Unemployment Benefit Duration and Startup Success*

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Abstract

Despite the importance of business creation for the economy and a relevant share of new firms being started out of unemployment, research has focused on analyzing the effect of unemployment insurance (UI) policy on re-employment outcomes. For this paper, we assess how the UI benefit duration affects the motivation for starting up out of unemployment, as well as the subsequent firms' success. We create a representative dataset on founders in Germany that links administrative social insurance with survey data. Exploiting reform-based and age-based exogenous variation in potential benefit duration (PBD) within the German UI system, we find that longer PBD leads to longer actual unemployment duration of those becoming self-employed. The UI duration elasticity is higher than common estimates for those becoming re-employed. With increasing unemployment benefit duration, the founders' outcomes in terms of self-assessed motivation, sales and employment growth become inferior. This net causal effect can be rationalized by a mix of composition and individual-level duration effects. Our findings suggest that the fiscal externality of UI on startup success should be considered for the (optimal) design of UI systems.

JEL-Classifications: D22, J21, J23, J44, J62, J64, J65, L11, L25, L26, M13
Keywords: entrepreneurship, unemployment insurance, fiscal externality

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1 Introduction

Business creations play an important economic role in stimulating productivity, fostering structural change, and foremost, offering jobs for their founders and additional employees (Aghion et al., 2009; Dent et al., 2016; Haltiwanger et al., 2013). Self-employment accounts for 10-15 percent of the labor force in most OECD countries. Thereby, a little known fact is that each year, one quarter of all new business creations is started out of unemployment.[1] Due to the spread of new forms of employment in the digital economy (e.g. Uber drivers), the relevance of transitions from unemployment to self-employment can be expected to increase in the near future. Recent research in public economics demonstrates that the generosity of Unemployment Insurance (UI) systems in terms of potential benefit duration (PBD) and benefit levels affects re-employment outcomes of those transitioning from unemployment to employment. Despite their economic importance, however, transitions from unemployment to self-employment (business creations) are largely ignored and little is known about how the design of unemployment insurance affects the behavior of potential entrepreneurs and the subsequent performance of their firms. Our paper therefore sheds light on this topic by analyzing how the potential UI benefit duration affects the actual unemployment benefit duration (ABD) of those transitioning to self-employment, their motivation for starting a firm (push/pull factors), and the success of their firms in terms of sales and employment growth.[2]

The effect of longer potential benefit duration (PBD) on self-employment outcomes seems a priori unclear. On the one hand, when longer PBD incentivizes longer actual unemployment, losses in financial, social, and human capital might lead to a gradual decrease in startup quality. For instance, longer unemployment duration could decrease financial means, increase difficulties to attract external financial capital (due to stigmatization), lead to losses of business contacts, or a depreciation of skills and knowledge.

[1] In Germany, the empirical setting of this paper, around 25-30 percent of all founders between 2005 to 2015 have been unemployed before starting their firms. According to data from the Mannheim Enterprise Panel and the ZEW/IAB Start-Up Panel, there were around 200,000 startups each year between 2000 and 2015. This corresponds to about 50,000-60,000 startups out of unemployment per year.

[2] Concerning the notation in our paper: with *self-employment*, we refer to the labor market status to distinguish unemployment, employment and self-employment. Within the labor market status of self-employment, the term *founder* refers to the person starting a firm which covers both firms with and without employees. The term *entrepreneur* is used to focus on the fact of a founder running the firm after its startup. The term *startup* refers to the act of starting a firm and is used as a synonym for new firm.

On the other hand, a period of unemployment might be used to better prepare for self-employment, e.g. by acquiring new skills or developing market entry strategies. Apart from these *individual-level duration effects*, there are likely to be *composition effects*, as individuals with high motivation and ability possibly leave unemployment the fastest. Thus, with longer unemployment duration, a higher amount of individuals with low ability and motivation could remain to found a startup. In our study, we identify the overall causal effect of potential UI benefit duration on startup success and thus the (net) result of the government's UI policy. We rationalize which mechanisms could explain our results with the help of post-hoc analyses and a formalized job search model.

For this paper, we construct a dataset that links a representative panel survey of founders in Germany to administrative data on their own and their employees' labor market histories. Thereby, we obtain a representative linked employer-employee dataset for founders. Due to their high level of detail, German administrative data on labor market histories have been widely used in research (e.g. von Wachter and Bender, 2006; Dustmann et al., 2009), allowing for a good comparability of our measures with those used by previous research in the context of transitions to dependent employment. Our data enable us to consider two types of outcome variables, the founders' self-assessment as measured by their motivation to start up (*necessity* vs. *opportunity* driven entrepreneurship), and their objectively measurable outcomes, such as annual sales and employment growth during the first years of business. We focus on startup growth as outcome, since growth potential in the first years should be more directly influenced by unemployment duration than more distant outcomes, which ultimately allows a clear attribution of the measured effects. Early growth is also a predictor of long-term firm success (Sedláček and Sterk, 2017).

To identify the causal effects of unemployment benefit duration on startup success, we exploit exogenous variation through both policy reforms of PBD, and age-specific cutoffs in the PBD schedule of the German unemployment insurance. Our main empirical strategy is an Instrumental Variable (IV) approach. We instrument PBD (and actual unemployment benefit duration) with the interaction term "being in the relevant age cohort" (only those above 45 years were affected by reforms) and "becoming unemployed after the reform changed maximum PBD". The reforms of 2006 and 2008 jointly reduced maximum PBD by at least six months for affected cohorts. Our IV approach entails the features of both

Difference-in-Differences (DiD) and Regression Discontinuity Design (RDD). In general, results remain robust when conducting a RDD to estimate the effect induced by age cut-offs in the PBD schedule or a DiD approach based on policy reforms.

Our results show a net negative causal effect of longer PBD on startup success. More specifically, our estimates suggest that longer PBD increases actual unemployment duration implying a UI elasticity of around 0.6, which is higher than recent estimates of 0.15 suggest when focusing on dependent re-employment (see e.g. Schmieder and von Wachter, 2016). Via this channel, longer PBD significantly increases the likelihood that individuals start firms out of *necessity* - compared to a situation in which they start the firm because of an *opportunity* motive - by about two percent per additional month of PBD. Moreover, and particularly when focusing on the non-manufacturing sectors, we consistently find a negative effect of longer PBD on actual outcomes in terms of employment and sales growth in the first two years after starting up.

These net causal effects can be driven by *individual-level duration*, *composition effects*, or a mix of both. We explain this with a stylized search model in Section 5. Empirically we find limited evidence for *composition effects* in observable characteristics of unemployed founders in response to UI policy changes. Hence, our findings suggest that the net effect is mostly driven by an *individual-level duration effect*, i.e. that the ability of individuals to succeed as entrepreneur depreciates the longer they are unemployed. Pushing them into self-employment as measure of last resort might lead to high individual and social costs. The results therefore indicate that by setting the length of PBD, the government can affect the quality of firms starting out of unemployment. Through this channel, changes in PBD may induce considerable fiscal externalities (Lawson, 2017) which affect the cost-benefit analysis of the UI system depending on the startup success (out of unemployment).

Our study makes three major contributions. First, we document how the PBD in the unemployment insurance affects the unemployment duration of future entrepreneurs. In this way, we analyze how a group of unemployed individuals who have not been analyzed by previous studies focusing on re-employment outcomes reacts to UI policies. In this context, it is ex-ante unclear whether the positive causal effect of PBD on actual UI benefit duration – which is usually found for those becoming re-employed as wage workers – also exists for those starting a business (and whether we can expect similar effect sizes).

This has direct implications for the cost of UI systems since additional fiscal externalities have to be considered because of the transitions from unemployment to self-employment.

Second, we provide evidence on how the UI policy affects the motivation of founders, i.e. whether they start a firm because of a business *opportunity* or out of *necessity* (as a last resort). In this way, our study illustrates how unemployment insurance policies can serve as a tool to maximize the share of *opportunity*-driven startups. This type of startup might have the highest potential for generating long-term economic value. Our results further suggest on this score that self-classifications can serve as an important indicator for the future potential of a startup and are therefore worthy of attention in themselves.

Third, we facilitate an understanding of how the growth potential (success) of startups in terms of employment generation and sales depends on UI policy. This is important for decisions on the optimal design of unemployment insurances since it affects their cost-benefit ratio. There are also implications for the optimal design of active labor market policies which incentivize unemployed individuals to transition into self-employment, particularly regarding the question of when such policies should come into practice. Thus, our results are informative for nascent entrepreneurs, money lenders, and policy makers.

Our paper connects several strands of the literature on entrepreneurship and public economics which have so far evolved parallel to each other. First, research on entrepreneurship has investigated potential determinants of becoming a firm founder (e.g. Evans and Leighton, 1989; Berglann et al., 2011; Levine and Rubinstein, 2017). Stylized facts suggest that unemployment increases the propensity to become self-employed (e.g. Evans and Leighton, 1990*b*,*a*; Meager, 1992; Blanchflower and Meyer, 1994; Kuhn and Schuetze, 2001; Andersson and Wadensjö, 2007; von Greiff, 2009; Røed and Skogstrøm, 2014*b*,*a*) but that previously unemployed founders perform worse in entrepreneurship than those transitioning from dependent employment (e.g. Andersson and Wadensjö, 2007). However, the entrepreneurship literature so far has largely ignored significant heterogeneity among the unemployed in terms of their motivation to start a business, and their firms' subsequent performance. In addition, the issue of *necessity*- versus *opportunity*-driven entrepreneurship has only been discussed in the context of very specific active labor market policies (e.g. Caliendo and Künn, 2011; Caliendo and Kritikos, 2010, for the case of startup subsidies) but not in the more important context of the general UI system.

In studying the effects of potential benefit duration on the timing of when unemployed individuals move (or are pushed) into self-employment (including its subsequent outcomes), we contribute to the entrepreneurship literature by providing evidence for the potential implications of the UI system on the success of firms started by unemployed individuals.[3]

Second, this project also adds to the literature of public economics on the optimal design of unemployment insurance by providing evidence for the effect of potential benefit duration on future entrepreneurs. The public economics literature has discussed several aspects concerning the optimal design of unemployment insurance policies, i.e. the level of benefits and their eligible duration (e.g. Hopenhayn and Nicolini, 1997; Katz and Meyer, 1990*a*,*b*; Lalive, 2008; Schmieder et al., 2012, 2016; Kolsrud et al., 2018). Its focus has been on investigating effects on subsequent employment outcomes, those predominantly being re-employment wages (e.g. Le Barbanchon, 2016; Schmieder et al., 2016; Le Barbanchon et al., 2019; Nekoei and Weber, 2017). Results suggest that increases in potential benefit duration (PBD) lead to increases in actual unemployment duration (ABD). However, the effects of longer actual unemployment on re-employment wages remain disputed. For instance, Nekoei and Weber (2017) argue that longer PBD can either induce delay in job acceptance (and simply subsidize leisure) or be beneficial by improving job opportunities (through subsidizing a longer search that results in job matches of higher quality). While Nekoei and Weber (2017) find that the latter positive effect dominates in Austria, Schmieder et al. (2016) report negative effects of unemployment duration on re-employment wages in Germany. We contribute to this debate by providing evidence of the causal effect of unemployment benefit duration on self-employment outcomes based on our newly created dataset. Thus, our paper ultimately complements the analysis of UI benefits with respect to post-unemployment outcomes (Jarosch and Pilossoph, 2019).

We proceed as follows: in Section 2, we explain our data construction and conduct a descriptive analysis. Section 3 illustrates the institutional background and our identification strategies for deriving causal effects. In Section 4, we present our empirical estimates which we rationalize in a stylized model in Section 5. Section 6 provides our conclusion.

[3]Though self-employment is a smaller fraction of the total labor force (e.g. 10% in Germany) than employment, founders can be considered incubators of (re)-employment. Even if only five percent of all the unemployed start a firm, the employment spillovers are significant: if a startup employs on average two employees after one year (three after three years), this means that we talk de facto about at least 15 (to 20) percent of the unemployment stock that may benefit from those startups, which neglects the fact that through new startups individuals may be saved from becoming unemployed in the first place.

2 Data and Descriptive Analysis

2.1 Dataset

For this paper's empirical analysis, we constructed data that matches the employer information of the IAB/ZEW Start-Up Panel with employee register data from the statistics of the German Federal Employment Agency. In this way, we circumvent the data limitation that German employer-employee linked administrative social security data normally put on any information regarding self-employed individuals. Self-employed individuals in Germany are not obliged to contribute to the public social security system. In contrast, it is mandatory for regular dependent employees to make social security contributions.

The IAB/ZEW Start-Up Panel is a joint research project from the Institute for Employment Research of the German Federal Employment Agency (IAB), the Leibniz Centre for European Economic Research (ZEW), and Creditreform, Germany's largest credit rating agency (see Fryges et al., 2010, for details on the sample design of the dataset). This dataset is a sample taken from the Mannheim Enterprise Panel ("MUP") which contains basic information on almost the entire universe of firms in Germany, including start-ups. The information is collected by Creditreform, which conducts credit ratings for basically all firms in Germany (Bersch et al., 2014). To be more precise, the Start-Up Panel is a random sample of the MUP providing a representative dataset of young firms from almost all industries (the primary sector, public sector and energy sector are excluded). Information is collected by means of a yearly telephone survey (computer-aided telephone interviews, CATI). The sample of the IAB/ZEW Start-Up Panel is stratified by the year of firm formation and by industry sector. Stratification is controlled for by including dummy variables for the stratification cells in all regressions. Currently, the IAB/ZEW Start-Up Panel contains data on more than 21,000 firms founded between 2005 and 2015.[4]

The linked register data are drawn from the "Integrated Employment Biographies" provided by the German Federal Employment Agency. These administrative data yield information on the start and end dates of all employment and unemployment spells in the founders' (and the start-ups' employees') employment history and their potential unemployment benefit duration. The data are reported by the social insurance agencies.

[4]The first survey wave was conducted in 2008, collecting data on firms founded between 2005 to 2007.

They are generated by the employing establishment and collected by the employment agency. Due to their high level of detail, the data are widely used in scientific research (e.g. von Wachter and Bender, 2006; Dustmann et al., 2009; Schmieder et al., 2016).

We matched the founders' and the start-ups' employees employment histories from the German Federal Employment Agency with the firm-level data of the IAB/ZEW Start-Up Panel by applying text search algorithm methods[5]. As a result, we obtained the most representative employer-employee linked dataset for founders in Germany as of this date. Our matched dataset covers longitudinal information on approximately 18,000 start-ups.

Comparing survey with recorded administrative data, our dataset reveals already some interesting observations. In the IAB/ZEW Start-Up Panel survey, about 15% of interviewees state that at least one founder in the team has been unemployed just before starting up the new venture. Our linked dataset confirms that almost 76% of founders are classified identically in the survey and administrative register data when it comes to the founder's previous labor market history. Only 20% of founders who have some registered unemployment spell before becoming self-employed do not reveal that they have been unemployed in the survey. Instead, less than four percent of founders report to have started a firm out of unemployment when there is, in fact, no unemployment-related entry in their social insurance records. In summary, these patterns are in line with differences between survey and administrative data concerning individual labor market histories that have been observed in the psychology literature. In fact, feeling ashamed of not having a job may lead to under-reporting of unemployment (e.g. Chletsos et al., 2013).

The high percentage of identical classifications and further quality checks conducted on the matching process (Appendix C.1) confirm the quality of our survey data on founders and of our new dataset linking them with administrative data. In conclusion, the created linked dataset allows us to derive representative results for founders in Germany and appears to be the most appropriate currently available resource for this purpose.

[5]We were able to match labor market histories of about 80% of the founders from the IAB/ZEW Start-up Panel based on their names, birth date, and additional geographical information. Given that not all founders were necessarily employed i.e. subject to social insurance in Germany before (e.g. as they have always been self-employed), this is a very high ratio of matched individuals. Moreover, we were able to match establishment data to about 90% of those start-ups that self-reported employees subject to registration with the German social insurance based on the establishments' names and addresses. Self-reported information is taken from an interview. For more details on the construction of our dataset, see Appendix C.

2.2 Descriptive Analysis

For the purpose of this study, we focus on the approximately 12,000 cases in which the firm was started by a single founder (as opposed to a team).[6] Moreover, our dataset includes both non-team founders that have and those that do not have any employees. In the main empirical analysis, we focus on roughly 1,300 firms whose non-team-founders were unemployed directly before starting their firms. They were between 35 and 65 years of age when entering unemployment, and became unemployed before some major reforms led to changes in the availability of start-up subsidies for the unemployed in 2012. We only include individuals for which all required information on control variables is available and who have collected enough contribution months to be entitled to maximum PBD.

Detailed summary statistics for all variables are shown in Table 2: i.e. for our regression sample of previously unemployed founders (and those of them with above median unemployment duration) as well as for a reference group of previously employed founders. The non-team founders are typically male (85%) and of German origin (94%). They have on average 17 years of experience in the industry they start up and most of them (85%) have never been self-employed before entering unemployment. The founders are on average 44.44 years old, about 39% enter unemployment when they are at least 45 years old (and hence belong to the treatment group in the subsequent causal analysis). In terms of education, 28% of founders achieved university degrees and 13% of them held managerial positions in the 5 years before starting up. Having on average a PBD of 12.32 months, the mean actual unemployment duration is 4.79 months before they enter self-employment.

Figure 2 compares outcomes of all entrepreneurs in our sample, distinguishing those who started their business out of unemployment with those that became entrepreneurs out of having been regularly employed (marked as not unemployed in Figure 2)[7]. The results show large differences between the two groups in terms of full-time equivalent (FTE) employment and sales. Having been unemployed before starting a firm is associated with

[6] The reason for this decision is that in order to detect the effect of PBD on subsequent firm outcomes, it is important to identify the unemployment duration effect, which is most clearly possible analyzing a single founder, i.e. a non-team founder (as opposed to a team of founders).

[7] As explained in Section 2.1 and in the footnotes of figures, we focus on non-team founders that are 35 to 65 years old. All firms are included independent of the survival length. Figure 1 shows the outcomes in terms of employment and sales per year for all entrepreneurs in the linked dataset. Note, that the graphs look very similar when we condition on firms that survive at least three or five years. These graphs are available upon request, and they confirm that startup success is relevant (and not biased by survival).

inferior outcomes when becoming an entrepreneur both in terms of the levels but also the growth trajectory of subsequent firm outcomes. Those who survive seven years as self-employed (SE), entering SE out of employment, can on average increase their sales by more than 100,000 Euro per year. Instead, founders who were previously unemployed and survive seven years, on average, only experience concave-shaped sales growth: they achieve an average increase in sales per year from about 150,000 to 300,000 Euro after seven years. Similarly, they only manage to increase FTE employment from about 0.5 to 1.5 employees (compared to an increase from 1 to 2 FTE employees in the other group).

Zooming in on those entering self-employment out of unemployment, Figure 3 compares outcomes of the previously unemployed entrepreneurs in our sample, split at the median unemployment duration. The results show that large differences between the two groups evolve over time in terms of both FTE employment and sales per year. Longer prior unemployment duration before starting a firm seems therefore associated with inferior outcomes as entrepreneurs who are not necessarily visible in the year of foundation but develop over the first years of firm's existence. These descriptive results indicate that a large part of the outcome differentials between previously unemployed and not unemployed founders are driven by unemployed founders with high unemployment duration.

One interesting feature from our dataset is the fact that we have information on the motivation of founders for starting up. Founders are asked about their motivation to start a business only during the first interview of the year in which they enter the panel survey (to best reflect the initial start-up reason) and can only choose one answer category. Table 1 shows how we define the different answer categories into either *necessity* driven motivation for starting up or into *opportunity* driven motivation for becoming an entrepreneur. In fact, we classify the answer categories "self-determined working" and the "realisation of business idea" as well as "better earning potential"[8] as indicators for founders that could be defined as being *opportunity* driven entrepreneurs. Instead, individuals answering "no suitable employment options" or "escape from unemployment" as main motives for starting a firm can be defined as belonging to the category of *necessity* driven or *pushed* entrepreneurs (Figure A.1). Table 2 shows that one third of previously unemployed non-team founders indicate to have been *pushed* into self-employment.

[8]We tested all results by excluding founders who self-reported this motivation category. However, all results remain robust and thus we decided to maintain the classification as indicated in the main text.

Figure 4 compares outcomes of all non-team founders in our sample, split by their self-reported motivation: being an *opportunity* or a *necessity/pushed* driven founder. The graphs reveal that those founders reporting an *opportunity*-driven motivation for starting their business experience faster growth in sales and full-time equivalent (FTE) . This suggests that the motivation appears to be a good predictor for subsequent start-up success and that the notion of different types of entrepreneurs defined along the lines of their motivation describes observed differences adequately. Finally, Figure 5 compares outcomes of the previously unemployed founders in our sample, split by their self-reported motivation. It reveals considerable differences between the two groups in terms of FTE employment and sales. Starting a business out-of unemployment with a *necessity* motivation is associated with worse outcomes over the self-employment spell compared to those launching a firm (out-of unemployment) being motivated by *opportunity* considerations.

Conducting OLS regressions of the actual benefit duration on being classified as *necessity* (*pushed*) entrepreneur, sales and FTE employment (one and two years after having started the business) controlling for individual labor market experience, education, gender, nationality, year and industry fixed effects show that the graphically observed correlation is quite robust (Table 3). In fact, simple regression analysis suggests that one month more of actual unemployment duration is associated with a 1.7 percentage point increase in *pushed* founders (five percentage in relative terms given an original basis of about now 35 % *necessity* entrepreneurs). Moreover, one month of actual benefit duration is significantly correlated with a decrease in sales and FTE employment (Table 3). This is reconfirmed when focusing on non-manufacturing sectors (75% of our sample) in Table 4. Non-manufacturing sectors offer easier market entry possibilities due to lower initial investment requirements and, thus, are most relevant for the entry of founders transitioning from unemployment to self-employment. In other words, actual unemployment duration has statistically significant relationship with subsequent self-employment outcomes.

In conclusion, the descriptive analysis already reveals that there appear to be significant differences for firm outcomes depending on the labor market history of the founder. In particular, starting a business out of unemployment is associated with worse outcomes in terms of sales and employment when compared to start-ups from founders who have been previously employed (not unemployed).

Moreover, given previous unemployment history, longer unemployment duration seems to be correlated with worse self-assessment (more *necessity* in contrast to *opportunity* motivation) and subsequently worse firm outcomes.

3 Institutions and Empirical Strategy

The goal of this paper is to find out whether potential benefit duration (PBD) causally affects actual unemployment duration for the founders that start up out of unemployment and whether in consequence actual unemployment duration causally affects the motivation for starting a business out of unemployment as well as subsequent firm outcomes. The main identification challenges lie in the fact that we need to exploit exogenous variation in PBD to learn how the length of eligible benefit duration causally affects actual unemployment duration (ABD), and hence how in general ABD affects outcome variables of interest. Otherwise, we face endogeneity problems. In theory, there may be, for instance, strategic behavior in becoming unemployed under the better PBD scheme conditions or the PBD (or actual unemployment duration) may be correlated with characteristics of unemployed people (e.g. previous working experience) that, in fact, explain the observed outcome. To solve these identification issues, we exploit policy reform and age-cutoff based exogenous variation in the PBD schedule within the German UI system.

We conduct an instrumental variables (IV) approach as main estimation strategy and check the robustness of our results by further conducting a regression discontinuity design (RD) and a difference-in-difference (DiD) approach. This allows us to derive the net causal effect of PBD on the actual UI duration elasticity of founders, the motivation to become self-employed, and on objective measures of startup success. To begin with, we explain the main institutional features the identification strategies rely upon.

3.1 Institutional Background: German UI system and reforms

In general, individuals in Germany who lose a job without fault of their own are entitled to unemployment insurance (UI) benefits ("Arbeitlosengeld I") if they satisfy certain *eligibility constraints*. These require UI benefit claimants to have paid social insurance contributions for at least 12 months within the last two years (3 years before February

2006). The replacement rate has not changed since 1995 and is fixed at 60 percent of previous after-tax (net) earnings (67 percent if a person has dependent children). After exhausting unemployment insurance benefits, one can get social security benefits tied to the existential minimum ("Arbeitslosengeld II"), which is subject to annual means testing.[9]

The potential benefit duration (PBD) depends, first, on an individual's age at the start of the unemployment spell, and second, on the number of months worked in jobs covered by social insurance (*contribution months*) within a defined time period before claiming UI benefits (*coverage constraint*: 7 years before February 2006 and 5 years afterwards). For all workers satisfying the *eligibility constraints*, the PBD is 6 months, which corresponds to the 12 months of contributions paid before the UI spell starts (Table 5). Then, for each four additional *contribution months* before starting an UI spell, the PBD increases by two months. However, workers younger than 45 years can only reach a maximum PBD of 12 months, which corresponds to 24 months of contributions, i.e. they can not get more than 12 months PBD if they have collected more than 24 *contribution months*. This maximum PBD cutoff increases with the age. For instance, before February 2006, 30 months of contribution led to 15 months of PBD for workers equal or older than 45 years at the start of their UI spell. As Table 5 illustrates, workers older or equal to 57 years could reach with 64 months of contributions the maximum PBD of 32 months. Thus, they could acquire 20 months more PBD compared to a worker younger than 45 years who had also contributed 64 months just before entering UI in the same month.

While the potential benefit duration (PBD) rules have been stable for workers that enter UI at an age younger than 45 years, the maximum PBD cutoffs have changed for the age groups over 45 years in February 2006 and a second time in January 2008. Each reform affected those individuals entering UI in the months after its implementation, whereas already unemployed individuals were still treated according to the rules in place in the month when they entered UI . Table 6 summarizes the eligibility criteria and changes over the different reforms[10]. The reform of 2006 led to a considerable reduction in the maximum PBD for all age groups above 45 years. The reform of 2008 led to a comparatively small increase in maximum PBD for some age groups above 50 years.

[9]In line with our data, the analysis focuses on 2005-2015. Thus, we describe the German UI system as it exists since 2005. Appendix B.1 gives more details on the labor market reforms in the early 2000s.

[10]For an overview of reforms in the German UI benefit before the time period studied in this paper, see Schmieder et al. (2012). For the time period studied we refer to e.g. Price (2018) and Appendix B.1.

In total, the net reform effect comparing the time period before February 2006 to that one after January 2008 can be characterized by a reduction in PBD for all age cohorts entering the UI system at an age older or equal to 45. The net effect is a reduction of at least six months (Table 6).

3.2 Main Empirical Strategy: Instrumental Variables (IV)

The identifying variation that we exploit in our three empirical estimation models stems from the age-dependent discontinuities in potential benefit duration (PBD) (Table 5) and from two reforms of the maximum PBD in 2006 and 2008 (Table 6).[11]

Our main empirical estimation models follow the Instrumental Variable (IV) approach of Le Barbanchon et al. (2019). The idea is to exploit the fact that the PBD in the German UI system depends on age-cut offs and that there have been reforms that only changed the PBD but not UI benefit levels. Thus, instrumenting PBD (or actual unemployment benefit duration) by an interaction of the reform and the age-cutoff is a useful instrument. It should satisfy the exclusion restriction because the differences in outcomes among individuals are unlikely to be explained by just small differentials in age (under or over the age cutoff) and the time when becoming unemployed (before or after the reform). We estimate IV models of the form:

$$y_{it} = \alpha + \beta * Treated_{it} + \gamma * PBD_{it} + \delta * X_{it} + year_t + \epsilon_{it} \tag{1}$$

$$y_{it} = \alpha + \beta * Treated_{it} + \gamma * ABD_{it} + \delta * X_{it} + year_t + \epsilon_{it} \tag{2}$$

where for each founder i in month t: y is the outcome variable which can be motivation for starting a firm, sales or employment growth in the first and second year after foundation (i.e. yearly sales in Euro and yearly number of full-time equivalent (FTE)

[11] Startup Subsidies do not depend on age and though there was a change in the scheme of startup subsidies in 2006, first, we also use the 2008 reform as source of variation when relying on reform-based variation in PBD, and second, the age discontinuities we exploit exist at each point in time. Thus, our source of variation is not correlated with any changes occurring for the startup subsidies for the unemployed (compare Appendix B.2). Moreover, we control in all regressions for the KfW-funding variable which is a proxy for most other forms of startup subsidies in Germany. Note that the purpose of this paper is to understand the role of the general UI PBD framework on the unemployed that exit into self-employment and not on rare active labor market policies. However, as most of these subsidies can be interpreted as an extension of PBD, learning about the general PBD effect on those who start a firm out-of-unemployment is important.

employees, both variables measured in logarithmic terms). Moreover, α is a constant and X is a vector of firm- and founder-specific control variables (education, managerial experience, self-employment experience, industry experience, gender, being subsidized, industry-fixed effects). Finally, we control for macroeconomic conditions and trends in the unemployment or self-employment rate by taking into account year-fixed effects.[12]

The potential benefit duration (PBD_{it}) and the actual benefit duration (ABD_{it}) are instrumented by the instrumental variables: *IV06=After(02/2006)*Treated(age≥45)* which reflects the effect of a decrease in PBD by at least 6 months and/or *IV08=After(01/2008)*Treated(50≤age≤54)* which reflects the effect of an increase in PBD by at least 3 months. This leads to the IV first-stage models:

$$PBD_{it} = \alpha + \beta * Treated_{it} + \gamma * IV06\ (+\gamma * IV08) + \delta * X_{it} + year_t + \epsilon_{it} \tag{3}$$

$$ABD_{it} = \alpha + \beta * Treated_{it} + \gamma * IV06\ (+\gamma * IV08) + \delta * X_{it} + year_t + \epsilon_{it} \tag{4}$$

The first-stage models may be regarded as tests about the strength of our instrumental variable (IV). As the IV should be correlated with the variable of interest, PBD (ABD), the F-Statistic of equation 1 (2) should be larger than 10 in order to avoid weak IV issues. In fact, our instruments turn out to be very strong, with equation 1 yielding high F-statistics with values above 100 and always at least 10 in any specification (compare Tables 9 to 16). In other words, the first-stage model (equation 3) proves that our instrument is a strong predictor of the instrumented variable of interest (PBD_{it}). Moreover, one would expect that the corresponding F-statistic of equation 2 will be smaller because the IV should be correlated in the first place with the policy variable that changed through the reforms, PBD, and only in second order with the actual benefit duration (ABD). However, we also instrument the ABD in order to understand how changes of PBD may affect subsequent outcomes of unemployed individuals that transfer from unemployment to self-employment and that are induced by changes in ABD initiated through the original change in PBD.[13]

Our IV approach exploits both reform-based and age cutoffs-based exogenous variation in order to estimate the causal effect of PBD on ABD, the motivation for starting a

[12]We tested taking out observations from January 2006 so that the year effects fully capture the after-reform dummy. Conducting this approach does not alter our results.

[13]The IV estimator has the interpretation of a (local) average treatment effect of PBD/ABD on our outcomes similar to the IV approach of Schmieder et al. (2016) that is used for estimating the wage effect.

business, and on startup success. Thus, it has most external validity as compared to two other estimation approaches which it nests. For robustness checks, we also conduct a regression discontinuity design (RDD) estimation that only exploits the age-cutoffs in the PBD schedule to derive the causal local average treatment effect (see Section 4.2.1). Finally, a difference-in-difference (DiD) strategy that only relies on the reforms in the PBD schedule allows us to estimate the causal treatment effect (see Section 4.2.3).

4 Results

In this section, we focus on the net causal effect of potential benefit duration (PBD) on ABD and on the net causal effect of PBD/ABD on the motivation for starting up (out of unemployment) and on subsequent firm outcomes.

4.1 Main Results: Instrumental Variabels (IV)

First, we estimate instrumental variable (IV) models as explained in the methods Section 3. Tables 9, 10 and Tables 11, 12 show our main results that use the policy reform of 2006 as an instrument for longer potential benefit duration (PBD). Tables 7, 8 show our OLS baseline results. Tables 13, 14, 15, 16 show results of using both instrumental variables for the reforms of 2006, and 2008 (cf. Section 3.2). Note that we repeat all main results focusing only on non-manufacturing sectors. The reason is that the non-manufacturing sectors might be of particular relevance for market entry by unemployed individuals because entry into these sectors usually requires comparably low initial investment. Hence, focusing on non-manufacturing sectors may allow us to abstract from investment-driven unobserved heterogeneity. Importantly, all our results remain consistent and robust. Most findings are even more precisely estimated in the restricted sample (still 75% of our sample).

To begin with, for the case where we only conduct simple OLS regression with potential benefit duration (PBD) as main explanatory variable, results on actual benefit duration (ABD) , the motivation for starting a business and subsequent firm outcomes are shown in Table 7. In all regressions, we control for education, previous labor market experience, individual characteristics (gender, nationality), industry, and year-fixed effects.

More highly educated individuals tend to be less likely to start a business out of self-reported *necessity*. Previous managerial experience contributes to better performance in terms of sales and employment growth. Being female or foreigner does not have any differential effect concerning actual unemployment duration or the motivation for starting a business. If at all, these two characteristics may be associated with lower sales growth. Moreover, a funding dummy for subsidies from the Federal Employment Agency and from the KfW control for any potential concerns related to startup subsidies (Appendix B.2).

The OLS results translate into a duration elasticity of about 0.5, as a one month increase in PBD increases ABD by 0.47 months. Moreover, one month of additional PBD increases the probability of starting a business out of necessity by about two percentage points. Finally, more PBD appears to imply less sales and full-time equivalent (FTE) employment growth in the first two years after starting the business. The results are confirmed and are measured more precisely when focusing on the non-manufacturing sectors (Table 8).

However, to establish causality, we apply the instrumental variables (IV) approach as explained in Section 3.2. The causal IV estimates suggest that longer potential benefit duration (PBD) leads to longer actual unemployment benefit duration (ABD) before individuals transfer from unemployment to self-employment. This has been shown so far only with respect to re-employment. Via this channel, longer PBD increases the probability that individuals start a company out of *necessity* reasons (and not because they perceive a business *opportunity*). Moreover, longer PBD decreases firm performance in terms of employment and sales over the first years in business. The F-statistic is well above 10 in all versions of the IV models and hence indicates a good predictive power of the instrument (Section 3.2). A one month increase in the PBD leads to a 0.6 month increase in the actual unemployment duration. In the second stage, this increase in ABD leads to a 1.5 percent higher probability to start a firm out of *necessity* (Table 9). Given that the average probability to start a firm out of *necessity* is around 35 percent, this corresponds to a relative increase of five percent, which is economically significant. Turning to the effects on more objective outcomes, we find that only the effect on sales after two years remains of statistical significance. A one month increase in the PBD leads to 7.2% lower sales in the second year. Focusing on the non-manufacturing sectors, Table 10 shows that

the negative effects of about one percentage point on FTE employment are statistically significant after the second year. Moreover, in the latter sample, the other effects get even stronger. In summary, our IV results confirm the initial OLS results.

Finally, our results are reconfirmed when using both IVs, that is $IV06$ for the 2006 reform, which decreased PBD by at least six months, and $IV08$ for the 2008 reform that increased PBD for three months. In fact, the results for changes in PBD on our outcomes of interest in Table 13 are very similar to those in Table 9 which are only based on $IV06$. The same is true when we focus on the non-manufacturing sectors. Table 14 based on two instrumental variables shows very similar results to the ones based only on $IV06$ (Table 10). We repeat the IV estimation instrumenting actual unemployment duration (ABD). The findings are shown in Table 11 and 15. They are in line with the described results for potential benefit duration. Table 12 and 16 show regressions based on actual benefit duration focusing on the non-manufacturing sector, and also confirm our main results.

4.2 Robustness Checks: Two Further Estimation Strategies

4.2.1 Regression Discontinuity Design (RDD)

The RDD exploits age-dependent discontinuities in the potential benefit duration (PBD) estimating the equation:

$$y_i = \alpha \mathbf{1}(age_i \geq c) + f(age_i, \beta) + f(age_i, \gamma) \times \mathbf{1}(age_i \geq c) + X_i'\delta + \epsilon_i \tag{5}$$

where individual age is the forcing variable, y_i is the outcome variable of interest, actual unemployment duration and subsequent performance as an entrepreneur, X_i is a set of individual-specific covariates, and ϵ an error term. Thus, $\mathbf{1}(age_i \geq c)$ reveals to us whether individuals benefit from extended PBD. The α measures the discontinuity, i.e. the effect of interest, namely how PBD affects the outcomes of those who start a firm out of unemployment.

In the RDD, we focus on the period from 2008 onward, an age range from 45 until 54 years, and an age-cutoff at 50 years. Below an age of 50 years, the maximum potential benefit duration is 12 months. Above an age of 50 years, the maximum PBD is 15 months. This allows us to exploit an exogenous increase in the PBD of three months.

This furthermore requires the identification assumption that there is no precise manipulation of the running variable around the cutoff (workers do not plan to become strategically unemployed just after an age threshold is reached to exploit higher potential benefit duration).[14] By restricting it to individuals who only become unemployed after January 2008, we see that they all face the same maximum PBD schedule as shown in columns (6), (7) in Table 5 or 6. As in the time period studied no other major labor market reforms occured and startup subsidies remained unchanged (Appendix B.2), the only relevant difference in the PBD is driven by age-cutoffs. This can be tested by conducting a McCrary density test investigating whether there is bunching around the age-cutoff in the unemployment rate of workers that become unemployed when aged between 45 and 54 years. Figure A.2 shows that the test is passed.

4.2.2 Regression Discontinuity Design (RDD) Results

This regression discontinuity design (RDD) approach has been already exploited to study earlier reforms of maximum potential benefit duration (PBD) in the German UI system by Schmieder et al. (2012, 2016). These authors show that the RDD approach is credible for the time period studied (1987 to 2004). We take this empirical approach to investigate a more recent period (2003 to 2011). Moreover, we exploit the reformed age-dependent maximum PBD schedules with respect to a sample of individuals that is excluded in existing studies due to the data limitations that we surpass with this paper, i.e. we focus on those who transfer from unemployment to self-employment (not employment).

Results of the RDD are summarized in Figures A.2, A.3, A.4 and Table A.1. First, results of a McCrary density test do not indicate significant discontinuity in the distribution of individuals entering unemployment around the cutoff (Figure A.2). Thus, this test provides evidence that the assumptions of the RDD are met. Furthermore, Figure A.3 shows that our data construction process has been successful, because in line with the age-dependent rules on the maximal PBD, as explained in Tables 5 and 6, in the years since 2008, one would expect there to be an increase of around three months at the age of 50 for individuals who have contributed at least 30 months to social security.

[14] Le Barbanchon (2016) shows that this RDD approach works in the context of analyzing a French reform that increased PBD for certain unemployed individuals. Nekoei and Weber (2017) conduct a similar RDD estimating the effect of UI generosity on unemployment duration and re-employment wages in Austria.

Indeed, our sample shows that the PBD increases, even though only by around 2.1 months instead of 3 months (first panel in Figure A.3). Furthermore, our RDD strategy reveals that an increase of 2.1 months in potential unemployment benefit duration translates into a significant increase in actual unemployment duration of about 1.2 months. That is, our RDD estimation approach suggests that the duration elasticity for unemployed persons that eventually start a business is around the value of 0.6 (second panel in Figure A.3).

Unfortunately, the number of observations that can be used for the RDD is limited. Since information on sales is missing for a significant number of observation and sales are more volatile compared to employment outcomes, we are only able to derive meaningful RDD results for employment after one year and after two years (Figure A.4). The RDD results suggest that an increase of about 2.1 months decreases full-time equivalent (FTE) employment by about 12 percentage points in the first year and about 25 percentage points in the second year. This means that an increase of one month in PBD leads to a reduction in employment by about 6 percentage points in the first year and 12.5 percentage points in the second year after founding the firm.

In summary, the RDD results are fully consistent with those of IV approach. Longer PBD leads to an increase in actual unemployment duration (ABD), which then leads to a decrease in subsequent startup success as measured in terms of FTE employment growth.

4.2.3 Differences-in-Differences (DID) Approach

The DiD approach exploits the reform-induced changes in the potential benefit duration (PBD) (similar to Cottier et al., 2019) estimating the equation:

$$y_{it} = \alpha + \beta * Treated_{it} + \gamma * After_t + \delta * (Treated * After)_{it} + X_{it} + \epsilon_{it} \tag{6}$$

where α is a constant and X_{it} is a vector of person-specific controls (gender, nationality, education, managerial skills) and ϵ an error term for each individual i in month t. Then, δ indicates the causal reform effect of PBD on our outcomes of interest y, the actual benefit duration, the motivation for starting up, and subsequent outcomes as self-employed.

In the DiD setting, we exploit the 2006 reform. Thus $After_t = 1$ is a dummy indicating if an individual becomes unemployed after February 2006. The Treatment-Group consists

of workers entering an UI spell at an age equal to or higher than 45 years, whereas the Control-Group consists of those younger than 45 when claiming UI benefits. The reform effect measures the treatment of reducing PBD (and thus ABD) by at least 3 months.

4.2.4 Differences-in-Differences (DiD) Results

Our results for the differences-in-differences (DiD) strategy are summarized in Table A.4. Our DiD results capture the causal effect of potential benefit duration (PBD) on actual unemployment duration (ABD) and consequently of the decrease of unemployment duration on the motivation for starting up, as well as subsequent firm outcomes.
The first column of Table A.4 shows that a reduction of at least three months in PBD significantly reduces actual unemployment duration by around 3.6 months. This reconfirms that there is a positive causal relationship between potential and actual benefit duration, and not only with respect to re-employment. The result suggests that the translation from potential into actual unemployment duration may be stronger with respect to reductions than increases in the PBD. The results for other outcomes are not statistically significant in the DiD setting when considering all sectors (columns 5/6 in Table A.4). Focusing again on the non-manufacturing sector as robustness check, Table A.3 reconfirms our findings. As before, the effects now appear to be measured more precisely. The DiD results confirm that reducing PBD leads to a statistically significant reduction in actual unemployment duration and to statistically significantly higher sales growth after two years.

4.3 Discussion of Results and Mechanisms

Our empirical results based on three different estimation methods (IV, RDD, DiD) suggest a number of conclusions. First, longer PBD increases actual UI duration for those unemployed individuals who start a firm. Hence, our results document that what prior literature has established for individuals transitioning from unemployment to employment (e.g Schmieder and von Wachter, 2016) also holds for individuals transitioning from unemployment to self-employment. In terms of size, our estimated duration elasticity is slightly above 0.6[15] and thus a bit higher than what recent estimates focusing on transitions from

[15]For the OLS regression, we find a duration elasticity of about 0.48; for the IV strategy, we get a duration elasticity of around 0.67; for the RDD strategy, we find a duration elasticity of around 0.6; and for the DiD strategy, we find a duration elasticity of around 1. Note that differences in results across the different estimation strategies are to be expected: the RDD measures the local average treatment effect, whereas the DiD derives the average treatment effect. Our IV strategy constitutes a compromise

unemployment to paid employment and on increases in PBD suggest.[16] However, our UI duration elasticity estimate corresponds to the median of 0.53 which can be calculated based on the estimates of 18 studies that estimate the UI duration elasticity with respect to employment (compare Appendix, Table 2 in Doris et al., 2018).[17]

Second, longer PBD (via longer actual unemployment duration (ABD)) increases the fraction of *pushed* entrepreneurs. More unemployed individuals seem to literally escape unemployment by becoming self-employed out of self-reported *necessity* instead of an *opportunity*-driven motivation. Finally, we find overall consistent but not always statistically precisely measured evidence that longer PBD/ABD reduces the subsequent success of firms that are started out of unemployment (in terms of sales/employment growth).

The estimated (causal) effects of longer PBD on startup motivation and success can be driven by different mechanisms. On the one hand, longer PBD can be expected to change the behavior of unemployed individuals, thereby leading to a different composition of founders that decide to start a firm out of unemployment. On the other hand, by incentivizing longer actual unemployment duration (ABD), longer PBD could alter the success potential at the individual level (duration effect) i.e. whether longer actual unemployment durations lead to losses of financial, social, and human capital, e.g. through losses of professional contacts, stigmatization effects, or depreciation of skills and knowledge.

We attempt to assess the potential influence of both mechanisms by analyzing composition changes in previously unemployed and a reference group of previously not unemployed founders before and after the UI reform of 2006 (our main source of exogenous variation in PBD). In Table 17, we provide t-tests for before/after reform comparisons of our main explanatory variables and an additionally added broader indicator of founder quality: the average daily wage in employment within five years before starting up (capped at the social security contribution ceiling). We add this measure to assess the potential influence of unobserved factors that we do not control for in our models.

of RDD and DiD. Thus, our IV results are expected to be between RDD and DiD. Finally, the fact that IV estimates are larger than OLS estimates shows that measurement error which would lead to downward bias is limited in our data set.

[16] Le Barbanchon et al. (2019) finds 0.3 for France, Nekoei and Weber (2017) find 0.016 for Austria or Schmieder et al. (2016) 0.15 for Germany (in the period before 2004), but they all focus only on transitions from unemployment insurance into employment. However, for a decrease in UI generosity Doris et al., 2018 find larger effects. Moreover, they provide an overview of studies with higher estimates.

[17] Moreover, Farber et al. (2015) suggest that the extensive margin of UI extensions is rather negligible.

Looking at all unemployed founders in our regression sample that are in the age-based treatment group (two left panels), we observe almost no significant changes in composition before or after the reform. Consistent with the reform and our estimation results, the average ABD of treated founders increases significantly. Moreover, significantly more founders receive subsidies by the Federal Employment Agency in the period after the reform (we control for these subsidies in our regressions). Most notably, the (statistically) insignificant but sizable increase in average founders' pre-unemployment wages after the reform is in line with a composition mechanism of "better" founders due to lower PBD. The fact that we find smaller effect sizes for the reference group of previously not unemployed founders (right panels of Table 17) points towards the possibility of composition effects induced by the reform on the pool of unemployed founders. Hence, composition effects could be one mechanism behind our results but do not seem to be their main driver.

As a further test, we re-estimate our main OLS and IV models without any control variables (see Tables A.6 and A.7). This allows us to assess whether including covariates, which should substantially reduce the impact of composition effects, affect our point estimates for changes in PBD. When estimated without control variables, all point estimates for changes in PBD or ABD remain very similar. Hence, the test does not suggest strong reform-induced composition changes in unemployed founders as a driver of our results.

This assessment is supported by the summary statistics in Table 2. Differences in human capital between unemployed founders and the reference group of not unemployed founders seem more sizeable than the small differences between all unemployed founders and unemployed founders with above median unemployment duration. Hence, it is unlikely that these differences over the unemployment duration explain our regression results.

In summary, our data indicate the existence of both *composition* and *individual-level duration effects* induced by the UI policy reforms. Of the two, our data rather suggests reform-induced *individual-level duration effects* as the main mechanism behind the estimated effects on startup success. However, future research should investigate the mechanisms in more details and quantify the relative importance of *composition* versus *individual-level duration* effects.

5 Stylized Theoretical Model

In the following, we present a stylized model to rationalize the empirical findings that we observed in the previous Section 4. We conclude this Section by showing policy options in the model (Section 5.2), implications in terms of fiscal externalities (Section 5.3) and general policy implications of our findings (Section 5.4).

5.1 The Framework

We consider workers who become unemployed in period $t = 0$ as risk-neutral, provided they stay in unemployment receiving UI benefits for duration d.[18] In each time period (month), they receive unemployment benefits b_t until the maximal potential unemployment benefit duration PBD is reached (compare Section 3.1). Focusing on the case of a two-layer UI system, this means that benefits can be defined as $b_t = \bar{b}$ for $t \leq PBD$, where $\bar{b}$ is the constant UI benefits which the unemployed individual receives for the entire UI spell (until exhausting benefits at the potential benefit duration PBD). The UI benefits depend on the previous wage; they constitute the replacement rate fraction of the average monthly wage income over the six months before entering unemployment. Then, $b_t = \tilde{b} < \bar{b}$ for $t > PBD$, where $\tilde{b}$ can be interpreted as Germany's existential minimum assistance "Arbeitslosengeld II" that is independent of previous contribution months and lower than the wage-dependent UI benefits ($\bar{b}$). Without loss of generality, this amount is the same for all eligible claimants.[19] We assume that each individual has a latent entrepreneurial ability $\theta \sim G(\theta)$, where $G()$ is a normal density function. Then in each time period, an unemployed individual has to decide whether to search for employment or to start a firm, i.e. to become self-employed. Let V_u^e be the value function of an unemployed individual searching for employment, and V_u^{se} that of an unemployed individual starting a business. Then, the decision of an unemployed individual is characterized by her value function:

$$V_t^u = max\{V_{u,t}^e, V_{u,t}^{se}\} \tag{7}$$

[18] The model is in continuous time and the horizon lasts for each worker until retirement time T.

[19] Note that the replacement rate for UI benefits ($\bar{b}$) is 60% for single individuals and 67% for individuals with dependent children. When receiving the existential minimum ($\tilde{b}$), the additional amount received per child on top of the basic minimum approximately corresponds to the general child allowances every parent receives from the German federal state ("Kindergeld"). Thus, the relative drop in income when exhausting UI benefits does not vary much per person independent of the family structure and we abstract from this issue for the purpose of this paper.

Value of Searching for Employment out of Unemployment Ignoring savings (workers live hand-to-mouth), the value of searching for employment when the individual is unemployed can be characterized by:

$$V^e_{u,t} = b_t - \psi_t(s_t) + \beta\Big\{p_t[1 - F(\phi_t)] \int_{\phi_t}^{\infty} V^e_{t+1}(w_{t+1})dF(w_{t+1}) + [p_t F(\phi_t) + (1 - p_t)]\, V^u_{t+1}\Big\} \quad (8)$$

The unemployed individual receives consumption flow utility from benefits $c_{u,t} = b_t$[20], but faces search costs ψ_t, which, in line with the literature (e.g. Schmieder and von Wachter, 2016), we assume to be a differentiable, increasing and convex function of search effort s_t. With probability $p_t = p(s_t, \theta)$ that depends on search effort and (entrepreneurial) ability, the unemployed worker receives a job offer for period $t + 1$. Note that in this setting, the individual's optimal behaviour is characterized by a reservation wage ϕ_t above which any wage offer $w_t \geq \phi_t$ is accepted.[21] Thus, with probability $1 - F(\phi_t)$ the offer is accepted and she becomes re-employed, receiving the corresponding expected value of being employed V^e_{t+1} (see equation 9). However, with probability $F(\phi_t)$, the offer is too low and is rejected. In this case and if the worker receives no offer (with probability $1-p_t$), she remains unemployed in the next month and receives the next period value of being in unemployment, V^u_{t+1} (equation 7). As usual, β is the discount factor of future period returns.[22] The two-layer UI system implies through the parameter b_t that if an individual stays unemployed, surpassing the potential benefit duration (PBD), the outside option will decline to the existential minimum (from $b_t = \bar{b}$ to $b_t = \tilde{b} < \bar{b}$). Thus, a drop in the value function ($V^e_{u,t}$) is to be expected in the month of the unemployment spell when the PBD is reached.

The Value of Being in Employment is then characterized by:

$$V^e_t = (w_t - \tau) + \beta\{\lambda_t V^u_{t+1} + (1 - \lambda_t)V^e_{t+1}\} \quad (9)$$

[20]Note that $c_{u,t} = b_t + y_u$ where y_u could be income from other sources that, if assumed to remain constant over the UI spell and exogenously given, would not alter our qualitative conclusions and could represent e.g. represents support from family members.

[21]Note that the cumulative distribution function $F()$ may depend on the duration of unemployment, for instance, due to depreciation in human capital or (statistical) discrimination or stigma effects, as explained by Jarosch and Pilossoph (2019) and experimental evidence suggests (Oberholzer-Gee, 2008).

[22]One could introduce myopic behavior of agents by changing the discount factor. We abstract from this complication, as we have no empirical evidence for irrational behavior driving our results.

An employed worker receives consumption flow utility $c_{e,t} = w_t - \tau$, i.e. consumption based on net wage.[23] Variable λ_t is an exogenous separation rate that may vary depending on macroeconomic conditions over time. Then, with probability λ_t, the worker may lose her job and become unemployed again, but with probability $1 - \lambda_t$ the worker remains employed. As a simplifying restriction, we ignore the option of moving from employment to self-employment but focus on flows from unemployment to self-employment, as this resembles our available empirical setting and is the relevant labor market flow we study.

Value of entering Self-Employment out of Unemployment The value for an unemployed individual to become self-employed out of unemployment is characterized by:

$$V_{u,t}^{se} = b_t - \psi_t^{se}(s_t, \theta) + \beta\Big\{p_t[1 - F(\phi_t)] \int_{\phi_t}^{\infty} V_{t+1}^{se}(\pi_{t+1}) dF(\pi_{t+1}) + [p_t F(\phi_t) + (1 - p_t)]\, V_{t+1}^{u}\Big\} \quad (10)$$

An unemployed individual evaluating whether to become self-employed faces a similar value function as in the case of searching for employment (equation 8). Again, she reveives a consumption flow utility in the form of unemployment benefits b_t and faces search costs $\psi_t^{se}(s_t)$. These search costs could be different and more dependent on the individual than in the case of searching for employment, since an individual has to develop an idea, do market research, or find capital instead of writing applications in a more standardized process of looking for paid employment. Furthermore, becoming self-employed is more dependent on one's own skills θ. The higher the entrepreneurial ability, the smaller are market-entry search costs. The individual unemployed still faces a reservation wage ϕ_t above which potential profits from self-employment would be accepted. However, if potential profit is too low, the individual may remain in unemployment to look for employment. Otherwise, if profits as self-employed are higher than the reservation wage $\pi_t \geq \phi_t$, she will prefer to start up.

Value of Being in Self-Employment The value of being in self-employment can be characterized by the following value function:

$$V_{ut}^{se} = \pi_t(\theta) + sub_t + \beta\{\gamma(\theta) V_{t+1}^{u} + (1 - \gamma(\theta)) V_{t+1}^{se}\} \quad (11)$$

[23] Taxes could be also designed to be proportional taxes $(1-t)$ without changing the qualitative results.

A self-employed person earns profits $\pi_t(\theta)$ (net of a startup cost) and may get a subsidy sub_t. Thereby, the returns $\pi_t(\theta)$ are assumed to be increasing in entrepreneurial skills ($\frac{\partial \pi_t()}{\partial \theta} > 0$) reflecting that, for instance, the quality of successful business ideas may increase with θ. Similarly, the probability that the startup fails, $\gamma(\theta)$, is assumed to be decreasing in entrepreneurial ability, $\frac{\partial \gamma()}{\partial \theta} < 0$, reflecting e.g. that better business ideas are less likely to produce failure. Thus, with probability $(1 - \gamma(\theta))$ the startup survives and with probability $\gamma(\theta)$, the founder has to return to unemployment, V^u_{t+1} (eq. 7).

The Effect of Unemployment Duration on Value Functions The unemployed workers decision problem (equation 7) is to maximize expected utility between the value of moving from unemployment to employment and the value of becoming self-employed out of unemployment. See Appendix D.1 for the derivation of results.

First, the **value function of moving from unemployment to employment** can be characterized by equation (8) where V^e_{t+1} is characterized by equation (9). It is important to note that given a fixed level of (entrepreneurial) ability θ, the value function $V^e_{u,t}$ features negative **duration dependence** $\frac{\partial V^e_{ut}}{\partial d}|\theta < 0$. There are two main sources for UI duration dependence: the search effort may vary over the unemployment duration and over time the benefit levels are decreasing (at least once reaching PBD with the drop to the existential minimum).[24] The accepted job offer's value depends on both search effort determining the job offer arrival rate $p(s_t, \theta)$ and on the re-employment wage.[25].

We derive the optimal search intensity and reservation wage paths in order to observe how these variables react to an increase in $d = PBD$. We find that the reservation wage is positively correlated to the unemployment duration, i.e. $\frac{\partial \phi_t}{\partial d} > 0$. The search intensity reacts negatively to an increase in potential unemployment duration, i.e. $\frac{\partial s_t}{\partial d} < 0$. This implies that an individual will prefer to stay longer unemployed when PBD is increased.

[24] Nekoei and Weber (2017) show that a directed search model incorporates these two sources of duration dependence and includes the random search McCall-style model that we presented as a special case. Moreover, they show that selectivity may be positively, and duration dependence negatively affecting re-employment wages.

[25] Note that there have been different theories proposed to explain this finding. They include, for instance, first, that human capital or job-specific skills may decay over the non-employment spell. Second, statistical discrimination has been suggested for explaining this finding because it implies that less able persons remain longer unemployed. Third stock-flow matching could also explain duration dependence as it implies that those entering unemployment and not quickly finding a match become increasingly dependent on the inflow of new posted vacancies (and flow variables are quantitatively smaller than stock variables).

Negative UI duration dependence has been shown to be an empirically robust finding regarding re-employment outcomes, even if there is not yet a consensus concerning the welfare implications for post-unemployment wages (e.g. Schmieder et al., 2016; Schmieder and von Wachter, 2016; Nekoei and Weber, 2017).

Second, the **value function of moving from unemployment to self-employment** can be characterized by equation (10) where V^{se}_{t+1} is characterized by equation (11). Holding entrepreneurial ability fixed, this value function is also dependent on unemployment duration d, that is $\frac{\partial V^{se}_{ut}}{\partial d}|\theta < 0$, but in absolute terms, it is smaller than $\frac{\partial V^{e}_{ut}}{\partial d}$, ie. $\frac{\partial V^{e}_{ut}}{\partial d}|\theta < \frac{\partial V^{se}_{ut}}{\partial d}|\theta < 0$. We derive this by exploiting the definitions of $V^{e}_{u,t}$ and $V^{se}_{u,t}$. By assuming that the value of leaving unemployment in the next period depends on average on the present value of the reservation wage, we can write $V^{e}_{u,t+1} = \frac{1}{\rho}\phi_t$. In the case of self-employment, the latter definition has to be extended in the following way: $V^{se}_{t+1} = \frac{1-\gamma(\theta)}{\rho}$ ϕ_t, because one can only become self-employed with a probability of $[1 - \gamma(\theta)]$.

Deriving the optimal reservation wage and search intensity paths, we show that the optimal search intensity for business opportunities is less dependent on unemployment duration d. Thus, the negative unemployment duration dependence for becoming self-employed is smaller than in the case of searching for employment. This reflects the idea that self-employment can be interpreted as an alternative professional activity more dependent on one's own skills than on the labor market conditions and is thus approximately independent of unemployment duration (compare Appendix D.1). Moreover, the search process for self-employment is different from the search for regular employment.

Now it is possible to rationalize our empirical results by analyzing qualitatively how the value functions for becoming employed V^{e}_{ut} (equation 8) and self-employed V^{se}_{ut} (equation 10) evolve with unemployment duration d and how this influences an unemployed individual's decision, given her entrepreneurial ability. Figure 6 illustrates that the unemployed individual will prefer to find a job provided that the value function for searching employment V^{e}_{ut} is above the value function for becoming self-employed V^{se}_{ut}. Vice versa she prefers to start a business when $\mathbf{V^{se}_{ut}} > \mathbf{V^{e}_{ut}}|\theta$. The red line depicts $\frac{\partial V^{e}_{ut}}{\partial d}|\theta < 0$. The blue line shows $\frac{\partial V^{e}_{ut}}{\partial d}|\theta < \frac{\partial \mathbf{V^{se}_{ut}}}{\partial \mathbf{d}}|\theta < 0$. Moreover, the vertical black line marks the PBD; at this point of unemployment duration, the red line drops by $x = \bar{b} - \tilde{b}$ because UI benefits $\bar{b}$ drop to the existential minimum $\tilde{b}$ (compare Appendix B).

Thus, the stylized model suggests that potential benefit duration can determine the composition of the self-employed who transition from unemployment. This becomes apparent when analyzing how unemployed individuals behave in this model.

First of all, holding everything fixed but changing entrepreneurial ability, we can observe the following. As Figure 7 illustrates, some high ability individuals may always decide to become self-employed once unemployed i.e. having to find a new employment. Instead, Figure 8 shows that certain low-skilled unemployed persons would never decide to become self-employed, but rather search for employment. Note, that we are thinking about individuals that have been employees and after falling into unemployment start to consider self-employment as an alternative to re-employment. Thus, they may only start to think about their entrepreneurial ability once they become unemployed.

As Figure 9 illustrates, our model can explain how the government can influence the composition of unemployed individuals that decide to become self-employed out of unemployment via setting the length of potential benefit duration (PBD). The longer one is unemployed before moving to self-employment, the lower her θ and thus the lower subsequent firm performance appears to be (i.e. the composition changes).
Moreover, if we considered negative duration effects, in response to longer unemployment duration that was induced through longer PBD to be an issue, then we would reach similar qualitative conclusions. In other words, *composition* effects and *duration* effects or a mixture of both, would be in line with the empirical evidence i.e. that PBD positively affects actual benefit duration and through the latter negatively affects the motivation to become self-employed as well as subsequent startup success.

Finally, as Figure 10 shows, our model can also rationalize our results for the case that unemployment duration would not additionally harm potential self-employment outcomes i.e. in the case of zero UI duration dependence for self-employment outcomes. Then, the empirical result of the subsequent startup success declining over the unemployment duration of a founder may also be rationalized with a horizontal value functions V_u^{se} that is independent of d. To summarize, Figure 11 demonstrates that the government can change startup success by setting the PBD.

5.2 Further Policy Options in the Model

Early Re-training for Employment Figure 12 shows that, given the same maximal PBD, early re-training can reduce the rate at which V_u^e declines with actual unemployment duration. Thus, for a fixed PBD, retraining may improve welfare, maintaining consumption smoothing and general matching considerations for unemployment to employment transitions. This could reduce the number of *necessity* founders via slowing the negative UI duration dependence in V_u^e that is itself causally influenced by PBD.

Targeted Subsidies for Self-Employment As Figure 13 illustrates, targeted subsidies to unemployed workers that may have revealed some entrepreneurial skills, e.g. by a business plan, would increase V_u^s, thus, the post-unemployment startup success probability. In that way, they could ease the decision of unemployed individuals with promising ideas to stop searching for employment, while focusing on preparing their startup. Consequently, this could reduce their time in unemployment (hence the fiscal externality).[26]

5.3 Implications for Fiscal Externality

Thinking about optimal UI benefit duration, one has to consider the social costs of changing the potential benefit duration which is the so called fiscal externality it creates (Lawson, 2017). That is, in the spirit of the Baily-Chetty framework (e.g. Chetty, 2009; Kroft and Notowidigdo, 2016), optimal UI benefit duration should balance the welfare benefits of additional insurance created that helps to smooth overall consumption with the social cost of extending PBD. The latter is captured by the fiscal externality (the effect on government budget).

To illustrate the role of taking self-employment out-of unemployment into account, let us consider an example. In her last pre-unemployment job, a worker earns wage w and pays taxes τ.[27] The worker enters unemployment in time period T_0. In line with our results, extending potential benefit duration (PBD) would induce longer actual unemployment of $(T - T_0)$ periods. In time period T, the unemployed individual becomes

[26] Early training for self-employment (relaxing the assumption of entrepreneurial types, such that some skills may be trained through external support) could increase V_u^s. Thus, the post-unemployment startup success probability could be increased, e.g. by coaching them in setting up better business plans.

[27] Without loss of generality, we just consider proportional taxes and follow Lawson (2017) in assuming that the fiscal externality of social security programs works through labor income taxes.

self-employed. If the person becomes a *necessity* entrepreneur who actually does not want to become self-employed but only becomes self-employed to escape unemployment, her profits π_s could be lower than the pre-unemployment wage w (as proxy for the hypothetical re-employment wage) during her self-employment spell (lasting from period $T+1$ until time period S). If in addition the *necessity* entrepreneur failed at time S and would drop back into unemployment from time $S+1$ onward, this would produce costs of forgone tax revenues $\tau\pi_s$ and the benefits paid during unemployment (b). Writing the example of the necessity entrepreneur down into one formula, we get:

$$FiscalExternality = (\tau w + b)(T - T_0) + \sum_{s=T+1}^{S} \tau(w - \pi_s) + \sum_{s=S+1} (\tau\pi_s + b)D_s \qquad (12)$$

The first term is the standard duration effect, which imposes a negative fiscal externality in the case of limited UI duration. In fact, longer non-employment duration implies that the government forgoes potential tax revenue (τw) and in addition has to pay for the unemployment insurance expenditures b over the non-employment spell of the unemployed worker. By increasing PBD, this effect would increase the negative fiscal externality, not only for those who then become employed (Schmieder et al., 2016), but as we showed also for those who start a business out-of unemployment, because in both cases the PBD is positively linked to actual unemployment length.

The second term takes into account the effect of the unemployment insurance on self-employment performance for the government budget. In the given example, when the profits as self-employed are below pre-unemployment wages ($\pi_s < w$) [as proxy for hypothetical re-employment wage], the negative fiscal externality would increase.[28] However, in theory this term could also decrease the overall negative fiscal externality: if $\pi_s > w$. This might be the case for *opportunity* entrepreneurs who have a good business plan and may be better off compared to pre-unemployment wages or other re-employment options.[29]

The last term expresses the extra cost if the self-employed fails and subsequently has to return to unemployment. In that case a second-order duration effect consisting of forgone tax revenue and potential benefit payments could further increase the fiscal externality.

[28]Note that this case is plausible even at low income levels. Regular wage are usually bound by minimum wages, whereas the corresponding earnings from self-employment have no lower bound.

[29]In fact, if this positive effect dominated, this would correspond to the positive UI wage effect as suggested by Nekoei and Weber (2017) for those who start a business instead of finding re-employment.

In summary, taking the effect of longer potential benefit duration (PBD) on self-employment performance into account may change the overall fiscal externality of the unemployment insurance. This in turn could alter optimal UI considerations. For instance, if PBD pushed many unemployed individuals into *necessity* entrepreneurship and this caused the negative fiscal externality to grow, as in the given example, this may imply a decrease of optimal PBD. Given that the optimal UI literature usually only considers the transition from unemployment into paid employment (ignoring transitions into self-employment), if at all, only the first standard duration term in equation 12 applies. Thus, it is important to consider the impact of PBD on self-employment and the associated fiscal externality when it comes to the optimal design of the unemployment insurance.

5.4 Policy Implications

First, our results could have implications for the design of optimal UI policy. The previous Section (5.3) shows that the potential UI benefit duration (PBD) may increase the fiscal externality through its effect on self-employment performance. In abstracting from the fact that unemployed individuals can also choose to enter self-employment instead of employment, the literature and politics have neglected this effect. Too much selection into self-employment due to necessity may imply high social costs. Thus, the general UI system should design optimal PBD in a way that considers both employment and self-employment outcomes. Moreover, this could improve our insights into the so called value of non-employment that itself is important for the results of many wage bargaining models (Jäger et al., 2019).

Second, since economic trends induced by digitization may lead to more self-employment in the future, thinking about the design of social safety nets, in particular with respect to unemployment insurance for these people, may become increasingly relevant. In that respect, the results for Germany, with a low overall unemployment rate, may be considered to be rather lower bound estimates. Thus, the paper shifts attention to an important discussion of how to best design social safety nets for self-employed individuals.

Finally, the findings in our paper may also be relevant in the evaluation of active labor market policies (ALMPs). This is because ALMPs can be interpreted as measures that usually involve extending PBD and providing subsidies that correspond to UI benefits.

Often, those active labor market policies target the long-term unemployed. In the light of our results, this raises questions as to what extent current policies for those unemployed individuals are desirable. Our results indicate that interventions should not be measures of last resort but instead target the unemployed individuals early during their unemployment spell. In general, more investment in early retraining and well-targeted startup subsidies for unemployed individuals who have sustainable business ideas could improve who decides to start a firm. This could reduce fiscal externalities and improve social welfare.

6 Conclusion

This paper addresses the question of how the potential unemployment insurance (UI) benefit duration (PBD) affects the actual unemployment duration (ABD) before unemployed individuals become self-employed, as well as their motivations to become self-employed and their outcomes as entrepreneurs. While existing literature has addressed how UI policies affect the unemployment duration and re-employment wages of those transitioning to dependent employment, we are the first to address this issue in the context of transitions to self-employment by creating a new representative dataset on founders in Germany. Since active labor market policies, which incentivize mainly long-term unemployed individuals to become self-employed, are commonly used as policy measures to fight unemployment, understanding the effects of the design of UI policies on self-employed seems highly relevant.

Using instrumental variables methods (RDD and DiD for robustness), we identify the causal effects of the PBD on entrepreneurial outcomes by exploiting reform and age-based exogenous variation in PBD within the German UI system. We find that in a sample of previously unemployed founders, longer PBD leads to longer actual unemployment duration and, through the latter, increases the propensity that unemployed individuals are *pushed* into self-employment (out of *necessity*), as opposed to starting a firm because of a business *opportunity*. Moreover, longer unemployment duration is associated with worse entrepreneurial performance in terms of both employment growth and sales.

This net negative (overall) causal relationship can be rationalized by a mix of both an *effect on the composition* of startups out of unemployment, and an *individual-level*

duration effect on the founders over the UI spell. In a stylized formal model, we show how both mechanisms can explain why the government's change in PBD causally generates our observed findings for firms started out of unemployment. Extensions of our empirical analyses show little changes to the composition of unemployed founders over different UI policy regimes and therefore suggest that our results are at least partly driven by UI duration policy affecting the individual-level entrepreneurial potential. A consistent explanation for this finding is that individuals' financial, social, and human capital depreciates in unemployment. However, an exact empirical derivation of the quantitative importance of the different mechanisms behind our findings is beyond the scope of this paper. Analogously to the literature on UI policy effects on individuals transitioning to dependent employment (e.g. Schmieder and von Wachter, 2016), additional research, data, and methods are needed to better assess the contributions of different mechanisms to the overall policy effect. Independent of the exact mechanism, our results allow us to conclude that there exists a causal effect from UI policy with respect to PBD via actual unemployment durations to startup motivation and startup success.

Given the current lack of evidence regarding the role of PBD on startup success (or self-employment in general), our results are thus of strong relevance from a public policy perspective. They show how important it is that self-employment out of unemployment is considered in typical optimal UI models that are based on the sufficient statistics approach following the Baily-Chetty model (Chetty, 2009; Landais et al., 2018). Ignoring entrepreneurship out of unemployment likely leads to fiscal externalities. For instance, UI policy could trigger firm creations by low performing *necessity* entrepreneurs whose tax revenues are comparably low or who may cause extra costs for society when returning to unemployment. Rather than pushing the long-term unemployed into self-employment, UI policies might therefore be more profitable when targeted at early re-training for those who would otherwise become self-employed out of *necessity* later. Our results are particularly relevant for all countries with generous UI benefit duration and countries granting extended UI benefit duration for founders starting a business out of unemployment. Due to its relatively low unemployment and self-employment rate levels, our results for Germany may be lower bound estimates for other countries.[30]

[30] Camarero Garcia and Hansch (2019) investigate the role of UI benefit levels on self-employment for Spain. This complements the picture in that the results of both PBD and UI benefit levels on self-employment reveal the total effect of UI on the transition channel from unemployment to self-employment.

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List of Abbreviations

ABD actual unemployment benefit duration.

DiD Difference-in-Differences.

FTE full-time equivalent.

IAB Institute for Employment Research of the German Federal Employment Agency.

IV Instrumental Variable.

PBD potential benefit duration.

RDD Regression Discontinuity Design.

SE self-employed.

UE Unemployment.

UI Unemployment Insurance.

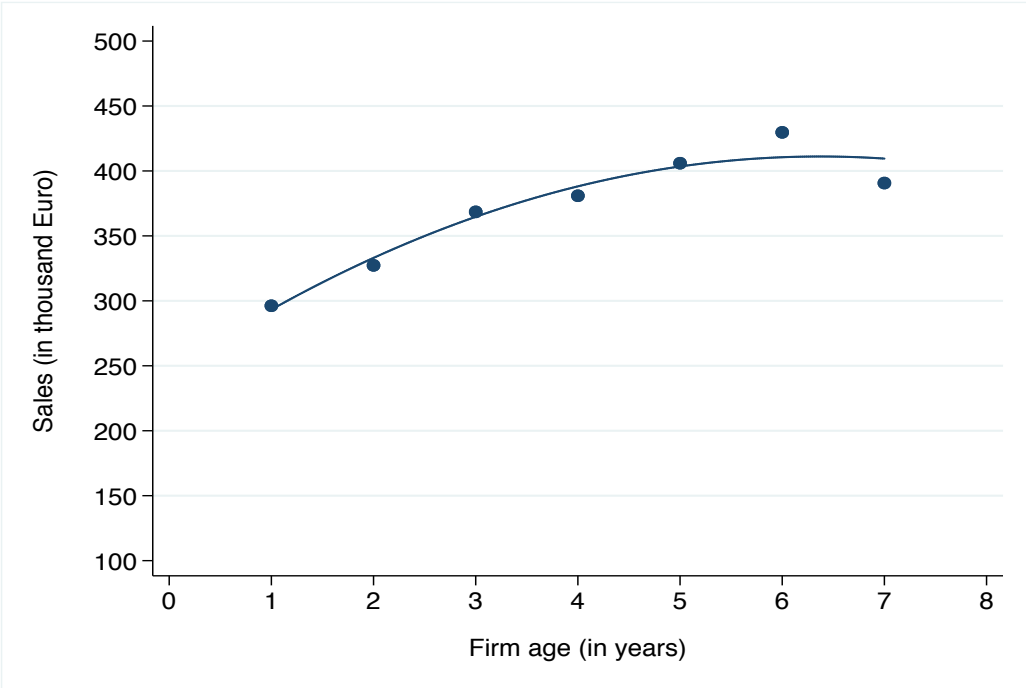
ZEW Leibniz Centre for European Economic Research.

7 Figures & Tables

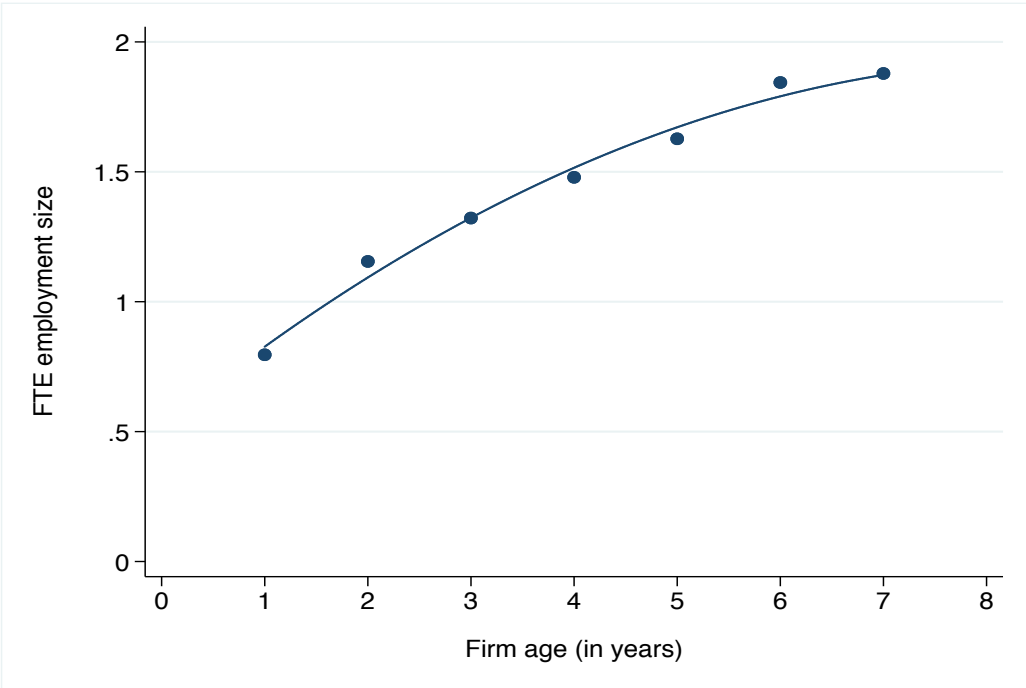
7.1 Figures

Figure 1: Firm Outcomes in Years after Foundation for All Founders

(a) Sales in EUR



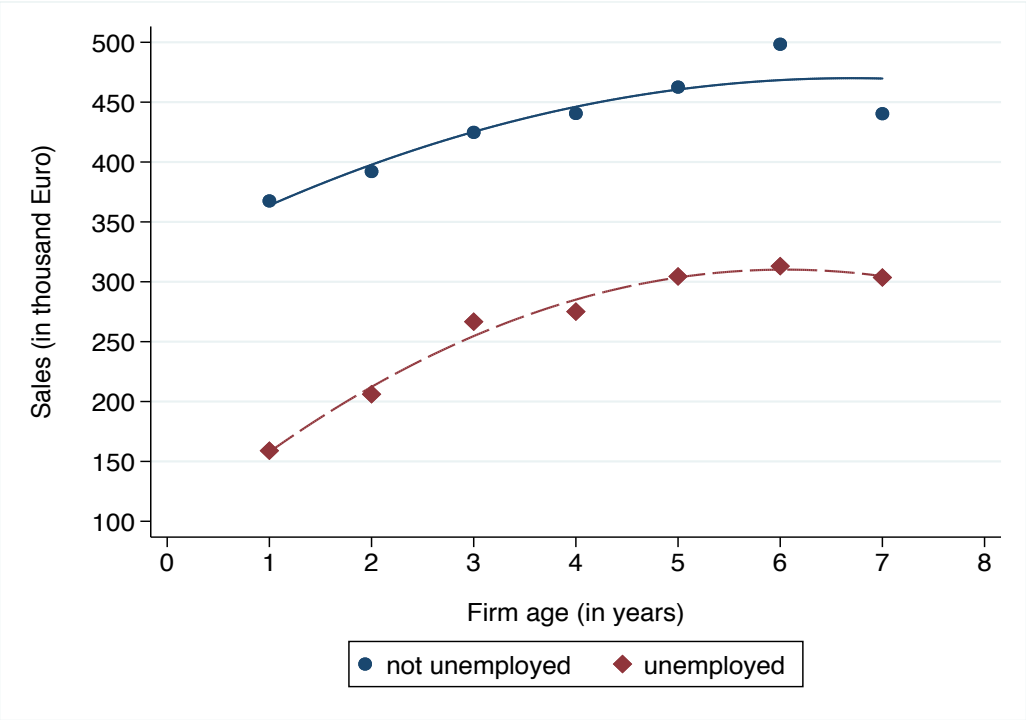
(b) Full-Time Equivalent Employment



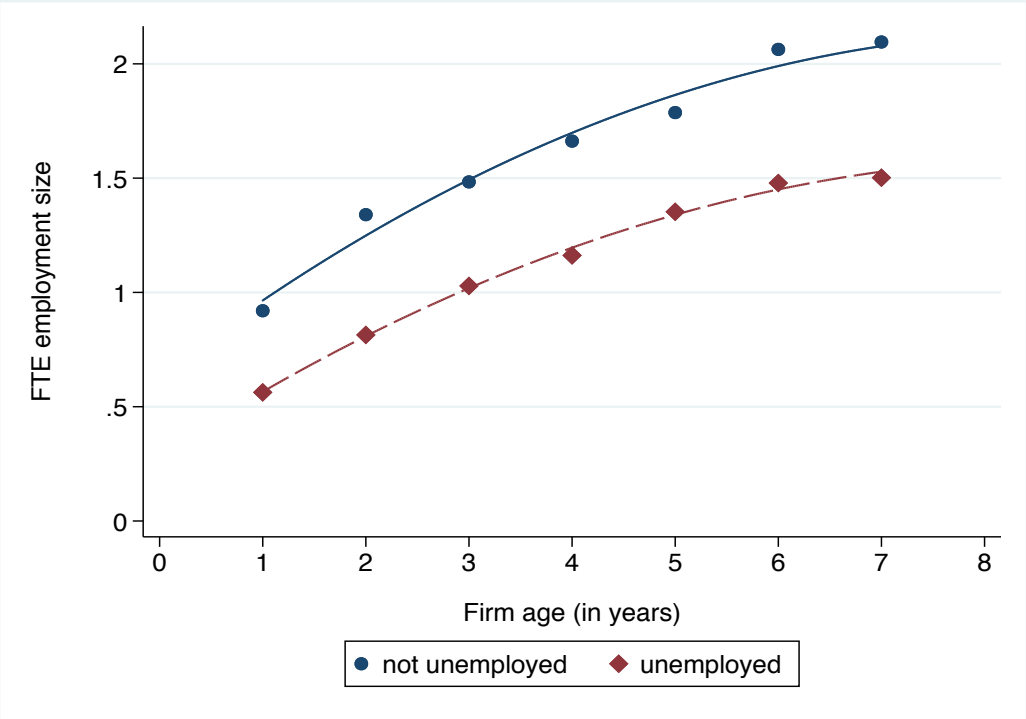
Notes: The Figure shows firm outcomes of non-team founders aged 35-65 (analogous to the definition of our main estimation sample) in years after foundation. We see the outcomes of startups in terms of sales per year and full-time equivalent employment based on 5,250 (sales) and 5,850 (employment) startups established between 2005 and 2011 from our linked dataset (see Section 2). Firms usually stay in the panel for seven years but can drop out if they fail or refuse to take part in more than two consecutive years. Thus, less firms are observed in year seven compared to year one after starting up.

Figure 2: Descriptive Analysis (1): Firm Outcomes in Years after Foundation by Previous Employment Status

(a) Sales in EUR



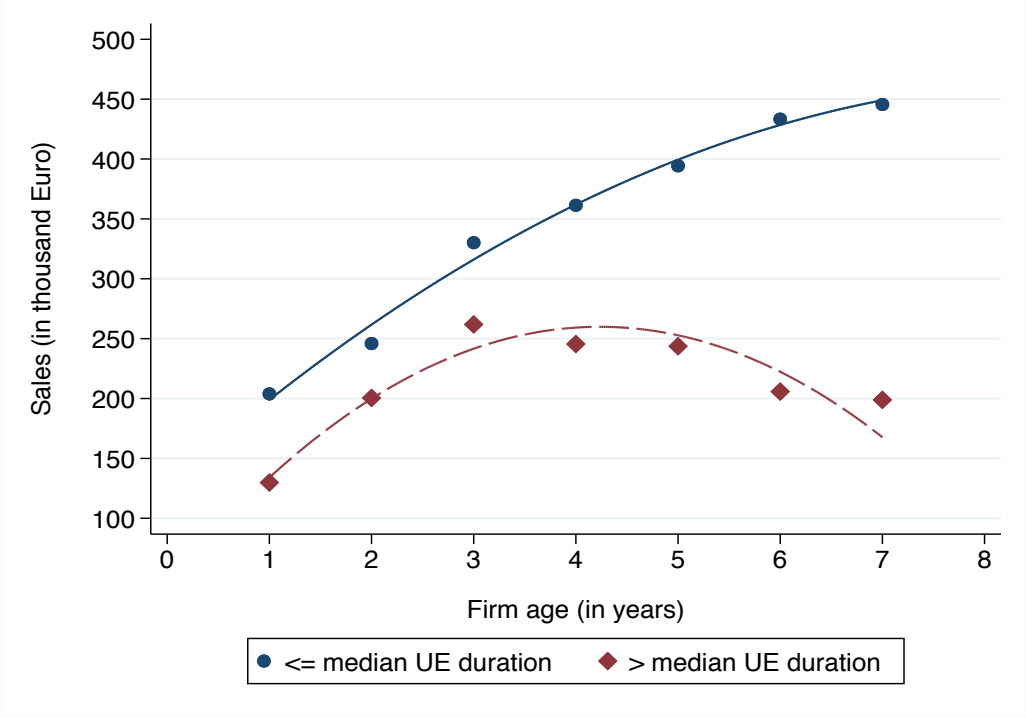
(b) Full-Time Equivalent Employment



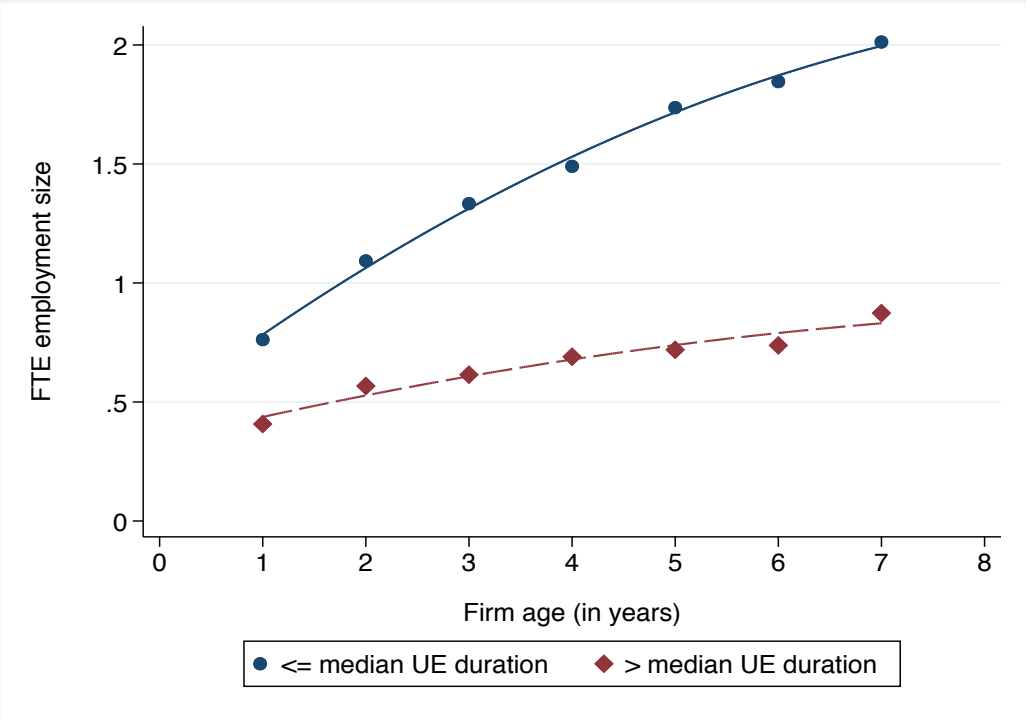
Notes: The Figure shows firm outcomes of non-team founders aged 35-65 (see the definition of our main estimation sample in Table 2) in years after foundation split by the previous labor market status of the founder (not unemployed or unemployed). We cover startups established between 2005 and 2011 from our linked dataset as described in Section 2.

Figure 3: Descriptive Analysis (2): Firm Outcomes in Years after Foundation split by Median Unemployment Duration

(a) Sales in EUR



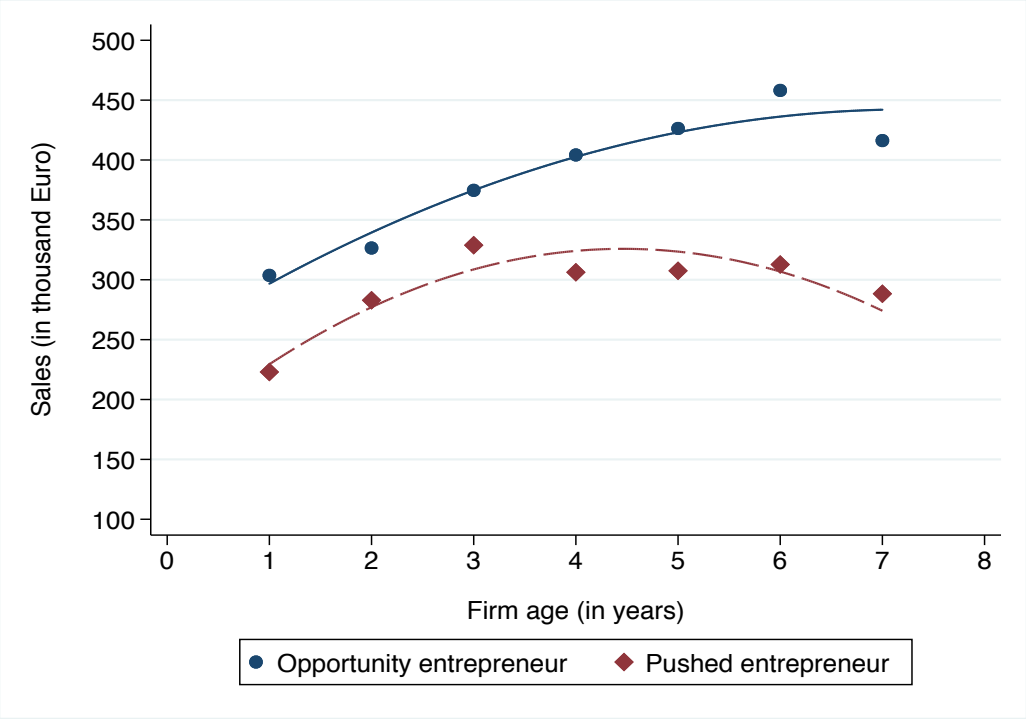
(b) Full-Time Equivalent Employment



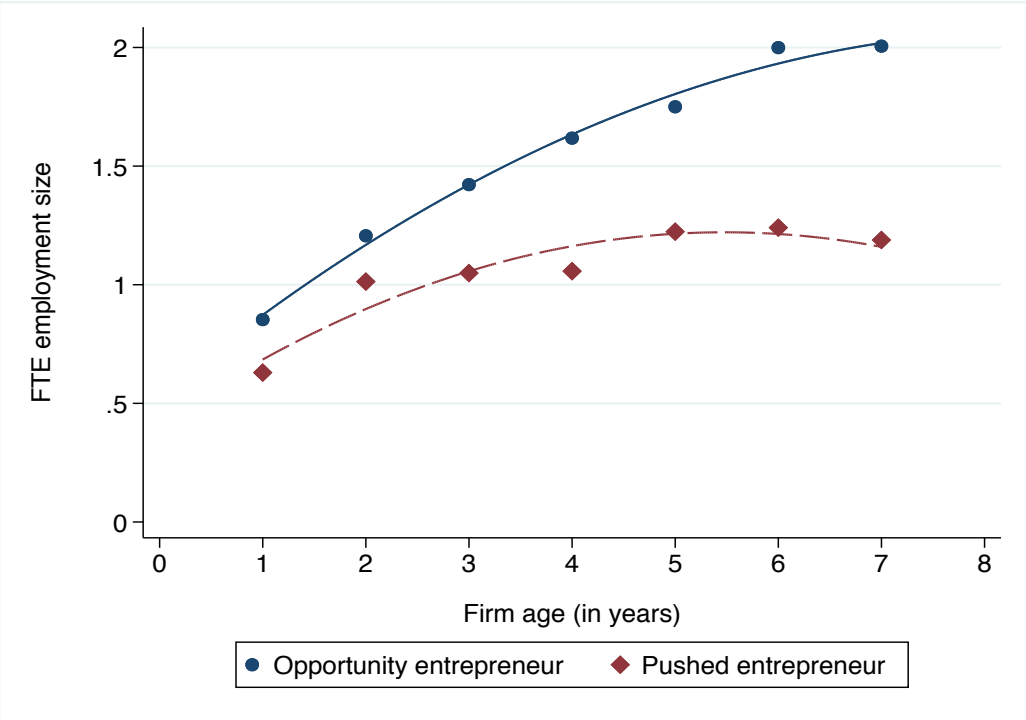
Notes: The Figure shows firm outcomes of non-team founders aged 35-65 (see the definition of our main estimation sample in Table 2) with previous unemployment spell in years after foundation split at the medium (actual) unemployment duration. We cover startups established between 2005 and 2011 from our linked dataset as described in Section 2.

Figure 4: Descriptive Analysis (3): Firm Outcomes in Years after Foundation split by Motivation for Starting Up

(a) Sales in EUR



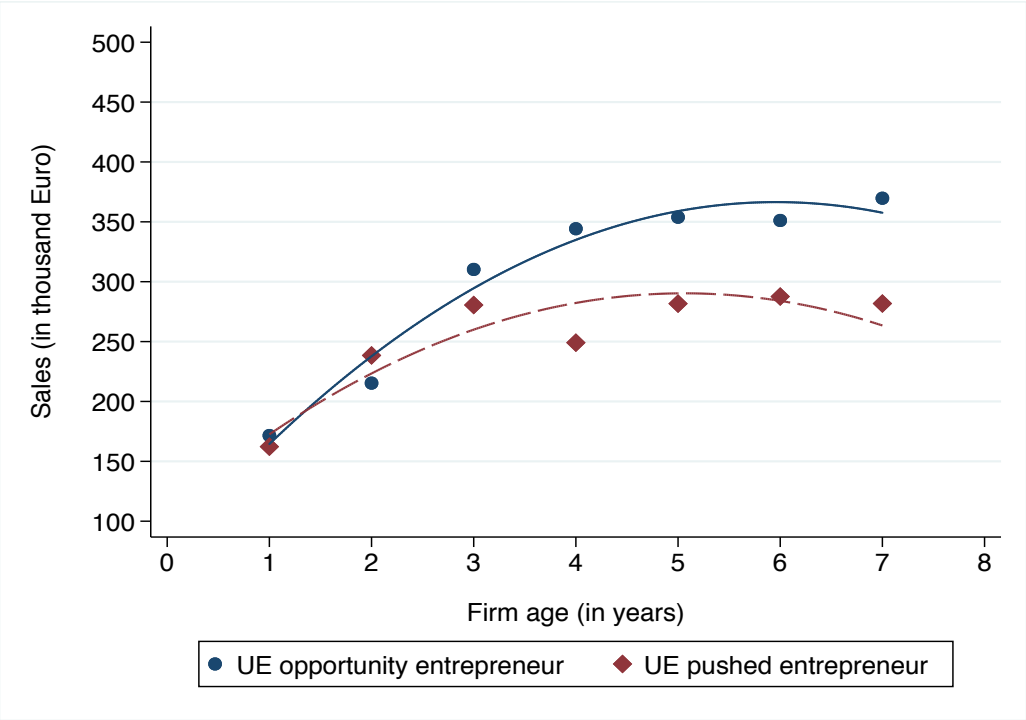
(b) Full-Time Equivalent Employment



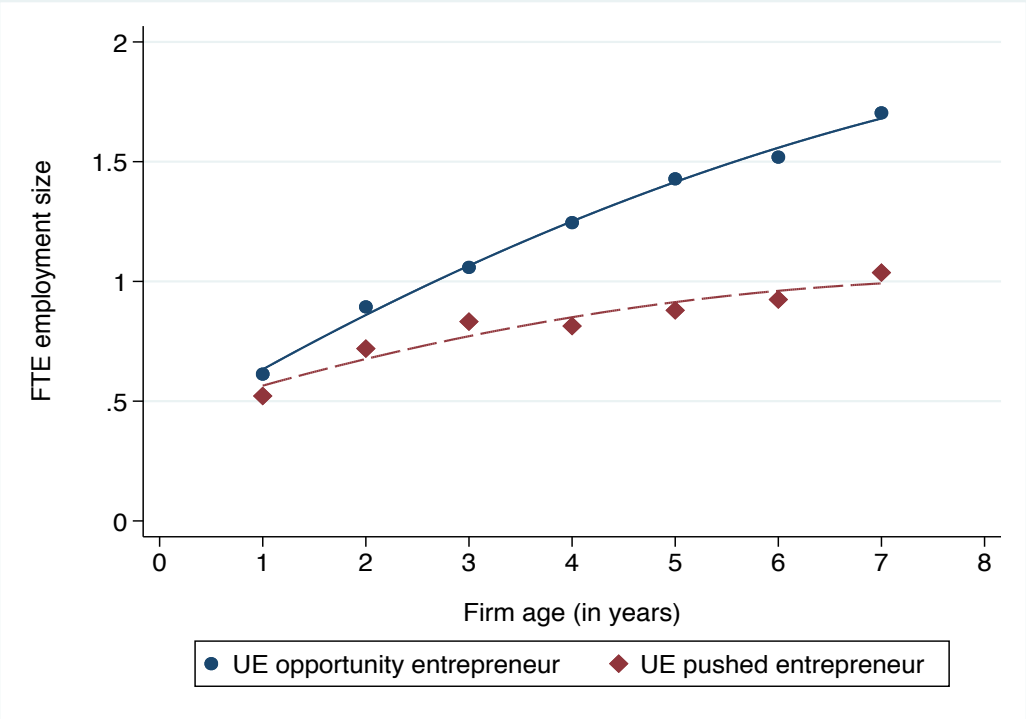
Notes: The Figure shows firm outcomes of non-team founders aged 35-65 (analogous to the definition of our main estimation sample) in years after foundation split by self-reported motivation, i.e. *opportunity* vs. *pushed*/*necessity* driven entrepreneurship. We cover approximately 5,050 (sales) and 5,600 (employment) startups established between 2005 and 2011 from our linked dataset as described in Section 2. The notion of using, instead of *necessity*-driven founder, the term *pushed* entrepreneur is best understood by checking the spikes of the exit rate from unemployment into self-employment split by the motivation to start up which is shown in Figure A.1.

Figure 5: Descriptive Analysis (4): Firm Outcomes in Years after Foundation by Motivation for Starting Up out of Unemployment

(a) Sales in EUR

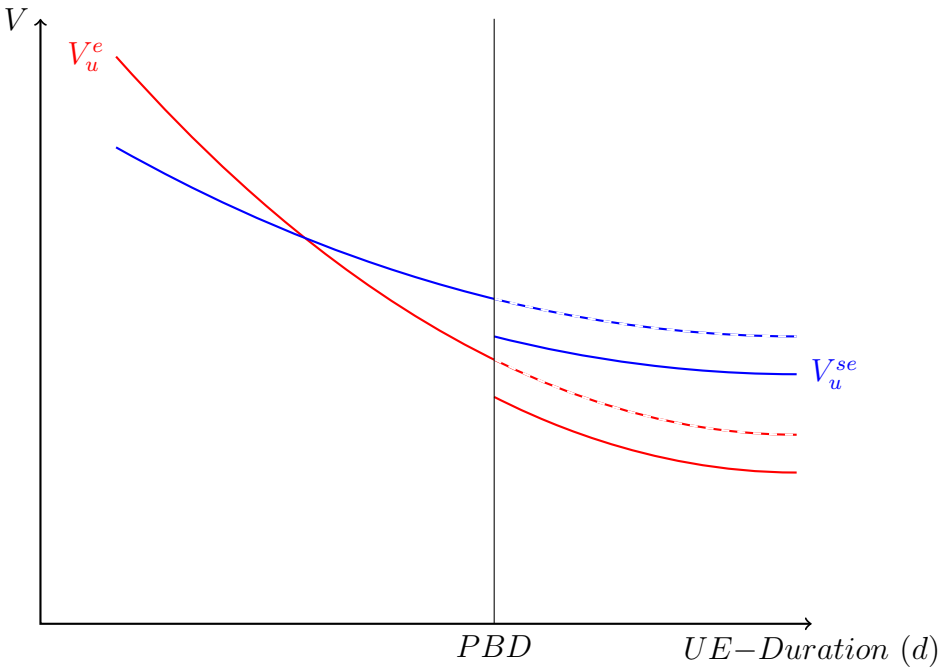


(b) Full-Time Equivalent Employment



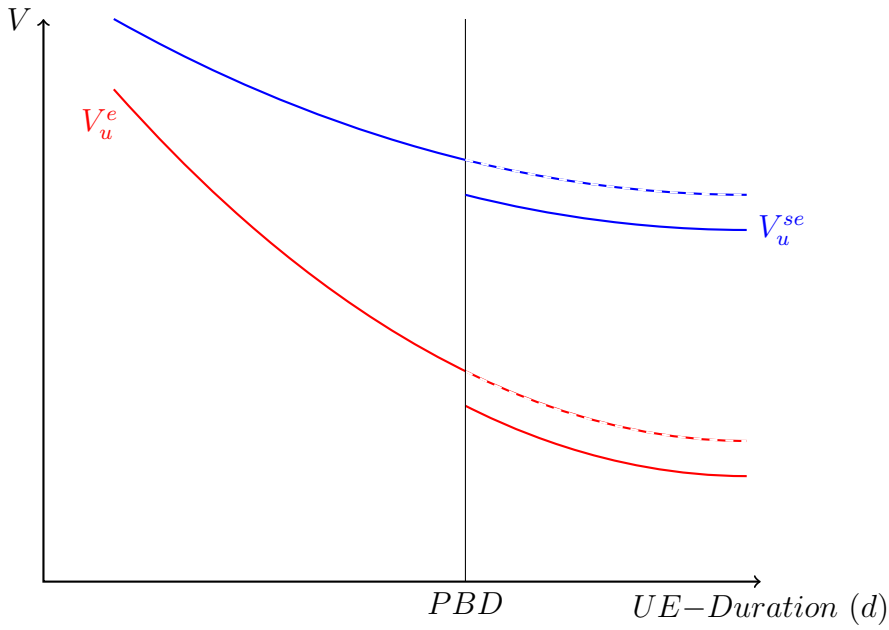
Notes: The Figure shows firm outcomes of non-team founders aged 35-65 (see the definition of our main estimation sample in Table 2) with previous unemployment spell in years after foundation split by self-reported motivation, i.e. *opportunity* vs. *pushed/necessity* driven entrepreneurship. We cover startups established between 2005 and 2011 from our linked dataset as described in Section 2.

Figure 6: Selection into Self-Employment



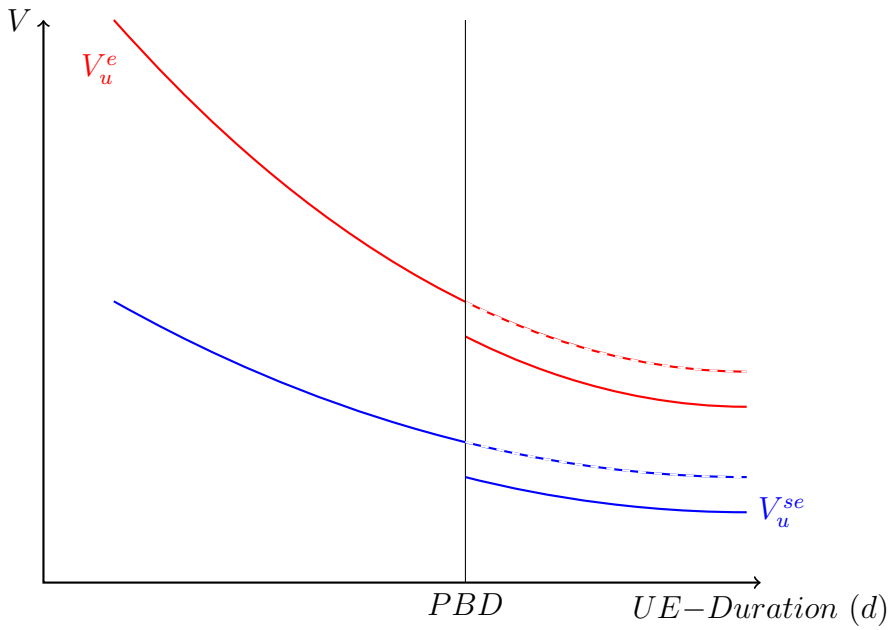
Notes: The figure illustrates how the value functions for becoming employed V_{ut}^e and self-employed V_{ut}^{se} evolve with actual unemployment duration d according to the stylized model as explained in Section 5. The red line depicts $\frac{\partial V_{ut}^e}{\partial d}|\theta < 0$. The blue line depicts $\frac{\partial V_{ut}^{se}}{\partial d}|\theta$ for which it holds that: $0 > \frac{\partial V_{ut}^{se}}{\partial d}|\theta > \frac{\partial V_{ut}^e}{\partial d}|\theta$. The vertical black line marks the potential benefit duration (PBD). At this point of unemployment duration the red/blue line drop by $x = \bar{b} - \tilde{b}$ because UI benefits $\bar{b}$ drop to the existential minimum $\tilde{b}$ (compare equations 8 and 10). In this example, the unemployed individual would first prefer to search for employment. But once the red line crosses the blue one: from this unemployment duration (d) onward, the unemployed individual would prefer starting a business. Note that these results hold as long as depreciation in entrepreneurial skills is smaller in absolute terms than depreciation in employment skills and thus as long as the blue line has a less negative slope than the red line. If the value of becoming self-employed out of unemployment was independent of unemployment duration d, then the blue line would be a horizontal line, and the associated pure selection story could also explain our main results i.e. that longer PBD leads to longer actual unemployment duration and more *pushed* startups.

Figure 7: Selection into Self-Employment: High Entrepreneurial Ability



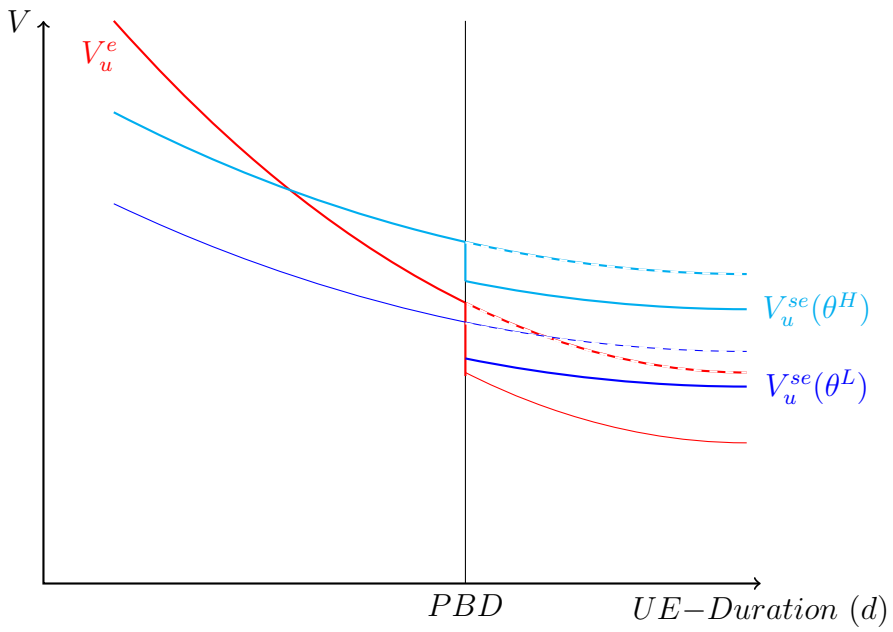
Notes: The figure illustrates how the value functions for becoming employed V_{ut}^e and self-employed V_{ut}^{se} evolve with unemployment duration according to the stylized model as explained in Section 5. The red line depicts $\frac{\partial V_{ut}^e}{\partial d}|\theta < 0$. The blue line depicts $\frac{\partial V_{ut}^{se}}{\partial d}|\theta$ for which it holds that: $0 > \frac{\partial V_{ut}^{se}}{\partial d}|\theta > \frac{\partial V_{ut}^e}{\partial d}|\theta$. The vertical black line marks the potential benefit duration: at this point of unemployment duration the red/blue line drops by $x = \bar{b} - \tilde{b}$, as UI benefits $\bar{b}$ drop to the existential minimum $\tilde{b}$ (eqs. 8 and 10). The unemployed individual learns to have such high entrepreneurial ability that she starts a business.

Figure 8: Selection into Employment: Low Entrepreneurial Ability



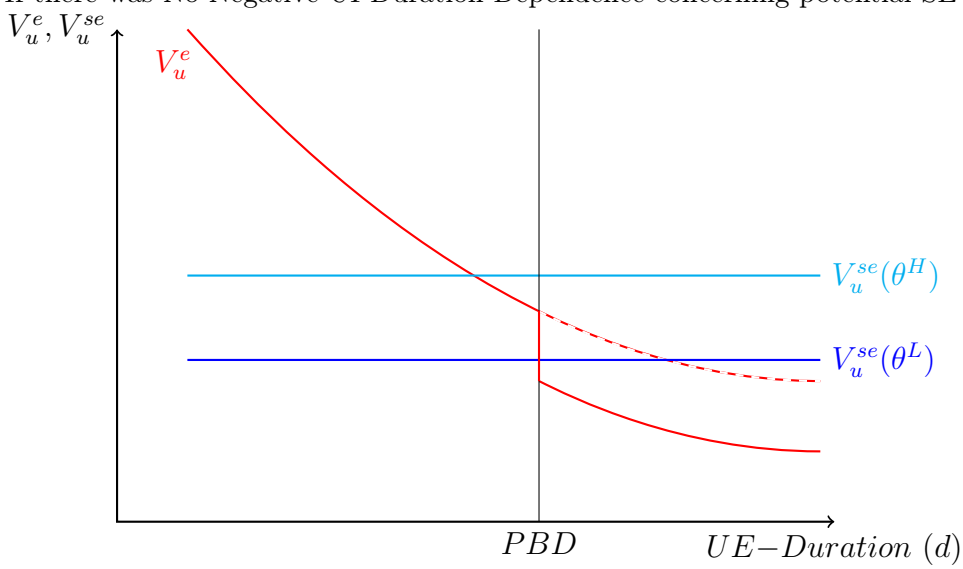
Notes: The figure illustrates how the value functions for becoming employed V_{ut}^e and self-employed V_{ut}^{se} evolve with unemployment duration according to the stylized model as explained in Section 5. The red line depicts $\frac{\partial V_{ut}^e}{\partial d}|\theta < 0$. The blue line depicts $\frac{\partial V_{ut}^{se}}{\partial d}|\theta$ for which it holds that: $0 > \frac{\partial V_{ut}^{se}}{\partial d}|\theta > \frac{\partial V_{ut}^e}{\partial d}|\theta$. The vertical black line marks the potential benefit duration: at this point of unemployment duration the red/blue line drops by $x = \bar{b} - \tilde{b}$, as UI benefits $\bar{b}$ drop to the existential minimum $\tilde{b}$ (eqs. 8 and 10). The unemployed individual learns to have such low entrepreneurial ability that she prefers employment.

Figure 9: PBD Rules can influence the Composition of Startups out of Unemployment



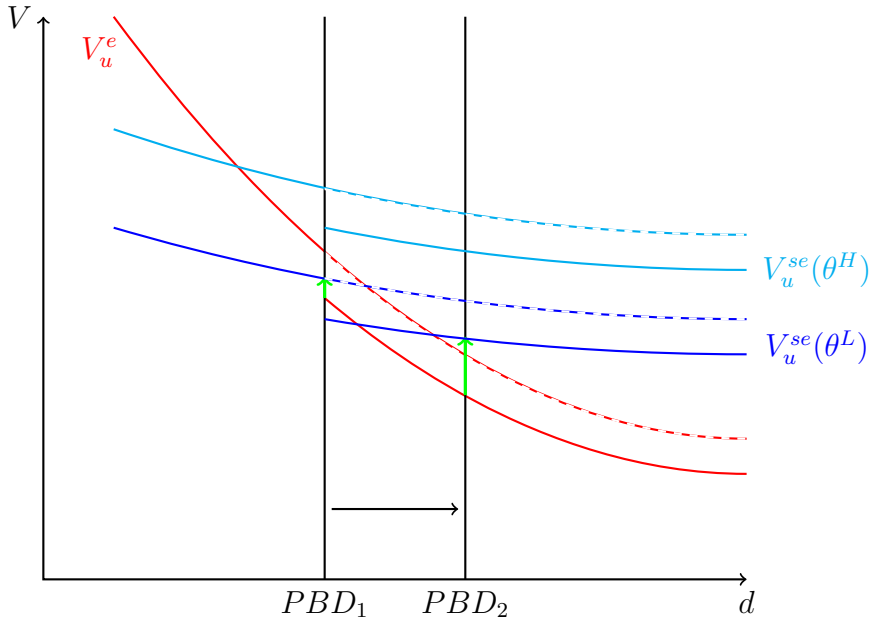
Notes: The figure illustrates how the value functions for becoming employed V_{ut}^e and self-employed V_{ut}^{se} evolve with unemployment duration according to the stylized model in Section 5. The red line depicts $\frac{\partial V_{ut}^e}{\partial d}|\theta < 0$. The cyan/blue line depicts $\frac{\partial V_{ut}^{se}}{\partial d}|\theta$ for which it holds that: $0 > \frac{\partial V_{ut}^{se}}{\partial d}|\theta > \frac{\partial V_{ut}^e}{\partial d}|\theta$. The vertical black line marks the potential benefit duration (PBD): at this point of unemployment duration the red/blue line drops by $x = \bar{b} - \tilde{b}$, as UI benefits $\bar{b}$ drop to the existential minimum $\tilde{b}$ (eqs. 8 and 10). In this example, the unemployed individual with high ability θ_H would decide to become self-employed after a short UI duration (cyan line), whereas the other unemployed individual θ_L would intensify search for employment before reaching PBD (red line to the left of PBD), when V_{ut}^e suddenly drops below V_{ut}^{se} (blue line to the right of PBD). Here, the government could induce type H to become self-employed and L to search for employment.

Figure 10: If there was No Negative UI Duration Dependence concerning potential SE Outcomes



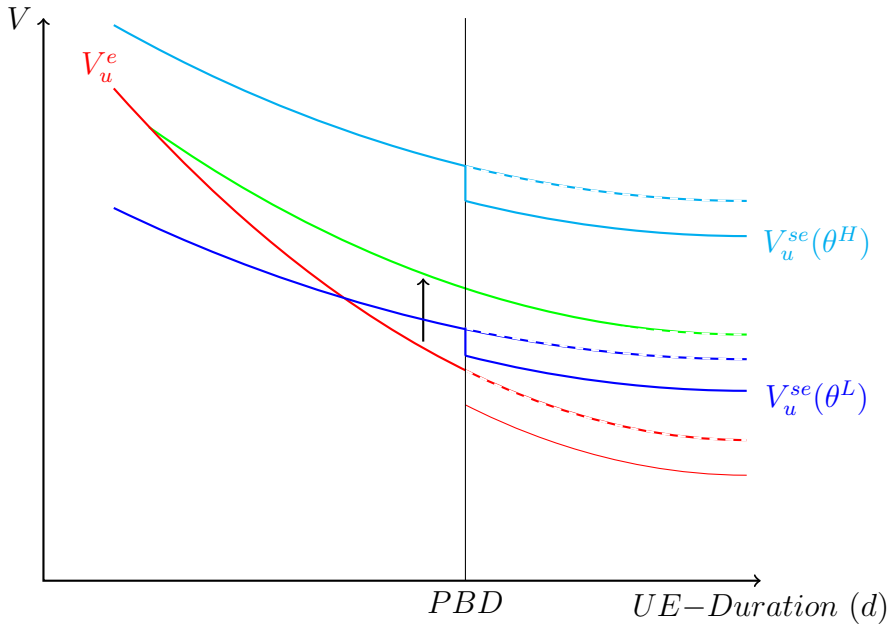
Notes: The figure illustrates how the value functions for becoming employed V_{ut}^e and self-employed V_{ut}^{se} evolve with unemployment duration d according to the stylized model as explained in Section 5. The red line depicts $\frac{\partial V_{ut}^e}{\partial d}|\theta < 0$. The blue line depicts $\frac{\partial V_{ut}^{se}}{\partial d}|\theta = 0$. The vertical black line marks PBD: at this point of unemployment duration the red/blue line drops by $x = \bar{b} - \tilde{b}$, as UI benefits $\bar{b}$ drop to the existential minimum $\tilde{b}$ (eqs. 8 and 10).

Figure 11: PBD Rules can influence the Composition of Startups out of Unemployment (Increase in PBD)



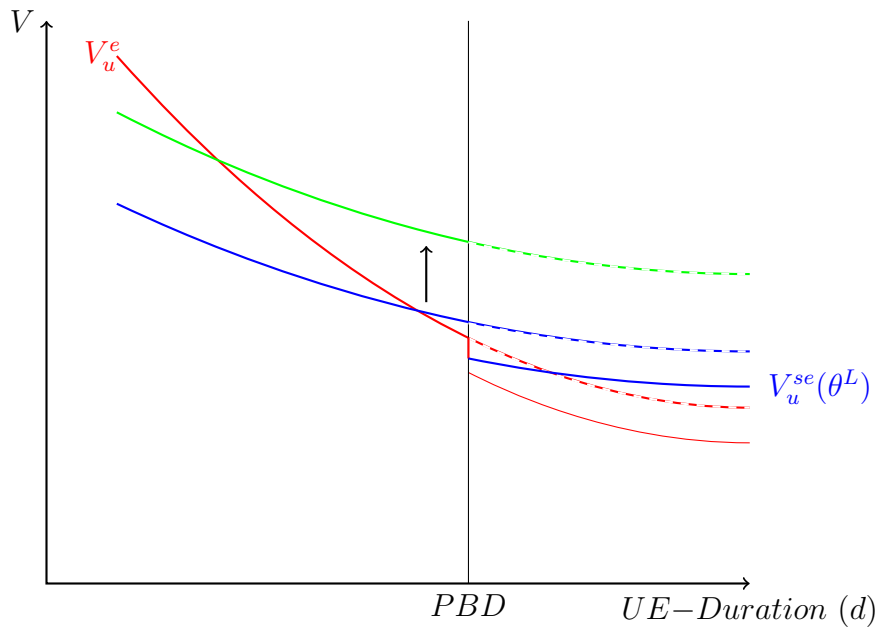
Notes: The figure illustrates how the value functions for becoming employed V_{ut}^e and self-employed V_{ut}^{se} evolve with unemployment duration according to the stylized model in Section 5. The red line depicts $\frac{\partial V_{ut}^e}{\partial d}|\theta < 0$. The cyan/blue line depicts $\frac{\partial V_{ut}^{se}}{\partial d}|\theta$ for which it holds that: $0 > \frac{\partial V_{ut}^{se}}{\partial d}|\theta > \frac{\partial V_{ut}^e}{\partial d}|\theta$. The vertical black line marks the potential benefit duration (PBD): at this point of unemployment duration the red/blue line drops by $x = \bar{b} - \tilde{b}$, as UI benefits $\bar{b}$ drop to the existential minimum $\tilde{b}$ (eqs. 8 and 10). In this example, the government increases PBD (PBD moves to the right). PBD_1 represents the initial potential benefit duration. PBD_2 the extended one. At the initial PBD_1, the unemployed individual with high ability (θ_H) would decide to become self-employed after a short UI duration (cyan line), whereas the other unemployed individual (θ_L) would rather accept the next job when reaching PBD_1 (red curve is above dark blue curve at PBD_1). This illustrates, that in theory, increasing the potential benefit duration to PBD_2 can change the composition among the unemployed individuals start up. Now, the value for becoming self-employed would be higher for both high individuals with θ_H (*opportunity* entrepreneurs) and for individuals with θ_L (*necessity* entrepreneurs) compared to the value for transitioning from unemployment to wage employment (at PBD_2 the dark blue curve is now above the red curve). This illustrates how PBD can change the composition of startups created out of unemployment.

Figure 12: Early Re-training for Wage-Employment



Notes: The figure illustrates how the value functions for becoming employed V_{ut}^e and self-employed V_{ut}^{se} evolve with unemployment duration d according to the stylized model in Section 5. The red line depicts $\frac{\partial V_{ut}^e}{\partial d}|\theta < 0$. The cyan/blue line depicts $\frac{\partial V_{ut}^{se}}{\partial d}|\theta$ for which it holds that: $0 > \frac{\partial V_{ut}^{se}}{\partial d}|\theta > \frac{\partial V_{ut}^e}{\partial d}|\theta$. The vertical black line marks the potential benefit duration (PBD): at this point of d the red/blue line drops by $x = \bar{b} - \tilde{b}$, as UI benefits $\bar{b}$ drop to the existential minimum $\tilde{b}$ (eqs. 8, 10). By early retraining, the value function of searching for employment V_{ut}^e could be increased, as the green line indicates.

Figure 13: Targeted Subsidies for Self-Employment



Notes: The figure shows how the value functions for becoming employed V_{ut}^e and self-employed V_{ut}^{se} evolve with unemployment duration according to the stylized model in Section 5. The red line depicts $\frac{\partial V_{ut}^e}{\partial d}|\theta < 0$. The blue line depicts $\frac{\partial V_{ut}^{se}}{\partial d}|\theta$ for which it holds that: $0 > \frac{\partial V_{ut}^{se}}{\partial d}|\theta > \frac{\partial V_{ut}^e}{\partial d}|\theta$. The vertical black line marks the potential benefit duration (PBD): at this point of unemployment duration the red/blue line drops by $x = \bar{b} - \tilde{b}$, as UI benefits $\bar{b}$ drop to the existential minimum $\tilde{b}$ (eqs. 8 and 10). By providing startup subsidies or special training for future self-employed, the government could increase V_{ut}^{se}, as shown by the green line.

7.2 Tables

Table 1: Definition of Necessity/Pushed vs. Opportunity Founders for Regression Sample

Motive to become entrepreneur	Opportunity entrepreneur	Pushed entrepreneur
Self-determined working	527	0
Realisation of business idea	255	0
Better earning potential	32	0
Tax incentives	3	0
No suitable employment options	0	169
Escape from unemployment	0	260
Forced by former employer	0	10
Total	817	439

Note: This table is based on information from the IAB/ZEW Start-Up Panel and shows only our main regression sample. 1,300 non-team founders with maximal UI potential benefit duration that have been previously unemployed are considered in this table (see the definition of our main estimation sample in Table 2). Founders are asked about their motivation for starting a firm during the survey interview that is conducted when they enter the panel for the first time. Note that the intuition behind using the term *pushed* entrepreneur can be well understood by checking the spikes of the exit rate from unemployment into self-employment split by the motivation to start up, which is shown in Figure A.1. This is corroborated when looking at Table 2: Previously employed founders are much less likely to feel pushed into entrepreneurship (21% vs. 35% for previously unemployed founders.)

Table 2: Summary Statistics: Regression Sample - for previously Unemployed (above median unemployment duration) or Employed Founders

	Regression sample of unemployed founders					Founders with > median UE duration					Previously not unemployed founders				
Variable	N	Mean	SD	Min	Max	N	Mean	SD	Min	Max	N	Mean	SD	Min	Max
Unemployment (UE) Duration (in months)	1291	4.79	4.56	0.03	36.17	641	8.02	4.52	3.12	36.17	0				
PBD (in months)	1291	12.32	4.25	0.59	37.42	641	13.31	4.62	3.52	37.42	0				
Tertiary degree (=1)	1291	0.28	0.45	0	1	641	0.30	0.46	0	1	1610	0.35	0.48	0	1
Founder was self-employed (SE) before (=1)	1291	0.15	0.36	0	1	641	0.16	0.37	0	1	1610	0.23	0.42	0	1
Managerial Experience as Employee (=1)	1291	0.13	0.33	0	1	641	0.14	0.34	0	1	1610	0.15	0.36	0	1
Female founder (=1)	1291	0.15	0.35	0	1	641	0.15	0.35	0	1	1610	0.13	0.34	0	1
Founder of non-German origin (=1)	1291	0.06	0.23	0	1	641	0.07	0.25	0	1	1610	0.05	0.21	0	1
SE Subsidy by Federal Employment Agency (=1)	1291	0.75	0.43	0	1	641	0.73	0.44	0	1	1610	0.38	0.49	0	1
Industry Experience (in years)	1291	17.22	9.52	1.00	50.00	641	17.00	10.33	1.00	50.00	1610	16.56	9.15	1.00	54.00
Age of Founder (in years)	1291	44.44	5.93	35.09	65.11	641	45.28	6.20	35.34	65.11	1610	43.93	6.01	35.00	63.85
Sales in Year 1	1039	173,661	461,647	0	8,123,565	507	134,149	451,385	0	8,123,565	1309	399,872	2,467,627	0	84,370,000
Sales in Year 2	851	231,293	665,161	0	13,640,000	409	212,599	830,844	0	13,640,000	1067	400,055	1,121,272	0	24,180,000
FTE Employment after Year 1	1291	0.61	1.60	0	16.50	641	0.39	1.26	0	13.00	1610	1.02	3.28	0	74.50
FTE Employment after Year 2	1272	0.85	2.08	0	28.25	628	0.54	1.44	0	12.50	1597	1.45	4.26	0	95.75
Pushed/Necessity Motive (=1)	1256	0.35	0.48	0	1	631	0.39	0.49	0	1	1531	0.21	0.41	0	1
Technology-intensive services	1291	0.19	0.39	0	1	641	0.20	0.40	0	1	1610	0.23	0.42	0	1
High-technology manufacturing	1291	0.09	0.28	0	1	641	0.08	0.28	0	1	1610	0.12	0.33	0	1
Skill-intensive services	1291	0.05	0.21	0	1	641	0.05	0.22	0	1	1610	0.08	0.27	0	1
Software supply and consultancy	1291	0.03	0.18	0	1	641	0.03	0.18	0	1	1610	0.06	0.23	0	1
Non-high-tech manufacturing	1291	0.12	0.33	0	1	641	0.11	0.31	0	1	1610	0.12	0.33	0	1
Other business-oriented services	1291	0.07	0.25	0	1	641	0.07	0.25	0	1	1610	0.05	0.22	0	1
Cons.-or. services in creative sect.	1291	0.02	0.15	0	1	641	0.02	0.15	0	1	1610	0.03	0.16	0	1
Consumer-oriented services	1291	0.10	0.30	0	1	641	0.10	0.30	0	1	1610	0.07	0.25	0	1
Construction	1291	0.16	0.36	0	1	641	0.15	0.35	0	1	1610	0.11	0.31	0	1
Retail & wholesale	1291	0.18	0.38	0	1	641	0.19	0.39	0	1	1610	0.14	0.35	0	1

Notes: This table shows summary statistics for non-team founders that have started their business out of unemployment (first panel). In the second panel, our table shows the same statistics for the sub-sample of these non-team founders that had equal or greater than median unemployment duration before starting up. The table only includes those individual that have maximum PBD at the beginning of the unemployment spell, since the empirical strategies require that our main regression sample consists of non-team founders that have achieved these criteria. Note that out of the around 4,000 non-team founders having unemployment experience before starting up in our data, approximately 1,300 satisfy the criteria to be included in our main regression sample: they became unemployed between 2003 and 2011, were between 35 and 65 years old when becoming unemployed, are eligible to maximum potential benefit duration, and have information on all included control variables available. Finally, the the right-hand panel of this table shows the same summary statistics for a reference group of founders who have started their business out of employment, i.e. they have not been previously unemployed.

Table 3: OLS Results: **Actual Benefit Duration (ABD)** on Motivation of Founder and Firm Outcomes

	(1) Necessity Motive (=1)	(2) Sales Year 1 (log)	(3) Sales Year 2 (log)	(4) FTE Employment Year 1 (log)	(5) FTE Employment Year 2 (log)
UE Duration (in months)	**0.017*****	**-0.139*****	**-0.096*****	**-0.016*****	**-0.023*****
	(0.003)	(0.027)	(0.018)	(0.003)	(0.003)
Tertiary degree (=1)	-0.050	-0.663**	-0.029	0.076**	0.074*
	(0.032)	(0.283)	(0.168)	(0.034)	(0.039)
Founder was SE before (=1)	-0.009	0.031	-0.125	-0.006	-0.018
	(0.037)	(0.336)	(0.211)	(0.040)	(0.045)
Managerial Experience as Employee (=1)	-0.059	0.169	0.618***	0.135***	0.173***
	(0.038)	(0.350)	(0.164)	(0.049)	(0.056)
Industry Experience (in years)	0.003*	0.034**	0.003	0.001	0.001
	(0.001)	(0.014)	(0.009)	(0.001)	(0.002)
Female founder (=1)	0.013	-0.993**	-0.361*	0.069	0.104**
	(0.039)	(0.404)	(0.210)	(0.046)	(0.052)
Founder of non-German origin (=1)	0.033	-1.758***	-0.509	-0.015	-0.048
	(0.060)	(0.673)	(0.418)	(0.055)	(0.054)
SE Subsidy by Federal Employment Agency (=1)	0.073**	-0.413	-0.289*	-0.056*	-0.086**
	(0.032)	(0.280)	(0.168)	(0.033)	(0.037)
Industry/Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
N	1256	1039	851	1291	1272
R-sq.	0.063	0.122	0.126	0.150	0.158
Mean of dependent variable	0.35	10.074	11.271	0.271	0.361
(abs. value for log-terms)		173,661	231,293	0.605	0.847

Notes: Robust standard errors are shown in parentheses and significance levels are indicated by: *** 1%, ** 5%, * 10%. This table shows the OLS regression of our main outcome variables (motivation for starting up; sales and employment growth after year 1, 2) on the founders' actual unemployment benefit duration (ABD) before starting up. We control for the founders' education, their previous work experience, and individual characteristics. Moreover, we include year and industry (of the startup) fixed effects. We also include dummies to control for the receipt of subsidies from the Federal Employment Agency and for funding by the KfW bank (Appendix B.2). Our regression sample consists of non-team founders who became unemployed between 2003 and 2011, who were 35 to 65 years old when becoming unemployed, and for whom information on all included control variables is available.

Table 4: OLS Results: **ABD** on Motivation of Founder and Firm Outcomes **focusing on Non-Manufacturing Sector**

	(1) Necessity Motive (=1)	(2) Sales Year 1 (log)	(3) Sales Year 2 (log)	(4) FTE Employment Year 1 (log)	(5) FTE Employment Year 2 (log)
UE Duration (in months)	**0.018*****	**-0.128*****	**-0.102*****	**-0.016*****	**-0.024*****
	(0.003)	(0.029)	(0.021)	(0.003)	(0.003)
Tertiary degree (=1)	-0.069*	-0.392	0.143	0.059*	0.057
	(0.036)	(0.290)	(0.168)	(0.035)	(0.041)
Founder was SE before (=1)	0.009	0.119	-0.262	0.015	0.031
	(0.042)	(0.343)	(0.230)	(0.045)	(0.051)
Managerial Experience as Employee (=1)	-0.096**	0.022	0.457**	0.130**	0.178***
	(0.042)	(0.381)	(0.184)	(0.053)	(0.060)
Industry Experience (in years)	0.002	0.021	0.001	0.002	0.002
	(0.002)	(0.015)	(0.011)	(0.002)	(0.002)
Female founder (=1)	0.006	-0.693*	-0.512**	0.077	0.096*
	(0.043)	(0.413)	(0.232)	(0.051)	(0.056)
Founder of non-German origin (=1)	-0.047	-1.820**	-0.843*	-0.076	-0.080*
	(0.064)	(0.724)	(0.496)	(0.047)	(0.047)
SE Subsidy by Federal Employment Agency (=1)	0.070*	-0.629**	-0.277	-0.054	-0.069*
	(0.036)	(0.309)	(0.202)	(0.035)	(0.040)
Industry/Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
N	999	815	661	1022	1009
R-sq.	0.076	0.103	0.145	0.167	0.168
Mean of dependent variable	0.352	10.21	11.251	0.25	0.329
(abs. value for log-terms)		179,344	237,112	0.549	0.76

Notes: Robust standard errors are shown in parentheses and significance levels are indicated by: *** 1%, ** 5%, * 10%. This table shows the OLS regression of our main outcome variables (motivation for starting up; sales and employment growth after year 1, 2) on the founders' actual unemployment benefit duration (ABD) before starting up in the non-manufacturing sector (75% of our sample). We control for the founders' education, their previous work experience, and individual characteristics. Moreover, we include year and industry (of the startup) fixed effects. We also include dummies to control for the receipt of subsidies from the Federal Employment Agency and for funding by the KfW bank (Appendix B.2). Our regression sample consists of non-team founders who became unemployed between 2003 and 2011, who were 35 to 65 years old when becoming unemployed, and for whom information on all included control variables is available.

Table 5: Potential UI Benefit Duration (months) in Germany based on Contributions/Age

(1) Contribution Months	(2) before 02/2006	(3) Age Rules	(4) from 02/2006 until 12/2007	(5) Age Rules	(6) since 01/2008	(7) Age Rules
12	6		6		6	
18	9		9		9	
24	12		12		12	
30	15	≥ 45	15	≥ 55	15	≥ 50
36	18		18	≥ 55	18	≥ 55
44	22	≥ 47	18	≥ 55	22	≥ 58
48	24		18	≥ 55	24	≥ 58
52	26	≥ 52	18	≥ 55	24	≥ 58
64	32	≥ 57	18	≥ 55	24	≥ 58

Notes: The table shows how potential unemployment insurance (UI) benefit duration (PBD) varies with the number of contribution months (column 1), i.e. the number of months a worker paid UI contributions that are mandatory for jobs covered by the social security. The rules state that after having satisfied the minimum eligibility requirement (eg. at least 12 contributions within last 24 months) half of the number of contribution months translate into PBD. However, at some point a maximum PBD is reached and additional contribution months can no longer increase PBD. This table presents the age rules for maximum PBD, i.e. for which age groups the indicated PBD is available, since only with increasing age does the maximum PBD increase. Maximum PBD by age group is also shown in Table 6. Columns (2) and (3) show the PBD regime before February 2006, columns (4) and (5) between February 2006 and December 2007 and columns (6) and (7) since January 2008.

Table 6: Maximum Potential UI Benefit Duration (in months) in Germany

(1) Age	(2) before 02/2006	(3) Reduction in months	(4) from 02/2006 until 12/2007	(5) Extension in months	(6) since 01/2008	(7) Net-Effect in months
<45	12	0	12	0	12	0
45-46	18	-6	12	0	12	-6
47-49	22	-10	12	0	12	-10
50-51	22	-10	12	+3	15	-7
52-54	26	-14	12	+3	15	-11
55-56	26	-8	18	0	18	-8
57	32	-14	18	0	18	-14
>58	32	-14	18	+6	24	-8

Notes: The table shows how potential unemployment insurance (UI) benefit duration (PBD) varies by age group and over time for unemployed individuals who had worked for at least the number of contribution months within the last five years (seven years before 02/2006) necessary to get the maximum PBD of their age group according to Table 5 without intermittent UI spell. This table shows that the reform of February 2006 represents a considerable decline in PBD for workers aged above 45 years. In contrast, the reform of January 2008 partially increased PBD again. However, in total the net effect across both reforms demonstrates that all age groups beyond 45 years suffered a considerable decline in PBD (cf. Section 3).

Table 7: OLS Results: **Potential Benefit Duration (PBD)** on Actual Benefit Duration (ABD), Motivation of Founder and Firm Outcomes

	(1) UE Duration (in months)	(2) Necessity Motive (=1)	(3) Sales Year 1 (log)	(4) Sales Year 2 (log)	(5) FTE Employment Year 1 (log)	(6) FTE Employment Year 2 (log)
PBD (in months)	**0.471*****	**0.023*****	**-0.036**	**-0.049****	**-0.004**	**-0.009****
	(0.048)	(0.003)	(0.024)	(0.022)	(0.004)	(0.004)
Tertiary degree (=1)	-0.386	-0.073**	-0.636**	0.027	0.079**	0.081**
	(0.291)	(0.032)	(0.289)	(0.173)	(0.034)	(0.040)
Founder was SE before (=1)	0.116	-0.014	-0.001	-0.095	-0.009	-0.019
	(0.338)	(0.037)	(0.341)	(0.213)	(0.040)	(0.045)
Managerial Experience as Employee (=1)	-0.004	-0.069*	0.160	0.609***	0.134***	0.173***
	(0.346)	(0.038)	(0.356)	(0.168)	(0.050)	(0.057)
Industry Experience (in years)	-0.013	0.001	0.036**	0.007	0.001	0.002
	(0.015)	(0.001)	(0.014)	(0.009)	(0.002)	(0.002)
Female founder (=1)	0.176	0.013	-1.075***	-0.369*	0.065	0.100*
	(0.326)	(0.039)	(0.405)	(0.221)	(0.047)	(0.053)
Founder of non-German origin (=1)	0.299	0.034	-1.853***	-0.553	-0.021	-0.056
	(0.500)	(0.059)	(0.674)	(0.446)	(0.056)	(0.057)
SE Subsidy by Federal Employment Agency (=1)	-0.301	0.061*	-0.401	-0.277	-0.053	-0.080**
	(0.292)	(0.031)	(0.281)	(0.171)	(0.034)	(0.038)
Industry/Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	1291	1256	1039	851	1291	1272
R-sq.	0.256	0.077	0.099	0.096	0.133	0.134
Mean of dependent variable	4.785	0.35	10.074	11.271	0.271	0.361
(abs. value for log-terms)			173,661	231,293	0.605	0.847

Notes: Robust standard errors are shown in parentheses and significance levels are indicated by: *** 1%, ** 5%, * 10%. This table shows the OLS regression of our main outcome variables (ABD, motivation for starting up; sales and employment growth after year 1, 2) on the founders' potential benefit duration (PBD) before starting up. We control for the founders' education, their previous work experience, and individual characteristics. Moreover, we include year and industry (of the startup) fixed effects. We also include dummies to control for the receipt of subsidies from the Federal Employment Agency and for funding by the KfW bank (Appendix B.2). Our regression sample consists of non-team founders who became unemployed between 2003 and 2011, who were 35 to 65 years old when becoming unemployed, and for whom information on all included control variables is available.

Table 8: OLS Results: **PBD** on ABD, Motivation of Founder and Firm Outcomes **for Non-Manufacturing Sector**

	(1) UE Duration (in months)	(2) Necessity Motive (=1)	(3) Sales Year 1 (log)	(4) Sales Year 2 (log)	(5) FTE Employment Year 1 (log)	(6) FTE Employment Year 2 (log)
PBD (in months)	**0.484*****	**0.022*****	**-0.067*****	**-0.070*****	**-0.010*****	**-0.015*****
	(0.053)	(0.004)	(0.026)	(0.026)	(0.003)	(0.004)
Tertiary degree (=1)	-0.462	-0.092***	-0.324	0.225	0.069*	0.072*
	(0.335)	(0.036)	(0.295)	(0.168)	(0.036)	(0.041)
Founder was SE before (=1)	0.443	0.015	0.065	-0.250	0.008	0.023
	(0.369)	(0.042)	(0.351)	(0.235)	(0.046)	(0.052)
Managerial Experience as Employee (=1)	0.052	-0.098**	0.005	0.430**	0.130**	0.178***
	(0.387)	(0.043)	(0.383)	(0.188)	(0.053)	(0.061)
Industry Experience (in years)	0.001	0.001	0.022	0.005	0.002	0.003
	(0.016)	(0.002)	(0.015)	(0.011)	(0.002)	(0.002)
Female founder (=1)	0.329	0.007	-0.787*	-0.539**	0.072	0.090
	(0.370)	(0.043)	(0.415)	(0.244)	(0.052)	(0.057)
Founder of non-German origin (=1)	0.303	-0.040	-1.882***	-0.876	-0.081*	-0.088*
	(0.546)	(0.065)	(0.723)	(0.533)	(0.047)	(0.049)
SE Subsidy by Federal Employment Agency (=1)	-0.287	0.062*	-0.597*	-0.252	-0.049	-0.060
	(0.342)	(0.036)	(0.310)	(0.202)	(0.036)	(0.041)
Industry/Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	1022	999	815	661	1022	1009
R-sq.	0.266	0.082	0.085	0.116	0.153	0.145
Mean of dependent variable	4.895	0.352	10.21	11.251	0.25	0.329
(abs. value for log-terms)			179,344	237,112	0.549	0.76

Notes: Robust standard errors are shown in parentheses and significance levels are indicated by: *** 1%, ** 5%, * 10%. This table shows the OLS regression of our main outcome variables (ABD, motivation for starting up; sales and employment growth after year 1, 2) on the founders' potential benefit duration (PBD) before starting up in the non-manufacturing sector (75% of our sample). We control for the founders' education, their previous work experience, and individual characteristics. Moreover, we include year and industry (of the startup) fixed effects. We also include dummies to control for the receipt of subsidies from the Federal Employment Agency and for funding by the KfW bank (Appendix B.2). Our regression sample consists of non-team founders who became unemployed between 2003 and 2011, who were 35 to 65 years old when becoming unemployed, and for whom information on all included control variables is available.

Table 9: IV Results for Reform 2006: **Potential Benefit Duration** on Actual Benefit Duration (ABD), Motivation of Founder and Firm Outcomes

	(1) PBD (in months)	(2) UE Duration (in months)	(3) Necessity Motive (=1)	(4) Sales Year 1 (log)	(5) Sales Year 2 (log)	(6) FTE Employment Year 1 (log)	(7) FTE Employment Year 2 (log)
PBD (in months)		**0.661*****	**0.015****	**0.034**	**-0.072***	**0.003**	**-0.006**
		(0.094)	(0.007)	(0.052)	(0.039)	(0.007)	(0.008)
Tertiary degree (=1)	0.313	-0.513*	-0.075**	-0.689**	0.048	0.071**	0.078**
	(0.221)	(0.289)	(0.032)	(0.289)	(0.169)	(0.034)	(0.039)
Founder was SE before (=1)	-0.025	0.121	-0.022	-0.014	-0.093	-0.012	-0.020
	(0.278)	(0.345)	(0.037)	(0.339)	(0.210)	(0.039)	(0.045)
Managerial Experience as Employee (=1)	0.301	-0.023	-0.077**	0.144	0.613***	0.130***	0.171***
	(0.305)	(0.348)	(0.038)	(0.353)	(0.165)	(0.050)	(0.057)
Industry Experience (in years)	0.014	-0.017	0.001	0.033**	0.009	0.001	0.001
	(0.011)	(0.014)	(0.001)	(0.015)	(0.010)	(0.002)	(0.002)
Female founder (=1)	0.002	0.198	0.004	-1.088***	-0.366*	0.063	0.099*
	(0.274)	(0.325)	(0.038)	(0.402)	(0.216)	(0.046)	(0.052)
Founder of non-German origin (=1)	0.021	0.207	0.042	-1.897***	-0.530	-0.023	-0.057
	(0.372)	(0.505)	(0.058)	(0.666)	(0.427)	(0.055)	(0.056)
SE Subsidy by Federal Employment Agency (=1)	0.398*	-0.406	0.067**	-0.437	-0.269	-0.056*	-0.081**
	(0.214)	(0.294)	(0.031)	(0.279)	(0.167)	(0.033)	(0.038)
IV_06	**-8.743*****						
	(0.505)						
Industry/Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First-stage F-statistic		299.421	286.66	223.603	220.761	299.421	296.11
N	1291	1291	1256	1039	851	1291	1272
R-sq.	0.470	0.234	0.083	0.094	0.094	0.130	0.134
Mean of dependent variable	12.324	4.785	0.35	10.074	11.271	0.271	0.361
(abs. value for log-terms)				173,661	231,293	0.605	0.847

Notes: Standard errors are shown in parentheses and significance levels are indicated by: *** 1%, ** 5%, * 10%. This table shows the IV regression of our outcome variables (ABD, motivation for starting up; sales/employment growth after year 1, 2) on the founders' PBD before starting up that is instrumented by *IV06* (Section 3.2). Column 1 shows the first-stage regression of the IV model in column 2. We control for the founders' education, previous work experience, and individual characteristics. We include year and industry (of the startup) fixed effects, and dummies to control for subsidies from the Federal Employment Agency and for funding by the KfW (Appendix B.2). Our regression sample consists of non-team founders who became unemployed between 2003 and 2011, were 35 to 65 years old when becoming unemployed, and for whom information on all control variables is available.

Table 10: IV Results for Reform 2006: **PBD** on ABD, Motivation of Founder, Firm Outcomes **for Non-Manufacturing Sector**

	(1) PBD (in months)	(2) UE Duration (in months)	(3) Necessity Motive (=1)	(4) Sales Year 1 (log)	(5) Sales Year 2 (log)	(6) FTE Employment Year 1 (log)	(7) FTE Employment Year 2 (log)
PBD (in months)		**0.722*****	**0.010**	**0.004**	**-0.115****	**-0.008**	**-0.018****
		(0.109)	(0.008)	(0.056)	(0.051)	(0.006)	(0.008)
Tertiary degree (=1)	0.434*	-0.641*	-0.089**	-0.390	0.269	0.064*	0.071*
	(0.248)	(0.331)	(0.036)	(0.296)	(0.167)	(0.036)	(0.041)
Founder was SE before (=1)	-0.296	0.517	0.006	0.078	-0.270	0.005	0.019
	(0.312)	(0.385)	(0.042)	(0.350)	(0.234)	(0.044)	(0.051)
Managerial Experience as Employee (=1)	0.137	0.068	-0.105**	-0.000	0.423**	0.127**	0.176***
	(0.350)	(0.387)	(0.042)	(0.377)	(0.186)	(0.053)	(0.060)
Industry Experience (in years)	0.011	-0.006	0.001	0.019	0.008	0.002	0.002
	(0.013)	(0.016)	(0.002)	(0.016)	(0.012)	(0.002)	(0.002)
Female founder (=1)	0.086	0.312	0.001	-0.818**	-0.533**	0.069	0.088
	(0.313)	(0.368)	(0.042)	(0.412)	(0.238)	(0.051)	(0.056)
Founder of non-German origin (=1)	-0.101	0.252	-0.032	-1.922***	-0.828	-0.079*	-0.085*
	(0.395)	(0.554)	(0.063)	(0.708)	(0.508)	(0.046)	(0.048)
SE Subsidy by Federal Employment Agency (=1)	0.333	-0.389	0.071**	-0.633**	-0.236	-0.049	-0.058
	(0.234)	(0.341)	(0.036)	(0.307)	(0.198)	(0.035)	(0.040)
IV_06	**-8.401*****						
	(0.569)						
Industry/Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First-stage F-statistic		217.975	209.815	155.049	153.108	217.975	216.04
N	1022	1022	999	815	661	1022	1009
R-sq.	0.477	0.232	0.083	0.079	0.110	0.153	0.145
Mean of dependent variable	12.327	4.895	0.352	10.21	11.251	0.25	0.329
(abs. value for log-terms)				179,344	237,112	0.549	0.76

Notes: Standard errors are shown in parentheses and significance levels are indicated by: *** 1%, ** 5%, * 10%. This table shows the IV regression of our outcome variables (ABD, motivation for starting up; sales/employment growth after year 1, 2) on the founders' PBD before starting up in the non-manufacturing sector (75% of the sample) that is instrumented by *IV06* (Section 3.2). Column 1 shows the first-stage regression of the IV model in column 2. We control for the founders' education, previous work experience, and individual characteristics. We include year and industry (of the startup) fixed effects, and dummies to control for subsidies from the Federal Employment Agency and for funding by the KfW (Appendix B.2). Our regression sample consists of non-team founders who became unemployed between 2003 and 2011, were 35 to 65 years old when becoming unemployed, and for whom information on all control variables is available.

Table 11: IV Results for Reform 2006: **Actual Benefit Duration (ABD)** on Motivation of Founder and Firm Outcomes

	(1) UE Duration (in months)	(2) Necessity Motive (=1)	(3) Sales Year 1 (log)	(4) Sales Year 2 (log)	(5) FTE Employment Year 1 (log)	(6) FTE Employment Year 2 (log)
UE Duration (in months)		**0.022****	**0.060**	**-0.118***	**0.005**	**-0.010**
		(0.010)	(0.095)	(0.063)	(0.011)	(0.012)
Tertiary degree (=1)	-0.313	-0.063**	-0.662**	-0.030	0.074**	0.073*
	(0.311)	(0.031)	(0.287)	(0.164)	(0.034)	(0.039)
Founder was SE before (=1)	0.067	-0.024	-0.023	-0.129	-0.013	-0.020
	(0.357)	(0.037)	(0.343)	(0.208)	(0.040)	(0.045)
Managerial Experience as Employee (=1)	0.144	-0.076**	0.146	0.624***	0.130***	0.171***
	(0.380)	(0.038)	(0.358)	(0.162)	(0.050)	(0.057)
Industry Experience (in years)	-0.008	0.001	0.035**	0.003	0.001	0.001
	(0.015)	(0.001)	(0.015)	(0.010)	(0.002)	(0.002)
Female founder (=1)	0.240	-0.001	-1.118***	-0.357*	0.062	0.101*
	(0.361)	(0.038)	(0.408)	(0.205)	(0.047)	(0.052)
Founder of non-German origin (=1)	0.226	0.037	-1.928***	-0.489	-0.024	-0.054
	(0.505)	(0.059)	(0.670)	(0.400)	(0.055)	(0.054)
SE Subsidy by Federal Employment Agency (=1)	-0.086	0.075**	-0.423	-0.288*	-0.054	-0.085**
	(0.311)	(0.031)	(0.281)	(0.166)	(0.034)	(0.037)
IV_06	**-5.815*****					
	(0.921)					
Industry/Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
First-stage F-statistic		39.831	23.487	24.016	40.992	41.07
N	1256	1256	1039	851	1291	1272
R-sq.	0.189	0.075	0.072	0.124	0.120	0.149
Mean of dependent variable	4.828	0.35	10.074	11.271	0.271	0.361
(abs. value for log-terms)			173,661	231,293	0.605	0.847

Notes: Standard errors are shown in parentheses and significance levels are indicated by: *** 1%, ** 5%, * 10%. This table shows the IV regression of our outcome variables (motivation for starting up; sales/employment growth after year 1, 2) on the founders' actual benefit duration (ABD) before starting up that is instrumented by *IV06* (Section 3.2). Column 1 shows the first-stage regression of the IV model in column 2. We control for the founders' education, previous work experience, and individual characteristics. We include year and industry (of the startup) fixed effects, and dummies to control for subsidies from the Federal Employment Agency and for funding by the KfW (Appendix B.2). Our regression sample consists of non-team founders who became unemployed between 2003 and 2011, were 35 to 65 years old when becoming unemployed, and for whom information on all control variables is available.

Table 12: IV Results for Reform 2006: **ABD** on Motivation of Founder, Firm Outcomes **for Non-Manufacturing Sector**

	(1) UE Duration (in months)	(2) Necessity Motive (=1)	(3) Sales Year 1 (log)	(4) Sales Year 2 (log)	(5) FTE Employment Year 1 (log)	(6) FTE Employment Year 2 (log)
UE Duration (in months)		**0.014**	**0.007**	**-0.171****	**-0.011**	**-0.025****
		(0.011)	(0.092)	(0.077)	(0.009)	(0.011)
Tertiary degree (=1)	-0.305	-0.081**	-0.387	0.145	0.057	0.056
	(0.357)	(0.035)	(0.289)	(0.163)	(0.035)	(0.040)
Founder was SE before (=1)	0.243	-0.001	0.074	-0.283	0.011	0.030
	(0.374)	(0.042)	(0.346)	(0.228)	(0.044)	(0.050)
Managerial Experience as Employee (=1)	0.158	-0.105**	-0.001	0.475***	0.128**	0.177***
	(0.434)	(0.042)	(0.380)	(0.183)	(0.053)	(0.060)
Industry Experience (in years)	0.002	0.001	0.019	0.002	0.001	0.002
	(0.017)	(0.002)	(0.016)	(0.012)	(0.002)	(0.002)
Female founder (=1)	0.356	-0.003	-0.823**	-0.485**	0.072	0.095*
	(0.407)	(0.042)	(0.419)	(0.227)	(0.051)	(0.055)
Founder of non-German origin (=1)	0.198	-0.035	-1.925***	-0.781*	-0.076*	-0.078*
	(0.551)	(0.063)	(0.709)	(0.464)	(0.046)	(0.047)
SE Subsidy by Federal Employment Agency (=1)	-0.084	0.075**	-0.631**	-0.280	-0.053	-0.068*
	(0.367)	(0.035)	(0.306)	(0.201)	(0.035)	(0.039)
IV_06	**-5.987*****					
	(1.047)					
Industry/Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
First-stage F-statistic		32.673	19.62	19.994	34.939	34.852
N	999	999	815	661	1022	1009
R-sq.	0.209	0.089	0.077	0.124	0.165	0.168
Mean of dependent variable	4.926	0.352	10.21	11.251	0.25	0.329
(abs. value for log-terms)			179,344	237,112	0.549	0.76

Notes: Standard errors are shown in parentheses and significance levels are indicated by: *** 1%, ** 5%, * 10%. This table shows the IV regression of our outcome variables (motivation for starting up; sales/employment growth after year 1, 2) on the founders' actual benefit duration (ABD) before starting up in the non-manufacturing sector (75% of the sample) that is instrumented by *IV06* (Section 3.2). Column 1 shows the first-stage regression of the IV model in column 2. We control for the founders' education, previous work experience, and individual characteristics. We include year and industry (of the startup) fixed effects, and dummies to control for subsidies from the Federal Employment Agency and for funding by the KfW (Appendix B.2). Our regression sample consists of non-team founders who became unemployed between 2003 and 2011, were 35 to 65 years old when becoming unemployed, and for whom information on all control variables is available.

Table 13: IV Results for **Reforms 2006 & 2008**: **PBD** on Actual Benefit Duration (ABD), Motivation of Founder and Firm Outcomes

	(1) PBD (in months)	(2) UE Duration (in months)	(3) Necessity Motive (=1)	(4) Sales Year 1 (log)	(5) Sales Year 2 (log)	(6) FTE Employment Year 1 (log)	(7) FTE Employment Year 2 (log)
PBD (in months)		**0.649*****	**0.015****	**0.030**	**-0.074****	**0.004**	**-0.006**
		(0.093)	(0.007)	(0.049)	(0.038)	(0.007)	(0.008)
Tertiary degree (=1)	0.247	-0.467	-0.076**	-0.671**	0.057	0.075**	0.080**
	(0.217)	(0.286)	(0.032)	(0.288)	(0.168)	(0.034)	(0.040)
Founder was SE before (=1)	-0.157	0.185	-0.025	0.012	-0.082	-0.006	-0.018
	(0.268)	(0.342)	(0.037)	(0.338)	(0.207)	(0.039)	(0.045)
Managerial Experience as Employee (=1)	0.291	-0.006	-0.077**	0.150	0.615***	0.131***	0.172***
	(0.302)	(0.346)	(0.038)	(0.353)	(0.165)	(0.050)	(0.057)
Industry Experience (in years)	0.008	-0.014	0.000	0.034**	0.009	0.001	0.001
	(0.011)	(0.014)	(0.001)	(0.015)	(0.010)	(0.002)	(0.002)
Female founder (=1)	-0.015	0.186	0.005	-1.100***	-0.368*	0.062	0.099*
	(0.273)	(0.321)	(0.038)	(0.401)	(0.216)	(0.047)	(0.052)
Founder of non-German origin (=1)	0.134	0.219	0.042	-1.899***	-0.535	-0.022	-0.057
	(0.364)	(0.504)	(0.058)	(0.666)	(0.427)	(0.054)	(0.056)
SE Subsidy by Federal Employment Agency (=1)	0.446**	-0.411	0.067**	-0.446	-0.272	-0.058*	-0.081**
	(0.210)	(0.295)	(0.031)	(0.280)	(0.167)	(0.033)	(0.038)
IV_06	**-9.316*****						
	(0.514)						
IV_08	**2.356*****						
	(0.353)						
Industry/Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First-stage F-statistic		41.07	147.61	115.608	119.869	154.434	152.383
N	1291	1291	1256	1039	851	1291	1272
R-sq.	0.487	0.242	0.084	0.096	0.094	0.133	0.135
Mean of dependent variable	12.324	4.785	0.35	10.074	11.271	0.271	0.361
(abs. value for log-terms)				173,661	231,293	0.605	0.847

Notes: Standard errors are shown in parentheses and significance levels are indicated by: *** 1%, ** 5%, * 10%. This table shows the IV regression of our outcome variables (ABD, motivation for starting up; sales/employment growth after year 1, 2) on the founders' PBD before starting up that is instrumented by *IV06* and *IV08* (Section 3.2). Column 1 shows the first-stage regression of the IV model in column 2. We control for the founders' education, previous work experience, and individual characteristics. We include year and industry (of the startup) fixed effects, and dummies to control for subsidies from the Federal Employment Agency and for funding by the KfW (Appendix B.2). Our regression sample consists of non-team founders who became unemployed between 2003 and 2011, were 35 to 65 years old when becoming unemployed, and for whom information on all control variables is available.

Table 14: IV Results for **Reforms 2006 & 2008**: **PBD** on ABD, Motiv. of Founder, Firm Outcomes **focusing on Non-Manufacturing Sector**

	(1) PBD (in months)	(2) UE Duration (in months)	(3) Necessity Motive (=1)	(4) Sales Year 1 (log)	(5) Sales Year 2 (log)	(6) FTE Employment Year 1 (log)	(7) FTE Employment Year 2 (log)
PBD (in months)		**0.721*****	**0.010**	**-0.002**	**-0.115****	**-0.007**	**-0.017****
		(0.108)	(0.008)	(0.055)	(0.050)	(0.007)	(0.008)
Tertiary degree (=1)	0.391	-0.585*	-0.091**	-0.371	0.266	0.066*	0.072*
	(0.244)	(0.327)	(0.036)	(0.295)	(0.166)	(0.036)	(0.041)
Founder was SE before (=1)	-0.396	0.595	0.003	0.097	-0.275	0.009	0.021
	(0.304)	(0.380)	(0.042)	(0.352)	(0.233)	(0.044)	(0.051)
Managerial Experience as Employee (=1)	0.112	0.096	-0.106**	0.006	0.422**	0.128**	0.177***
	(0.348)	(0.381)	(0.043)	(0.378)	(0.185)	(0.053)	(0.060)
Industry Experience (in years)	0.006	-0.003	0.001	0.020	0.008	0.002	0.002
	(0.012)	(0.016)	(0.002)	(0.016)	(0.012)	(0.002)	(0.002)
Female founder (=1)	0.065	0.298	0.002	-0.825**	-0.533**	0.068	0.088
	(0.312)	(0.362)	(0.042)	(0.411)	(0.238)	(0.051)	(0.056)
Founder of non-German origin (=1)	0.031	0.214	-0.030	-1.928***	-0.824	-0.081*	-0.086*
	(0.386)	(0.558)	(0.063)	(0.710)	(0.510)	(0.046)	(0.048)
SE Subsidy by Federal Employment Agency (=1)	0.378	-0.409	0.071**	-0.636**	-0.234	-0.050	-0.058
	(0.231)	(0.342)	(0.036)	(0.306)	(0.197)	(0.035)	(0.040)
IV_06	**-8.955*****						
	(0.579)						
IV_08	**2.115*****						
	(0.385)						
Industry/Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First-stage F-statistic		34.852	107.841	78.456	84.474	112.178	110.896
N	1022	1022	999	815	661	1022	1009
R-sq.	0.493	0.241	0.084	0.080	0.110	0.155	0.146
Mean of dependent variable	12.327	4.895	0.352	10.21	11.251	0.25	0.329
(abs. value for log-terms)				179,344	237,112	0.549	0.76

Notes: Standard errors are shown in parentheses and significance levels are indicated by: *** 1%, ** 5%, * 10%. This table shows the IV regression of our outcome variables (ABD, motivation for starting up; sales/employment growth after year 1, 2) on the founders' PBD before starting up in the non-manufacturing sector (75% of the sample) that is instrumented by *IV06* and *IV08* (Section 3.2). Column 1 shows the first-stage regression of the IV model in column 2. We control for the founders' education, previous work experience, and individual characteristics. We include year and industry (of the startup) fixed effects, and dummies to control for subsidies from the Federal Employment Agency and for funding by the KfW (Appendix B.2). Our regression sample consists of non-team founders who became unemployed between 2003 and 2011, were 35 to 65 years old when becoming unemployed, and for whom information on all control variables is available.

Table 15: IV Results for **Reforms 2006 & 2008**: **Actual Benefit Duration (ABD)** on Motivation of Founder and Firm Outcomes

	(1) UE Duration (in months)	(2) Necessity Motive (=1)	(3) Sales Year 1 (log)	(4) Sales Year 2 (log)	(5) FTE Employment Year 1 (log)	(6) FTE Employment Year 2 (log)
UE Duration (in months)		**0.023****	**0.058**	**-0.121***	**0.004**	**-0.010**
		(0.010)	(0.095)	(0.063)	(0.011)	(0.012)
Tertiary degree (=1)	-0.314	-0.065**	-0.649**	-0.019	0.077**	0.075*
	(0.311)	(0.031)	(0.287)	(0.163)	(0.034)	(0.039)
Founder was SE before (=1)	0.065	-0.029	-0.002	-0.111	-0.007	-0.016
	(0.358)	(0.037)	(0.342)	(0.205)	(0.040)	(0.045)
Managerial Experience as Employee (=1)	0.143	-0.077**	0.150	0.627***	0.131***	0.172***
	(0.381)	(0.038)	(0.358)	(0.161)	(0.050)	(0.056)
Industry Experience (in years)	-0.008	0.001	0.036**	0.004	0.001	0.001
	(0.015)	(0.001)	(0.015)	(0.010)	(0.002)	(0.002)
Female founder (=1)	0.242	-0.001	-1.126***	-0.361*	0.061	0.100*
	(0.361)	(0.038)	(0.407)	(0.204)	(0.047)	(0.052)
Founder of non-German origin (=1)	0.222	0.036	-1.930***	-0.497	-0.023	-0.053
	(0.505)	(0.058)	(0.670)	(0.397)	(0.055)	(0.054)
SE Subsidy by Federal Employment Agency (=1)	-0.087	0.075**	-0.431	-0.295*	-0.056*	-0.085**
	(0.312)	(0.031)	(0.282)	(0.166)	(0.034)	(0.037)
IV_06	**-5.798*****					
	(0.961)					
IV_08	**-0.075**					
	(0.900)					
Industry/Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
First-stage F-statistic		152.383	11.84	12.17	20.8	20.98
N	1256	1256	1039	851	1291	1272
R-sq.	0.189	0.077	0.073	0.125	0.124	0.151
Mean of dependent variable	4.828	0.35	10.074	11.271	0.271	0.361
(abs. value)			173,661	231,293	0.605	0.847

Notes: Standard errors are shown in parentheses and significance levels are indicated by: *** 1%, ** 5%, * 10%. This table shows the IV regression of our outcome variables (motivation for starting up; sales/employment growth after year 1, 2) on the founders' actual benefit duration (ABD) before starting up that is instrumented by *IV06* and *IV08* (Section 3.2). Column 1 shows the first-stage regression of the IV model in column 2. We control for the founders' education, previous work experience, and individual characteristics. We include year and industry (of the startup) fixed effects, and dummies to control for subsidies from the Federal Employment Agency and for funding by the KfW (Appendix B.2). Our regression sample consists of non-team founders who became unemployed between 2003 and 2011, were 35 to 65 years old when becoming unemployed, and for whom information on all control variables is available.

Table 16: IV Results for **Reforms 2006 & 2008**: **ABD** on Motivation of Founder and Firm Outcomes **for Non-Manufacturing Sector**

	(1) UE Duration (in months)	(2) Necessity Motive (=1)	(3) Sales Year 1 (log)	(4) Sales Year 2 (log)	(5) FTE Employment Year 1 (log)	(6) FTE Employment Year 2 (log)
UE Duration (in months)		**0.014**	**0.005**	**-0.166****	**-0.011**	**-0.025****
		(0.011)	(0.091)	(0.075)	(0.009)	(0.011)
Tertiary degree (=1)	-0.300	-0.083**	-0.372	0.153	0.060*	0.059
	(0.356)	(0.035)	(0.290)	(0.161)	(0.035)	(0.041)
Founder was SE before (=1)	0.252	-0.005	0.096	-0.271	0.015	0.034
	(0.376)	(0.042)	(0.346)	(0.225)	(0.044)	(0.050)
Managerial Experience as Employee (=1)	0.160	-0.107**	0.005	0.475***	0.129**	0.178***
	(0.435)	(0.042)	(0.381)	(0.182)	(0.053)	(0.060)
Industry Experience (in years)	0.003	0.001	0.020	0.002	0.002	0.002
	(0.017)	(0.002)	(0.016)	(0.012)	(0.002)	(0.002)
Female founder (=1)	0.355	-0.002	-0.830**	-0.488**	0.071	0.095*
	(0.406)	(0.042)	(0.418)	(0.226)	(0.051)	(0.055)
Founder of non-German origin (=1)	0.189	-0.033	-1.934***	-0.793*	-0.079*	-0.079*
	(0.552)	(0.063)	(0.710)	(0.464)	(0.046)	(0.047)
SE Subsidy by Federal Employment Agency (=1)	-0.086	0.075**	-0.637**	-0.283	-0.054	-0.069*
	(0.368)	(0.035)	(0.306)	(0.200)	(0.035)	(0.039)
IV_06	**-5.962*****					
	(1.111)					
IV_08	**-0.103**					
	(1.085)					
Industry/Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
First-stage F-statistic		110.896	10.01	10.13	17.61	17.7
N	999	999	815	661	1022	1009
R-sq.	0.209	0.090	0.078	0.128	0.168	0.169
Mean of dependent variable	4.926	0.352	10.21	11.251	0.25	0.329
(abs. value for log-terms)			179,344	237,112	0.549	0.76

Notes: Standard errors are shown in parentheses and significance levels are indicated by: *** 1%, ** 5%, * 10%. This table shows the IV regression of our outcome variables (motivation for starting up; sales/employment growth after year 1, 2) on the founders' actual benefit duration (ABD) before starting up in the non-manufacturing sector (75% of the sample) that is instrumented by *IV06* and *IV08* (Section 3.2). Column 1 shows the first-stage regression of the IV model in column 2. We control for the founders' education, previous work experience, and individual characteristics. We include year and industry (of the startup) fixed effects, and dummies to control for subsidies from the Federal Employment Agency and for funding by the KfW (Appendix B.2). Our regression sample consists of non-team founders who became unemployed between 2003 and 2011, were 35 to 65 years old when becoming unemployed, and for whom information on all control variables is available.

Table 17: Potential Mechanisms: The Role of Selection on Observable Characteristics is limited - Composition and Treatment Effect play a role

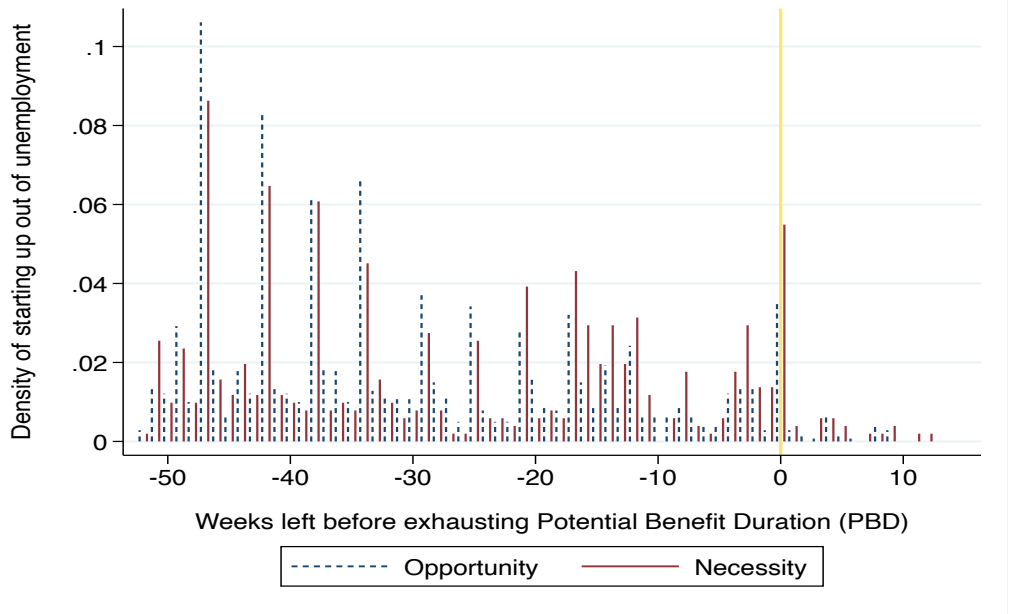
	Treated unemployed from main sample			All unemployed from main sample			"Treated" non-unemployed from comparison group			All non-unemployed from comparison group		
	Mean (before) N=106	Mean (after) N=397	After -before	Mean (before) N=259	Mean (after) N=1032	After -before	Mean (before) N=94	Mean (after) N=509	After -before	Mean (before) N=256	Mean (after) N=1354	After -before
UE Duration (in months)	**11.171**	**4.873**	**-6.299*** **	**7.943**	**4.193**	**-3.75*** **						
Tertiary degree (=1)	0.33	0.28	-0.05	0.20	0.23	0.03	0.32	0.30	-0.03	0.35	0.25	-0.10*
Founder was SE before (=1)	0.17	0.19	0.02	0.15	0.18	0.03	0.26	0.32	0.05	0.25	0.27	0.01
Managerial Experience as Employee (=1)	0.17	0.15	-0.02	0.13	0.13	0.00	0.16	0.19	0.03	0.14	0.16	0.02
Industry Experience (in years)	20.02	18.81	-1.22	16.10	16.31	0.21	22.71	17.27	-5.44***	17.15	15.38	-1.77
Female founder (=1)	0.17	0.25	0.08	0.13	0.20	0.07	0.18	0.23	0.05	0.14	0.20	0.06
Founder of non-German origin (=1)	0.08	0.04	-0.03	0.04	0.07	0.03	0.08	0.05	-0.02	0.06	0.07	0.01
SE Subsidy by Federal Employment Agency (=1)	0.65	0.80	0.15*	0.65	0.80	0.15***	0.27	0.34	0.07	0.30	0.36	0.06
Technology-intensive services	0.05	0.06	0.01	0.05	0.05	0.00	0.05	0.06	0.01	0.06	0.06	0.00
High-technology manufacturing	0.01	0.01	0.00	0.00	0.01	0.01***	0.01	0.02	0.01	0.01	0.01	0.00
Skill-intensive services	0.06	0.08	0.02	0.03	0.05	0.02	0.08	0.08	0.00	0.09	0.07	-0.02
Software supply and consultancy	0.00	0.01	0.00	0.00	0.01	0.00*	0.01	0.01	0.00	0.01	0.01	0.00
Non-high-tech manufacturing	0.03	0.04	0.01	0.04	0.05	0.01	0.03	0.05	0.02	0.03	0.05	0.02***
Other business-oriented services	0.07	0.11	0.04	0.10	0.14	0.03	0.04	0.12	0.08*	0.12	0.12	-0.01
Cons.-or. services in creative sect.	0.08	0.02	-0.06	0.10	0.05	-0.05	0.24	0.11	-0.13	0.15	0.09	-0.06
Consumer-oriented services	0.30	0.31	0.01	0.26	0.26	0.00	0.15	0.24	0.09	0.14	0.23	0.10*
Construction	0.11	0.20	0.09*	0.19	0.20	0.01	0.12	0.10	-0.02	0.16	0.14	-0.02
Retail & wholesale	0.29	0.17	-0.12	0.21	0.18	-0.03	0.28	0.21	-0.07	0.24	0.22	-0.02
Average daily wage in 5 years before founding	107.87	124.75	16.88	96.87	106.56	9.69	129.17	125.10	-4.06	127.03	119.66	-7.37

Notes: Significance levels are indicated by: *** 1%, ** 5%, * 10%. . This table show t-test comparison of different subgroups for the observable characteristics. In the first panel, we compare those unemployed individuals that are affected by 2006 reform. In the second panel, we compare all unemployed individuals before and after the 2006 reform. In the third panel, we compare the potentially treated non-unemployed and in the fourth panel, we do so for all non-unemployed individuals.

A Appendix: Tables & Figures

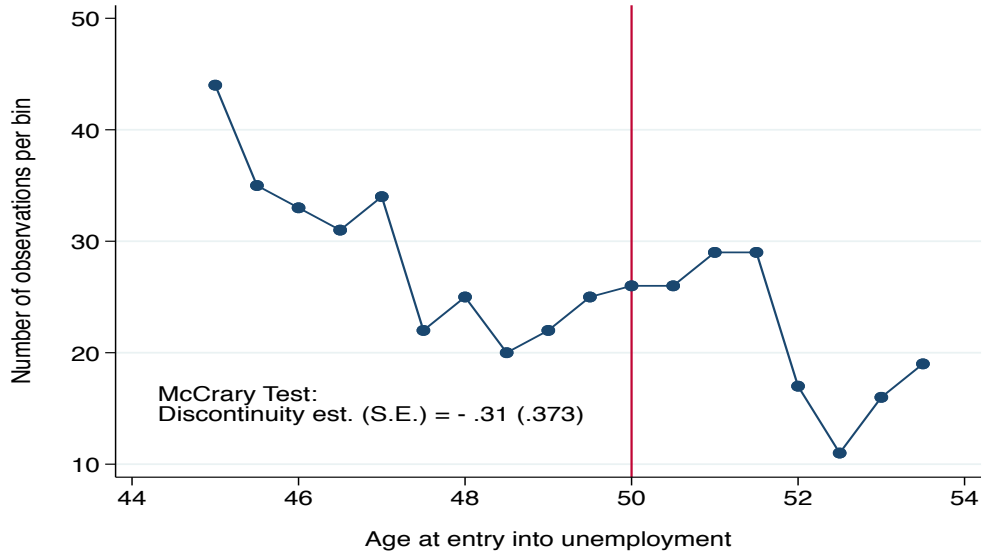
A.1 Figures

Figure A.1: Spikes at exhausting Potential Benefit Duration: Necessity/Pushed Founders



Notes: This Figure shows the difference between actual and potential unemployment duration, i.e. when the unemployed individual starts a firm given his/her remaining PBD. The Figure shows that when UI benefits run out (remaining PBD is close to 0) the spike in the exit rate from unemployment to self-employment is significantly higher for those indicating to start a firm due to *necessity* motives (red lines) compared to those indicating an *opportunity* motive (blue dashed spikes). Thus, it is plausible to use the term *pushed* for *necessity*-driven founders (cf. Section 2). For a review of the literature on UI spikes, see also Card et al. (2007).

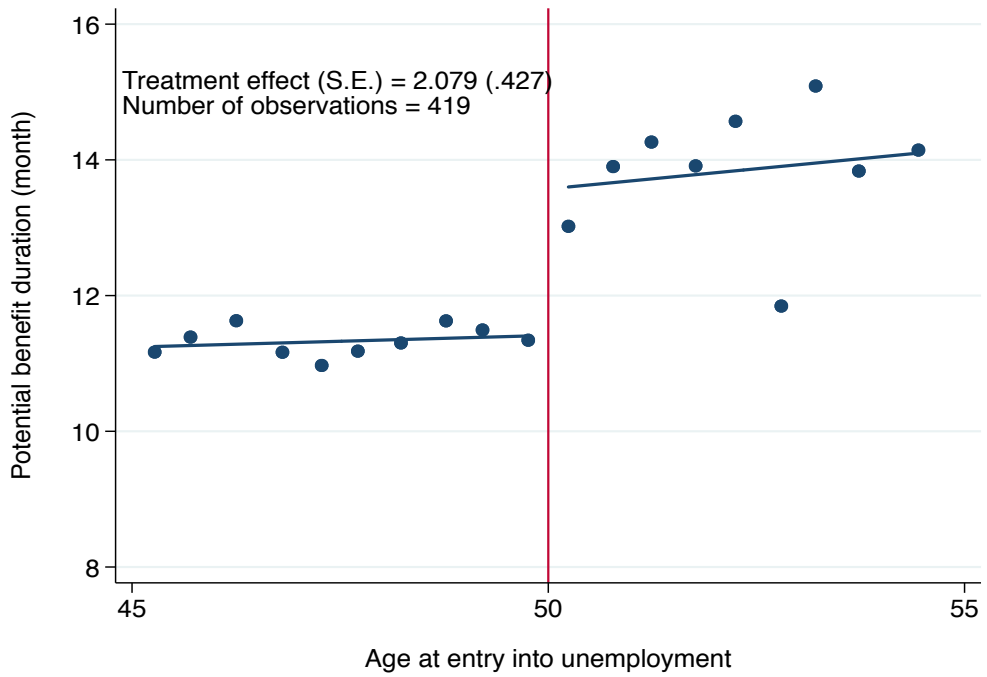
Figure A.2: RDD-Strategy McCrary Test for Age 50 Cutoff in 2008-2011



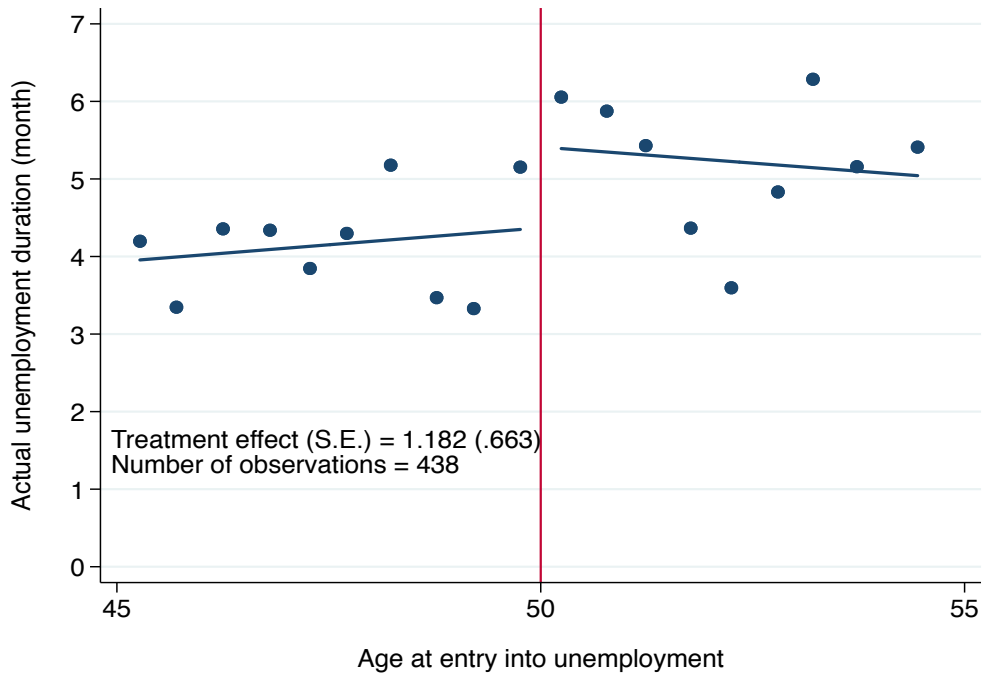
Notes: This Figure shows the necessary checks concerning the identifying assumption of the Regression Discontinuity Design (RDD) strategy. This involves conducting a Mc-Crary test that confirms that eligible persons are not strategically becoming unemployed to exploit the age discontinuity in order to optimize their potential benefit duration (PBD). See also Section 4.2.1.

Figure A.3: RDD-Results for Age 50 Cutoff in 2008-2011: Exogenous Increase of 3 months in PBD

(a) RDD-Results: Increase in Potential Benefit Duration (PBD)



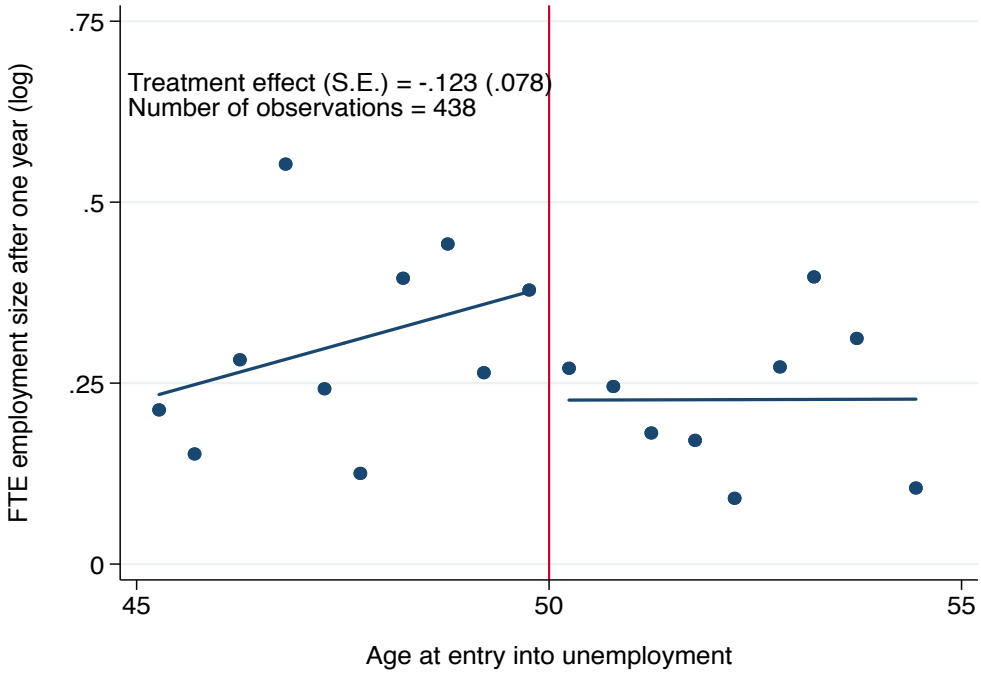
(b) RDD-Effect of 3 months Increase in PBD on Actual Unemployment Duration



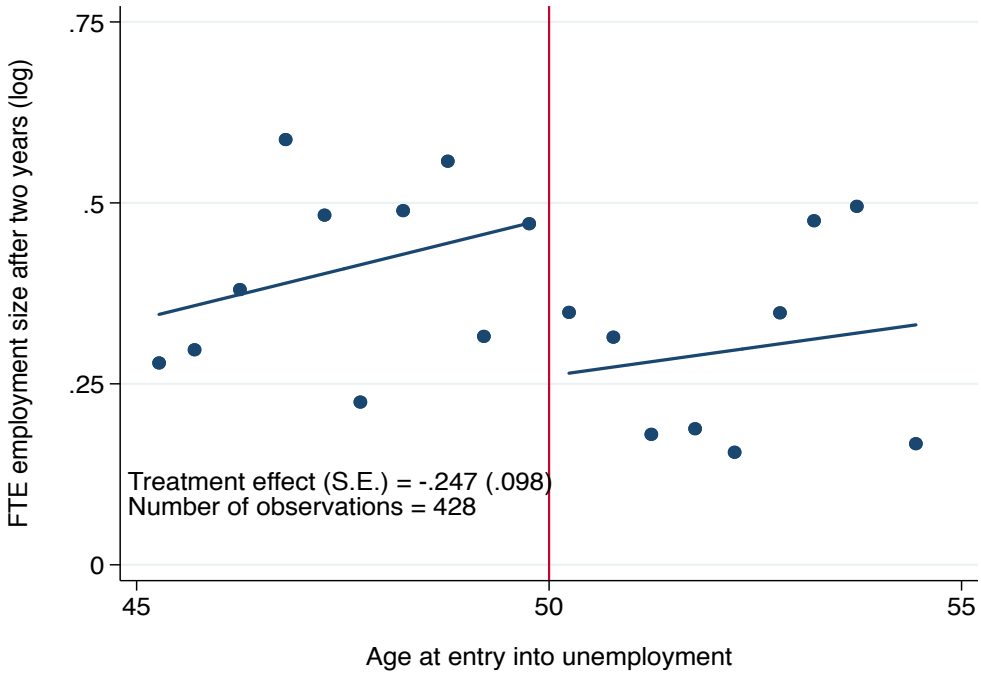
Notes: This Figure shows in (a) that potential benefit duration increases by approximately 3 months around the age 50 cutoff, thus it confirms that our data construction process has been successful. Moreover Figure (b) shows regression discontinuity design (RDD) results for the actual unemployment duration of non-team founders (age 45-54) who have become unemployed. Consistent with our IV estimates longer PBD increases actual unemployment duration (ABD). For details on the RDD strategy, see Section 4.2.1.

Figure A.4: RDD-Results for Age 50 Cutoff in 2008-2011: Exogenous Increase of 3 months in PBD

(a) RDD-Results: Full-Time Equivalent (FTE) Employment after Year 1



(b) RDD-Results: Full-Time Equivalent (FTE) Employment after Year 2



Notes: This Figure shows regression discontinuity design (RDD) results for employment growth outcomes of non-team founders (age 45-54) who have been previously unemployed. Consistent with our IV estimates longer actual unemployment duration induced by longer PBD leads to less growth in terms of FTE employment. For details on the RDD strategy, see Section 4.2.1. Detailed results are shown in Table A.1.

A.2 Tables

Table A.1: Regression Discontinuity Design (RDD) Results: Exogenous Increase of 3 months in PBD at age 50 cutoff

	(1) PBD (in months)	(2) UE Duration (in months)	(3) FTE Employment Year 1 (log)	(4) FTE Employment Year 2 (log)
RDD Treatment-Effect	**2.079*****	**1.182***	**-0.123**	**-0.247****
	(0.427)	(0.663)	(0.078)	(0.098)
Tertiary degree (=1)	0.536	0.103	0.048	0.051
	(0.333)	(0.404)	(0.065)	(0.060)
Founder was SE	-0.614**	0.720	0.000	0.025
before (=1)	-0.022	(0.556)	(0.058)	(0.076)
Managerial Experience	-0.022	0.188	0.196**	0.194**
as Employee (=1)	(0.269)	(0.389)	(0.071)	(0.075)
Industry Experience	0.003	-0.013	0.002	0.001
(in years)	(0.010)	(0.021)	(0.003)	(0.003)
Female founder (=1)	-0.265	0.233	0.179*	0.097
	(0.237)	(0.508)	(0.096)	(0.084)
Founder of	0.129	0.248	0.050	-0.037
non-German origin (=1)	(0.749)	(0.804)	(0.076)	(0.093)
SE Subsidy by Federal	0.871***	-0.568	-0.140***	-0.086
Employment Agency (=1)	(0.241)	(0.549)	(0.042)	(0.058)
Industry/Year Fixed Effects	Yes	Yes	Yes	Yes
N	419	438	438	428
R2	0.299	0.083	0.156	0.165
Mean of dependent variable	12.254	4.49	0.279	0.367

Notes: Standard errors are shown in parentheses and significance levels are indicated by: *** 1%, ** 5%, * 10%. This table shows the regression discontinuity design (RDD) results for an exogenous increase of 3 months in PBD at the age 50 cutoff in 2008-2011.This table shows the RDD regression of our outcome variables (PBD, ABD, employment growth after year 1, 2) on an increase of PBD of around 3 months before starting up (Section 4.2.1). We control for the founders' education; previous work experience; and individual characteristics. We include year and industry (of the start-up) fixed effects; and dummies to control for subsidies from the Federal Employment Agency and for funding by the KfW (Appendix B.2). Our regression sample consists of non-team founders who became unemployed between 2008 and 2011, were 45 to 54 years old when becoming unemployed, and for whom information on all control variables is available.

Table A.2: DiD Results for 2006 Reform: Reduction of at least 3 months in PBD

	(1) UE Duration (in months)	(2) Necessity Motive (=1)	(3) Sales Year 1 (log)	(4) Sales Year 2 (log)	(5) FTE Employment Year 1 (log)	(6) FTE Employment Year 2 (log)
Treatment-Effect	**-3.582*****	**-0.094**	**-0.253**	**0.413**	**-0.041**	**-0.005**
=Treated*After	(0.884)	(0.070)	(0.494)	(0.345)	(0.062)	(0.072)
Treated	4.254***	0.232***	0.142	-0.491	0.043	-0.013
	(0.853)	(0.063)	(0.419)	(0.320)	(0.054)	(0.064)
After	-5.091***	-0.087	-0.093	0.417	0.030	0.142*
	(0.605)	(0.071)	(0.517)	(0.378)	(0.062)	(0.074)
Tertiary degree (=1)	-0.217	-0.068**	-0.679**	0.007	0.072**	0.074*
	(0.294)	(0.032)	(0.289)	(0.173)	(0.034)	(0.040)
Founder was SE before (=1)	0.061	-0.023	-0.016	-0.082	-0.012	-0.019
	(0.335)	(0.037)	(0.343)	(0.213)	(0.040)	(0.045)
Managerial Experience as Employee (=1)	0.179	-0.072*	0.150	0.592***	0.131***	0.169***
	(0.368)	(0.039)	(0.358)	(0.169)	(0.050)	(0.058)
Industry Experience (in years)	-0.001	0.001	0.034**	0.006	0.001	0.001
	(0.015)	(0.002)	(0.015)	(0.010)	(0.002)	(0.002)
Female founder (=1)	0.112	0.003	-1.090***	-0.358	0.064	0.102*
	(0.337)	(0.039)	(0.409)	(0.218)	(0.047)	(0.053)
Founder of non-German origin (=1)	0.253	0.042	-1.891***	-0.572	-0.023	-0.057
	(0.479)	(0.060)	(0.676)	(0.437)	(0.056)	(0.057)
SE Subsidy by Federal Employment Agency (=1)	-0.157	0.072**	-0.427	-0.285*	-0.055	-0.083**
	(0.297)	(0.032)	(0.282)	(0.169)	(0.034)	(0.038)
Industry/Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	1291	1256	1039	851	1291	1272
R-sq.	0.231	0.068	0.098	0.094	0.132	0.133
Mean of dependent variable	145.637	0.35	10.074	11.271	0.271	0.361
(abs. value for log-terms)			173,661	231,293	0.605	0.847

Notes: Standard errors are shown in parentheses and significance levels are indicated by: *** 1%, ** 5%, * 10%. This table shows the DiD regression of our outcome variables (ABD, motivation for starting up; sales/employment growth after year 1, 2) on a decrease of PBD of around 6 months, before starting up (Section 4.2.3). We control for the founders' education, previous work experience, and individual characteristics. We include year and industry (of the start-up) fixed effects, and dummies to control for subsidies from the Federal Employment Agency and for funding by the KfW (Appendix B.2). Our regression sample consists of non-team founders who became unemployed between 2003 and 2011, were 35 to 65 years old when becoming unemployed, and for whom information on all control variables is available.

Table A.3: DiD Results for 2006 Reform: Reduction of at least 3 months in PBD **focusing on the Non-Manufacturing Sector**

	(1) UE Duration (in months)	(2) Necessity Motive (=1)	(3) Sales Year 1 (log)	(4) Sales Year 2 (log)	(5) FTE Employment Year 1 (log)	(6) FTE Employment Year 2 (log)
Treatment-Effect	**-3.997*****	**-0.070**	**0.090**	**0.698***	**0.041**	**0.087**
=Treated*After	(1.006)	(0.078)	(0.511)	(0.415)	(0.058)	(0.071)
Treated	4.885***	0.201***	-0.231	-0.776**	-0.033	-0.096
	(0.971)	(0.071)	(0.427)	(0.391)	(0.048)	(0.061)
After	-5.004***	-0.032	-0.302	0.442	0.063	0.159**
	(0.686)	(0.082)	(0.600)	(0.450)	(0.062)	(0.074)
Tertiary degree (=1)	-0.222	-0.084**	-0.381	0.178	0.059	0.060
	(0.337)	(0.036)	(0.295)	(0.173)	(0.036)	(0.042)
Founder was SE before (=1)	0.203	0.002	0.073	-0.220	0.009	0.029
	(0.356)	(0.042)	(0.354)	(0.233)	(0.045)	(0.052)
Managerial Experience as Employee (=1)	0.226	-0.103**	0.002	0.412**	0.125**	0.172***
	(0.419)	(0.043)	(0.384)	(0.190)	(0.054)	(0.062)
Industry Experience (in years)	0.006	0.001	0.019	0.003	0.001	0.002
	(0.017)	(0.002)	(0.016)	(0.012)	(0.002)	(0.002)
Female founder (=1)	0.290	0.001	-0.829**	-0.525**	0.069	0.090
	(0.384)	(0.043)	(0.421)	(0.240)	(0.052)	(0.057)
Founder of non-German origin (=1)	0.255	-0.032	-1.920***	-0.878*	-0.079*	-0.086*
	(0.517)	(0.065)	(0.721)	(0.518)	(0.047)	(0.050)
SE Subsidy by Federal Employment Agency (=1)	-0.142	0.074**	-0.634**	-0.266	-0.051	-0.064
	(0.348)	(0.037)	(0.311)	(0.201)	(0.036)	(0.041)
Industry/Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	1022	999	815	661	1022	1009
R-sq.	0.252	0.071	0.080	0.112	0.147	0.141
Mean of dependent variable	149.003	0.352	10.21	11.251	0.25	0.329
(abs. value for log-terms)			179,344	237,112	0.549	0.76

Notes: Standard errors are shown in parentheses and significance levels are indicated by: *** 1%, ** 5%, * 10%. This table shows the DiD regression of our outcome variables (ABD, motivation for starting up; sales/employment growth after year 1, 2) on a decrease of PBD of around 6 months (Section 4.2.3), before starting up in the non-manufacturing sector (75% of the sample). We control for the founders' education, previous work experience, and individual characteristics. We include year and industry (of the start-up) fixed effects, and dummies to control for subsidies from the Federal Employment Agency and for funding by the KfW (Appendix B.2). Our regression sample consists of non-team founders who became unemployed between 2003 and 2011, were 35 to 65 years old when becoming unemployed, and for whom information on all control variables is available.

Table A.4: OLS - ABD Controlled vs Uncontrolled

	(1) Necessity Motive (=1)		(2) Sales Year 1 (log)		(3) Sales Year 2 (log)		(4) FTE Employment Year 1 (log)		(5) FTE Employment Year 2 (log)	
UE Duration (in months)	**0.017*****	**0.017*****	**-0.139*****	**-0.141*****	**-0.096*****	**-0.104*****	**-0.016*****	**-0.018*****	**-0.023*****	**-0.024*****
	(0.003)	(0.003)	(0.027)	(0.028)	(0.018)	(0.021)	(0.003)	(0.003)	(0.003)	(0.003)
CONTROLS	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
N	1256	1256	1039	1039	851	851	1291	1291	1272	1272
R-sq.	0.063	0.026	0.122	0.028	0.126	0.049	0.150	0.023	0.158	0.034
Mean of dependent variable	0.35	0.35	10.074	10.074	11.271	11.271	0.271	0.271	0.361	0.361
(abs. value for log-terms)			173,661	173,661	231,293	231,293	0.605	0.605	0.847	0.847

Table A.5: OLS - PBD Controlled vs Uncontrolled

	(1) UE Duration (in months)		(2) Necessity Motive (=1)		(3) Sales Year 1 (log)		(4) Sales Year 2 (log)		(5) FTE Employment Year 1 (log)		(6) FTE Employment Year 2 (log)	
PBD (in months)	**0.471*****	**0.498*****	**0.023*****	**0.023*****	**-0.036**	**-0.045***	**-0.049****	**-0.053****	**-0.004**	**-0.008****	**-0.009****	**-0.013*****
	(0.048)	(0.048)	(0.003)	(0.003)	(0.024)	(0.024)	(0.022)	(0.022)	(0.004)	(0.004)	(0.004)	(0.004)
CONTROLS	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
N	1291	1291	1256	1256	1039	1039	851	851	1291	1291	1272	1272
R-sq.	0.256	0.215	0.077	0.044	0.099	0.003	0.096	0.012	0.133	0.004	0.134	0.008
Mean of dependent variable	4.785	4.785	0.35	0.35	10.074	10.074	11.271	11.271	0.271	0.271	0.361	0.361
(abs. value for log-terms)					173,661	173,661	231,293	231,293	0.605	0.605	0.847	0.847

Notes: Standard errors are shown in parentheses and significance levels are indicated by: *** 1%, ** 5%, * 10%. These tables show the OLS regression of our main outcome variables (motivation for starting up; sales/employment growth after year 1, 2) on the founders' benefit duration (both ABD and PBD) before starting up. We analyze to which extent controls for founders' education, previous work experience and individual characteristics affect results compared to the standard case without controls. The fact that there are no remarkable differences shows that *composition effects* are limited.

Table A.6: IV - ABD Controlled vs Uncontrolled

	(1) UE Duration (in months)		(2) Necessity Motive (=1)		(3) Sales Year 1 (log)		(4) Sales Year 2 (log)		(5) FTE Employment Year 1 (log)		(6) FTE Employment Year 2 (log)	
UE Duration (in months)	**-5.815*****	**-5.695*****	**0.022****	**0.030*****	**0.060**	**0.145**	**-0.118***	**-0.115***	**0.005**	**-0.008**	**-0.010**	**-0.017**
	(0.921)	(0.846)	(0.010)	(0.010)	(0.095)	(0.092)	(0.063)	(0.066)	(0.011)	(0.010)	(0.012)	(0.011)
CONTROLS	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
First-stage F-statistic			39.831	45.318	23.487	26.687	24.016	23.626	40.992	45.866	41.07	45.886
N	1256	1256	1256	1256	1039	1039	851	851	1291	1291	1272	1272
R-sq.	0.189	0.135	0.075	0.021	0.072	.	0.124	0.048	0.120	0.016	0.149	0.032
Mean of dependent variable	4.828	4.828	0.35	0.35	10.074	10.074	11.271	11.271	0.271	0.271	0.361	0.361
(abs. value for log-terms)					173,661	173,661	231,293	231,293	0.605	0.605	0.847	0.847

Table A.7: IV - PBD Controlled vs Uncontrolled

	(1) PBD (in months)		(2) UE Duration (in months)		(3) Necessity Motive (=1)		(4) Sales Year 1 (log)		(5) Sales Year 2 (log)		(6) FTE Employment Year 1 (log)		(7) FTE Employment Year 2 (log)	
PBD (in months)	**-8.743*****	**-8.322*****	**0.661*****	**0.677*****	**0.015****	**0.020*****	**0.034**	**0.084***	**-0.072***	**-0.068***	**0.003**	**-0.005**	**-0.006**	**-0.012**
	(0.505)	(0.459)	(0.094)	(0.094)	(0.007)	(0.006)	(0.052)	(0.048)	(0.039)	(0.040)	(0.007)	(0.007)	(0.008)	(0.007)
CONTROLS	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
First-stage F-statistic			299.421	328.397	286.66	319.312	223.603	242.271	220.761	219.543	299.421	328.397	296.11	325.42
N	1291	1291	1291	1291	1256	1256	1039	1039	851	851	1291	1291	1272	1272
R-sq.	0.470	0.434	0.234	0.194	0.083	0.049	0.094	.	0.094	0.011	0.130	0.004	0.134	0.009
Mean of dependent variable	12.324	12.324	4.785	4.785	0.35	0.35	10.074	10.074	11.271	11.271	0.271	0.271	0.361	0.361
(abs. value for log-terms)							173,661	173,661	231,293	231,293	0.605	0.605	0.847	0.847

Notes: Standard errors are shown in parentheses and significance levels are indicated by: *** 1%, ** 5%, * 10%. These tables show the IV regression of our outcome variables (motivation for starting up; sales/employment growth after year 1, 2) on the founders' benefit duration (both ABD and PBD) before starting up that are instrumented by *IV06* (Section 3.2). We analyze to which extent controls for founders' education, previous work experience and individual characteristics affect results compared to the standard case without controls. The fact that there are no remarkable differences shows that *composition effects* are limited.

B Appendix: Institutional Details

B.1 Labour Market Reforms in Germany

In this paper we exploit parts of the big labor market reforms enacted between 2003 and 2005 that are known as *Hartz-Reforms* (compare e.g. Hartung et al. (2018), Petrunyk and Pfeifer (2018) or Price (2018) evaluating theses reforms).

- In 2003 the first two parts of this labour market reform were passed: the first measure (*Hartz I*) liberalized the sector of temporary work, thus allowing firms to hire workers from temp agencies for short-term periods. The second measure package (*Hartz II*) reduced the regulations on marginal employment and introduced an additional form of social security tax-favored employment (*midi-jobs*). Moreover, it created new subsidies for unemployed workers starting their own business (*Ich-AG*). But this program ended in 2006 and was replaced by the new startup subsidy scheme (*Gründungszuschuss*, see Appendix B.2).
- In 2004, the third reform package (*Hartz III*) renewed the structure and role of the federal employment agency. Most important, the original placement agencies (*Arbeitsämter*) and social security offices (*Sozialämter*) were merged into single institutions (*Arbeitsagenturen*). Moreover, additional *job centers* were set up in each municipality. Finally, case managers were introduced to have one person in charge of assisting unemployed workers over the entire job search process.
- In 2005, the last reform package (*Hartz IV*) transformed the three-tier system of unemployment benefits, unemployment assistance, and subsistence benefits into a two-tier system of unemployment benefits and subsistence benefits.
  - Concerning the benefit level, the reform involved abolishing unemployment assistance benefits (Arbeitslosenhilfe). The unemployment assistance depended on some previous work history and could be received for several years after unemployment insurance (UI) benefits expired. The net replacement rates were at 53% for a single person and could reach 57% for persons with dependent children. Instead, those who were not eligible for unemployment assistance could still get a minimum subsistence benefit (Sozialhilfe) that included rent payments but was not linked to previous wages. The reform of 2005 removed wage-dependent benefits for long-term unemployed, and merged unemployment assistance and subsistence benefit to create a new minimum benefit scheme (Arbeitslosengeld II) that is independent of previous wages and only intended to provide recipients with minimum benefits necessary to survive and subject to a tight means testing procedure. Instead, the unemployment insurance (UI) benefits (Arbeitslosengeld I) remained unchanged at a net replacement rate of 60% for single persons and 67% for those with dependent children. Note that in this paper, we only focus on individuals who enter unemployment and receive UI benefits, thus, they were not affected by these benefit level changes targeted to those having exhausted UI benefits.
  - Moreover, this package involved changing the duration of unemployment benefits (Table 6). The changes came only in effect for individuals claiming for UI benefits after February 1, 2006. In our identification strategy, we exploit this reform along with the 2008 one that partially increased the duration eligibility for older employees again (Lichter, 2016). Focusing on 30-60 years old, there is no potential interference with early retirement rules affecting only workers above 60 (ie. 63 since 2004).

B.2 Startup Subsidies

This Section provides an overview of startup subsidies in Germany. The important thing to note is that all the startup subsidies schemes were and are not dependent on the age of claimants and did not change exactly at the same point in time as the reforms on potential unemployment insurance (UI) benefit duration (PBD). Thus, they do not threaten the identification strategy as explained in Section 3.

1. Bridging Allowance (BA) - "Überbrückungsgeld" (1986-07/2006)
   - Eligibility: it covered individuals who were eligible for unemployment insurance (UI) benefits, and presented an externally approved business plan (issued by the regional chamber of commerce). It was not possible to quit a job and directly apply for this bridging allowance.
   - Amount: financial support was based on unemployment insurance (UI) benefits plus social security contributions and it could be provided for up to six months.
   - Until 2002, individuals had to stay unemployed for a minimum of one month to apply for BA. From 2002, one could apply for BA from the first unemployment day onward.
2. Existenzgründerzuschuss (Ich-AG) (startup subsidies (SUS)) (01/2003-06/2006)
   - Eligibility: it covered individuals who were eligible for unemployment insurance (UI) benefits, but also those with means-tested social assistance or limited labor market experience (hence it was open to more people than BA).
   - Amount: it involved a monthly lump-sum payment for up to three years with 600 Euro per month in the first year, 360 Euro per month in the second year, 240 Euro per month in the third year. In contrast to BA, this startup subsidies were approved yearly if self-employment income did not exceed 25,000 Euro per year.
   - There was no need of business plans for approval, but parallel receipt of BA and SUS was excluded.
3. New SUS: new startup subsidy program ("Gründungszuschuss") (08/2006-12/2011)
   - Eligibility: it covered individuals that were unemployed for at least one day, eligible to receive unemployment insurance (UI) (Arbeitslosengeld I) and that still had at least 90 days of potential UI benefit duration left when making the transition from unemployment to self-employment. Thus, it was not possible to get this startup subsidy when an unemployed worker just exhausted her UI benefits.
   - Amount: it involved UI benefits plus 300 Euro (for social security contributions) for nine months. It was possible to get an extension of six months by proving that the business is economically active. The amount of startup subsidies after the first nine months was reduced to just 300 Euro for the remaining six months. In total the startup subsidies could be taken for a maximum of 15 months.
   - The first period of SUS could be legally claimed by all persons who fulfilled the legal eligibility requirements. The second period was entirely subject to an assessment.
   - In case of returning from self-employment to unemployment, the potential benefit duration (PBD) would be reduced by the number of month the person received SUS up till a minimum of zero PBD months.

4. New SUS adjusted: startup subsidy program ("Gründungszuschuss") adjusted (01/2012-today)

    - Eligibility: it covers individuals that are unemployed for at least one day, eligible to receive unemployment insurance (UI) (Arbeitslosengeld I) and that still have at least 150 days (instead of previously 90 days) of potential UI benefit duration left when making the transition from unemployment to self-employment. Thus, it is not possible to get this star-up subsidy when an unemployed worker just exhausts her UI benefits.
    - Amount: it involves unemployment insurance benefits plus 300 Euro (for social security contributions) for six (instead of previously nine) months. It is possible to get an extension of nine (instead of six) months by proving that the business is economically active. The amount of startup subsidies after the first nine months is reduced to just 300 Euro for the remaining six months. In total, the startup subsidies can be taken for a maximum of 15 months.
    - The assessment for receiving startup subsidies has been extended to the first period. The previous legal right to claim this subsidy has been abolished by December 2011 and is now a subsidy that is available upon assessment of the caseworker at the federal employment agency.
    - Background: as part of public spending cuts, the intention was to reduce money allocated for such active labor market policies.

It should be noted that we control for any funding provided by the federal employment agency (Bundesagentur für Arbeit) in our regression. Thus, we control for these startup subsidies targeted at founders starting a business out of unemployment.

Moreover, it should be noted that in all regression models, we control for KfW-funding, ie. funding of startups by subsidized credits from the German government-owned development bank, Kreditanstalt für Wiederaufbau (KfW) (Reconstuction Credit Institute) that was formed in 1948 to fund the reconstruction of Germany after World War II. The funding via the KfW is an important channel through which startups in Germany are financed.

C Appendix: Technical Details of Data Construction

C.1 Details on the created linked dataset and the matching procedure

The IAB/ZEW Start-Up Panel is a random sample drawn from the "universe" of the Mannheim Enterprise Panel ("MUP"). The Mannheim Entreprise Panel is collected by Credireform (Germany's largest credit rating agency) and processed by ZEW. It covers basic information (addresses, phone numbers, industry, incorporation status, survival) about all "economically active" firms in Germany. This is guaranteed by automated synchronization with official commercial registers, automated synchronization with Chambers of Industry and Commerce (IHKs), active search for new firms by local Creditreform offices as well as by the fact that Creditreform usually receives a request for conducting a credit rating when new firms enter the market or require initially investments for starting their business.

Only independent new firms are sampled for the Start-Up Panel survey, which means that all start-ups are included but with a few exceptions: no subsidiaries, no new establishments of established firms, and no firm is included due to a business succession (also in case of insolvency). Instead, joint ventures and franchise are allowed and included. Moreover, a maximum of 75% of the firm may be held by other firms. In conclusion, the interviewee entering into the Start-Up Panel is financially engaged in the firm and usually the single founder or one member of a team of founder(s). The Start-Up Panel is a stratified random sample. The stratification is based on a variable indicating KfW-funding (until 2011), the founding year and the industry sector. The detailed first interview is supposed to take place within one year after the firm has been started. Only a small proportion of firms is first sampled up to three years after foundation to balance small stratification cells (they can be excluded). Shorter follow-up surveys are then conducted in the subsequent years. Each start-up stays in the sample for up to 7 interviews or until they drop out by missing two subsequent interviews. All information is retrieved by computer-assisted telephone interviews. By 2018, survey waves on cohorts 2005-2015 include 68,500 observations from 52,000 interviews on 21,200 firms.

The employment statistics contain information on all reportable employees subject to social security contributions in Germany. This includes apprentices, interns, and people in marginal part-time employment. All notifications on an individual's spells of employment and unemployment can be linked with the aid of a unique person-specific identifier, thereby revealing an employment history for each employee. A further identifier makes it possible to match the employees to establishments. However, there is no unique identifier to match establishments to firms. Therefore, we matched establishments to firms in the KfW/ZEW Start-Up Panel using a text search algorithm via firm/establishment names and addresses. The text search algorithm is described in detail in Appendix B of Czarnitzki et al. (2015) and has proved to deliver very reliable results in various settings.

In the matching procedure we were able to find about 90% of the firms in the KfW/ZEW Start-Up Panel that reported having employees in the yearly telephone surveys. We removed firms from the sample which reported that they had reportable employees but which we were unable to find during the matching procedure. In addition, to safeguard against false matches, all matches were double-checked manually and we excluded the matches in the 1st and 100th percentile of the difference between self-reported and process-generated firm sizes from the sample. The correlation coefficient between self-reported and process-generated firm sizes in the final firm-year panel dataset is slightly above 0.95.

D Appendix: Model Extension

D.1 Model: Derivations and Details

The Effect of Unemployment Duration on the Value of Searching for Employment Starting from the modeling framework as discussed in Section 5.1 with the value function of an unemployed individual searching for employment (equation 8), we have:

$$V^e_{u,t} = b_t - \psi_t(s_t) + \beta\Big\{p_t[1-F(\phi_t)]\int_{\phi_t}^{\infty} V^e_{t+1}(w_{t+1})dF(w_{t+1}) + [p_tF(\phi_t) + (1-p_t)]\,V^u_{t+1}\Big\} \quad (13)$$

This value function is increasing in the next period's wage w_{t+1}, such that the reservation wage plays an important role in the optimal search behavior. Every wage that is larger than the reservation wage, i.e $w_{t+1} \geq \phi_t$, will be accepted. Therefore, we can write equation 13 in terms of the following Bellman equation as:

$$V^e_{u,t} = b_t - \psi_t(s_t) + \beta\Big\{V^u_{t+1} + p_t[1-F(\phi_t)]\int_{\phi_t}^{\infty}\left[V^e_{t+1}(w_{t+1}) - V^u_{t+1}\right]dF(w_{t+1})\Big\} \quad (14)$$

As mentioned in chapter 5.1, $p_t = p(s_t, \theta)$. The case of leaving unemployment to employment is dependent on the search intensity and an unemployed individual's skill. Holding the level of ability θ fix, p_t is directly dependent on the search intensity s_t, and can be substituted accordingly.

Further, defining the discount factor β as $\frac{1}{1+\rho}$, with ρ being the discount rate (see Schmieder and von Wachter, 2016), one can rewrite equation 14 to:

$$V^e_{u,t} = b_t - \psi_t(s_t) + \frac{1}{1+\rho}\Big\{V^u_{t+1} + s_t[1-F(\phi_t)]\int_{\phi_t}^{\infty}\left[V^e_{t+1}(w_{t+1}) - V^u_{t+1}\right]dF(w_{t+1})\Big\} \quad (15)$$

Assuming that the value of unemployment is in equilibrium equal to the discounted reservation wage, we define $V^u_{t+1} = \frac{1}{\rho}\phi_t$. Analogously, the value of leaving unemployment in the next period depends on the present value of the reservation wage $V^e_{u,t+1} = \frac{1}{\rho}\phi_t$, or in this case $V^e_{u,t} = \frac{1}{\rho}\phi_{t-1}$.

Note that the individual is indifferent between leaving unemployment or staying unemployed at the exact level of the reservation wage when $V^e_{u,t+1} = V^u_{t+1}$. Knowing the reservation wage ϕ_t and the optimal search intensity s_t in period t will enable us to detect the reservation wage in period $t-1$. Therefore, plugging in $V^u_{t+1} = \frac{1}{\rho}\phi_t$, $V^u_t = \frac{1}{\rho}\phi_{t-1}$ into equation 15, we get:

$$\frac{1}{\rho}\phi_{t-1} = b_{t-1} - \psi_t(s_t) + \frac{1}{1+\rho}\Big\{\frac{1}{\rho}\phi_t + s_t[1-F(\phi_t)]\int_{\phi_t}^{\infty}\left[V^e_{t+1}(w_{t+1}) - \frac{1}{\rho}\phi_t\right]dF(w_{t+1})\Big\} \quad (16)$$

Multiplying equation 16 by $\rho(1+\rho)$, we get:

$$(1+\rho)\phi_{t-1} = (1+\rho)\rho(b_{t-1} - \psi_t(s_t)) + \phi_t + s_t[1-F(\phi_t)]\int_{\phi_t}^{\infty}\left[\rho V^e_{t+1}(w_{t+1}) - \phi_t\right]dF(w_{t+1}) \quad (17)$$

To find the optimal reservation wage, we need to derive the first-order conditions. With the optimal reservation wage implying indifference between the value functions for searching employment and for remaining unemployed (when $V^e_{u,t+1} = V^u_{t+1}$), we can further solve for the optimal search intensity (taking the derivative of equation 17 for s_t at the reservation wage ϕ_{t-1}):

$$(1+\rho)\rho\psi'_t(s_{t-1}) - [1 - F(\phi_{t-1})] \int_{\phi_{t-1}}^{\infty} [\rho V^e_t(w_t) - \phi_{t-1}]\, dF(w_t) = 0 \tag{18}$$

As mentioned in the main text, an unemployed individual receives a constant benefit b_t for a duration d. When $t \geq d = PBD$, the benefit drops to a lower and constant level. This illustrates the importance of duration d. Since the reservation wage and the optimal search intensity are two choice variables that directly influence the value for employment, we are interested in their behavior over the unemployment duration spell d.

Exploiting the fact $V^u_{t+1} = \frac{1}{\rho}\phi_t$, the first order condition for the optimal reservation path is given by:

$$\frac{\partial \phi_t}{\partial d} = \frac{\partial V^u_{t+1}}{\partial d}\rho \tag{19}$$

Taking the total derivative of equation 18 with respect to d, we get for the optimal search intensity path at period t:

$$\frac{\partial s_t}{\partial d} = -\frac{\partial \phi_t}{\partial d} \frac{[1 - F(\phi_t)]^2 + f(\phi_t) \int_{\phi_t}^{\infty} [\rho V^e_t(w_t) - \phi_t]\, dF(w_t)}{(1+\rho)\rho\psi''_t(s_t)} \tag{20}$$

If there exists at least the slightest chance someone cannot find a job by the time unemployment benefits expire i.e $t = d = PBD$, then a longer benefit duration in general increases the value for unemployment i.e $\frac{\delta V^u_{t+1}}{\delta d} > 0$. Equations 19 and 20 show that a longer d will lead to a higher reservation wage ϕ_t and a lower search intensity s_t.

This means that given the hazard of leaving unemployment is given as $h_t = s_t(1 - F(\phi_t))$, an extension of PBD would lower the probability of leaving unemployment in that period, thus increasing actual unemployment duration (compare also Schmieder and von Wachter, 2016). Moreover, this implies that the effect of unemployment duration on the value of searching for employment should be negative

$$\frac{\partial V^e_{ut}}{\partial d}|\theta < 0 \tag{21}$$

In other words, this model implies negative duration dependence which leads to the implications as described in the main text in Chapter 5.

The Effect of Unemployment Duration on the Value of Searching for Self-Employment
Starting from the modeling framework as discussed in Section 5.1 with the value function of an unemployed individual searching for employment (equation 10), we have:

$$V_{u,t}^{se} = b_t - \psi_t^{se}(s_t, \theta) + \beta\Big\{p_t[1 - F(\phi_t)] \int_{\phi_t}^{\infty} V_{t+1}^{se}(\pi_{t+1}) dF(\pi_{t+1}) + [p_t F(\phi_t) + (1 - p_t)]\, V_{t+1}^{u}\Big\} \quad (22)$$

Giving the same importance to the reservation wage and using the same definition for β as in the case before, holding θ fixed we can rewrite the above equation in terms of the following Bellman equation as:

$$V_{u,t}^{se} = b_t - \psi_t^{se}(s_t) + \beta\Big\{V_{t+1}^{u} + p_t^{se}[1 - F(\phi_t)] \int_{\phi_t}^{\infty} \left[V_{t+1}^{se}(\pi_{t+1}) - V_{t+1}^{u}\right] dF(\pi_{t+1})\Big\} \quad (23)$$

This value function is again increasing in the next period's profits as income when being self-employed π_{t+1}. Every potential profit as self-employed that is larger than the reservation wage, i.e $\pi_{t+1} \geq \phi_t$, will be accepted. Note that the search costs have a different interpretation in this case. ψ^{se} reflects costs related to developing a startup idea, doing the required research on it or finding capital. Furthermore, defining the discount factor β as $\frac{1}{1+\rho}$, with ρ being the discount rate, one can rewrite equation 23 to:

$$V_{u,t}^{se} = b_t - \psi_t^{se}(s_t) + \frac{1}{1+\rho}\Big\{V_{t+1}^{u} + p_t^{se}[1 - F(\phi_t)] \int_{\phi_t}^{\infty} \left[V_{t+1}^{se}(\pi_{t+1}) - V_{t+1}^{u}\right] dF(\pi_{t+1})\Big\} \quad (24)$$

For the case of moving from unemployment to self-employment, we define $V_{u,t+1}^{se} = \frac{1-\gamma(\bar{\theta})}{\rho}\phi_t$: i.e it depends also on the probability of startup success (survival), here for the average type at $\bar{\theta}$.

Note, that the individual is indifferent between leaving unemployment or staying unemployed at the exact level of the reservation wage when $V_{u,t+1}^{se} = V_{t+1}^{u}$. Knowing the reservation wage ϕ_t and the optimal search intensity s_t in period t will enable us to detect the reservation wage in period $t-1$. Plugging in $V_{t+1}^{u} = \frac{1-\gamma(\bar{\theta})}{\rho}\phi_t$, $V_t^{u} = \frac{1-\gamma(\bar{\theta})}{\rho}\phi_{t-1}$ into equation 24, we get:

$$\frac{1-\gamma(\bar{\theta})}{\rho}\phi_{t-1} = b_{t-1} - \psi_t^{se}(s_t) + \frac{1}{1+\rho}\Big\{\frac{1-\gamma(\bar{\theta})}{\rho}\phi_t + s_t^{se}[1 - F(\phi_t)] \int_{\phi_t}^{\infty} \left[V_{t+1}^{se}(\pi_{t+1}) - \frac{1-\gamma(\bar{\theta})}{\rho}\phi_t\right] dF(\pi_{t+1})\Big\} \quad (25)$$

After some rearranging we get:

$$[1 - \gamma(\bar{\theta})](1+\rho)\phi_{t-1} = (1+\rho)\rho(b_{t-1} - \psi_t^{se}(s_t)) + (1 - \gamma(\bar{\theta}))\phi_t + s_t^{se}[1 - F(\phi_t)] \int_{\phi_t}^{\infty} \left[\rho V_t^{se}(\pi_{t+1}) - (1 - \gamma(\bar{\theta}))\phi_t\right] dF(\pi_{t+1}) \quad (26)$$

To find the optimal reservation wage, we again need to derive the first-order conditions.

With the optimal reservation wage implying indifference between the value functions for becoming self-employed and for remaining unemployed (when $V^{se}_{u,t+1} = V^{u}_{t+1}$), we can further solve for the optimal search intensity (taking the derivative of equation 26 for s_t at the reservation wage ϕ_{t-1}):

$$(1+\rho)\rho\psi^{se\prime}{}_{t-1}(s_{t-1}) - [1 - F(\phi_{t-1})] \int_{\phi_{t-1}}^{\infty} \left[\rho V^{se}_{t}(\pi_t) - (1-\gamma(\bar{\theta}))\phi_{t-1}\right] dF(\pi_t) = 0 \tag{27}$$

As mentioned in the main text, an unemployed individual receives a constant benefit b_t for a duration d. When $t \geq d = PBD$, the benefit drops to a lower and constant level. This illustrates the importance of duration d. Since the reservation wage and the optimal search intensity are two choice variables that directly influence the value for employment, we are interested in their behavior over the unemployment duration spell d.

Exploiting the fact $V^{u}_{t+1} = \frac{(1-\gamma(\bar{\theta}))}{\rho}\phi_t$, the first order condition for the optimal reservation path is given by:

$$\frac{\partial \phi_t}{\partial d} = \frac{\partial V^{u}_{t+1}}{\partial d} \frac{\rho}{(1-\gamma(\bar{\theta}))} \tag{28}$$

Taking the total derivative of equation 27 with respect to d, we get for the optimal search intensity path:

$$\frac{\partial s_t}{\partial d} = -\frac{\partial \phi_t}{\partial d} \frac{[1-F(\phi_t)]^2 + f(\phi_t)\int_{\phi_t}^{\infty}\left[\rho V^{se}_{t}(\pi_t) - (1-\gamma(\bar{\theta}))\phi_t\right] dF(\pi_t)}{(1+\rho)\rho\psi''_t(s_t)} \tag{29}$$

Again when unemployment benefit duration increases and there is chance of not finding a job when benefits expire, we expect that $\frac{\partial V^{u}_{t+1}}{\partial d} > 0$. With ρ being the discount rate taking values < 1 and $[1-\gamma(\bar{\theta})]$ being the probability of startup success that is higher than ρ, the whole fraction is $\frac{\rho}{(1-\gamma(\bar{\theta}))} < 1$. The denominator becomes larger the higher an individual's ability θ. Equation 28 and 29 show that searching market opportunities for self employment exhibits a smaller unemployment duration dependence of the reservation wage path ($\frac{\partial \phi_t}{\partial d}$) and also a less negative duration dependence of the search intensity path ($\frac{\partial s_t}{\partial d}$).

This implies that given equation 22 the effect of unemployment duration on the value of searching for self-employment should be negative but less than in the case of searching for employment (compare equation 21)

$$\frac{\partial V^{e}_{ut}}{\partial d}|\theta < \frac{\partial V^{se}_{ut}}{\partial d}|\theta < 0 \tag{30}$$

In other words, this model implies negative duration dependence when searching for self-employment out of unemployment, however, it is less negative than the duration dependence when searching for employment. This leads to the implications as described in the main text in Chapter 5. Thus, $\frac{\partial V^{se}_{ut}}{\partial d}$ is larger than in the case of searching for employment, i.e. there is a higher UI duration elasticity - which is in line with our empirical results in Section 4.