Financial Constraints and Entrepreneurship: Evidence from Unemployment Insurance[*]

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Abstract

We study the effect of financial constraints on entrepreneurship using administrative data on a public program that allows Portuguese unemployed workers to collect the full amount of their unemployment benefits upfront in order to start a business. Exploiting age-based discontinuities in the amount of benefits, we find that an extra one thousand euros of funding increases entrepreneurship by 0.16 percentage points. The effect is stronger for incorporated entrepreneurs, especially for those in the top decile of the income distribution before unemployment. In addition, we find that the effect is more pronounced in the top quintile of the size distribution across all businesses and in the middle of the size, growth and profitability distributions among incorporated businesses. Our findings suggest that financial constraints hamper growth-oriented entrepreneurship.

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1 Introduction

Financial constraints are among the most common obstacles to new business creation cited by potential entrepreneurs and targeted by policy makers. Yet evidence that such constraints affect entrepreneurship is mixed. It has long been known that personal wealth and entrepreneurship are positively correlated (Evans and Jovanovic, 1989; Evans and Leighton, 1989), but this correlation could be driven by differences in ability or preferences, such as lower risk aversion, rather than access to finance (Hurst and Lusardi, 2004). Other studies investigate how entrepreneurship responds to financial sector reforms (Black and Strahan, 2002) or to changes in house prices (Adelino, Schoar, and Severino, 2015; Schmalz, Sraer, and Thesmar, 2017), but a key issue when exploiting such aggregate shocks is how to separate the effect of financial constraints from that of local demand and other general equilibrium effects (Kerr, Kerr, and Nanda, 2019).

In addition to these identification challenges, a growing body of research emphasizes the differences between entrepreneurs who have the skills and the desire to grow their businesses, and those who do not (La Porta and Shleifer, 2008; Schoar, 2010; Hurst and Pugsley, 2011; Levine and Rubinstein, 2016). While the latter account for the majority of businesses created, it is the former that are frequently associated with a key role in job creation (Murphy, Shleifer, and Vishny, 1991; Aghion and Howitt, 1992). Previous empirical evidence on how financial constraints affect different types of entrepreneurs, however, is limited.

This paper investigates the effect of financial constraints on entrepreneurship using administrative data on a Portuguese public program named Single Amount ("Montante Único"), which allows any individual on unemployment insurance (UI) to collect the entire amount of their benefits upfront in order to start a business. Program participants cannot earn income from any source other than their business for a period of three years, otherwise they must repay the full amount received. Our empirical setting has three key advantages. First, we are able to exploit sharp age-based discontinuities in the duration of unemployment benefits to generate exogenous variation in the amount that potential entrepreneurs receive upfront. This ensures that our shock is uncorrelated with ability, wealth and other unobserved de-

terminants of entrepreneurship. Second, our results cannot be explained by local demand shocks as we rely on cross-individual variation only. Finally, we observe the characteristics of the entrepreneurs and ex-post performance of the businesses they create through the Single Amount program, which enables us to characterize how different types of entrepreneurs are affected.

Our data include the full population of unemployed workers in Portugal in the 2009-2012 period. The quality of entrepreneurs in our sample compares favorably, if anything, with the broader population of workers. Unemployed workers have higher pre-unemployment earnings than the overall workforce, and businesses created through the program are more likely to be incorporated than the average business.[1] The distribution of outcomes among incorporated businesses created through the program is similar to the overall population of incorporated businesses. Our sample is therefore well suited to study the impact of financial constraints on different types of entrepreneurs.

The amount that potential entrepreneurs can access through the program equals €11,600 on average in our sample, and it increases discontinuously at age 30, at age 40 and at age 45. We exploit the exogenous increases around these age cutoffs using a regression discontinuity design. The average increase around the three age cutoffs equals €2,200, €2,700, and €4,400, respectively, and can exceed €12,000 depending on pre-unemployment earnings and experience. These increases in funding can affect a potential entrepreneur's ability to start a business, as the median initial funding (starting capital plus debt) for an incorporated firm in Portugal is €5,000. However, as shocks to expected wealth the increases in funding around the cutoffs are probably too small to lower risk aversion or increase the preference for "being one's own boss' (Hurst and Lusardi, 2004), especially since entrepreneurs must pay back the full amount received if they return to paid employment within three years in case their business fails. Thus, any increase in entrepreneurship around the age cutoffs is likely to be driven

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[1]Our sample period includes the 2010-2011 European sovereign debt crisis. Portugal was under a Financial Assistance Program by the European Commission, the International Monetary Fund (IMF) and the ECB (jointly, the Troika) between 2011 and 2014, and the unemployment rate rose to 16% during this period. The pool of unemployed workers during our sample period may therefore not be representative of unemployed workers at other moments in time.

by financial constraints, rather than preferences.

To validate our identification strategy, we first show that the age density and average pre-unemployment earnings are continuous around the age cutoffs, which indicates there is no strategic manipulation of the timing of unemployment in order to benefit from the increased amounts around the age cutoffs.

We find that the fraction of unemployed workers who start a business by collecting up-front payments through the Single Amount program increases discontinuously around each of the three age cutoffs. Instrumenting the amount that potential entrepreneurs are entitled to receive with these cutoffs, we find that an extra one thousand euros of funding significantly increases the rate of entrepreneurship by 0.16 percentage points. The unconditional probability of becoming an entrepreneur through the program is 1.2%. Thus, the estimate corresponds to a 13% increase in the probability of becoming an entrepreneur. The effect is economically significant and approximately linear in the amount. Our baseline estimate is robust when we add several controls and use different methods to fit the trends on either side of the age cutoffs.

We then examine how different types of entrepreneurs respond to the program using the same research design. We first focus on the legal form of the business. Levine and Rubinstein (2016) show that incorporation is a good proxy for growth-oriented entrepreneurship. As in other countries, incorporated businesses in Portugal enjoy limited liability but pay higher taxes and face heavier regulation.[2] Incorporated businesses are therefore more likely to be chosen by entrepreneurs undertaking projects with higher growth potential. On the one hand, entrepreneurs with higher potential projects may be better able or more motivated to obtain the necessary funding from their own savings or other sources. On the other hand, their funding needs are likely to be higher. We find that the effect on incorporated businesses is twice as strong as for unincorporated businesses. An extra one thousand euros of funding increases the likelihood of creating an incorporated business by 0.24 percentage points, which corresponds

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[2]The main differences are that incorporated businesses do not benefit from VAT exemptions, cannot be taxed at personal income tax rates and must submit annual financial statements certified by a chartered accountant.

to a 20% increase in the probability of becoming an entrepreneur, versus 0.11 percentage points for an unincorporated business. These findings suggest that financial constraints can impact the creation of growth-oriented businesses.

Next, we study the effect for different levels of income before unemployment. Higher pre-unemployment income could proxy for entrepreneurial potential for two reasons. First, it may capture individual characteristics that are valuable for entrepreneurs, such as education, ability or ambition to grow. Second, individuals with a better outside option in the labor market may be more selective about the entrepreneurial opportunities they pursue. We find that the effect of the program is stronger for entrepreneurs in the top of the income distribution before unemployment *and* incorporate their businesses. In fact, the effect on incorporated entrepreneurs in the top decile of the income distribution is nearly four times larger than our baseline estimate. In contrast, among unincorporated entrepreneurs, the effect is weaker at the top of the income distribution. These results are consistent with the notion that financial constraints disproportionately affect higher potential entrepreneurs.

The legal form of the business and pre-unemployment earnings are ex-ante measures of entrepreneurial quality. We next turn to ex-post measures of entrepreneurial performance. (Evans and Jovanovic, 1989) show that the effect of changes in financial constraints on the distribution of outcomes conditional on entry is ambiguous. If financially constrained workers select between entrepreneurship and paid employment as a function of their relative ability in the two occupations and their ability to invest, then access to additional funding has two effects. First, it induces entry by marginal entrepreneurs who would have otherwise selected into paid employment, which may lower average entrepreneurial performance. Second, it increases investment capacity for infra-marginal entrepreneurs who would have entered in any case, which may improve average performance. Rather than conditioning on entry, we focus on the effect of financial constraints on the entry rate of entrepreneurs with different levels of ex-post performance. This allows us to characterize how financial constraints affect the creation of different types of businesses.

We focus primarily on outcomes at age four, when entrepreneurs are no longer obligated

to return the amount received if they choose to exit and pursue other job opportunities. We start with survival, which we observe for incorporated firms only. We find that the entry of firms who survive for at least four years increases by 0.24 percentage points for each extra thousand euros of funding, which is similar to our baseline estimate for the entry probability of incorporated businesses. This indicates that the effect is driven by viable businesses who survive beyond the end of the program.

Next, we find that the effect of financial constraints is strongest for the creation of businesses in the top quintile of the size distribution across all businesses (i.e., when we include both unincorporated and incorporated businesses). This is consistent with the stronger effect on the creation of incorporated businesses, which tend to be larger. We then further examine the effect within the distribution of outcomes for incorporated businesses, for whom we observe a wider set of performance measures. We find that the effect of the program is stronger for the creation of incorporated businesses in the middle of the distribution, rather than in the tails. Specifically, our point estimates are largest for businesses in the middle quintile of the distribution of sales, in the second quintile of the distribution of assets, and in the fourth quintile of the distributions of sales growth, earnings before interest and taxes (EBIT) and labor productivity. Thus, when we focus on incorporated firms, we find that the program promotes the creation of mid-performing firms but not necessarily of firms at the top of the distribution.

The lack of an effect at the top of the distribution of incorporated firms is of interest because of the weight of upper-tail firms on aggregate employment and output. However, this finding should be interpreted with care because upper tail firms, in particular those above the 90th percentile, are under-represented in the sample of firms created through the Single Amount program. This limits our ability to estimate an effect at the top of the distribution. One possibility is that the population of unemployed workers simply does not include high potential entrepreneurs, although their high pre-unemployment wages relative to the overall population of workers suggest otherwise. Another possibility is that the amounts available through the Single Amount program, and the increase in funding around age cutoffs, are

not enough to finance the creation of upper tail firms. This does not seem to be the case as the median initial funding for firms in the top quintile of sales at age 4 is €10,000 in the overall population, which is less than the average funding amount available through the Single Amount program. Still, we cannot rule out that lack of access to subsequent funding plays a role. Finally, high-growth entrepreneurs may have better access to other sources of funding or they may be willing to save more to take advantage of a high potential business opportunity.

Taken together, our findings suggest that financial constraints impair growth-oriented entrepreneurship. The effect of financial constraints is more pronounced for high-skill entrepreneurs, incorporated businesses and businesses at the top of the size distributions across all businesses. However, when we focus on incorporated businesses, financial constraints seem to primarily affect the creation of firms in the middle of the distribution, but not at the top of the distribution.

Our paper contributes to the literature on financial constraints and entrepreneurship (see Kerr and Nanda (2011) for a review). Past evidence on the effect of liquidity constraints on entrepreneurship using individual shocks to wealth, such as inheritances, is mixed (Holtz-Eakin, Joulfaian, and Rosen (1994); Blanchflower and Oswald (1998); Hurst and Lusardi (2004)). Several papers find that shocks to local house prices can boost entrepreneurship through increases in the value of collateral (Adelino, Schoar, and Severino, 2015; Corradin and Popov, 2015), although Kerr, Kerr, and Nanda (2019) find that most of the effect operates through local demand shocks. Schmalz, Sraer, and Thesmar (2017) isolate the effect of house prices on liquidity from local demand and wealth effects by comparing full home owners (treatment group) with renters and partial owners (control group), who cannot access housing collateral in their setting, in the same region in France. We add to this literature in several ways. First, we employ a regression discontinuity design (RDD), which ensures that our treated and control groups do not differ in terms of ability, risk aversion and other unobserved determinants of entrepreneurship. This may not hold when comparing inheritance recipients with non-recipients. Or when comparing full home owners with renters or partial owners, who by construction have different levels of initial wealth. Second, our research design identifies the

effect of liquidity solely using cross-individual variation, rather than using an aggregate shock such as changes in house prices. Thus, our results cannot be driven by local demand shocks or other general equilibrium effects. We also present evidence on how financial constraints affect different types of entrepreneurs, both in terms of ex-ante potential and ex-post performance. Finally, the real estate collateral channel requires entrepreneurs to be full home owners and to borrow from a financial intermediary, who has discretion in the decision to lend and associated loan terms. In our setting, individuals obtain additional liquidity from a public program.

We also contribute to the literature on unemployment insurance and labor supply. Several papers in that literature exploit age-based discontinuities for identification as we do, but focus on employment outcomes (Card, Chetty, and Weber, 2007; Centeno and Novo, 2009; Nekoei and Weber, 2017). Hombert, Schoar, Thesmar, and Sraer (2017) exploit a French reform in which the unemployed who choose to start a business do not receive any cash upfront, but are instead allowed to retain the rights to their unemployment benefits in case their business fails within three years, lowering the risk of entrepreneurship. We also study entrepreneurship in the context of unemployment insurance, but examine the role of financial constraints rather than risk aversion.

2   Institutional Background

The unemployment benefits system in Portugal includes unemployment insurance (UI) and unemployment assistance (UA). The latter applies to all individuals who either exhausted their UI benefits (Subsequent UA) or did not fulfil the requirements of eligibility to receive UI benefits (Initial UA). Both UI and Initial UA beneficiaries are entitled to participate in the Single Amount program ("Montante Único"). In this section, we describe the rules for these unemployment benefits in Portugal during our sample period from 2009 to 2012. During this period there was a reform of the UI and UA rules in April 2012. The first subsection explains the UI and Initial UA rules, while the second subsection explains the Single Amount program rules.

2.1 Unemployment Insurance and Initial Unemployment Assistance

To be eligible for both UI and Initial UA, individuals are required to accumulate the employee's Social Security monthly contributions during a certain period prior to the date of the involuntary dismissal. The minimum number of monthly contributions during the two years preceding the date a worker became unemployed was 15 months until March 2012 (before the reform) and is 12 months since April 2012 (after the reform).[3] In case individuals do not fulfil such requirement but they worked for at least six months in the year prior to becoming unemployed they are entitled to the Initial UA. In addition, the Initial UA requires individuals to be means-tested such that the household does not earn more than the minimum wage, per capita.

If eligible, the unemployed individual receives a monthly tax-exempt payment. In most of the cases, the Initial UA solely depends on whether the individual lives alone. Initial UA beneficiaries are entitled to their net wages during the first six of the eight months preceding the beginning date of the unemployment spell, up to a maximum of €335 if they live alone or €419 if they live with other members of the household. The UI benefit value is linked to the labor income that was reported during the first 12 of the 14 months before the dismissal date. Before July 2010, the replacement rate was 65% of gross wages, whereas since July 2010 it is 75% of the net wages (which is equivalent to between 59% and 67% of gross wages). During the sample period, the individuals were guaranteed at least €419, unless this amount was below their net wages (which could happen, for example, if they worked part-time and earned the minimum wage). At the upper end, the monthly amount was capped at €1,258 before April 2012, and is capped at €1,048 since April 2012.

The monthly amount is attributed to individuals for a pre-determined period of time, which depends on age at the date of involuntary dismissal and on Social Security contributions during the individual's career. The following table summarizes the duration (in months) of the Initial UA and UI before and after the April 2012 reform.

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[3]There was a short period between January and June 2010 (before the reform) during which the minimum number of monthly contributions was 12 months.

Potential Duration (in months)

Age (years)	Contributions Since Last Spell	Before April 2012		After April 2012	
		Potential Duration	Extra Potential Duration [†]	Potential Duration	Extra Potential Duration [†]
<30	< 15	9	up to 4	5	up to 4
	[15,24[			7	
	≥ 24	12		11	
[30,40[	<15	12	up to 4	6	up to 4
	[15,24[			11	
	[24,48[			14	
	≥ 48	18			
[40,45[	<15	18	up to 4	7	up to 4
	[15,24[			12	
	[24,60[			18	
	≥ 60	24			
≥45	<15	24	up to 8	7	up to 6
	[15,24[			12	
	[24,60[			18	
	≥ 60	30			

[†] The extra potential duration is 1 month (1.5 months in case of "up to 6", and 2 months in case of "up to 8") for each 5 consecutive years of contributions in the 20 years preceding the date of involuntary dismissal.

The 2012 reform reduced the potential duration across the board, but did not change the age thresholds that we exploit in our identification strategy. We account for such changes in our analysis by using the potential amount that entrepreneurs can access, which depends on whether they were affected by the reform or not. The reform also introduced an additional threshold at age 50, which we do not exploit since most of our sample became unemployed before March 2012 and were unaffected by the reform.[4]

2.2 Single Amount Program

The Single Amount Program was introduced in 1989 and allows unemployed individuals to receive the entire amount of their UI benefits upfront in order to start a business. Individuals

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[4]Before the reform, the potential duration ranged between 9 and 38 months, while after April 2012 the individuals were entitled only to a potential duration that ranged between 5 and 26 months. The decrease in duration was not homogeneous across individuals depending on the number of monthly contributions since last unemployment spell and career history, but affected all individuals.

can request the entire amount in their first month of UI or later, in which case they only receive the monthly payments that are left of the remaining potential duration. Under the UI rules for monthly amounts and potential duration described above, the upfront payment under the Single Amount program could reach a maximum of 47,791 euros.

The legal form of the new business can be unincorporated or incorporated. Individuals can choose to start a business by themselves or to partner with others. The only requirement is that the individual cannot obtain income from any other source than his/her business for a period of three years. Otherwise he/she must pay back the full amount received under the program. This implies that if the business fails the individual must pay back the amount received in order to be able to take a job in the three year period after receiving the single amount. Both the project approval (that should be done until after 90 working days after the proposal delivery) as well as the project monitoring are performed by the local Social Security offices.

3 Data

3.1 Sample Description

Our study uses administrative data collected by the Portuguese Social Security services. The data cover resident population in Portugal with a work-related link (i.e., workers, unemployment beneficiaries, and disability pensioners) to Social Security between January 2009 and December 2013. The data include all payments related to unemployment benefits. The unit of observation is individual-payment, where each payment contains information on the amount, potential duration, starting date, ending date, and on transitions between UI and the Single Amount program. The data also contain all the information regarding the periods of registered employment, unemployment and disability pensions the unit of observation is individual-event. Regarding employment, for each observation, we have information on the wage, type of employment, starting date, ending date, firm identifier and industry.

Since we do not have the entire career history for each individual, we follow the literature

and consider only the first unemployment benefit we observe in the data (after January 2009) as the unique unemployment benefit period of that individual. This strategy rules out multiple unemployment spells of the same individual. It also rules out any subsequent modifications to UI benefits as we will focus on UI and Initial UA - the two benefits in which individuals are entitled to request the Single Amount. Among those individuals who transition into the Single Amount program, nearly 90% do so within one year of the start of their UI or Intial UA benefits. We therefore restrict our sample to individuals who started receiving benefits before January 2013, in order to minimize right censoring.

We then match our individual data to administrative data on firm financial statements from "Informacao Empresarial Simplificada (IES)". IES covers the universe of incorporated firms, and we use data from 2009 to 2016. This allows us to measure outcomes for incorporated firms that were started under the Single Amount program. We use the firm's tax ID number to match the databases.

3.2 Variable Definitions

We define entrepreneurs as the individuals who participate in the Single Amount program, either as unincorporated self-employed workers or who create a new incorporated firm.[5] We measure the potential amount of funding these entrepreneurs are entitled to as their monthly benefit payment multiplied by the number of months of potential duration of their benefits. Age is measured at the date that unemployment benefits start. Pre-unemployment wages are the monthly wages reported to Social Security in the last employment prior to involuntary dismissal.

Our data set includes firm-level variables. For unincorporated self-employed individuals we only observe their reported earnings to Social Security. Individuals with less than €200 thousand in sales report a percentage of sales (20% for goods and 70% for services). Those with higher sales report their net income. In both cases monthly reported earnings are capped at

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[5]Participants are also allowed to join an existing firm by acquiring an ownership stake; we do not define those cases as entrepreneurs.

12 times the "Indexante dos Apoios Sociais", which equals just over €5000 during our sample period. We do not observe whether reported earnings correspond to a percentage of sales or net earnings, or the sales breakdown between goods and services. In the results where we include sales for unincorporated workers, sales are defined as reported earnings divided by 70%. We obtain similar results when we use 20% instead. Sales for incorporated businesses are directly reported in IES.

IES contains additional variables for incorporated businesses such as total assets, earnings before interest and taxes (EBIT), number of employees, paid-in capital. Labor productivity is defined as sales divided by number of employees.

3.3 Descriptive Statistics

Table 1 reports summary statistics for the universe of employed individuals, unemployed individuals, and unemployed individuals who become entrepreneurs under the Single Amount program. For employed individuals, we present statistics from the last job we observe in the data. For unemployed individuals, we report statistics from the last job before unemployment. The unemployed population is similar in age and gender to the employed population, but have higher monthly wages (€1,363 vs €1,085 on average). This suggests that our sample of unemployed individuals includes skilled individuals with the potential to create growth-oriented businesses. We note that our sample period includes a severe recession, during which the unemployment rate rose from 9% in 2009 to 16% in 2013. The unemployed population during this period may therefore not be representative of other periods.

We find that 1.2% of unemployed individuals in our sample selected into the Single Amount program. Program participants are marginally older on average as very few young workers participate, and are disproportionately high-skill as indicated by their substantially higher pre-unemployment wages (€2,458 vs €1,363 on average). This suggests the program successfully attracts high potential entrepreneurs. They are also more likely to be male, in line with previous studies that find that males are more likely to start new businesses (Rosa, Carter, and Hamilton, 1996; Verheul and Thurik, 2001; Fairlie and Robb, 2009).

The businesses created through the Single Amount program are more likely to be incorporated than the overall population of firms (44% vs 32%). Table 2 reports summary statistics for incorporated firms created through the program and in the overall population, at entry and at ages 2 and 4. Overall, the two populations are similar except at the top of the distribution. Above the 90th percentile, Single Amount firms have lower sales and EBIT than the overall population. The differences at the top of the distribution are larger for total assets, but smaller for labor productivity. This suggests that the program might alleviate financial constraints, but it does not eliminate them entirely.

4   Identification Strategy

We exploit age-based discontinuities in the potential duration of unemployment benefits to generate exogenous variation in the amount that potential entrepreneurs can receive upfront, using a RDD. This ensures that the variation in funding we exploit is uncorrelated with ability, wealth and other unobserved determinants of entrepreneurship. The amount increases discontinuously at age 30, at age 40, and at age 45. In our baseline specification we instrument the potential amount ($Amount$) that unemployed workers are entitled to receive under the Single Amount program using the three age cutoffs and fitting quadratic polynomials around each of the age cutoffs. The first stage regression is given by:

$$Potential\ Amount_i = \alpha_0 + \phi_1 \times \mathbb{1}(Age_i \geq 30) + \phi_2 \times \mathbb{1}(Age_i \geq 40) + \phi_3 \times \mathbb{1}(Age_i \geq 45)$$

$$+ \alpha_1 \times Age_i + \alpha_2 \times Age_i^2 + \sum_{j=1}^{2} \gamma_{1j} \times (Age_i - 30)^j \times \mathbb{1}(Age_i \geq 30)$$

$$+ \sum_{j=1}^{2} \gamma_{2j} \times (Age_i - 40)^j \times \mathbb{1}(Age_i \geq 40)$$

$$+ \sum_{j=1}^{2} \gamma_{3j} \times (Age_i - 45)^j \times \mathbb{1}(Age_i \geq 45) + \epsilon_i$$

And the second stage regression is given by:

$$E_i = \beta_0 + \beta_1 \times Potential\ \widehat{Amount}_i + \beta_2 \times Age_i + \beta_3 \times Age_i^2$$

$$+ \sum_{j=1}^{2} \theta_{1j} \times (Age_i - 30)^j \times \mathbb{1}(Age_i \geq 30) + \sum_{j=1}^{2} \theta_{2j} \times (Age_i - 40)^j \times \mathbb{1}(Age_i \geq 40)$$

$$+ \sum_{j=1}^{2} \theta_{3j} \times (Age_i - 45)^j \times \mathbb{1}(Age_i \geq 45) + \omega_i$$

where E_i is a dummy variable that takes a value of one if an individual i becomes an entrepreneur under the Single Amount program, and zero otherwise; and $\mathbb{1}$ is the indicator function.

An advantage of the RDD design is that the identification assumptions offer testable predictions. To validate our design we present two tests. We investigate the distribution of age and pre-unemployment wage around the age cutoffs. If individuals respond strategically to the age-based UI duration rules, we might expect to see bunching in ages above the threshold. Figure 1 shows the distribution (absolute frequency) of age at the date of the involuntary dismissal. We can see that the distribution evolves smoothly through the age cutoffs. Figure 2 shows the average pre-unemployment (i.e., last job before unemployment) wage by age. We cannot observe significant discontinuities at the age cutoffs. Thus, these tests are consistent with the absence of strategic manipulation in the timing of dismissal around the age cutoffs, which validates our identification strategy.

5   Results

This section examines the effect of the funding obtained under the Single Amount program on the probability of becoming an entrepreneur. We first instrument the *Potential Amount* with the age cutoffs. The first-stage corresponds to a regression of the potential amount of funding on the age cutoffs in equation (1). All regressions control for a quadratic polynomial,

which allows for different coefficients on either side of each cutoff. We present estimates of model specifications with and without observable covariates (region, nationality and gender dummies). Table 3 reports the estimates. Column (1) presents the coefficient estimates of a model specification without covariates. The increase in potential amount is €2,193, €2,739 and €4,429 at the 30, 40 and 45 age cutoffs, respectively. We obtain similar estimates in column (2) when the model specification includes covariates. Figure 3 presents graphical evidence on changes in potential amount at the age cutoffs, corresponding to our specification without covariates. The figure shows a clear upward jump in the average potential amount at the three age cutoffs, and that the quadratic polynomials offer a nearly perfect fit to the data.

The reduced-form regressions correspond to a linear probability model of the entrepreneur dummy variable (E) on the age cutoffs. Figure 4 presents graphical evidence. The figure shows a significant increase in the probability of becoming an entrepreneur at the three age cutoffs, and that the quadratic polynomials again fit the data closely. The increase is larger around the 30 and 45 year-old cutoffs. Table 3 reports estimation results from the reduced-form model. Column (3) presents the the coefficient estimates of a model specification without covariates. The increase is 0.46 percentage points at age 30, 0.22 percentage points at age 40, and 0.74 percentage points at age 45. The estimates are statistically significant at the 1% level at age 30 and 45 but statistically insignificant at age 40. We obtain similar estimates in column (4) when the model specification includes covariates.

The second-stage corresponds to a regression of the entrepreneur dummy variable (E) on the predicted *Potential Amount* obtained in the first-stage regression. Figure 5 presents graphical evidence. The figure plots the probability (linear probability model) of becoming an entrepreneur by predicted potential amount. The figure shows a positive slope, which indicates that an increase in predicted potential amount leads to an increase in the probability of becoming an entrepreneur. Table 3 reports estimation results from the model in equation (2). Column (5) in Table 3 presents the coefficient estimates of a model specification without covariates. The increase in probability is 0.16 percentage points for each additional one

thousand euros of potential amount. We obtain similar estimates in column (6) when the model specification includes covariates.

5.1 Legal Form

We next examine how different types of entrepreneurs respond to the program. We study the effect of financial constraints on entrepreneurship conditional on the legal form of the business. Levine and Rubinstein (2016) show that incorporation is a good proxy for growth-oriented entrepreneurship. Thus, incorporated businesses are more likely to be chosen by entrepreneurs undertaking high potential and riskier projects.

Figure 6 presents graphical evidence on the probability of becoming an *unincorporated* entrepreneur by age (reduced form model). The figure shows a significant increase in the probability of becoming an unincorporated entrepreneur at age 30. The increase in probability is less economically significant at the age 40 and 45. Figure 7 presents graphical evidence on the probability of becoming an *incorporated* entrepreneur by age. The figure shows a significant increase in the probability of becoming an incorporated entrepreneur at the age 30 and 45 but a modest increase at the age 40. Table 4 presents the estimates of the reduced-form regressions separately for the probability of becoming an unincorporated entrepreneur (column (1)) and an incorporated entrepreneur (column (2)).[6]. The increase in probability is statistically significant at age 30 for unincorporated businesses and at the age 45 for incorporated businesses. Columns (3) and (4) present the estimates of the second-stage regression separately for unincorporated and incorporated entrepreneurs, respectively. The coefficients are statistically and economically significant. The increase in the probability of becoming an unincorporated entrepreneur is 0.11 percentage points for each additional one thousand euros of potential amount. The effect is more pronounced in the case of incorporated entrepreneurs with an increase in probability of 0.24 percentage points. We conclude that financial constraints seem to impair growth-oriented entrepreneurship as incorporated businesses usually

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[6]We divide the coefficients by the proportion of unincorporated and incorporated businesses, respectively, in the overall population of firms (roughly 2/3 and 1/3), in order to make the coefficients comparable with each other and with our baseline coefficient for the sample of all businesses

have higher growth potential than unincorporated businesses.

5.2   Pre-Unemployment Wages

In this subsection, we study the effect of the Single Amount program on entrepreneurship for different levels of individual wages before unemployment. Higher pre-unemployment wages could proxy for entrepreneurial potential because it may capture individual characteristics that are valuable for entrepreneurs, such as education, ability or ambition to grow. In addition, individuals with a better outside option in the labor market may be more selective about the entrepreneurial opportunities they pursue.

We estimate our baseline regression of the probability of becoming an entrepreneur on the predicted amount in equation (2) separately for the sample of each pre-unemployment (i.e., in the last job before unemployment) wage decile. We estimate the coefficients separately for the creation of unincorporated and incorporated businesses. Figure 8 presents graphical evidence on the probability of becoming an unincorporated or incorporated entrepreneur in each pre-unemployment wage decile. The figure shows that the increase in the probability of becoming an entrepreneur is more pronounced at the top of the income distribution for incorporated entrepreneurs. The increase in probability is about 0.6 percentage points for each extra one thousand euros of potential amount, which is nearly four times larger than our baseline estimate of 0.16 percentage points. In contrast, among unincorporated entrepreneurs, the effect is weaker at the top of the wage distribution. These results suggest that the Single Amount program promotes the creation of firms by high-potential entrepreneurs.

5.3   Post-Entry Performance

In this subsection, we turn to ex-post outcomes. We do not estimate the effect on the distribution of outcomes conditional on entry, which would be ambiguous ((Evans and Jovanovic, 1989)). If financially constrained workers select into entrepreneurship or paid employment as a function of their relative ability in the two occupations and their ability to invest, then access to additional funding has two opposite effects. First, it induces entry by

marginal entrepreneurs who would have otherwise selected into paid employment, which may lower average entrepreneurial performance. Second, it increases the investment capacity of infra-marginal entrepreneurs who would have entered in any case, which improves average entrepreneurial performance.

Rather than conditioning on entry, we examine the effect of the Single Amount program on the probability of becoming an entrepreneur by level of post-entry performance. For each outcome, we estimate our baseline specification in equation (2), except we redefine the dependent variable to equal one when an individual becomes an entrepreneur *and* attains a given level of ex-post performance (e.g. sales, survival, etc), and zero otherwise. In this way, we are able to characterize the effect of the program on different types of entrepreneurs with respect to ex-post performance. We focus primarily on outcomes at the age 4, when entrepreneurs are no longer obligated to return the amount received if they choose to exit and pursue other job opportunities.

We start with survival, which we observe for incorporated firms only. We estimate the effect of funding obtained through the program on the probability of becoming an entrepreneur and surviving up to a given age after entry (age 1 through 4). Table 5 presents the results. The coefficient is statistically significant for all ages. The effect is economically significant. For each extra one thousand euros of potential amount, the increase in the probability that a business is created and survives at least two years and four years is 0.26 and 0.24 percentage points, respectively. The coefficient at age four is the same as our baseline effect on incorporated entrepreneurship. This indicates that the effect of the program is driven by viable businesses who survive beyond the end of the program.

We next consider the distribution of sales at the age 4 across all businesses (i.e., sample of unincorporated and incorporated businesses). Specifically, we estimate the effect of the program on the probability of becoming an entrepreneur and reaching sales at a given quintile of the distribution. For all outcomes, we compute quintiles from the distribution of outcomes for the overall population of firms at the corresponding age, rather than from the distribution of firms created under the Single Amount program. Figure 9 shows that the increase in the

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probability of becoming an entrepreneur is more pronounced in the top quintile of the sales distribution across all new businesses. These results indicate that financial constraints impair the creation of growth-oriented businesses.

The larger coefficient in the top quintile is consistent with the stronger effect on the creation of incorporated businesses, which tend to be larger. We then restrict the analysis to incorporated entrepreneurs, and estimate the effect of the program across the distribution of outcomes for incorporated businesses, which account for the vast majority of aggregate output and employment.[7] Figure 10 shows that the effect of the Single Amount program is more pronounced in the middle (i.e., quintile 3) of the distribution of sales at the age 4.

We also examine other post-entry outcomes for incorporated entrepreneurs. Figure 11 shows the effect for each quintile of the distribution of sales growth, where growth is measured from entry to age four. We find that the effect is more pronounced for quintile 4. Figures 12 and 13 show that the effect is stronger in quintile 4 of the distribution of earnings before interest and taxes (EBIT) and labor productivity, respectively. Figure 14 shows that the effect is larger in quintiles 2 and 3 of the distribution of total assets. In short, we find that the effect of the Single Amount program is more pronounced in the middle of the distribution of post-entry performance measures among incorporated businesses.

6   Conclusion

The effect of financial constraints on entrepreneurship has been a controversial topic in the literature due to several data limitations and empirical challenges. We show that financial constraints are an important barrier to the quantity and quality of entrepreneurship using administrative data on a public program that allows Portuguese unemployed workers to collect the full amount of their unemployment benefits upfront in order to start a business.

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[7]We divide our coefficients by the proportion of incorporated businesses in the overall population of firms (roughly 1/3). In addition, we also divide them by the proportion of survivors in the overall population at each age, and multiply them by five when we focus on a given quintile of the distribution of outcomes. These adjustments ensure our coefficients are always comparable with each other and with our coefficient for all businesses at entry.

We identify the effects by exploiting age-based discontinuities in the duration and amount of unemployment benefits. We find that an extra one thousand euros of funding increases the probability of becoming an entrepreneur by 0.16 percentage points, which corresponds to a 13% increase. The effect on the probability of becoming an entrepreneur is more pronounced for incorporated businesses than for unincorporated businesses and for incorporated entrepreneurs in the top decile of the pre-unemployment wage distribution. In addition, we find that the effect on post-entry performance is stronger in the top quintile of the size distribution across all businesses and in the middle of the size distribution among incorporated businesses. Overall, our findings suggest that financial constraints hamper growth-oriented entrepreneurship and thus job creation and economic growth.

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Table 1: Summary Statistics - Workers

	(1) Employed	(2) Unemployed	(3) Program
Wage (euros)			
mean	1,112	1,363	2,458
p10	485	343	450
p50	744	875	1,282
p90	1,973	2,560	5,040
p99	5,716	8,553	19,549
Age			
mean	39.61	39.41	42.00
p10	27.00	26.00	32.00
p50	39.00	38.00	41.96
p90	54.00	55.00	52.61
p99	60.00	60.00	58.01
Male	0.53	0.52	0.63
Potential Amount (euros)			
mean		11,571	17,215
p10		3,859	7,199
p50		9,295	14,321
p90		20,866	33,955
p99		45,274	47,789
Lisbon		0.20	0.15
Portuguese		0.90	0.95
N	3,612,421	410,322	5,104

This table presents summary statistics at the individual level for three samples: (1) employed, defined as as all workers reporting employment earnings to Social Security during our sample period (2009-2012), (2) unemployed, which includes all workers who became unemployed during our sample period and (3) Single Amount program, which includes all workers who became unemployed during our sample period and became entrepreneurs through the Single Amount program. Wage and tenure are from the last job we observe for the employed sample, and for the last job before unemployment for the unemployed and Single Amount program samples. Age is measured at the beginning of the last job we observe for the employed sample, and at the time of unemployment for the unemployed and Single Amount program samples. When an individual experiences multiple unemployment spells during our sample period we include only the first spell.

Table 2: Summary Statistics - Incorporated Firms

	Entry		Age 2		Age 4	
	All	Program	All	Program	All	Program
Sales						
mean	68,238	55,058	205,180	137,749	251,732	182,228
p10	0	0	0	4,279	0	250
p50	14,088	16,134	50,951	54,429	62,487	64,614
p90	135,872	120,585	368,413	322,453	470,959	460,250
p99	839,138	657,148	2,355,366	1,344,645	3,028,531	1,605,918
EBIT						
mean	-1,541	-6,648	4,175	-465	7,128	5,523
p10	-15,624	-21,767	-20,854	-21,017	-19,334	-17,172
p50	-782	-4,561	517	49	1,737	1,416
p90	10,580	4,445	26,067	17,535	37,740	26,997
p99	84,371	31,144	176,201	77,874	269,693	132,470
Total Assets						
mean	152,000	56,438	364,531	80,321	403,452	106,744
p10	1,797	5,547	4,520	4,165	7,789	1,517
p50	19,755	30,477	46,235	39,346	67,727	47,022
p90	160,375	118,721	356,330	174,003	518,341	250,468
p99	1,467,595	386,218	2,824,666	589,966	4,018,493	1,008,155
Labor Productivity						
mean	33,807	25,135	68,046	52,290	72,120	59,882
p10	0	0	0	4,825	0	6,410
p50	9,192	10,502	25,413	26,109	29,286	31,647
p90	67,084	60,138	122,895	107,590	136,471	130,085
p99	350,700	227,498	661,638	371,190	720,000	570,454
Paid-in Capital						
mean	22,541	11,230	31,989	15,783	52,584	19,259
p10	100	1,000	500	2,000	2,000	2,500
p50	5,000	5,000	5,000	5,000	5,000	5,000
p90	20,000	25,781	35,000	39,500	50,000	50,000
p99	180,000	100,002	260,000	136,340	386,000	150,000
Survival	1.00	1.00	0.81	0.93	0.63	0.78
N	177,217	2,263	91,367	2,095	34,806	1,578

This table presents summary statistics at the firm level for two samples: (1) all firms, which includes the universe of incorporated firms and (2) Single Amount program firms, which include all incorporated firms started by unemployed workers who became entrepreneurs through the Single Amount program. Sales is total sales in euros. EBIT is earnings before interest and taxes in euros. Total assets is total assets in euros. Labor productivity is sales divided by the number of employees. Paid-in capital is the equity invested by the firm's owners in euros.

Table 3: Probability of Starting a Business and Unemployment Benefits - Baseline Results

	1st Stage		Reduced Form		IV	
	(1)	(2)	(3)	(4)	(5)	(6)
Age 30	2.193***	2.186***	0.00464***	0.00455***		
	(0.0383)	(0.0385)	(0.00111)	(0.00111)		
Age 40	2.739***	2.742***	0.00221	0.00223		
	(0.0924)	(0.0883)	(0.00206)	(0.00206)		
Age 45	4.429***	4.396***	0.00738***	0.00736***		
	(0.110)	(0.105)	(0.00203)	(0.00203)		
Potential Amount					0.00155***	0.00154***
					(0.000278)	(0.000279)
Covariates	No	Yes	No	Yes	No	Yes
N	430113	430113	430113	430113	430113	430113

This table reports estimates from our baseline specification. Columns (1) and (2) report the estimates of a regression of the potential amount received through the Single Amount program (in thousands of euros) on age-above 30, age-above 40 and age-above 45 dummy variables. Columns (3) and (4) report the estimates of a regression of the probability of becoming an entrepreneur on age-above 30, age-above 40 and age-above 45 dummy variables. Columns (5) and (6) report the estimates of a regression of the probability of becoming an entrepreneur on the potential amount received through the Single Amount program, instrumented with age-above 30, age-above 40 and age-above 45 dummy variables. All regressions control for a quadratic polynomial, which allows for different coefficients on either side of each cutoff. Columns (2), (4) and (6) include region, nationality, and gender dummies as covariates. The sample consists of all workers who became unemployed between 2009 and 2012. Robust standard errors are in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% level, respectively.

Table 4: Probability of Starting a Business and Unemployment Benefits - Sample of Incorporated and Unincorporated Businesses

	Reduced Form		IV	
	(1)	(2)	(3)	(4)
	Unincorporated	Incorporated	Unincorporated	Incorporated
Age 30	0.00473***	0.00445		
	(0.00123)	(0.00228)		
Age 40	0.00196	0.00272		
	(0.00228)	(0.00423)		
Age 45	0.00361	0.0149***		
	(0.00234)	(0.00395)		
Potential Amount			0.00110***	0.00243***
			(0.000317)	(0.000551)
N	430113	430113	430113	430113

This table reports estimates of a regression of the probability of becoming an incorporated or unincorporated entrepreneur on the potential amount (thousands of euros) received through the Single Amount program, instrumented with age-above 30, age-above 40 and age-above 45 dummy variables. Coefficients are divided by the proportion of unincorporated and incorporated businesses in the overall population of firms (roughly 2/3 and 1/3), in order to make them comparable with each other and with our baseline coefficient for all businesses. The sample consists of all workers who became unemployed between 2009 and 2012. Robust standard errors are in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% level, respectively.

Table 5: Probability of Starting a Business and Unemployment Benefits - Survival Analysis

	(1)	(2)	(3)	(4)
	Age 1	Age 2	Age 3	Age 4
Potential Amount	0.00238***	0.00256***	0.00283***	0.00235**
	(0.000569)	(0.000596)	(0.000628)	(0.000780)
N	430113	430113	430113	314455

This table reports estimates of a regression of the probability of becoming an incorporated entrepreneur *and* surviving up to a given age on the potential amount (thousands of euros) received through the Single Amount program, instrumented with age-above 30, age-above 40 and age-above 45 dummy variables. Coefficients are divided by the proportion of incorporated businesses in the overall population of firms (roughly 1/3), and again by the proportion of survivors at each age in the overall population, in order to make them comparable with each other and with our coefficient for incorporated businesses at entry. The sample consists of all workers who became unemployed between 2009 and 2012. Robust standard errors are in parentheses. *, ** and *** indicate significance at the 10%, 5% and 1% level, respectively.

Figure 1: Distribution of Age at Time of Unemployment
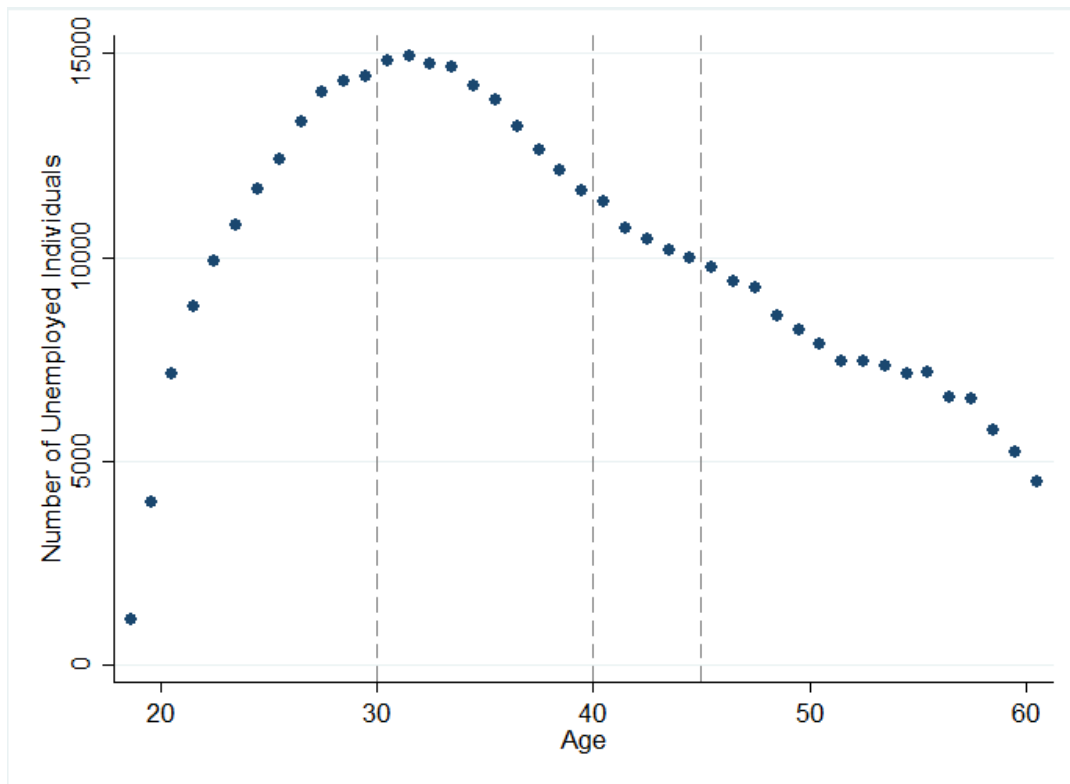
This figure plots the frequency of age among unemployed workers (at the date of the involuntary dismissal). The dashed lines represent the three age cutoffs at which the duration of unemployment benefits increases discontinuously. Age bins correspond to one-year intervals. The sample consists of all workers who became unemployed between 2009 and 2012.

Figure 2: Average Pre-Unemployment Wage by Age
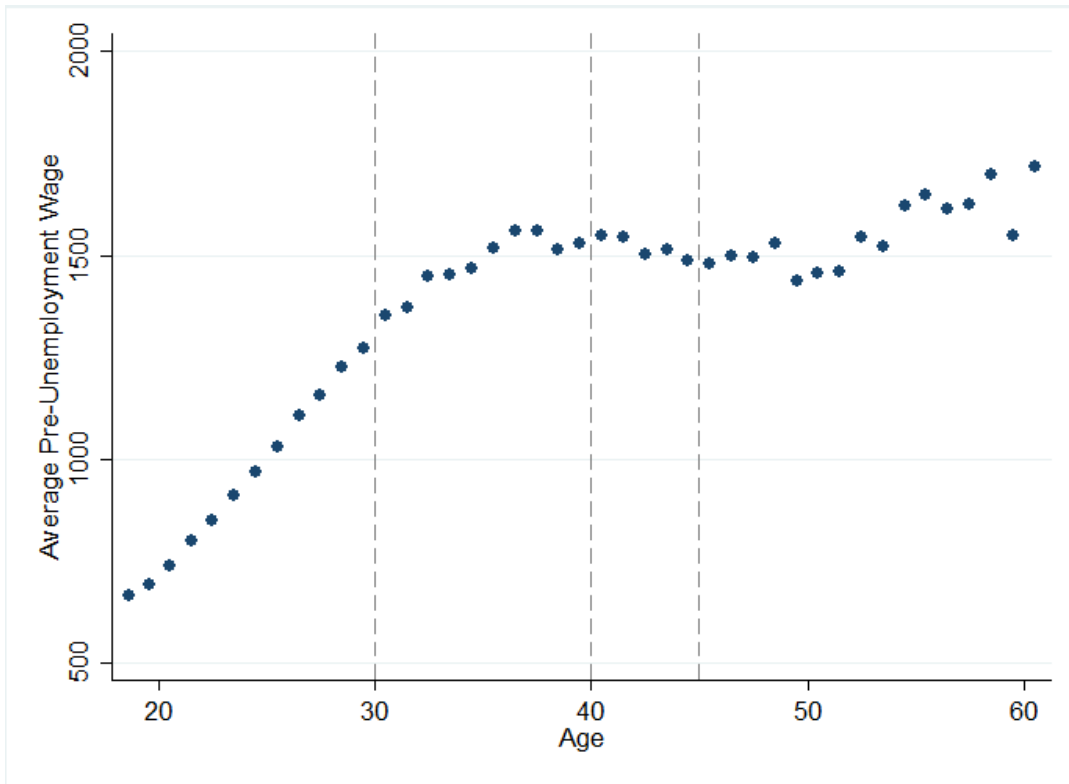
This figure plots the average pre-unemployment (i.e., last job before unemployment)) wage (euros per month) by age. The dashed lines represent the three age cutoffs at which the duration of unemployment benefits increases discontinuously. Age bins correspond to one-year intervals. The sample consists of all workers who became unemployed between 2009 and 2012.

Figure 3: Average Potential Amount by Age
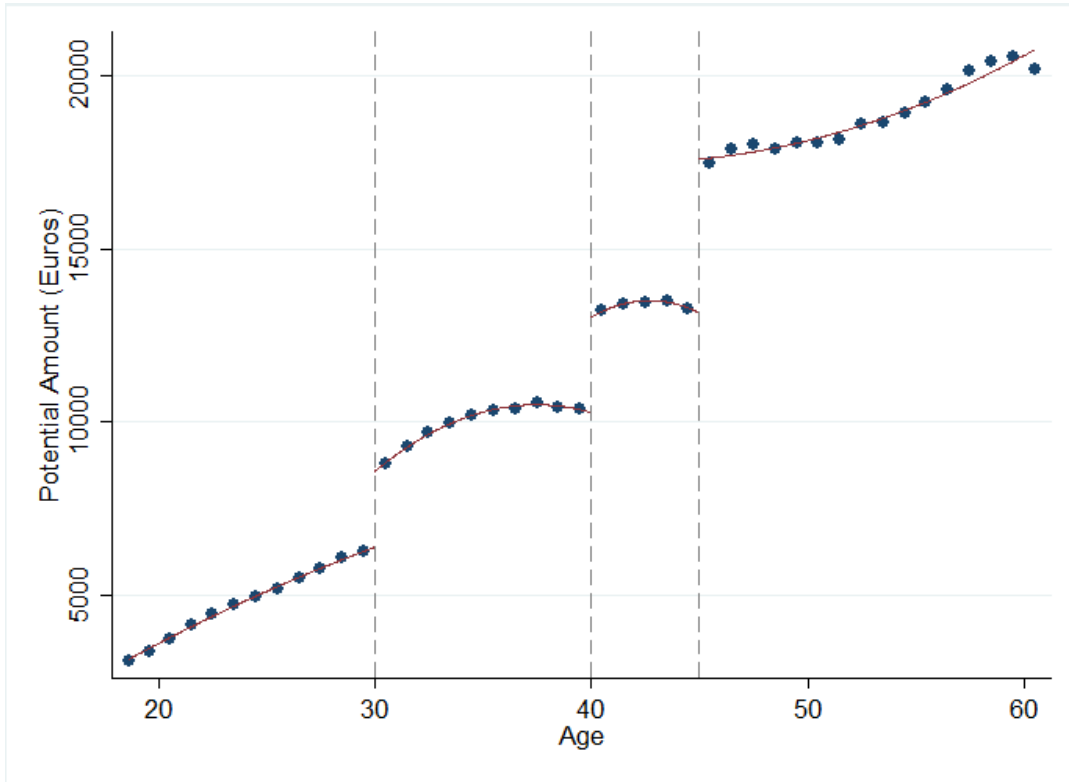
This figure plots the average amount (euros) that potential entrepreneurs can access through the Single Amount program by age. The dashed lines represent the three age cutoffs at which the duration of unemployment benefits increases discontinuously. Age bins correspond to one-year intervals. The sample consists of all workers who became unemployed between 2009 and 2012.
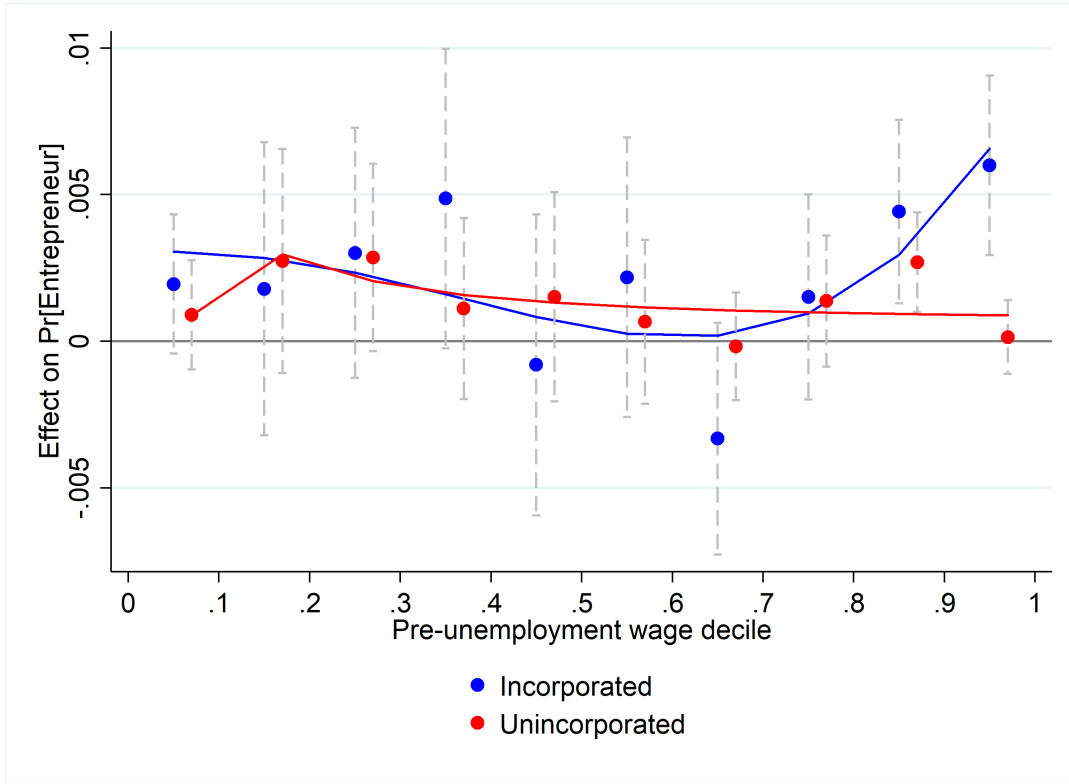
Figure 4: Probability of Becoming an Entrepreneur by Age
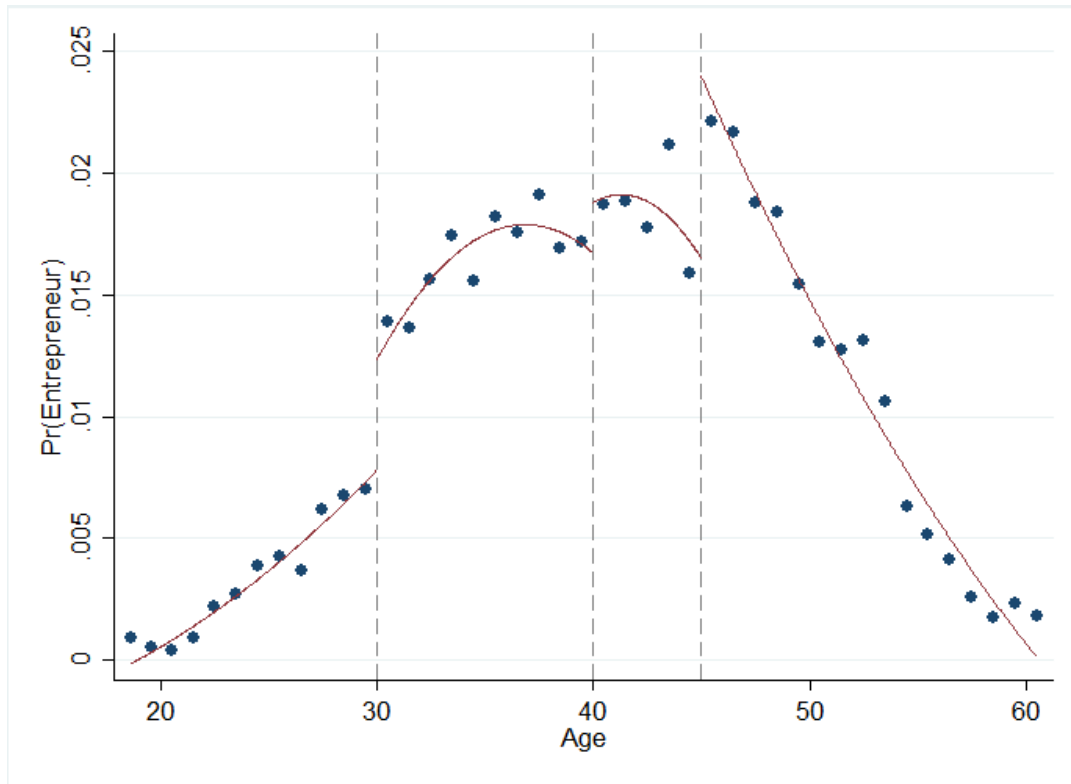
This figure plots the probability of becoming an entrepreneur through the Single Amount program by age, estimated as in column (3) of Table 3 The dashed lines represent the three age cutoffs at which the duration of unemployment benefits increases discontinuously. Age bins correspond to one-year intervals. The sample consists of all workers who became unemployed between 2009 and 2012.

Figure 5: Probability of Becoming an Entrepreneur by Potential Amount
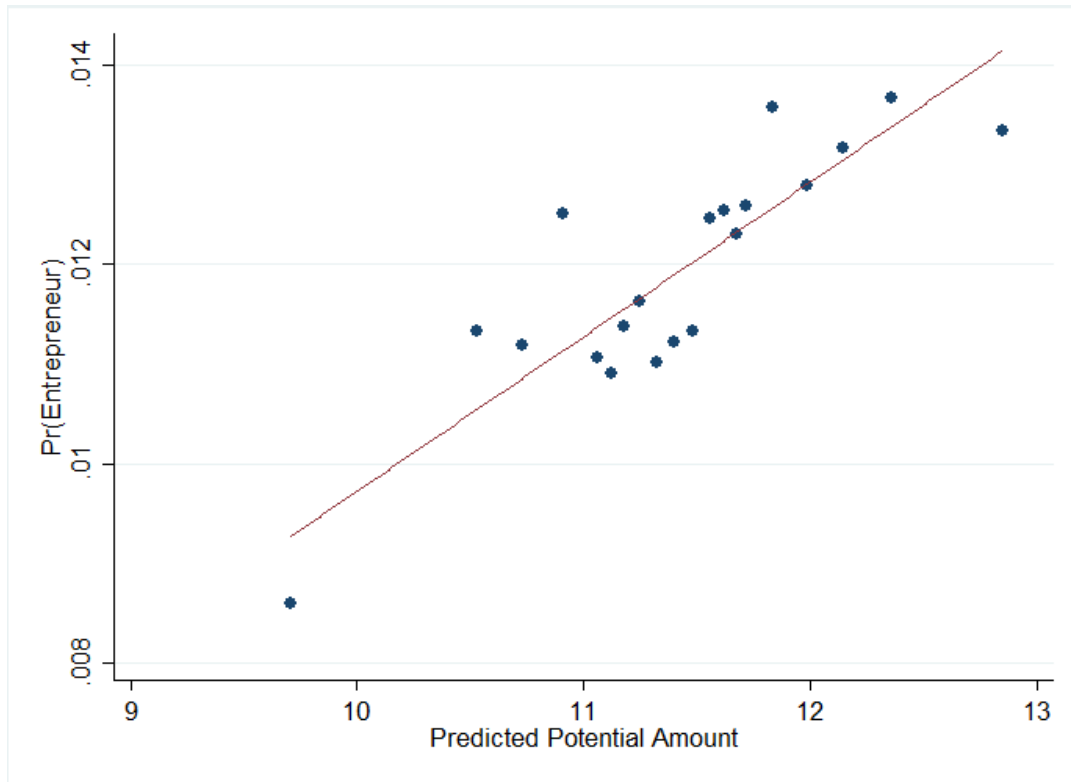
This figure presents a binned scatter plot of the probability of becoming an entrepreneur through the Single Amount program as a function of the potential amount received (in thousands of euros), estimated as in column (5) of Table 3. The amount is instrumented with the three age cutoffs at which the duration of unemployment benefits increases discontinuously. The sample consists of all workers who became unemployed between 2009 and 2012.

Figure 6: Probability of Becoming a Unincorporated Entrepreneur by Age
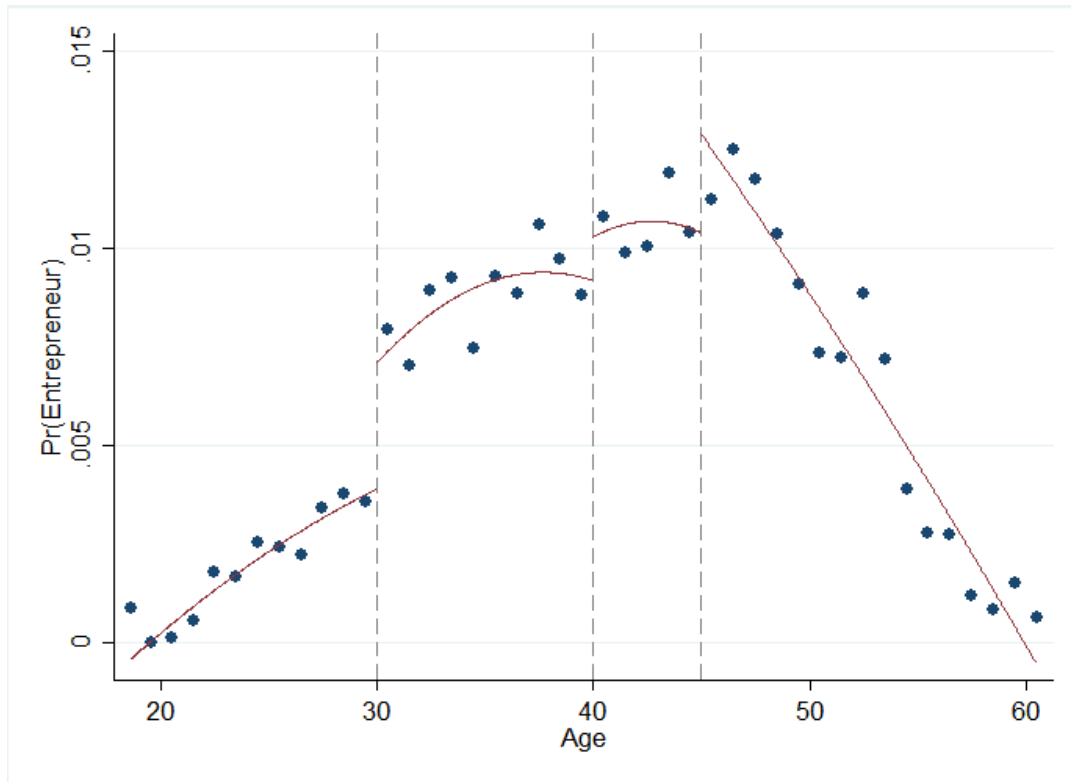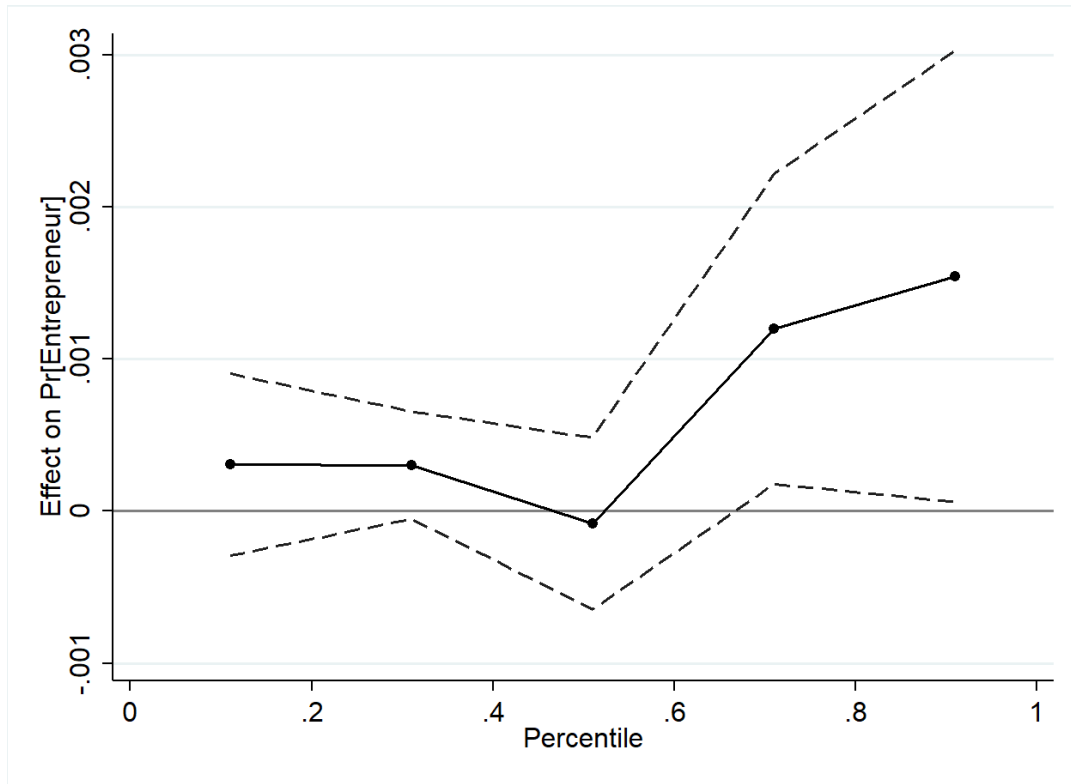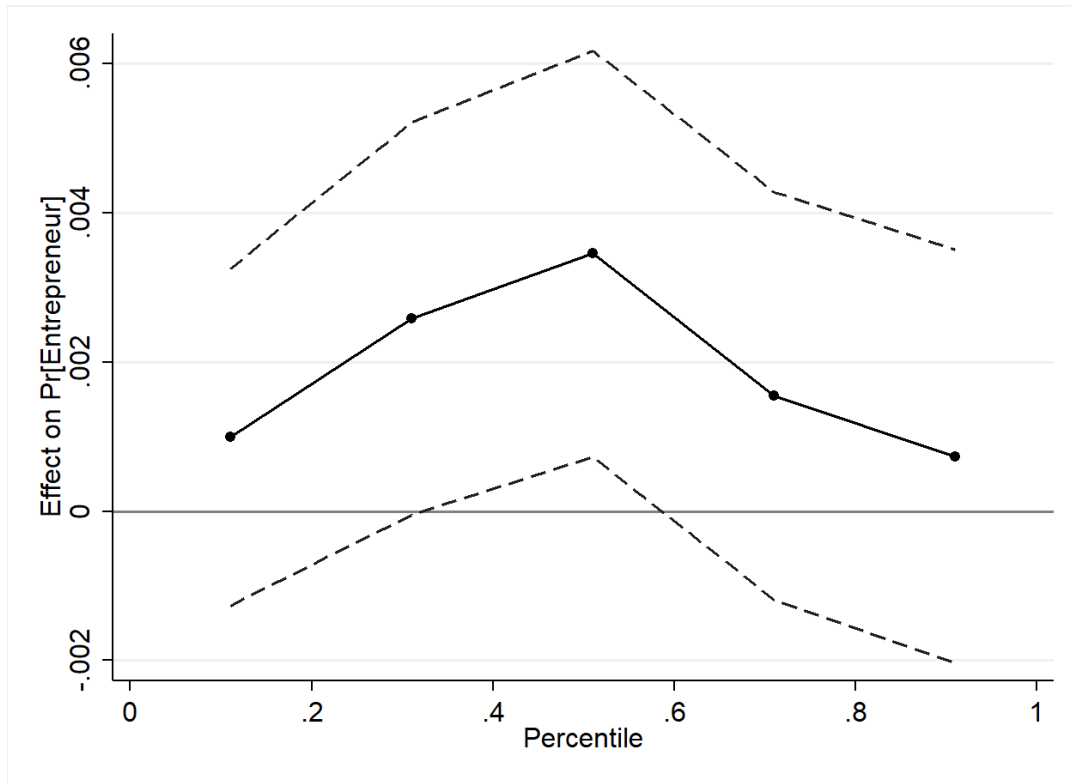

This figure plots the probability of becoming a unincorporated entrepreneur through the Single Amount program by age, estimated as in column (3) of Table 3. The dashed lines represent the three age cutoffs at which the duration of unemployment benefits increases discontinuously. Age bins correspond to one-year intervals. The sample consists of all workers who became unemployed between 2009 and 2012.

Figure 7: Probability of Becoming an Incorporated Entrepreneur by Age
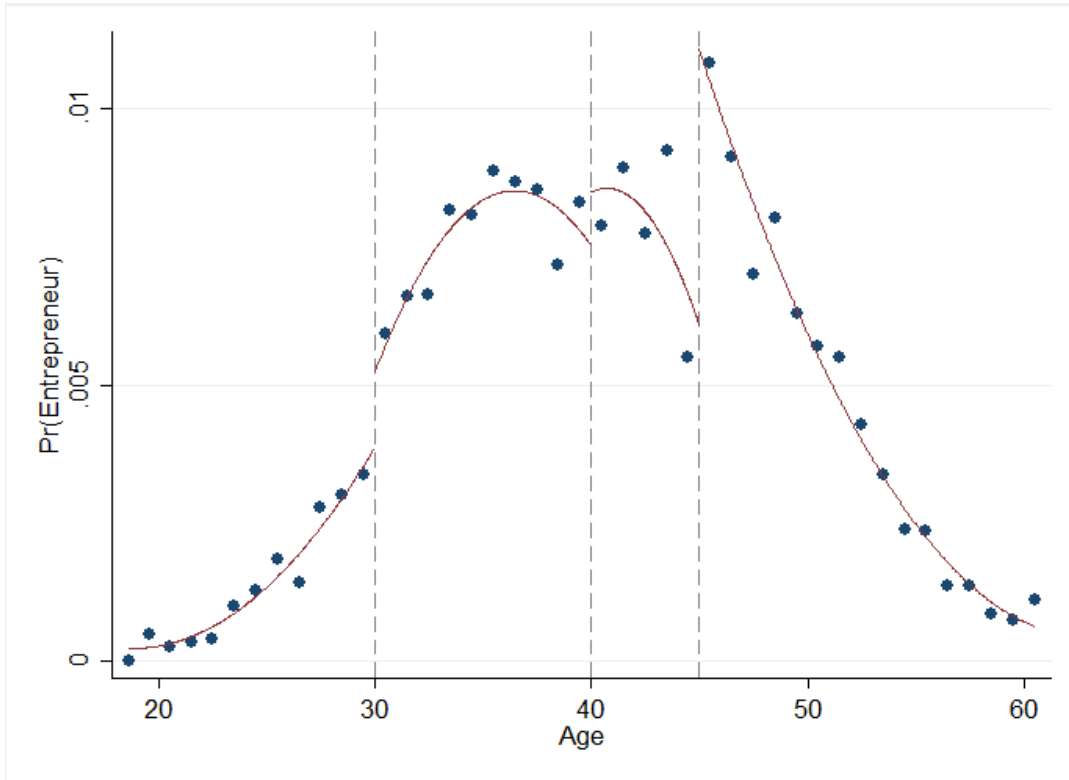
This figure plots the probability of becoming a unincorporated entrepreneur through the Single Amount program by age, estimated as in column (3) of Table 3. The dashed lines represent the three age cutoffs at which the duration of unemployment benefits increases discontinuously. Age bins correspond to one-year intervals. The sample consists of all workers who became unemployed between 2009 and 2012.

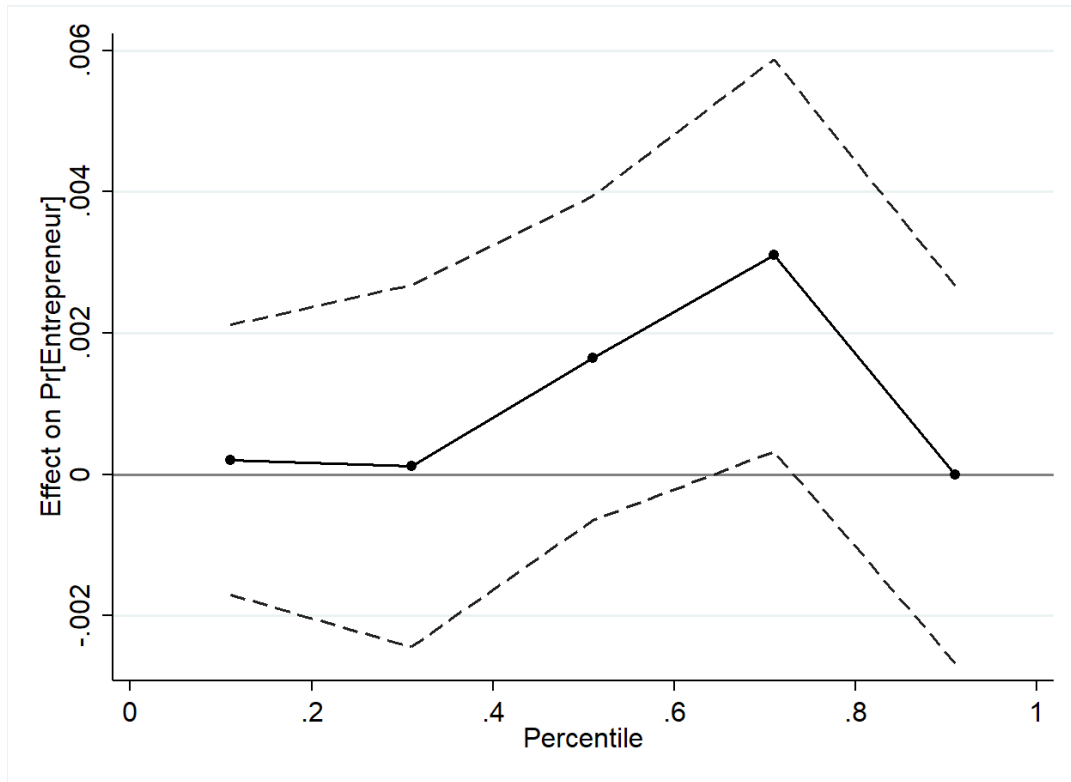Figure 8: Probability of Becoming an Entrepreneur by Wage Decile

This figure plots the probability of becoming an entrepreneur through the Single Amount program as a function of the potential amount received (in thousands of euros), estimated as in column (5) of Table 3 separately by pre-unemployment wage deciles. Coefficients are divided by the proportion of unincorporated and incorporated businesses in the overall population of firms (roughly 2/3 and 1/3), in order to make them comparable with each other and with our baseline coefficient for all businesses. 95% confidence intervals are represented by dashed lines. The two lines represent second degree fractional polynomials estimated on the coefficients for each legal form. Wage deciles are computed from the overall population of workers. The sample consists of all workers who became unemployed between 2009 and 2012.

Figure 9: Probability of Becoming an Entrepreneur by Sales Quintile

This figure plots the probability of becoming an entrepreneur through the Single Amount program as a function of the potential amount received (in thousands of euros), estimated as in column (5) of Table 3. Each coefficient represents the probability of creating a firm in a given quintile of the sales distribution at age 4. 95% confidence intervals are represented by dashed lines. Sales deciles are computed from the overall population of incorporated and unincorporated firms. The sample consists of all workers who became unemployed between 2009 and 2012.

Figure 10: Probability of Becoming an Incorporated Entrepreneur by Sales Quintile
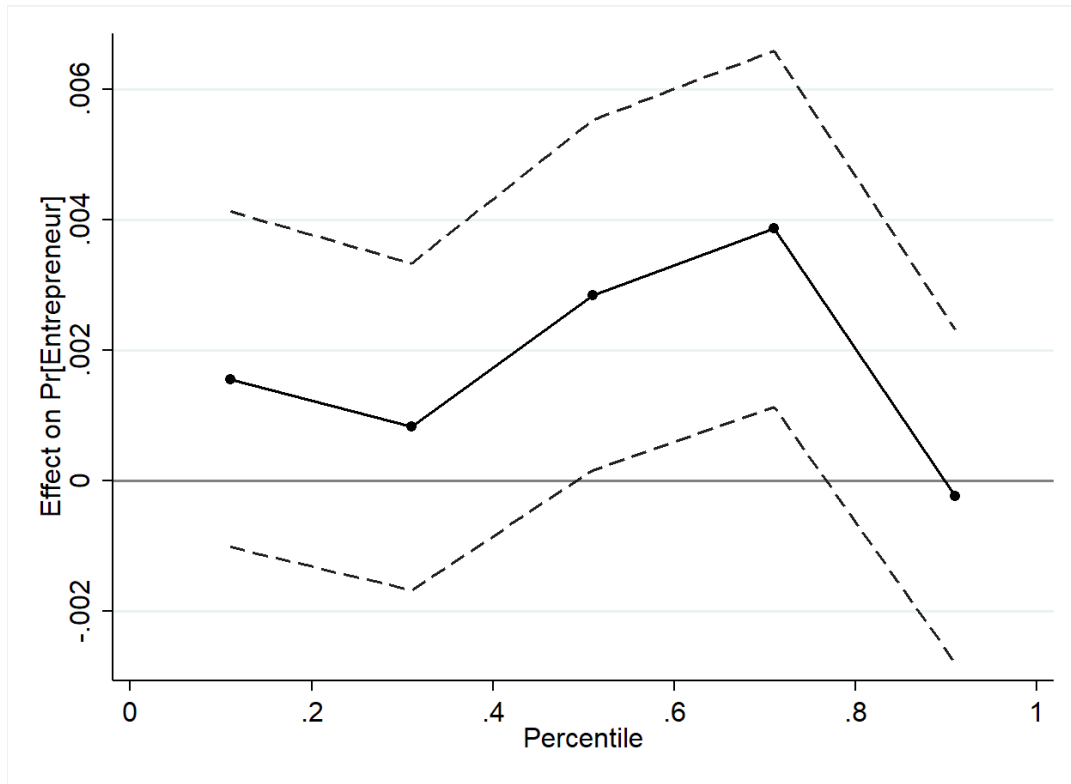

This figure plots the probability of becoming an incorporated entrepreneur through the Single Amount program as a function of the potential amount received (in thousands of euros), estimated as in column (5) of Table 3. Each coefficient represents the probability of creating a firm in a given quintile of the sales distribution at age 4. 95% confidence intervals are represented by dashed lines. Sales quintiles are computed from the overall population of incorporated firms. The sample consists of all workers who became unemployed between 2009 and 2012.

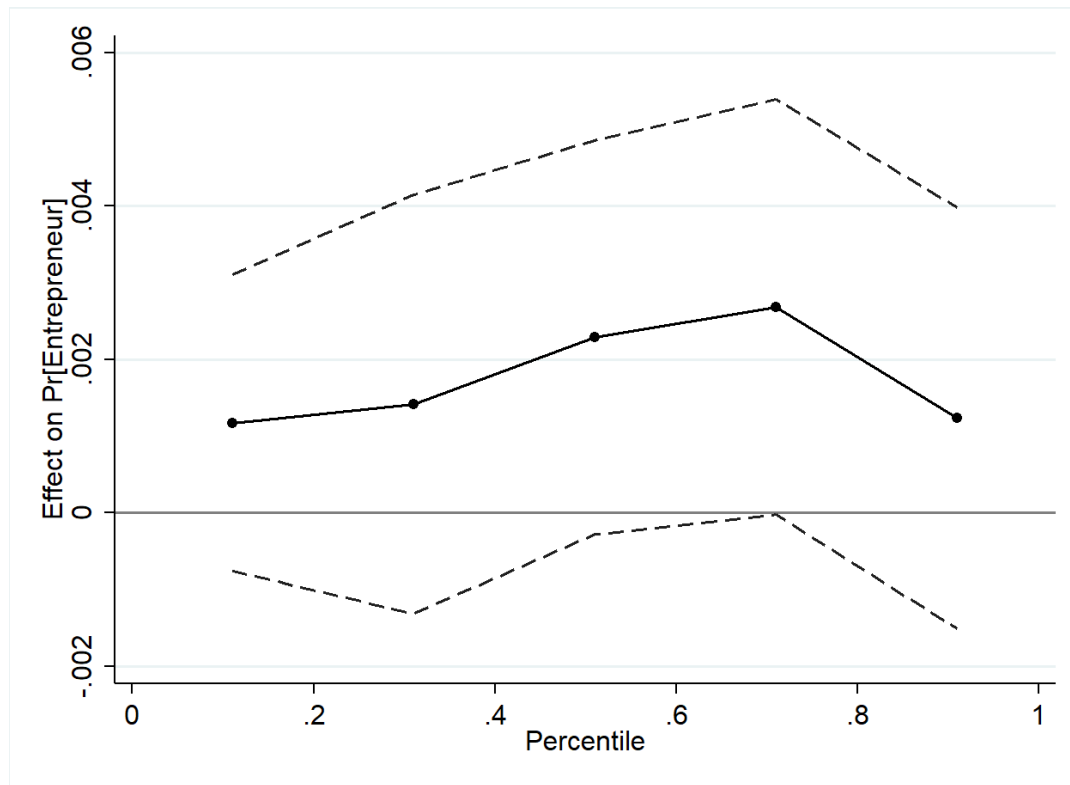Figure 11: Probability of Becoming an Incorporated Entrepreneur by Sales Growth Quintile

This figure plots the probability of becoming an incorporated entrepreneur through the Single Amount program as a function of the potential amount received (in thousands of euros), estimated as in column (5) of Table 3. Each coefficient represents the probability of creating a firm in a given quintile of the sales growth distribution, where growth is measured between entry and age 4. 95% confidence intervals are represented by dashed lines. Sales growth quintiles are computed from the overall population of incorporated firms. The sample consists of all workers who became unemployed between 2009 and 2012.

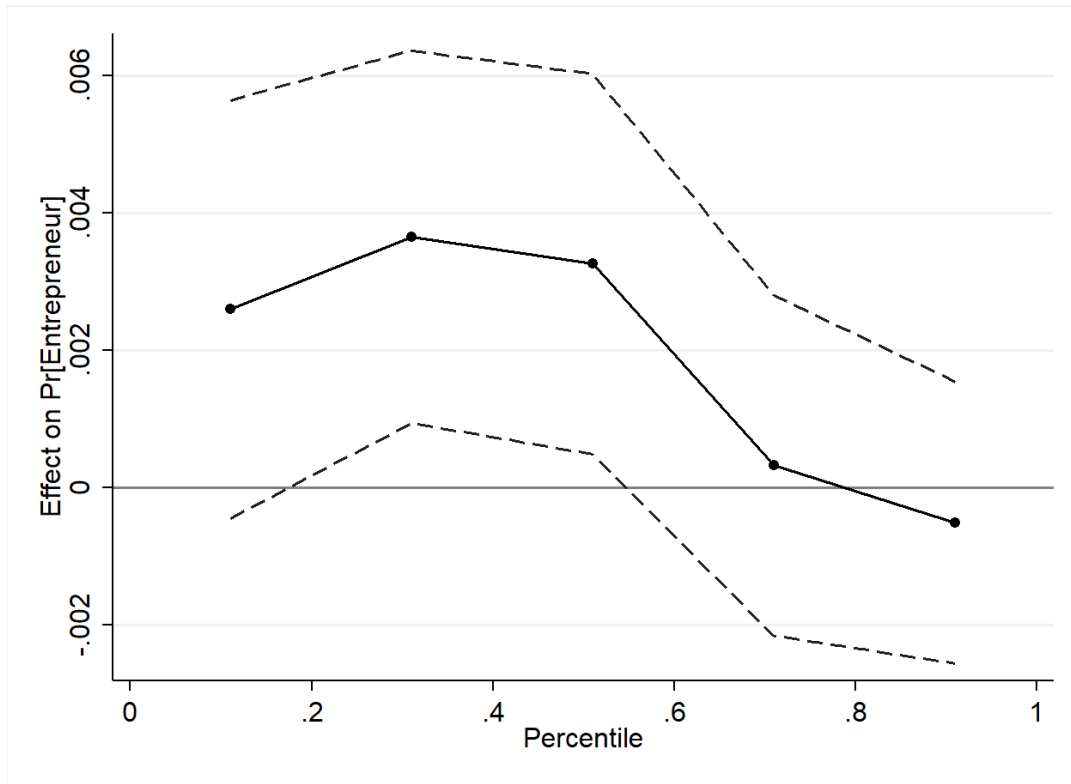Figure 12: Probability of Becoming an Incorporated Entrepreneur by EBIT Quintile

This figure plots the probability of becoming an incorporated entrepreneur through the Single Amount program as a function of the potential amount received (in thousands of euros), estimated as in column (5) of Table 3. Each coefficient represents the probability of creating a firm in a given quintile of the EBIT distribution at age 4. 95% confidence intervals are represented by dashed lines. EBIT quintiles are computed from the overall population of incorporated firms. The sample consists of all workers who became unemployed between 2009 and 2012.

Figure 13: Probability of Becoming an Incorporated Entrepreneur by Labor Productivity Quintile

This figure plots the probability of becoming an incorporated entrepreneur through the Single Amount program as a function of the potential amount received (in thousands of euros), estimated as in column (5) of Table 3. Each coefficient represents the probability of creating a firm in a given quintile of the labor productivity distribution at age 4. Labor productivity is measured as sales per worker. 95% confidence intervals are represented by dashed lines. Labor productivity quintiles are computed from the overall population of incorporated firms. The sample consists of all workers who became unemployed between 2009 and 2012.

Figure 14: Probability of Becoming an Incorporated Entrepreneur by Total Assets Quintile

This figure plots the probability of becoming an incorporated entrepreneur through the Single Amount program as a function of the potential amount received (in thousands of euros), estimated as in column (5) of Table 3. Each coefficient represents the probability of creating a firm in a given quintile of the total assets distribution at age 4. 95% confidence intervals are represented by dashed lines. Total assets quintiles are computed from the overall population of incorporated firms. The sample consists of all workers who became unemployed between 2009 and 2012.