the median equal to 12.6% of local GDP. Similarly, the value of local crops per capita is on average $2,926. Figure 1 illustrates the wide spatial distribution of agricultural resources across municipalities. Municipalities are divided into quintiles based on the production value of natural resources relative to GDP in 2000. The bottom quintiles have production values of roughly 1% to 5% of municipality GDP. In contrast, in the top quintile, municipalities have production values worth more than 45% of local GDP. The figure illustrates significant heterogeneity across municipalities. In fact, the heterogeneity across municipalities is even wider, given that different municipalities specialize in different portfolios of agricultural products, but this is not reflected in the figure.

International commodity prices are obtained from the Global Economic Monitor (GEM) Commodities database of the World Bank. We focus on the period 1998-2010. For each crop, we create a yearly measure of commodity prices starting in 1998 by taking the average price within the year. In some cases, there may be a single price that matches to multiple crops. For example, the price of tea is assigned to both "indian tea" and "yerba mate." Hence, we consolidate several agricultural crops to match prices. We standardize all units of measure to US dollars per ton. In the final dataset, we have 17 different commodities present in Brazil which are traded on the international commodity markets. The detailed distribution of these agricultural crops across municipalities is provided in Table A.1 of the Appendix.

III. Measuring Local Demand Shocks

We seek to evaluate the size and characteristics of the set of individuals who become entrepreneurs in response to local economic shocks. To do so, we create a measure that isolates changes in local income and local demand for each municipality, that varies over time, and that is plausibly exogenous to local economic growth and entrepreneurial decisions. This measure interacts the local endowment of agricultural crops with fluctuations in global commodity prices, which impact the value of the locally grown produce. Importantly, since the agribusiness sector in Brazil is large and highly developed, changes in crops prices likely affect not only the value of the locally grown crops, but also related businesses.

Different municipalities are endowed with different types of agricultural crops that they can grow locally. The local value of a crop in a given year is calculated as the product of the local crop quantity produced (Q) multiplied by its unit price (P) in international commodity markets. We are interested in exploring variations in the value of locally produced crops. While international prices are exogenous to municipality-specific economic conditions, quantities are less likely to be so. We therefore hold endowments fixed at their 1998 level, prior to the start of our sample period, so as to remove the endogenous component in the fluctuations of commodity values. We construct a proxy for the 1998 local endowment by averaging *production* quantities in the five years preceding the beginning of our analysis sample, i.e. between 1993-1997. Using this approach circumvents potential endogeneity concerns because historical production is likely to capture the (exogenous) spatial endowments of the agricultural crops, rather than potentially endogenous production activity, which may correlate with unobserved local shocks. This approach is standard in the literature (see, for example, Dube and Vargas (2013)). These historical endowments of agricultural crops are persistent due to the accumulation of local expertise and economic activity over long periods of time, and also because of the physical characteristics of the regions such as climate and soil.

Specifically, let $Q_{kj,98}$ be our proxy for the regional endowment of crop k in municipality j in 1998, measured by the average production in the past 5 years. Let P_{kt} be the international price of crop k in year t. Thus, the annual Crops Index (CI) for municipality j in year t is the sum over all crops of local agricultural endowments multiplied by the respective time-varying international prices:

$$CI_{jt} = \sum_{k} Q_{kj,98} * P_{kt}$$

Variations in this municipality-level measure allow us to approximate the ideal natural experiment where we randomly shock local economic conditions over time. The endowment part of the formula generates cross-sectional variation in the pre-existing exposure of different municipalities to different agricultural resources. International commodity price fluctuations generate time-series variation that is plausibly independent of local economic cycles. Together, they provide a municipality-year varying series of exogenous shocks to investment opportunities and local economic conditions generated by the differential exposure of different Brazilian municipalities to the changing global value of agricultural commodities.

Figure 2 illustrates the variation we observe in the value of municipal endowments of crops, as captured by the annual Crops Index. Specifically, in Figure 2 we plot the residual value of crops in a municipality after removing municipality and year fixed effects. The thin grey lines provide the time

time series of these residuals for a 10% random sample of municipalities in our sample. The solid lines are median (solid line), 10th and 90th percentiles (dashed lines) of the distribution of residuals in each year. As the figure illustrates, there is both significant cross-sectional variation within a given year and considerable time variation within a given municipality in the value of agriculture commodities.

In what follows, we examine the impact of local endowment shocks in the 10th percentile relative to the municipality mean. Specifically, let Z_{jt} be equal to one if the local agricultural endowment in municipality j is in the top 10th percentile change in the price distribution in year t relative to the municipality mean, and equal to zero otherwise. We consider municipality j to be "treated" in year t if $Z_{jt} = 1$. As we discuss below, the choice of a binary shock allows us to transparently estimate the characteristics of the individuals who create new businesses in response to local economic shocks. This choice does not affect the interpretation of our findings, as results hold when using the binary or the continuous measure of the shock.

There are two main identification concerns. First, at the aggregate level, we may be concerned that the price of commodities for which Brazil is a major producer and exporter are also correlated with local economic variables. To alleviate this concern, we re-estimate the main specifications after removing municipalities that account for a non-trivial share of the world export of any specific crop, and find that the results are largely unchanged.[11] A second concern is that regions with better opportunities attract individuals that are more likely to start businesses regardless, which is an important issue for our individual level analysis. We use municipality fixed effects to control for time-invariant sorting. However, there could still be a potential problem if agents can forecast the shock and migrate in anticipation of it. We see this scenario as unlikely since global commodity markets are highly developed and it is difficult to forecast commodity prices. Moreover, commodity price expectations are unlikely to drive mass-migration. Still, to mitigate this additional concern,

[11] Specifically, Brazil's exports account for more than 10% of world's exports for each of five crops (sugar cane, coffee, soybeans, yerba mate, tobacco). Hence, we compute the ratio between the value of production of these five crops over the total value production across all crops in a given municipality-year. For each year, we then rank municipalities based on this measure. A municipality that is ever in the top 10% of this ranking in any given year is removed from the analysis, as it is considered a potential driver of world commodity prices. We provide further details about this robustness check in the Appendix.

we opt to exclude from our sample individuals who moved to the municipality the year of the shock, and only focus on individuals who were already working in the municipality the year before.

IV. Municipality-Level Analysis

We start by estimating the impact of global commodity price fluctuations on municipality level economic activity. As discussed above, our strategy interacts this time-series variation with cross-sectional differences in municipal endowments of agricultural crops; that is, we use municipality-year level variation in the Crops Index as a source of plausibly exogenous fluctuations in local income and demand. Our main specifications use the binary version of the shock, introduced earlier. Specifically we estimate the following model:

$$Y_{jt} = \alpha_j + \beta Z_{jt} + \gamma X_{jt} + u_{jt}$$

where Y_{jt} is the outcome of interest, α_j are municipality fixed effect, Z_{jt} is the binary shock and X_{jt} is a set of controls that includes year dummies and log-population.

The main results are presented in Table 3. We find that positive shocks to the value of local crops generate significant economic growth in the treated municipalities. We find that treated municipalities experience a highly significant increase of 4.1% and 3.7% in local levels of formal employment (column 1) and total firms (column 3), respectively. In column 2 we see that this effect is accompanied by an increase in total income (across all local firms) of 2.9%, which indicates only a limited decrease in average local wages -likely capturing the increase in low skilled employment- and an overall increase in total income in the treated municipalities. Importantly for our purposes, the higher levels of local economic activity are mostly driven by the creation of new firms (column 4), which increase by 2.6%, rather than a higher likelihood of survival of existing firms, which instead seem unaffected given the small and statistically insignificant -0.004 effect on firm closures (column 5).[12]

[12] In appendix Table A.2 we also report the estimates obtained by regressing the outcomes on the continuous

These aggregate results emphasize the importance of entrepreneurship for the dynamics of local economic activity, a result consistent with Adelino et al. (2017), and provide a first preliminary step towards the novel analysis of the entrepreneurs who account for this new firm creation in response to local economic shocks. Before moving to the individual level analysis, we further unpack these aggregate results to discuss the nature of the shock and the relevance of new firm creation we observe for economic growth in our context.

Table 4 illustrates the impact of the shock by economic sector, which we categorize using the Brazilian CNAE industry codes into Agriculture and Mining (columns 1), Manufacturing (columns 2), Non-tradable (columns 3), and Services (columns 4). Panel A focuses on employment, and shows a statistically significant increase in employment levels in all but the Services sector. This finding is consistent with rising commodity prices having both a positive direct effect (8.4%) on the sectors responsible for the production of these commodities (Agriculture and Mining) and positive spillover effects on other industries that are potentially connected through various linkages. Interestingly for our purposes, when studying the aggregate sectoral impact on number of firms, in Panel B, we find that the vast majority of new firm creation is accounted for by firms in the non-tradable sector (column 3), where we observe a highly statistically significant increase of 5.5%, compared to small and statistically insignificant effects on other sectors.

The finding that new firm creation is fully driven by firms in the non-tradable sector indicates that global commodity price shocks primarily affect local levels of entrepreneurship through a local demand shock. That is, the increase in the value of locally grown crops generate higher levels of total income in the municipality, which arguably lead to a demand shock for the non-tradable sector and a subsequent increase in related investment opportunities. This is consistent with previous work that relies on Bartik (1991) type shocks to instrument for changes in local demand (Adelino et al. (2017); Mian and Sufi (2014); Stroebel and Vavra (2014)), and these findings represent the basis

measure CI_{jt}. Since both the dependent and the independent variables are in logs, the results can be interpreted as elasticities. A 10% increase in the index is associated with at 1.2% increase in the number of firms, a 0.7% increase in the inflow of new firms and an overall 0.6% increase in firm churn. Employment raises by 1.5% in response to the shock, and total payroll increases by 1.3%. All estimated effects are highly significant.

for our individual level analysis on local entrepreneurial responsiveness, which we carry out in the next section.

We finally ask whether the creation of economic activity we observe is economically relevant. New firms in the non-tradable sector that respond to local economic shocks may be short-lived or may not contribute to significant employment creation in the long-run. We explore these concerns in Table 5. Using firm-level data, and focusing on firm entry only, we estimate specifications where we use as dependent variables indicators for whether a new firm survives for at least 3 and 5 years (columns 1 and 2, respectively), and for whether a new firm has at least 3 or 5 employees five years after creation (columns 3 and 4, respectively). We find that, if anything, firms created in response to positive local economic shocks are significantly more likely to survive both after 3 and 5 years and that, conditional on survival after 5 years, these firms are likely to be larger. While survivorship and size are just proxies for firm success, these results suggest that new firms who respond to local demand shocks are an important and persistent propagation mechanism. We further corroborate in column 5 of Table 5, where we find that newly created firms are also more likely to be incorporated, which can be viewed as an ex-ante proxy for future growth plans of the businesses created (Levine and Rubinstein (2017)).

V. Individual-Level Analysis

A. Empirical Framework

In this section we move to our primary analysis, which aims to determine the distributional features of *marginal entrepreneurs*, namely those individuals who respond to local demand shocks by creating a new firm. We model the decision to start a (non- tradable) business using a binary choice linear probability model. Let the binary indicator variable T_{ijt} denote the decision in year t of an individual i in municipality j to become an entrepreneur. We again let $Z_{jt} = 1$ denote a time of exogenous increased local demand in municipality j, as proxied for by local agricultural endowment shocks. Let T_{1ijt} and T_{0ijt} denote the choice to become an entrepreneur when $Z_{jt} = 1$ and $Z_{jt} = 0$, respectively.

Then we define a marginal entrepreneur as an individual i who starts a business in response to the endowment shock, that is, an individual i for whom $T_{1ijt} = 1$ and $T_{0ijt} = 0$ or, equivalently, $T_{1ijt} > T_{0ijt}$. Our goal is to estimate the size and characteristics of this population.

To this goal, we investigate the heterogeneous entrepreneurial response to local demand shocks by individual characteristics. Specifically, let the variable n index demographic categories (e.g. terciles, quartiles) of a characteristic of interest such as age. We then estimate the following linear probability model for each subpopulation indexed by n, in particular for young individuals and then again for old individuals:

$$T_{injt} = \alpha_{nj} + \delta_{nt} + \beta_n \cdot Z_{jt} + \varepsilon_{injt}. \tag{1}$$

where α_{nj} denote municipality fixed effects and δ_{nt} denote time fixed effects. We allow each subpopulation to have its own baseline level of entrepreneurship and to have its own time trend.

Two assumptions are key to our empirical strategy. First, as long as Z_{jt} is uncorrelated with the error term, this specification provides a consistent estimate of β_n. A potential issue is that regions with better opportunities attract more entrepreneurial individuals, a concern that is alleviated by the fact that global commodity prices are highly liquid and forecasting is difficult, thus making it unlikely that individuals migrate in anticipation of the shock. As mentioned earlier, we further address these considerations by restricting our sample to individuals already living in the municipality at the time of the shock, and by controlling for time-invariant sorting through the inclusion of municipality fixed effects.

Second, we assume monotonicity, which says that $T_{1ijt} \geq T_{0ijt}$ for all i. This rules out cases where an individual starts a business when economic opportunities are weak, but does not start a business when opportunities are strong.

The assumptions of orthogonality and monotonicity imply that:

$$
\begin{aligned}
P\left(T_{1injt} > T_{0injt}\right) &= E\left[T_{1injt} - T_{0injt}\right] \\
&= E\left[T_{injt}|Z_{jt} = 1\right] - E\left[T_{injt}|Z_{jt} = 0\right] \\
&= \beta_n.
\end{aligned}
$$

Within this framework, the treatment coefficient β_n, reveals not only the increase in the probability to become an entrepreneur, but also the proportion of individuals in demographic category n who are marginal entrepreneurs.

Additionally, we would like to determine the distribution of characteristics *conditional* on being a marginal entrepreneur. This will allow us to compare the characteristics of marginal entrepreneurs to the overall Brazilian population and to the overall set of entrepreneurs. We can accomplish this with Bayes's rule. Let X_i be the characteristic of interest. Then, conditional on an individual i being a marginal entrepreneur, the probability that i is in category n can be calculated as follows:

$$
\frac{P\left(X_i = n|T_{1ijt} > T_{0ijt}\right)}{P\left(X_i = n\right)} = \frac{P\left(T_{1ijt} > T_{0ijt}|X_i = n\right)}{P\left(T_{1ijt} > T_{0ijt}\right)} = \frac{\beta_n}{\beta}
$$

where β is found by estimating equation (1) on the entire population. This implies that the distribution of characteristics of marginal entrepreneurs is given by:

$$
P\left(X_i = n|T_{1ijt} > T_{0ijt}\right) = \frac{\beta_n}{\beta} P\left(X_i = n\right).
$$

B. Age on the Entrepreneurial Response

What determines the entrepreneurial response to aggregate shocks? According to standard models such as Lucas (1978), ability is the relevant dimension along which individuals sort into entrepreneurship. In this type of model, to the extent that ability is an innate characteristics, the age profile of the population does not matter per se. Other theories, however, would predict that age does play a prominent role in the decision to start a business.[13]

On the one hand, if ability reflects skills accumulated over time as individuals move up in their career, it is reasonable to expect that individual responsiveness to aggregate shocks would increase with age (Lazear, 2005; Evans and Leighton, 1989). Similarly, to the extent that downpayment and collateral constraints matter for the ability to start a new business, older individuals again may be more responsive to new opportunities, having had more time to develop the necessary personal wealth (Quadrini, 1999). On the other hand, young individuals may be the most responsive if, for example, they have a greater tolerance for risk, limited outside options, or an overall higher degree of flexibility in their personal circumstances.[14] Ultimately, the extent to which any of these forces matter, and their relatives magnitudes, is an empirical question.

Relying on the econometric framework outlined in the previous section, we take this question to the data by investigating the heterogeneous response of different types of individuals to our specific local demand shocks. We center our initial analysis squarely around the role of age. Figure 3 reports the increase in entrepreneurial rates in response to the shock, estimated according to model (1) for different age quintiles. The results clearly illustrate that it is young individuals, those in the first two quintiles of the age distribution, who significantly respond to the shock. The likelihood of becoming an entrepreneur increases by 0.4 (out of 1000) under a positive shock or, equivalently, under the assumptions outlined in the previous section, 0.4 in a 1000 is the share of marginal entrepreneurs within the youngest quintile. The increase in the entrepreneurial rate is 0.25 for individuals in the second age quintile, and the increase becomes statistically insignificant and close to zero for individuals in the upper quintiles of the age distribution. These findings are consistent with several lifecycle considerations playing a key role in the individual entrepreneurial response.

We refine this analysis in Table 6, in which we show that the impact of age on the firm creation

[13] See Parker (2018) for a comprehensive review.

[14] See, for example, Miller 1984a; Reynolds and White 1997; Levesque and Minniti 2006; Delmar and Davidsson 2000; Arenius and Minniti 2005; Rotefoss and Kolvereid 2005; Wagner 2006; Bergmann and Sternberg 2007; Uusitalo 2001.

response is robust to the inclusion of a variety of other demographic characteristics. Column (1) shows the simple entrepreneurial responsiveness to the shock, controlling only for year and municipality fixed effects. As the table reports, 0.179 people out of 1000 are marginal entrepreneurs, reflecting a 6.2% increase in entrepreneurial activity in response to the shock when compared to the average flow of entrepreneurs in the economy (2.89 out of a 1000). In column (2), we add fixed effects that interact municipality dummies with an individual dummy for young individuals, defined as being in the bottom quartile of the age distribution. This specification therefore accounts for municipality level heterogeneity in the age composition, and yet the main effect remains largely unchanged. In column (3), we add an interaction term between the treatment variable and the young dummy. This column relays the same message as the previous figure. This group is a striking 5.7 times more responsive than the rest of the population.[15] We next show that this result is extremely robust in sign and magnitude to the inclusion of several other controls, such as sector dummies in column 4 (defined as the sector of the newly created firm), education dummies in column 5, and indicators for whether the individual had a generalist occupation (column 6) or a white collar one (column 7), in the year before founding the new firm.

We subsequently compare the distributional characteristics of marginal entrepreneurs to the average new entrepreneur in the Brazilian population. Letting Age_i be a random variable that equals n if an individual is in the n^{th} quantile of the age distribution, we obtain the conditional probability that a marginal entrepreneur is in the first tercile of the age distribution as:

$$P\left(Age_i = 1 | T_{1ijt} > T_{0ijt}\right) = \frac{\beta_1}{\beta} P\left(Age_i = 1\right)$$

where β_1 is estimated from model (1) only on the individuals in the first tercile of the age distribution, β is estimated from model (1) on the whole population, and $P\left(Age_i = 1\right) = \frac{1}{3}$ is the probability that anyone in the population is in the first tercile of the age distribution. The same statistics for all entrepreneurs in the population are computed directly from the data, as the fraction of individuals

[15] Specifically, the magnitude is obtained as: $\frac{0.0773+0.363}{0.363} \approx 5.69$

who create a new firm in a given year and that are in a particular age quartile.

We find that the average Brazilian who starts a business tends to be younger relative to the overall population, but that this feature is significantly more pronounced among marginal entrepreneurs. As Figure 4 illustrates, 50 percent of individuals who start a new business are aged 28 and younger. However, 75 percent of marginal entrepreneurs, those who respond to the demand shock, are aged 28 and younger. Likewise, only 8 percent of marginal entrepreneurs are in their thirties, compared to 31 percent among all new entrepreneurs. These results are consistent with the idea that the ability to respond quickly to new economic opportunities depends crucially on flexibility and the willingness to take risks, traits that younger individuals are significantly more likely to possess.

C. The Importance of Skill and Experience

So far we have illustrated that young individuals are disproportionally more likely to start a business in response to local economic shocks. Lifecycle considerations therefore seem crucial in understanding entrepreneurial dynamics and shock propagation mechanisms. Do wealth and skills also matter, as suggested by Lazear (2004) and many others? We first evaluate this question using univariate sorts across individual characteristics, with the results reported in Figure (A.1). As the Figure shows, the most responsive individuals have, on average, less years of work experience and are less wealthy, which we proxy for using total private sector wages accumulated since the first year of employment that we observe. Marginal entrepreneurs are also more likely to have the median level of education (i.e., high school), and are more likely to have managerial and generalist skills, as captured by occupations requiring multiple abilities as discussed earlier.

Of course, many of these characteristics, such as experience and wealth, are highly correlated with age and hence these results themselves provide little evidence on the role of wealth and skills in determining the entrepreneurial response. We therefore evaluate this question by exploring heterogeneity in firm creation *within* the population of young individuals, focusing on a battery of proxies for an individual's skill set.

Table 7 Panel A reports the estimates of the treatment effect for individuals in the bottom quartile of the age distribution, split according to these observable characteristics. The analysis shows that skills and wealth are significant determinants of individual responsiveness within the young (marginal) entrepreneurs. Within this group, we find that individuals who were previously employed in non-routine and cognitive occupations are significantly more responsive than others. The magnitude of the coefficients suggest that the former group is a staggering 30 times more responsive than the latter (Panel A, columns (1) and (2)). Similarly, individuals employed in generalist occupations are more than twice as responsive as those who do not have this type of experience (Panel A, columns (3) and (4)). Furthermore, columns (5) to (8) of Panel A show that within the young population marginal entrepreneurs are also more likely to come from white collar or managerial occupations (rather than blue collar) and to have at least a high school diploma. All these results are consistent with Lazear (2004) and other empirical studies emphasizing the importance of ability and skills to the entrepreneurial response.[16]

Table 8 Panel A reports a similar analysis for other proxies for ability, such as high pay growth relative to the other workers in the same municipality (Panel A, columns (1) and (2)). Again, among individuals with pay growth above the median, 0.483 in 1000 is the share of marginal entrepreneurs, while it is only 0.198 in 1000 for those with lower relative pay growth. Finally, columns (5) to (8) of panel B show that *within* the group of young individuals, both more experienced and wealthier individuals are more likely to be marginal entrepreneurs. Young individuals with higher than median experience are 2.7 times more responsive than individuals with lower experience. In terms of accumulated earnings, those in the upper half of the distribution are 55% more responsive than those in the bottom half (the significant estimated coefficient is 0.477 in the former group against a statistically insignificant 0.307 in the latter).

Strikingly, but conceptually in line with our previous results, the two panels B in Table 7 and Table 8 show that there is no statistically significant heterogeneous response when we perform the analogous analysis for the old individuals, i.e. those in the top three terciles of the age distribution.

In summary, within the young population, marginal entrepreneurs are more likely to have man-

[16] Examples include Wagner (2006); Djankov et al. (2005); Lazear (2005).

agerial skills, to be experienced, wealthy and educated, and to be on a positive pay growth path. That is, after conditioning on age, skill, experience and access to finance all affects entrepreneurial responsiveness to economic shocks, especially for the population of young (marginal) entrepreneurs.

VI. Heterogeneous Effects Across Municipalities

In the final part of our analysis we further investigate what frictions matter for the individual response to aggregate economic shocks, by investigating heterogeneous effects across municipalities. First, we study the role of financing constraints. Given that young individuals have less time to accumulate wealth, they may be more constrained, and we therefore posit that in municipalities with better access to finance the young should be even more responsive to aggregate economic shocks. Second, we investigate the importance of spillover effects and synergies among potential entrepreneurs. Following Lucas (1988) and Gennaioli et al. (2012), we hypothesize that young individuals should also be more responsive to the shock in areas with a higher presence of skilled individuals, due to human capital externalities and additional learning opportunities.

We study these heterogeneous effects across municipalities using the following methodology. First, we estimate a municipality fixed effect, λ_j, by exploiting the panel aspect of the data and estimating the following specification:

$$T_{ijt} = \alpha_j + \delta_t + \lambda_j \cdot Z_{jt} + \varepsilon_{ijt}, \tag{2}$$

where i, j, and t stand for individual, municipality and year, respectively. Z_{jt} is the top 10th percentile shock defined earlier, hence λ_j measures new firm creation in response to increases in local economic opportunities for each specific municipality. We then regress our estimated municipality fixed effects, $\hat{\lambda}_j$, on one local characteristic of interest at a time, measured at the beginning of the sample period. We denote these as factors, F_j. This yields the following equation:

$$\hat{\lambda}_j = \hat{\alpha}_j + \theta F_j + \gamma X_j + \mu_j, \tag{3}$$

where $\hat{\alpha}_j$ denotes the estimated mean fixed effects from equation (2), X_j is a set of controls that includes population and local GDP of municipality j, and μ_j is the error term. The results of this analysis are reported in Table 9.

We start by defining F_j as local access to finance, which we proxy for using several variables measured at the beginning of our analysis sample. Specifically, we consider municipalities with higher access to finance as those with a high density of local banks, local bank branches, government loans, total credit to small businesses, and total deposits. The results are summarized in Table 9, Panel A. All the estimated models suggest that in more developed financial markets there is a stronger entrepreneurial response of the young to the shock. All coefficients are positive and statistically significant, and the magnitudes are large. These results provide strong evidence consistent with the importance of financing constraints as barriers to the ability of marginal entrepreneurs to create economic activity when opportunities arise.

In Table 9, Panel B we subsequently explore the importance of aggregate human capital and demographic composition in generating positive entrepreneurial spillovers for the young individuals. With an analogous analysis, we measure the factor variable F_j using several proxies for human capital at the municipality level, in particular the average age (column 1), the share of individuals with generalist skills (column 2), the share of workers in white collar or managerial occupations (column 3), the share of entrepreneurs (column 4), and the share of employees in new firms (column 5). Consistent with cross-country evidence (Gennaioli et al. (2012)), we find that the entrepreneurial response of young individuals is more pronounced in younger regions and in regions with a higher share of skilled employees –as proxied for by all our measures.

In sum, these results point to the key role demographic structures and local levels of human capital play for entrepreneurial dynamics. In particular, while our previous findings provide evidence for the direct effects of demographic characteristics and other barriers to new firm creation, in this section we highlight the importance of indirect equilibrium effects for the entrepreneurial response to aggregate economic shocks.

VII. Conclusion

In this paper we identify and characterize the *marginal entrepreneurs*, defined as individuals who start a business in response to economic shocks. Understandanding the nature of these entrepreneurs can help us shed light on the mechanisms through which firm entry amplifies and propagates aggregate fluctuations, an issue which has been of key relevance to recent macroeconomic studies and policy discussions.

Specifically, we focus on the unique setting of Brazil, which allows us to analyze rich individual level longitudinal data for the entire formal sector, and to identify plausibly exogenous shocks to local demand by interacting municipality level historical production endowments of agricultural crops with contemporaneous changes in global commodity prices. Both these features are key to our empirical strategy, which allows us to first show that increases in commodity prices lead to a significant increase in local employment, income and new firm creation in the non-tradeable sector of the affected municipalities.

Moving to the main individual level analysis, we explore the demographic and career characteristics of the marginal entrepreneurs. Model the decision to start a new business using a linear probability binary choice model, we identify a sizeable 6.2% of the economy to be marginal entrepreneurs. Interestingly, they are are concentrated among the youngest individuals –likely to be more flexible and risk tolerant–, a result that is strongly robust alternative specifications. While the average entrepreneur in the economy also tends to be young, this trait is much more pronounced among marginal entrepreneurs. These results are therefore consistent with the idea that lifecycle considerations strongly influence the individual entrepreneurial response to the shock.Consistent with a large theoretical and empirical literature on entrepreneurship, we further uncover that within the young, marginal entrepreneurs are more likely to have managerial skills, to be experienced, wealthy and educated, and to be on a positive pay growth path. That is, while age appears as the defining characteristics of marginal entrepreneurs, wealth and skill play a significant role.

Finally, we explore cross-municipality variation to show that the entrepreneurial responsiveness of the young is concentrated in areas with well developed financial markets, and in areas with a higher presence of skilled individuals. These results are consistent with the presence of financial constraints and the importance of human capital externalities for new firm creation, respectively, thus suggesting that changes in demographic structure have indirect equilibrium, as well as direct, effects.

In sum, our paper sheds light on the potential ramifications of aging populations –one of the most profound demographic transitions of the past 50 years– for new firm creation and the responsiveness of entrepreneurs to aggregate economic shocks.

REFERENCES

_ , Song Ma, and David Robinson, "Firm Age, Investment Opportunities, and Job Creation," *The Journal of Finance*, 2017, *72* (3), 999–1038.

Allcott, Hunt and Daniel Keniston, "Dutch Disease or Agglomeration? The Local Economic Effects of Natural Resource Booms in Modern America.," *Review of Economics Studies*, forthcoming.

Arenius, Pia and Maria Minniti, "Perceptual variables and nascent entrepreneurship," *Small business economics*, 2005, *24* (3), 233–247.

Autor, David H, Frank Levy, and Richard J Murnane, "The skill content of recent technological change: An empirical exploration," *The Quarterly journal of economics*, 2003, *118* (4), 1279–1333.

Babina, Tania, "Destructive Creation at Work: How Financial Distress Spurs Entrepreneurship," 2015.

Backus, David, Thomas Cooley, and Espen Henriksen, "Demography and low-frequency capital flows," *Journal of International Economics*, 2014, *92*, S94–S102.

Bergmann, Heiko and Rolf Sternberg, "The changing face of entrepreneurship in Germany," *Small Business Economics*, 2007, *28* (2-3), 205–221.

Bilbiie, Florin O, Fabio Ghironi, and Marc J Melitz, "Endogenous entry, product variety, and business cycles," *Journal of Political Economy*, 2012, *120* (2), 304–345.

Blanchflower, David and Andrew Oswald, "What Makes an Entrepreneur?," *Journal of Labor Economics*, 1998, *16* (1), 26–60.

Caliendo, Lorenzo and Esteban Rossi-Hansberg, "The Impact of Trade on Organization and Productivity," *The Quarterly Journal of Economics*, 2012, *127* (3), 1393–1467.

Chatterjee, Satyajit and Russell Cooper, "Entry and exit, product variety, and the business cycle," *Economic Inquiry*, 2014, *52* (4), 1466–1484.

Clementi, Gian Luca and Berardino Palazzo, "Entry, exit, firm dynamics, and aggregate fluctuations," *American Economic Journal: Macroeconomics*, 2016, *8* (3), 1–41.

Colonnelli, Emanuele and Mounu Prem, "Corruption and Firms: Evidence from Randomized Audits in Brazil," 2017. mimeo.

Delmar, Frédéric and Per Davidsson, "Where do they come from? Prevalence and characteristics of nascent entrepreneurs," *Entrepreneurship & regional development*, 2000, *12* (1), 1–23.

Devereux, Michael B, Allen C Head, and Beverly J Lapham, "Aggregate fluctuations with increasing returns to specialization and scale," *Journal of economic dynamics and control*, 1996, *20* (4), 627–656.

Dix-Carneiro, Rafael, "Trade liberalization and labor market dynamics," *Econometrica*, 2014, pp. 825–885.

Djankov, Simeon, Edward Miguel, Yingyi Qian, Gerard Roland, and Ekaterina Zhuravskaya, "Who are Russia's entrepreneurs?," *Journal of the European Economic Association*, 2005, *3* (2-3), 587–597.

Dube, Oeindrila and Juan F Vargas, "Commodity price shocks and civil conflict: Evidence from Colombia," *The Review of Economic Studies*, 2013, *80* (4), 1384–1421.

Engbom, Niklas, "Firm and Worker Dynamics in an Aging Labor Market," Technical Report, Working Paper 2017.

Evans, David S and Boyan Jovanovic, "An estimated model of entrepreneurial choice under liquidity constraints," *Journal of political economy*, 1989, *97* (4), 808–827.

_ **and Linda S Leighton**, "Some empirical aspects of entrepreneurship," *The American Economic Review*, 1989, *79* (3), 519–535.

Gagnon, Etienne, Benjamin Kramer Johannsen, and J David Lopez-Salido, "Understanding the New Normal: the role of demographics," 2016.

Gathmann, Christina and Uta Schönberg, "How general is human capital? A task-based approach," *Journal of Labor Economics*, 2010, *28* (1), 1–49.

Gennaioli, Nicola, Rafael La Porta, Florencio Lopez de Silanes, and Andrei Shleifer, "Human capital and regional development," *The Quarterly journal of economics*, 2012, *128* (1), 105–164.

_ , Ron S Jarmin, and Javier Miranda, "Who creates jobs? Small versus large versus young," *Review of Economics and Statistics*, 2013, *95* (2), 347–361.

Hamilton, Barton, "Does Entrepreneurship Pay? An Empirical Analysis of the Returns to Self-Employment," *Journal of Political Economy*, 2000, *108* (3), 604–631.

Hombert, Johan, Antoinette Schoar, David Sraer, and David Thesmar, "Can Unemployment Insurance Spur Entrepreneurial Activity?," Working Paper 20717, National Bureau of Economic Research November 2014.

Humphries, John Eric, "The Causes and Consequences of Self-Employment over the Life Cycle," Technical Report, Mimeo, University of Chicago 2016.

Hurst, Erik and Annamaria Lusardi, "Liquidity Constraints, Household Wealth, and Entrepreneurship," *Journal of Political Economy*, 2004, *112* (2), 319 347.

Jaimovich, Nir and Henry E Siu, "The young, the old, and the restless: Demographics and business cycle volatility," *American Economic Review*, 2009, *99* (3), 804–26.

_ and Max Floetotto, "Firm dynamics, markup variations, and the business cycle," *Journal of Monetary Economics*, 2008, *55* (7), 1238–1252.

Jones, Benjamin F, "Age and great invention," *The Review of Economics and Statistics*, 2010, *92* (1), 1–14.

Kerr, Sari, William R Kerr, and Ramana Nanda, "House money and entrepreneurship," Technical Report, National Bureau of Economic Research 2015.

Kihlstrom, Richard E. and Jean-Jacques Laffont, "A General Equilibrium Entrepreneurial Theory of Firm Formation Based on Risk Aversion," *Journal of Political Economy*, 1979, *87* (4), 719–748.

Kopecky, Joseph Victor, "An aging dynamo: demographic change and the decline of entrepreneurial activity in the United States," 2017.

Lazear, Edward, "Entrepreneurship," *Journal of Labor Economics*, 2005, *23* (4), 649–680.

Lazear, Edward P, "Balanced skills and entrepreneurship," *The American Economic Review*, 2004, *94* (2), 208–211.

Levesque, Moren and Maria Minniti, "The effect of aging on entrepreneurial behavior," *Journal of Business Venturing*, 2006, *21* (2), 177–194.

Levine, Ross and Yona Rubinstein, "Smart and illicit: who becomes an entrepreneur and do they earn more?," *The Quarterly Journal of Economics*, 2017, *132* (2), 963–1018.

Liang, James, Hui Wang, and Edward P Lazear, "Demographics and entrepreneurship," Technical Report, National Bureau of Economic Research 2014.

Lucas, Robert E., "On the Size Distribution of Business Firms," *The Bell Journal of Economics*, 1978, *9* (2), 508–523.

Lucas, Robert E, "On the mechanics of economic development," *Journal of monetary economics*, 1988, *22* (1), 3–42.

Menezes-Filho, Naércio Aquino, Marc-Andreas Muendler, and Garey Ramey, "The Structure of Worker Compensation in Brazil, with a Comparison to France and the United States," 2008, *90* (2), 324–346.

_ **and** _ , "What explains the 2007–2009 drop in employment?," *Econometrica*, 2014, *82* (6), 2197–2223.

Miller, Joan G, "Culture and the development of everyday social explanation.," *Journal of personality and social psychology*, 1984, *46* (5), 961.

Miller, Robert A, "Job matching and occupational choice," *Journal of Political Economy*, 1984, *92* (6), 1086–1120.

Moskowitz, Tobias J. and Annette Vissing-Jorgensen, "The Returns to Entrepreneurial Investment: A Private Equity Premium Puzzle?," *American Economic Review*, September 2002, *92* (4), 745–778.

Muendler, Marc-Andreas, Jennifer Poole, Garey Ramey, and Tamara Wajnberg, "Job Concordances for Brazil: Mapping the Classificaçao Brasileira de Ocupaçoes (CBO) to the International Standard Classification of Occupations (ISCO-88)," *University of California, San Diego, unpublished manuscript*, 2004.

Parker, Simon C, *The economics of entrepreneurship*, Cambridge University Press, 2018.

Pugsley, Benjamin W and Aysegul Sahin, "Grown-up business cycles," 2015.

PwC, "Agribusiness in Brazil: an overview," 2013.

Quadrini, Vincenzo, "The importance of entrepreneurship for wealth concentration and mobility," *Review of income and Wealth*, 1999, *45* (1), 1–19.

Reynolds, Paul Davidson and Sammis B White, *The entrepreneurial process: Economic growth, men, women, and minorities*, Praeger Pub Text, 1997.

Rotefoss, Beate and Lars Kolvereid, "Aspiring, nascent and fledgling entrepreneurs: An investigation of the business start-up process," *Entrepreneurship & Regional Development*, 2005, *17* (2), 109–127.

Sedlácek, Petr, "Lost generations of firms and aggregate labor market dynamics," Technical Report, Tech. rep., WP 2014.

Sedláček, Petr and Vincent Sterk, "The growth potential of startups over the business cycle," *American Economic Review*, 2017, *107* (10), 3182–3210.

Sedlacek, Petr, Benjamin Pugsley, Vincent Sterk et al., "The Nature of Firm Growth," in "2017 Meeting Papers" number 196 Society for Economic Dynamics 2017.

Stroebel, Johannes and Joseph Vavra, "House prices, local demand, and retail prices," Technical Report, National Bureau of Economic Research 2014.

Uusitalo, Roope, "Homo entreprenaurus?," *Applied economics*, 2001, *33* (13), 1631–1638.

Wagner, Joachim, "Are nascent entrepreneurs "Jacks-of-all-trades"? A test of Lazear's theory of entrepreneurship with German data," *Applied Economics*, 2006, *38* (20), 2415–2419.

Figure 1
Spatial Distribution of Commodities (in 2000)
The map shows the cross sectional variation in the value of crop production relative to the GDP at the municipality level. Darker shades of blue indicate municipalities where crops are more relevant.

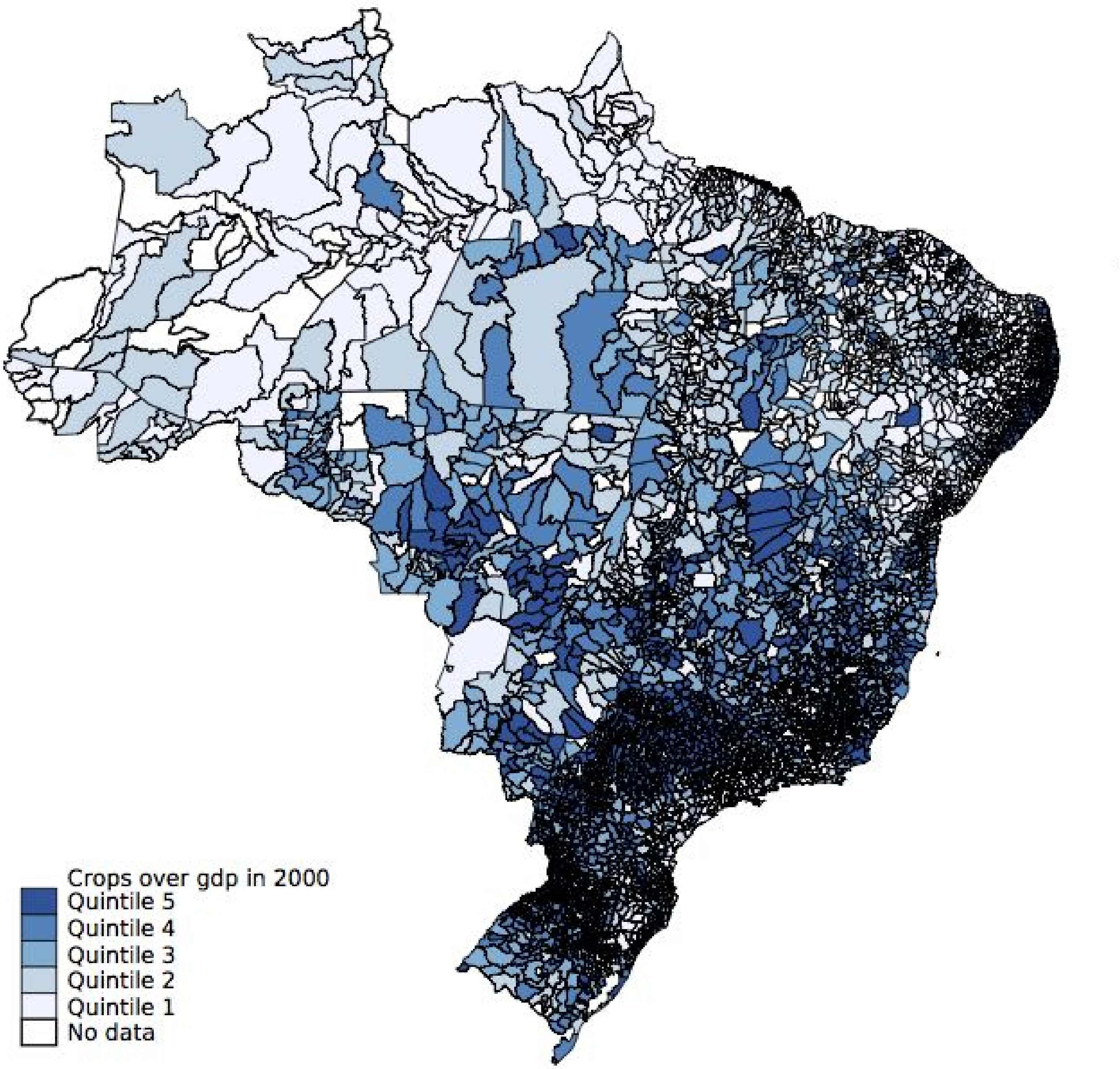


Figure 2
Residualized Crops Index

The graph captures the variation in the value of municipalities endowment, as captured by Crops Index (CI) and defined in the paper. The plotted variable is the residual from a regression of value of crops on municipality and year fixed effects. The thin grey lines are time series of these residuals for a 10% random sample of all the municipalities in our sample. The solid lines are median (solid line), tenth and ninetith percentiles (dashed lines) of the distribution of residuals in each year.

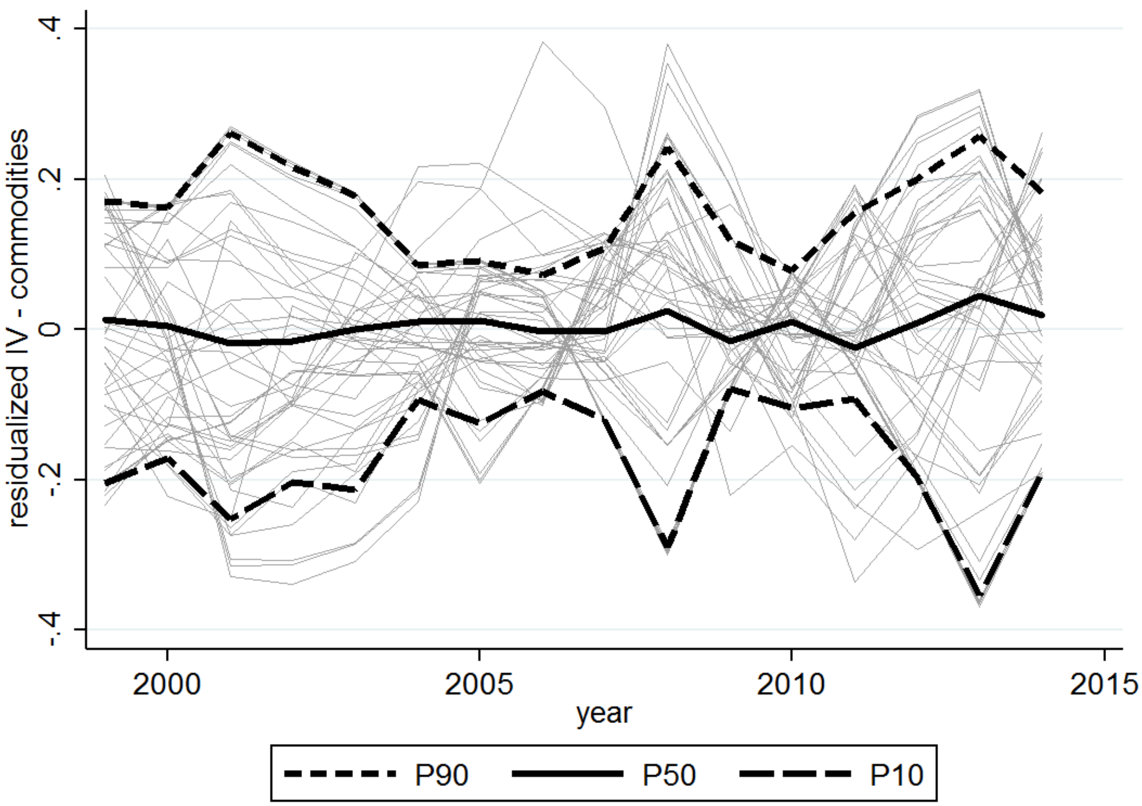


Figure 3

Entrepreneurial Response by Age Group

The coefficients reported in the graphs are estimates of β_n from the model $T_{injt} = \alpha_{nj} + \delta_{nt} + \beta_n \cdot Z_{jt} + \varepsilon_{injt}$ estimated on different age quintiles n. An observation in the model is an individual i, in age quintile n, municipality j and year t. Age quintiles are computed within municipality-year groups. The 95% confidence intervals are obtained from standard erros clustered at the municipality level. The magnitudes of the coefficients are in per-thousand points (e.g. the first coefficient in the figure means that the share of marginal entrepreneurs is 0.4 per-thousand individuals; the share of entrepreneurs in the data is 3 per-thousand).

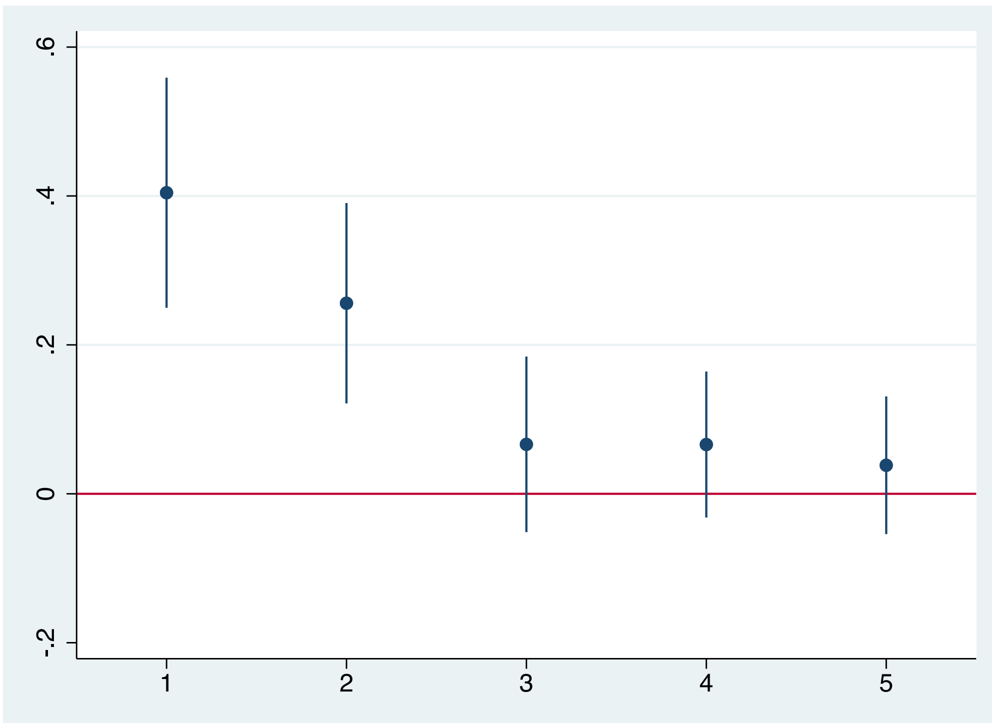


Figure 4

Age Profiles of Compliers, Average Entrepreneurs and Population

The conditional probabilities reported in the graphs are obtained directly from the data on the full population ($P(X)$) or obtained from estimates of β_n from the model $T_{injt} = \alpha_{nj} + \delta_{nt} + \beta_n \cdot Z_{jt} + \varepsilon_{injt}$ estimated on different age terciles. An observation in the model is an individual i, in subsample n, municipality j and year t. T is a dummy for being an entrepreneur, α and δ are municipality and time fixed effects, Z_{jt} is the shock to the commpodity index. Age ranks are computed over the entire population. $P(X|Complier)$ is obtained as the ratio β_n/β multiplied by the relevant $P(X)$: it measures the probability that an individual is in the relevant age group conditional on being a complier. $P(X|Entrepreneur)$ is obtained directly from the data.

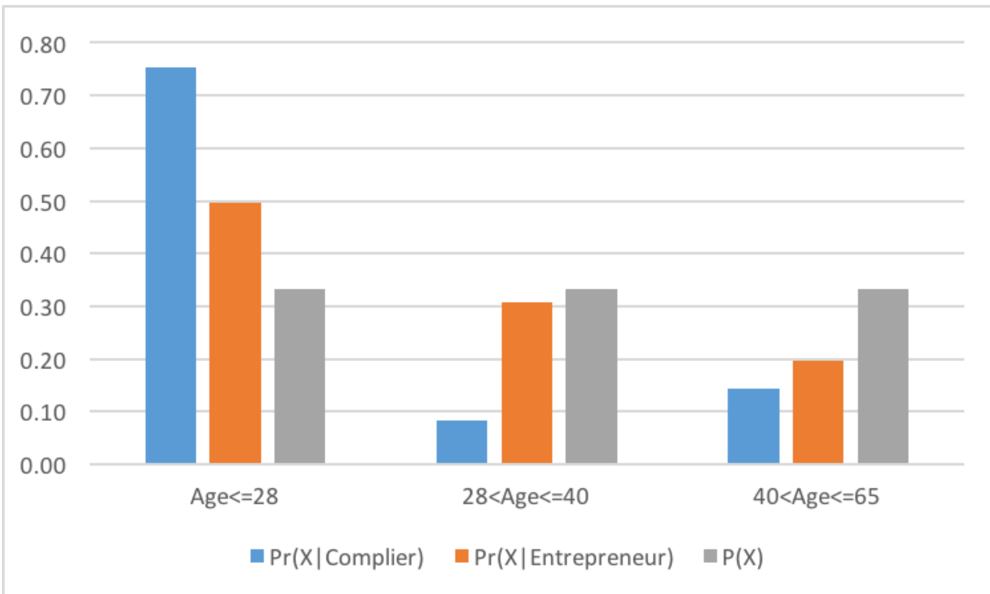


Table 1
Summary Statistics

This table reports summary statistics on the main data sources. Panel A describes sector level data. These data are build from the individual level RAIS dataset, and observations refers to the period 1998-2014, for municipalities with less than 500,000 people, and averaged across years. For each industry we report number of firms, employees and new firms, and their shares relative to the full sample. Panel B describes municipality level data. These data are built from the individual level RAIS dataset, and other sources described in the main text, and observations refers to the period 1998-2014, for municipalities with less than 500,000 people, and pooled at the municipality level. Some of the financial data is only available for a subset of the years and municipalities. Panel C describes the new firms in our data. These data are built from the RAIS data set and represent a cross section of new firms similarly obtained by pooling together data from the period 1998-2014. Panel D describes all the workers in a 5% sample of our data. This information is obtained from the RAIS individual data set, and observations refers to the period 1998-2014, for municipalities with less than 500,000 people, and excluding individuals who migrate from one municipality to another. Similarly, in Panel E we report statistics for the entrepreneurs in the same 5% sample.

Panel A: Industry Composition - Annual Data

	Share of Firms	Share of Employees	Share of New Firms
Agirculture/Mining	0.019	0.053	0.015
Manufacturing	0.153	0.325	0.122
Non-tradable	0.544	0.277	0.543
Transportation/Utilities/Commodities	0.054	0.062	0.057
Services	0.203	0.204	0.220

Panel B: Municipality Composition - Annual Data

	Obs.	Mean	SD	Median
RAIS				
# Firms	80,481	237.917	677.053	47
# Employees	80,481	3143.572	10783.486	342
# New Firms	80,481	32.909	89.746	7
# Hiring	80,481	1279.777	4538.89	129
# Separations	80,481	1164.287	4180.542	111
Other Data Sources				
Population	80,481	24122.059	45640.632	10914
GDP per capita (2000 US)	80,481	3093.78	3764.037	2217.473
Value of Commodities / GDP	80,481	0.867	2.521	0.126
Value of Commodities / Population	80,481	2926.984	10038.188	272.156
Total credit	50,282	20.794	97.986	4.129
Total BNDES credit	39,534	2.758	17.118	0.228

Table 2
(Continued)

Panel C: New Firms - Annual Data				
	Obs.	Mean	SD	Median
# Years survivorship	6,820,760	6.86	6.236	5
Employment at year of entry	6,820,760	7.984	251.707	2
Employment 2 years after entry	4,304,322	14.334	330.808	3
Employment 5 years after entry	2,685,616	18.967	426.648	4
Employment 10 years after entry	1,427,901	26.498	546.994	5

Panel D: Individuals Composition - Annual Data				
	Obs.	Mean	SD	Median
Years of Education	11884935	11.45	3.18	12
Male dummy	11884935	0.608	0.488	1
Blue collar worker	11884935	0.48	0.5	0
White collar worker	11884935	0.416	0.493	0
Manager	11884935	0.036	0.187	0
General skill set	11884935	0.193	0.395	0

Panel E: Founders Composition - Annual Data				
	Obs.	Mean	SD	Median
Years of Education	34,508	12.113	2.066	12
Male dummy	34,508	0.57	0.495	1
Blue collar worker in last job	34,508	0.402	0.49	0
White collar worker in last job	34,508	0.5	0.5	1
Manager in last job	34,508	0.045	0.206	0
Generalist in last job	34,508	0.205	0.404	0

Table 3
Aggregate Results

This table reports the estimated effect of changes in the value of crops on several outcomes. All the outcomes are obtained starting from the RAIS data aggregated at the municipality level. The data span the period 1998-2014. The treatment variable is the local endowment shock, obtained as a dummy that equals 1 for municipality j in year t if the local agricultural endowment in municipality j is in the top 10th percentile change in the price distribution in year t relative to the municipality mean, and equals zero otherwise. All specifications include controls for log-population, year dummies and municipality fixed effects. Standard errors are clustered by municipality. *,**, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)
	Total Employment	Total Income	Number Firms	Number New firms	Number Closures
Treatment	0.041***	0.029***	0.037***	0.026***	-0.004
	(0.009)	(0.010)	(0.005)	(0.007)	(0.007)
Year FE	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Observations	78,409	78,409	78,409	71,713	65,244
R-squared	0.426	0.499	0.667	0.238	0.362
Municipalities	5,431	5,431	5,431	5,416	5,393

Table 4
Aggregate Results by Sector

This table reports the estimated effects of changes in the value of crops on the share of new firm creation in different sectors. All the outcomes are obtained starting from the RAIS data aggregated at the municipality level. The value of crops is built from different sources as described in the main text. The treatment variable is the local endowment shock, obtained as a dummy that equals 1 for municipality j in year t if the local agricultural endowment in municipality j is in the top 10th percentile change in the price distribution in year t relative to the municipality mean, and equals zero otherwise. The data span the period 1998-2014. Standard errors are clustered by municipality. *,**, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: By Sector - Employment

	(1)	(2)	(3)	(4)
	Agriculture / Mining	Manufacturing	Non-tradable	Services
Treatment	0.084***	0.025*	0.040***	-0.000
	(0.020)	(0.014)	(0.009)	(0.014)
Year FE	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Observations	53,142	66,067	77,323	64,730
R-squared	0.050	0.177	0.520	0.243
Municipalities	4,649	5,078	5,430	5,198

Panel B: By Sector - Number of Firms

	(1)	(2)	(3)	(4)
	Agriculture / Mining	Manufacturing	Non-tradable	Services
Treatment	0.008	0.007	0.055***	-0.006
	(0.008)	(0.006)	(0.006)	(0.007)
Year FE	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Observations	53,142	66,067	77,323	64,730
R-squared	0.050	0.177	0.520	0.243
Municipalities	4,649	5,078	5,430	5,198

Table 5

New Firms - Ex-Post Outcomes

This table reports the estimated effectsof changes in the value of crops on the outcomes of new firms created. The value of crops is built from different sources as described in the main text. The treatment variable is the local endowment shock, obtained as a dummy that equals 1 for municipality j in year t if the local agricultural endowment in municipality j is in the top 10th percentile change in the price distribution in year t relative to the municipality mean, and equals zero otherwise. The data span the period 1998-2010. In columns (1)-(2) the dependent variable is a dummy that takes value one if the new firm survived more than 3 or 5 years, and takes value 0 otherwise. In columns (3)-(4) the dependent variable takes value 1 if the new firm has more than 3 or 5 employees five years after it was created. In column (5) the dependent variable is a dummy variable that equals to 1 if the firm was incorporated. Standard errors are clustered by municipality. *,**, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)
	$Survive \geq 3$	$Survive \geq 5$	$Employment \geq 3$	$Employment \geq 5$	*Incorporated*
Treatment	0.007***	0.006***	0.004**	0.003*	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Year FE	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Observations	2,503,842	2,503,842	2,503,842	2,503,842	2,503,842
R-squared	0.0071	0.0073	0.0122	0.0196	0.0465
Municipalities	5,416	5,416	5,416	5,416	5,416

Table 6
Young Responsiveness

This table reports the estimated effects of changes in the value of crops on the likelihood of observing a new entrepreneur. The value of crops is built from different sources as described in the main text. The treatment variable is the local endowment shock, obtained as a dummy that equals 1 for municipality j in year t if the local agricultural endowment in municipality j is in the top 10th percentile change in the price distribution in year t relative to the municipality mean, and equals zero otherwise. The data span the period 1999-2014. Column (1) captures the average response. Columns (2) to (6) show that young blasilians (those in the lower quartile of the age distribution) are the one who responds to the shock. Standard errors are clustered by municipality. *,**, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Founder	Founder	Founder	Founder	Founder	Founder	Founder
Treatment	0.179***	0.176***	0.0773	0.0813	0.0779	0.0794	0.0809
	(0.0630)	(0.0613)	(0.0645)	(0.0648)	(0.0648)	(0.0648)	(0.0647)
Treatment X Young			0.363**	0.358**	0.365**	0.366**	0.366**
			(0.159)	(0.159)	(0.159)	(0.159)	(0.159)
High School					1.86***	1.85***	1.74***
					(0.0407)	(0.0407)	(0.0406)
> High School					1.15***	1.13***	.882***
					(0.0478)	(0.0475)	(0.0486)
Generalist						0.552***	0.463***
						(0.0459)	(0.0467)
White Collar							.678***
							(0.047)
Year	Y	Y	Y	Y	Y	Y	Y
Municipality	Y	Y	Y	Y	Y	Y	Y
Municipality X Age Bottom Quart.	N	Y	Y	Y	Y	Y	Y
Sector	N	N	N	Y	Y	Y	Y
Observations (mil)	11.919	11.919	11.919	11.919	11.919	11.919	11.919

Table 7
Heterogeneity Within Municipalities (A)

This table reports the estimated effects of changes in the value of crops on the likelihood of observing a new entrepreneur among different subsets of the young population (those in the lowest quartile of the age distribution) and the old populations (those in the highest three quartiles). The treatment variable is the local endowment shock, obtained as a dummy that equals 1 for municipality j in year t if the local agricultural endowment in municipality j is in the top 10th percentile change in the price distribution in year t relative to the municipality mean, and equals zero otherwise. Standard errors are clustered by municipality. *,**, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A - Young Population								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Founder	Founder	Founder	Founder	Founder	Founder	Founder	Founder
Treatment	1.137***	0.035	.754**	.308**	.515**	.309**	.469***	.153
	(0.445)	(0.215)	(0.302)	(0.145)	(0.236)	(0.145)	(.157)	(.202)
Partition	Non-routine Cognitive		Generalist		White Collar		Education	
Partition Criteria	Yes	No	Yes	No	Yes	No	>=HS	<HS
Municipality FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations (mil)	0.431	1.597	0.623	2.671	1.484	1.810	2.67	0.622

Panel B - Old Population								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Founder	Founder	Founder	Founder	Founder	Founder	Founder	Founder
Treatment	.0424	.0957	.135	.0806	.12	.0794	.0903	.0878
	(.213)	(.13)	(.142)	(.0621)	(.103)	(.0757)	(.0716)	(.082)
Partition	Non-routine Cognitive		Generalist		White Collar		Education	
Partition Criteria	Yes	No	Yes	No	Yes	No	>=HS	<HS
Municipality FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations (mil)	1.105	3.093	1.679	6.946	3.481	5.144	3.148	5.477

Table 8
Heterogeneity Within Municipalities (B)

This table reports the estimated effects of changes in the value of crops on the likelihood of observing a new entrepreneur among different subsets of the young population (those in the lowest quartile of the age distribution) and the old populations (those in the highest three quartiles). The treatment variable is the local endowment shock, obtained as a dummy that equals 1 for municipality j in year t if the local agricultural endowment in municipality j is in the top 10th percentile change in the price distribution in year t relative to the municipality mean, and equals zero otherwise. Standard errors are clustered by municipality. *,**, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A - Young Population

	(1)	(2)	(3)	(4)	(5)	(6)
	Founder	Founder	Founder	Founder	Founder	Founder
Treatment	0.483***	0.198	0.571***	0.21	0.477**	0.307
	(0.152)	(0.273)	(0.193)	(0.187)	(0.188)	(0.187)
Partition	Pay growth		Experience		Accumulated Income	
Partition Criteria	>median	<median	>median	<median	>median	<median
Municipality FE	Y	Y	Y	Y	Y	Y
Observations (mil)	1.671	1.622	1.665	1.628	1.665	1.628

Panel B - Old Population

	(1)	(2)	(3)	(4)	(5)	(6)
	Founder	Founder	Founder	Founder	Founder	Founder
Treatment	0.0566	0.127	0.0315	0.152	0.0266	0.158
	(0.0679)	(0.0951)	(0.0666)	(0.0953)	(0.0669)	(0.0973)
Partition	Pay growth		Experience		Accumulated Income	
Partition Criteria	>median	<median	>median	<median	>median	<median
Municipality FE	Y	Y	Y	Y	Y	Y
Observations (mil)	4.332	4.293	4.293	4.293	4.293	4.293

Table 9

Heterogeneity Across Municipalities

This table estimates how the sensitivity to the shock changes across municipalities with different levels of access to finance in the municipality in the first year in which they are observed. Data are obtained from the Brazilian Central Bank datasets (Banco Central do Brasil, BCB) and the BNDES. The measure of sensitivity is λ_j, estimated from the model $T_{ijt} = \alpha_j + \delta_t + \lambda_j \cdot Z_{jt} + \varepsilon_{ijt}$. λ_j measures the municipality level increase in the likelihood of observing a new entrepreneur in response to the shock Z_{jt}. T is a dummy for being an entrepreneur, α and δ are municipality and time fixed effects, $Z_{jt}$is the shock to the commpodity index. The reported regressions refer to the model $\hat{\lambda}_j = \delta\hat{\alpha}_j + \theta F_j + \gamma X + \mu_j$, where $\hat{\alpha}_j$ is the estimated municpality fixed effect from the previous model, F_j is the measure of access to finance reported on the row *Factor Variable*. Standard errors are clustered by municipality. *,**, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A - Access to Finance					
	(1)	(2)	(3)	(4)	(5)
	Municipality Response ($\hat{\lambda}$)	Municipality Response ($\hat{\lambda}$)	Municipality Response ($\hat{\lambda}$)	Municipality Response ($\hat{\lambda}$)	Municipality Response ($\hat{\lambda}$)
Factor (F)	0.521***	0.42***	0.0251***	0.063***	0.0643***
	(0.0858)	(0.056)	(0.0089)	(0.0063)	(0.0059)
Factor Variable	Banks	Bank Branches	Government Funding	Total credit Small businesses	Total Deposits
Controls	Y	Y	Y	Y	Y
Observations	4864	4864	4609	5099	5099

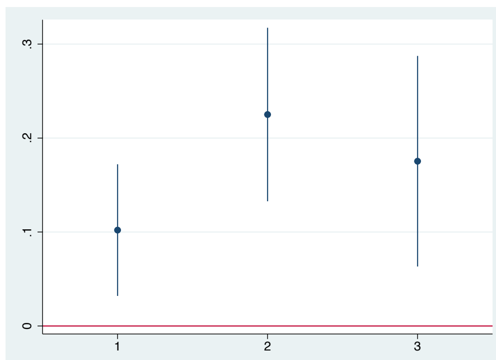
Panel B - Spillovers					
	(1)	(2)	(3)	(4)	(5)
	Municipality Response ($\hat{\lambda}$)	Municipality Response ($\hat{\lambda}$)	Municipality Response ($\hat{\lambda}$)	Municipality Response ($\hat{\lambda}$)	Municipality Response ($\hat{\lambda}$)
Factor (F)	-1.05***	0.201***	0.123***	0.0433**	0.344***
	(0.233)	(0.0503)	(0.044)	(0.0214)	(0.0283)
Factor Variable	Age	Generalists	White Collar	Founders	Employees in New Firms
Controls	Y	Y	Y	Y	Y
Observations	4899	4899	4899	4899	5099

Appendix

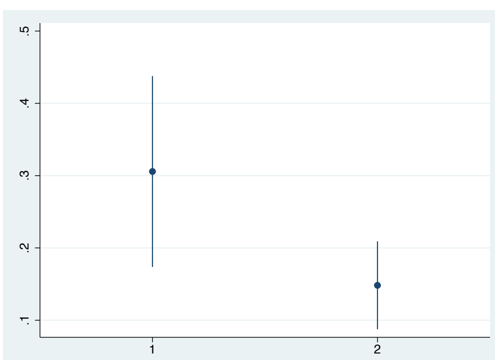
Figure A.1
Entrepreneurial Response Across Different Observable Characteristics

The coefficients reported in the graphs are estimates of β_n from the model $T_{injt} = \alpha_{nj} + \delta_{nt} + \beta_n \cdot Z_{jt} + \varepsilon_{injt}$ estimated on different subsamples. An observation in the model is an individual i, in subsample n, municipality j in year t. Subsamples: Panel (a) education levels (1 less than high school, 2 high school, 3, more than high school), Panel (b) type of occupation in $t-1$ (1 generalist occupation, 2 non generalist occupation), Panel (c) wealth quintiles, Panel (d) average pay growth between $t-4$ and $t-1$ quintiles, Panel (e) experience quintiles up to year $t-1$. All ranks are computed withing municipality-year group. The 95% confidence intervals are obtained from standard erros clustered at the municipality level. The magnitudes of the coefficients are in per-thousand points (e.g. the first coefficient of 0.4 in Panel (a) means that the share of marginal entrepreneurs is 0.4 per-thousand individuals; notice that the share of entrepreneurs in the data is 3 per-thousand).

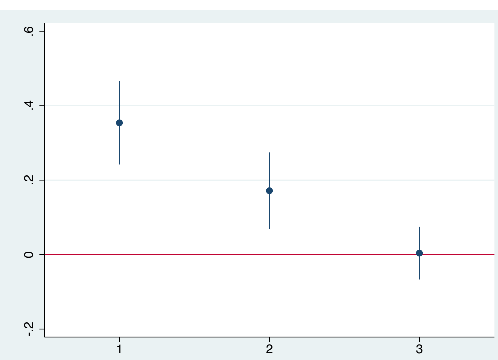
(a) **Education**



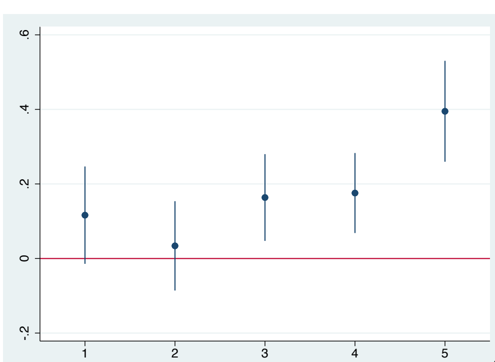
(b) **Generalist**



(c) **Wealth level rank**



(d) **Pay growth rank**



(e) **Experience Rank**

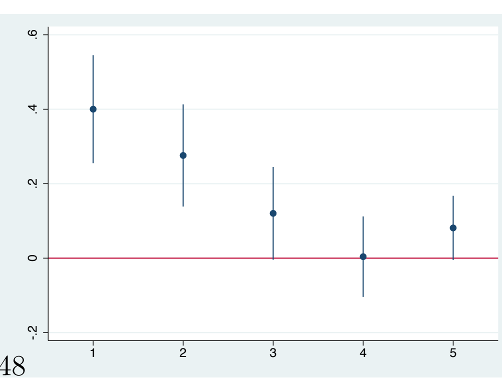
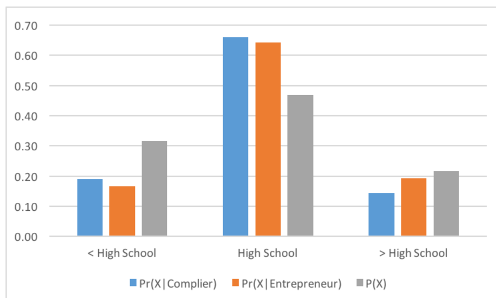


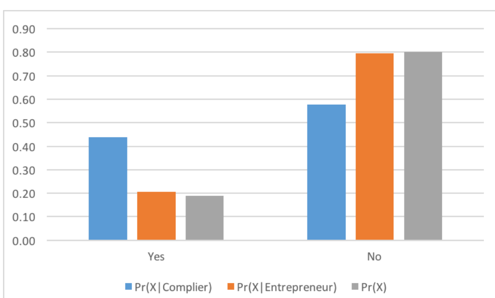
Figure A.2
Comparison Between Compliers and Average Entrepreneurs

The conditional probabilities reported in the graphs are obtained directly from the data on the full population ($P(X)$) or obtained from estimates of β_n from the model $T_{injt} = \alpha_{nj} + \delta_{nt} + \beta_n \cdot Z_{jt} + \varepsilon_{injt}$ estimated on different subsamples. An observation in the model is an individual i, in subsample n, municipality j in year t. T is a dummy for being an entrepreneur, α and δ are municipality and time fixed effects, $Z_{jt}$is the shock to the commpodity index. Subsamples: Panel (a) education levels (1 less than high school, 2 high school, 3, more than high school), Panel (b) type of occupation in $t-1$ (1 generalist occupation, 2 non generalist occupation), Panel (c) wealth quintiles, Panel (d) average pay growth between $t-4$ and $t-1$ quintiles, Panel (e) experience quintiles up to year $t-1$. All ranks are computed withing municipality-year group. Specifically, $P(X|Complier)$ is obtained as the ratio β_n/β multiplied by the relevant $P(X)$. It measures the probability that an individual belongs to the relevant category conditional on being a complier marginal entrepreneur. $P(X|Entrepreneur)$ is obtained directly from the data.

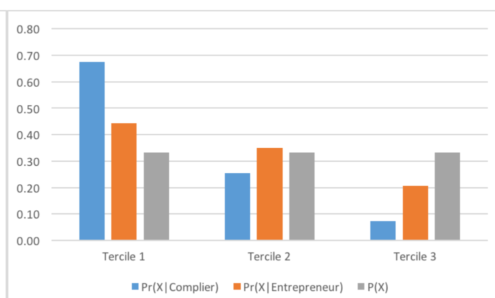
(a) **Education**



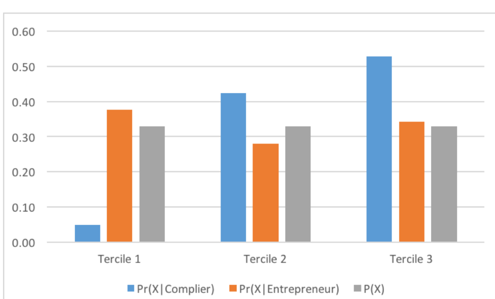
(b) **Generalist**



(c) **Wealth level rank**



(d) **Pay growth rank**



(e) **Experience Rank**

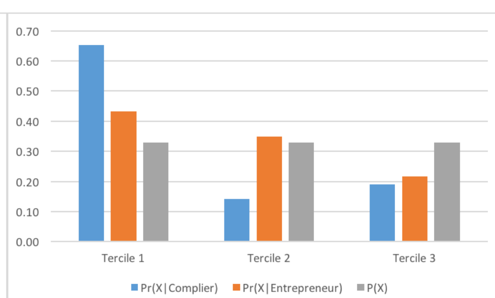


Table A.1
Agricultural Endowments Across Municipalities

This table provides a break down of agricultural crops and the number of municipalities in which they are being produced. The table also provide information on average value of these crops in 2000.

Crops	Total Municipalities	Total Value (USD Billions)
Sugarcanes	3529	204.38
Total Coffee	2030	9.87
Soybeans	1495	9.26
Maize	5003	3.67
Rice	4045	2.43
Cotton	1210	2.06
Tobaccos	973	2.05
Yerba mate	541	1.05
Cocoa	278	0.57
Wheat	815	0.32
Rubber	421	0.09
Sorghums	375	0.07
Indiantea	7	0.06
Orange	3763	0.05
Barley	183	0.03
Oatmeal	411	0.01
Banana	3870	0.01

Table A.2

Aggregate Results with Continuous Treatment

This table estimates the effect of changes in the value of crops on several outcomes. All the outcomes are obtained starting from the RAIS data aggregated at the municipality level. The value of crops is built from different sources as described in the main text. Both the dependent variables and the indepenedent variable of interest are logged so that the coefficient of interest can be interpreted as an elasticity. The data span the period 1999-2014. Panel A collects results that refer to firms: the number of firms, number of new firms, number of firm closures and firm churm at the municipality level. Panel B collects results that refer to employment levels and payrolls. Panel C collects results that refer to employmwent flows (hiring, separations and churn). Standard errors are clustered by municipality. *,**, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
		New	Firm	Firm
	Firms	Firms	Closures	Churn
Treatment	0.126***	0.068***	-0.014	0.062***
	(0.014)	(0.015)	(0.017)	(0.015)
Year FE	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Observations	78,409	71,713	65,244	73,843
R-squared	0.668	0.238	0.362	0.353
Municipalities	5,431	5,416	5,393	5,421