Necessity and Opportunity Entrepreneurs through the Business Cycle

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We construct a simple model of occupational choice among agents with differing abilities. The fraction of agents creating new businesses who are low ability rises during recessions. Thus, cohorts born during recessions are on average lower quality: their businesses yield lower initial earnings, grow more slowly, and are more likely to fail. We show that, because of their effects on the ability distribution of business founders, short-lived recessions can have long-term consequences for the quality of a cohort of firms.

1. Introduction

Business cycles have ambiguous effects on the rate of new firm formation. On the one hand economic downturns discourage *opportunity entrepreneurship*, by reducing the profitability of good ideas. On the other hand, downturns induce increases in the rate of *necessity entrepreneurship*, where individuals create businesses primarily because of involuntary job loss and the scarcity of vacancies. [Blau(1987) Evans and Leighton (1990), Blanchflower and Meyer (1994)]. The net effect of these two countervailing forces is that rates of new business creation may rise or fall during recessions. Indeed, the recent recession has had opposite effects on the rate of new business creation in Canada and the United States: between October 2008 and October 2009, self-employment declined by over four percent in the United States (Shane 2010) while in Canada it increased by the same amount [LaRochelle-Côté (2010)]. Recent macroeconometric evidence [Thurik *et al.* (2008)] suggests that on average increases in unemployment stimulate self-employment among OECD countries, but country-specific effects seem to be strong.

Whether the net effect of recessions is to increase or decrease new business formation, increases in the fraction of new businesses that are founded by necessity entrepreneurs are likely to have marked effects on the quality of new businesses. Necessity entrepreneurs typically have less human and financial capital [Caliendo, and Kritikos (2009)], and they are less likely to have business ideas with significant growth prospects [Shane (2009)]. As a result, they also invest less in their business [Evans and Jovanovic (1989), Santarelli and Vivarelli, (2007)], and they are less likely to incorporate [Bruhn (2008)].

Reduced business quality, lower investment, and lower human capital together imply lower earnings and lower earnings growth rates for necessity entrepreneurs [e.g., Bates (1990), Preisendörfer and Voss (1990)]. These factors also imply lower survival rates for necessity entrepreneurs [e.g., Block and Wagner (2010), Caliendo and Kritikos (2009)], and there is some tentative evidence that these lower survival rates may be entirely explained by differences in human capital [Block and Sandner (2009)]. However, because of their lower human capital, necessity entrepreneurs also have lower opportunity costs after any recession is over. Thus,

despite evidence indicating lower average survival rates, some necessity entrepreneurs are likely to persist in business for quite some time while earning relatively little [Gimeno *at al.* (1997), Hamilton (2000)].

Figure 1 illustrates some of these forces at work in Ireland during the recent recession. After a long period of decline, from 2002 to 2008, the rate of nascent entrepreneurial activity recorded by the Global Entrepreneurship Monitor rose significantly between 2008 and 2010. At the same time, there was a dramatic increase in the fraction of entrepreneurs reporting that they were creating businesses out of necessity rather than because good opportunities had presented themselves. Between 2002 and 2008, necessity entrepreneurship had never accounted for more than fifteen percent of nascent entrepreneurs; in 2010 they accounted for over thirty percent. Note also the marked decline between 2008 and 2010 in the discontinuation rate – the rate at which nascent entrepreneurs give up business activities and (in most cases) return to wage employment.
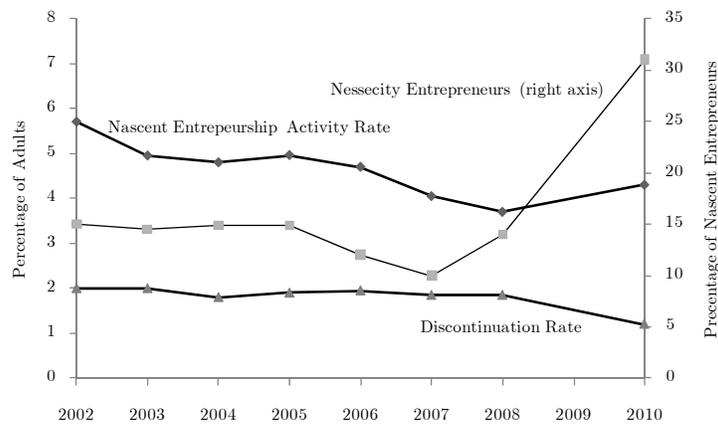
Figure 1. *Entrepreneurial activity in Ireland, 2002-2010.* Source; Kelley *et al.* (2011, p. 51)

This paper constructs and numerically evaluates a model that builds on two premises. First, that necessity entrepreneurs account for a larger fraction of businesses among cohorts of firms created during recessions. Second, necessity entre-

preneurs operate firms with relatively poor performance, but many of them continue in operation for extended periods of time. We conjecture that these two premises together imply that transitory economic downturns induce long-lasting effects through the quality of the business they spawn.

To examine this conjecture, we construct a simple dynamic model of occupational choice in the presence of involuntary job loss and uncertain job finding, in which agents vary in their innate ability. The model yields three distinct sets of agents: a group of high-ability opportunity entrepreneurs who create businesses regardless of the state of the economy; a group of moderate-ability agents who only create businesses as necessity entrepreneurs after involuntary job loss; and a group of low-ability agents who never create businesses. Business earnings are stochastically increasing in ability, so necessity entrepreneurs on average earn less than opportunity entrepreneurs. However, the profit level that triggers exit is endogenously increasing in ability, so necessity entrepreneurs will continue to operate businesses that opportunity entrepreneurs would abandon.

We then calibrate the model using estimates from the literature on relative performance and survival, and examine the evolution of the distribution of profits among cohorts of firms that were created during recessions and during normal times. Our model suggests that a short-lived recession can induce an economically meaningful decline in the earnings of a cohort, and this decline persists for many years after the economy has returned to full-employment. For example, median earnings of new businesses are, immediately upon entry, about one percent lower for a cohort entering in a recession year than for a baseline cohort. This difference grows over time, despite the more rapid exit rate of low-ability entrepreneurs. After four years, median earnings differ by about 2.2 percent, and after ten years by about 2.4 percent.

2. Ability and Entry into Self-Employment

Ability is indexed by α. Employees earn a wage, $w(\alpha)$, which is increasing in ability. At the end of the period they retain their job with probability $\mu(\alpha)$, where $\mu'(\alpha) \geq 0$, and with probability $1 - \mu(\alpha)$ they are laid off. Agents may eschew wage work in favor of establishing a business. Doing so costs nothing, but

it takes one period to establish the business, which does not begin to yield a flow of income until the next period. An unemployed agent has two choices. First, he may actively search for a job, which yields employment in the subsequent period with probability $\lambda(\alpha)$, where $\lambda'(\alpha) \geq 0$. Unemployment benefits, $b(\alpha)$, $b'(\alpha) \geq 0$, are payable only to agents who were involuntarily laid off and are actively looking for work, and they are payable only for the first period of unemployment. Second, the agent may establish a business. It is not possible to establish a business and look for wage work, so no unemployment benefits are payable in this case.

2.1 *Occupational Choices*

Let $V_E(\alpha)$ and $V_S(\alpha)$ denote the values of being employed and having established a business. We will define the expected payoff to self-employment later, and for the moment we will simply note that it is strictly increasing in α. Let $V_U^1(\alpha)$ denote the value of being unemployed in the first period after being laid off, and let $V_U^2(\alpha)$ denote the value in the second and subsequent periods of unemployment.

The Bellman equation for a wage worker is

$$V_E(\alpha) = \max \left\{ w(\alpha) + \beta \mu(\alpha) V_E(\alpha) + \beta(1 - \mu(\alpha)) V_U^1(\alpha), \, \beta V_S(\alpha) \right\}. \tag{1}$$

The first-period of involuntary unemployment yields value

$$V_U^1(\alpha) = \max \left\{ b(\alpha) + \beta \lambda(\alpha) V_E(\alpha) + \beta(1 - \lambda(\alpha)) V_U^2(\alpha), \, \beta V_S(\alpha) \right\}, \tag{2}$$

while the second and subsequent periods yield

$$V_U^2(\alpha) = \max \left\{ \beta \lambda(\alpha) V_E(\alpha) + \beta(1 - \lambda(\alpha)) V_U^2(\alpha), \, \beta V_S(\alpha) \right\}. \tag{3}$$

We make the following assumptions:

    A.1 $w(\alpha) > \beta(\alpha) \, \forall \alpha,$

    A.2 $\mu(\alpha) \geq \lambda(\alpha) \, \forall \alpha,$

    A.3 Let A_E denote the set of employed agents that do not immediately

enter self-employment. Then $V_S'(\alpha) > V_E'(\alpha) \; \forall \alpha \in A_E$.

Assumption A.1 says that wages exceed unemployment benefits for all abilities. A.2 states that keeping a job is more likely than finding a job for all abilities. These two assumptions are not contentious: in the United States, national average unemployment benefits are 36 percent of previous earnings [Fletcher and Hedgpeth (2010)], while job retention rates are much greater than job finding rates in all OECD countries [Hobijn and Sahin (2007, Table 4)].

The third assumption states that expected self-employment earnings are more sensitive to ability than are wages. As is well known [*cf.* Jovanovic (1994)], if no restrictions are imposed on the returns to ability in self-employment relative to wage work, essentially arbitrary relationships between ability and occupational choice are possible. Assumption A.3 is consistent with Rosen's (1981) theory of superstars, in which the most able must enter self-employment in order to capture the full returns to their ability. It is also consistent with empirical evidence. For example, in samples that are reasonably representative of the population as a whole [e.g., Hamilton's (2000) analysis of the SIPP sample] the self-employed earn less than their observationally-equivalent counterparts in wage work, while in samples that focus on higher ability workers [e.g., Gort and Lee (2007) and Ohyama (2007), both using the SESTAT sample] self-employment earnings exceeds wages among the most able and are lower than wages among the less able in the sample.

Assumptions A.1 through A.3 are sufficient to establish the following result:

LEMMA 1. (a), $V_E(\alpha), V_U^1(\alpha),$ *and* $V_U^2(\alpha)$ *are increasing in* α. (b) $V_E(\alpha) \geq V_U^1(\alpha)$ $\geq V_U^2(\alpha),$ *with strict inequalities for* α *sufficiently small.*

We establish these results by graphical means. Figure 2 illustrates the choices that are made by agents as their ability varies. By assumption A.3, the present value of establishing a business intersects the value of continuing in wage employment once from below, indicated by α_3. Self-employment is preferred to wage employment only for agents with ability greater than α_3. Below this threshold, $V_E(\alpha) > V_U^1(\alpha)$, so the agent in his first period of unemployment who is indifferent between job search and business creation has ability level $\alpha_2 < \alpha_3$. Similar-
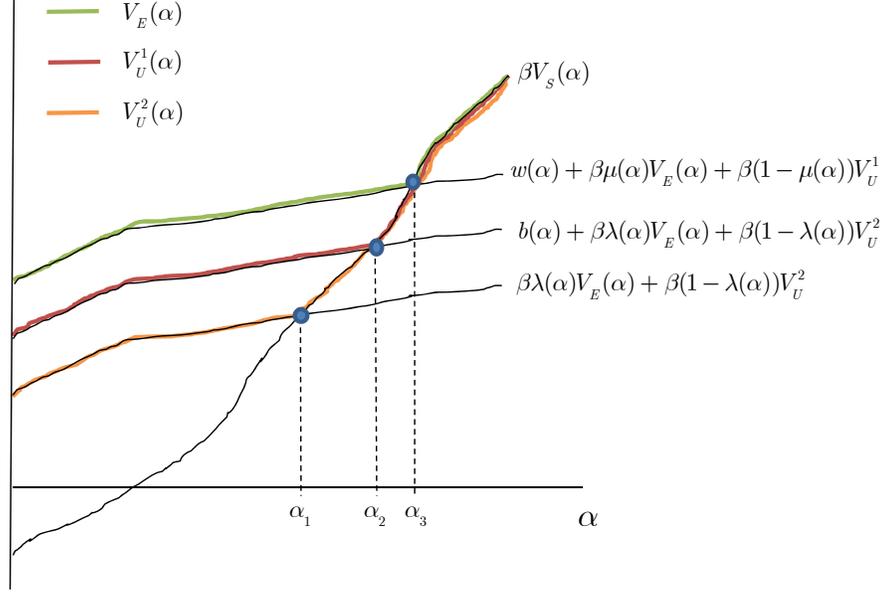
Figure 2. *Occupational choices by ability.*

ly, $V_U^1(\alpha) > V_U^2(\alpha)$ for all $\alpha < \alpha_2$, yielding a third critical value, $\alpha_1 < \alpha_2$; agents in their second period of unemployment with ability level greater than α_1 abandon job search and establish a business. We summarize these observations in the following proposition:

PROPOSITION 1. *There exist $\alpha_1 < \alpha_2 < \alpha_3$ such that (a) if $\alpha > \alpha_3$, the agent always chooses self-employment; (b) if $\alpha < \alpha_1$, the agent never chooses self-employment; (c) if $\alpha_2 < \alpha < \alpha_3$, the agent chooses self-employment in the first period of unemployment, and (d) if $\alpha_1 < \alpha < \alpha_2$, the agent chooses self-employment in the second period of unemployment.*

For ease of reference, we shall refer to agents that form a business regardless of their employment status as opportunity entrepreneurs. Agents that create a business immediately after involuntary job loss will be referred to as necessity I entrepreneurs, while those that enter only after losing unemployment benefits will be referred to as necessity II entrepreneurs.

2.2 *Self-Employment Earnings and Exit*

Self-employment earnings are not known in advance of establishing the business. Agents contemplating business entry know only that per-period profits are given by

$$\pi_t(q) = \gamma q + \varepsilon_t, \tag{4}$$

where q is fixed business quality and ε is an idiosyncratic shock to earnings. The value of the shock in the first period after business creation is normalized to zero. Quality is a random draw from the conditional distribution $F(q \mid \alpha)$, which is strictly decreasing in α. That is, business quality is stochastically increasing in agent ability. The idiosyncratic shocks exhibit persistence: they are draws from $G(\varepsilon' \mid \varepsilon)$, which is strictly decreasing in ε.

Job search is not possible while creating or managing a business, and unemployment benefits are not payable to agents who close down their business.[1] We shall also assume that an agent who closes down his business cannot create another business without first receiving an offer of wage employment. Thus, we can write the opportunity cost of continuation as

$$V_U^3(\alpha) = \beta\lambda(\alpha)V_E(\alpha) + \beta(1 - \lambda(\alpha))V_U^3(\alpha)$$

$$= \frac{\beta\lambda(\alpha)}{1 - \beta(1 - \lambda(\alpha))}V_E(\alpha) \equiv V_U^2(\alpha). \tag{5}$$

As in Hopenhayn (1992), there exists a profit threshold, $\pi^*(\alpha)$, such that agents close their business the first period that profits fall below the threshold. The opportunity cost of business ownership is increasing in α, so the exit threshold is higher for more able agents. The Bellman equation for a business owner with ability α and currently earning profits π is given by

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[1] Former business owners do not generally qualify for unemployment benefits unless they paid unemployment insurance. For sole proprietorships, partnerships, and owners of limited liability companies, payment into unemployment insurance requires electing to have one's business treated as a corporation for tax purposes. Few small business owners choose to do so in practice.

$$V_S(\alpha, \pi) = \max\left\{\pi + \beta \int V_s(\alpha, \pi')dH(\pi' \mid \pi), V_U^3(\alpha)\right\} \tag{6}$$

where H is strictly decreasing in π. The effect of agent ability on the expected duration of a business is in general ambiguous. On the one hand, higher-ability agents will be more likely to abandon a business of any given quality because their opportunity cost of continuation is greater. On the other hand, higher-ability agents are more likely to establish a high-quality business, which induces longer survival times. Which of these effects dominate depends on the sensitivity to ability of expected business quality, and the effect of business quality on the likelihood that profits fall below the appropriate threshold for an agent. It is easy to conjure up examples in which expected business survival is increasing in ability, decreasing in ability, or in which the relationship is non-monotonic.

As $\pi = \gamma q$ in the first period of entry, the expected value of creating a business is given by

$$\beta V_S(\alpha) = F\left(\pi^*(\alpha) \mid \alpha\right)\frac{\beta^2\lambda(\alpha)}{1 - \beta(1 - \lambda(\alpha))}V_E(\alpha) + \beta\gamma \int\limits_{q \geq \pi^*(\alpha)} q\,dF(q \mid \alpha)$$

$$+ \beta^2 \int\limits_{q \geq \pi^*(\alpha)} \int V_s(\alpha, \pi')dH(\pi' \mid q)\,dF(q \mid \alpha). \tag{7}$$

Equations (1)-(3) and (7) define the optimal choices in the model, which are as described in Proposition 1 as long as assumption A.3 holds. From (7), it is easy to verify that $V_S(\alpha)$ is strictly increasing in γ, so that a sufficient condition for Assumption A.3 to hold is that γ be sufficiently large.

3. Dynamics of the Firm Size Distribution

In this section, we analyze a simple model of firm growth and survival. The model, which is presented in subsection 3.1, is a standard neoclassical growth model [*cf*. Hopenhayn (1992)], in which initial earnings depend on business quality, earnings growth is exogenous and stochastic, and the exit threshold depends on agent ability. Subsection 3.2 reviews empirical evidence on the growth and survival of young businesses, and uses this evidence to calibrate parameters of the

model. The calibrated model is then used in subsection 3.3 to measure the persistence of low-quality cohorts born during recessions.

3.1 *Firm growth and survival*

Suppose that

$$\varepsilon_t = \theta(q)t + \varepsilon_{t-1} + \sigma v_t, \tag{8}$$

Where $\theta'(q) \geq 0$ gives potentially better growth prospects to higher-quality businesses, and v_t is a standard normal random variable. To explore the survival time of a firm with quality q founded by an agent with ability α, we need the distribution of the Markov time, T, that satisfies

$$T = \inf\left\{t : \pi_t(q) \leq \pi^*(\alpha)\right\}, \tag{9}$$

where $\pi_t(q) - \theta(q)t = q + \varepsilon_t$ is a random variable with normally-distributed increments in each period. This is a first-passage problem which, following convention, we will analyze in continuous time. Define

$$\omega_t = \frac{q + \theta(q)t - \pi_t}{\sigma}, \tag{10}$$

which is normal with zero mean and variance t, while the increments to ω_t are independent standard Normals. The continuous time stochastic process that gives rise to the same distribution as ω_t at t=0,1,2, . . . , is a standard zero-drift Wiener process, $\omega(t)$, with boundary condition $\omega(0)$=0. The absorbing barrier for π_t is $\pi^*(\alpha)$ Hence, the corresponding barrier for $\omega(t)$ is obtained by replacing π_t in (10) with $\pi^*(\alpha)$. The transformed first passage problem is therefore given by the distribution of the Markov time, T, that satisfies

$$T = \inf\left\{\tau : \omega(\tau) \geq \frac{\theta(q)t}{\sigma} + \frac{q - \pi^*(\alpha)}{\sigma}\right\}. \tag{11}$$

Equation (11) defines the first-passage time of a Wiener process to a linear barrier that is moving away from the origin if $\theta(q) > 0$, and toward the origin if $\theta(q) < 0$ (Figure 3 plots the former case). Exit is immediate if $q \leq \pi^*(\alpha)$. For $q > \pi^*(\alpha)$, the distribution of T is given by the well-known Bachelier-Lévy for-

mula [e.g., Cox and Miller (1965:221)]

$$P(T \mid \alpha, q) = \Phi\left(-\frac{q - \pi^* + \theta t}{\sqrt{\sigma^2 T}}\right) + e^{-2\theta(q - \pi^*)/\sigma^2}\Phi\left(-\frac{q - \pi^* - \theta t}{\sqrt{\sigma^2 T}}\right), \qquad (12)$$

where $\Phi(\bullet)$ is the distribution function of a standard normal random variable, and where for clarity the dependence of θ on q and of π^* on α have been suppressed.

Taking the limit of (12) yields

$$P^\infty(\alpha, q) = \lim_{T \to \infty} P(T \mid \alpha, q) = \begin{cases} 1, & \text{if } \theta(q) \leq 0 \\ e^{-2\theta(q - \pi^*)/\sigma^2} < 1, & \text{if } \theta(q) > 0 \end{cases}. \qquad (13)$$

If there is no positive drift to profits, all firms eventually die. In contrast, with positive drift, some firm will survive indefinitely. The unconditional distribution of firm exit times is then obtained by taking expectations over q and over the ability distribution of firm owners.
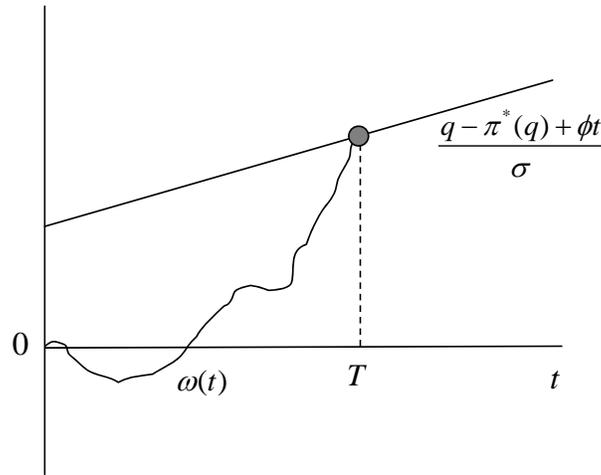
Figure 3. *The first passage problem.*

The evolution of the distribution of the size of surviving firms is straightforward to characterize. Let $\omega(t)$ denote the value at time t of the Wiener process (10). For any $\omega < \left(\theta t + q - \pi^*\right)/\sigma$, the probability that $\omega(t) = \omega$ without having previously crossed the boundary is given by the complement to the crossing probability of a Brownian bridge that begins at $\omega(0) = 0$, terminates at $\omega(t) = \omega$, and has an absorbing boundary $\left(\theta t + q - \pi^*\right)/\sigma$. This is a well-known distribution [e.g., Scheike (1992), Proposition 3], given by

$$\psi_t(\omega; \alpha, q) \equiv \Pr\left\{\omega(\tau) < \frac{\theta t + q - \pi^*}{\sigma} \, \forall \tau \in [0,t] \mid \omega(t) = \omega\right\}$$

$$= \begin{cases} 1 - \exp\left\{-\frac{2}{t}\left(\frac{q - \pi^*}{\sigma}\right)\left(\frac{\theta t + q - \pi^*}{\sigma} - \omega\right)\right\}, & \omega < \dfrac{\theta t + q - \pi^*}{\sigma} \\[2mm] 0, & \omega \geq \dfrac{\theta t + q - \pi^*}{\sigma} \end{cases}. \quad (14)$$

As the unconditional distribution of $\omega(t)$ is normal with mean zero and variance t, the density of ω at time t among surviving firms is obtained upon weighting each point in the density of a truncated standard normal random variable by the relative probability that the process attains that particular value of ω at time t without having previously crossed the absorbing barrier. That is,

$$g_t(\omega \mid \alpha, q) = \frac{\psi_t(\omega; \alpha, q)\phi_t(\omega)}{\displaystyle\int_{-\infty}^{(q - \pi^*(\alpha))/\sigma} \psi_t(\omega; \alpha, q)\phi_t(\omega)d\omega}, \quad (15)$$

where $\phi_t(\omega)$ is the normal density with mean zero and variance t. Then, by the method of transformations, the density of profits among surviving firms is

$$g_t(\pi \mid \alpha, q) = \frac{\psi_t\left((\phi t + q - \pi)/\sigma; \alpha, q\right)\phi_t((\theta t + q - \pi)/\sigma)}{\sigma\displaystyle\int_{-\infty}^{(q - \pi^*)/\sigma} \psi_t\left(\omega; \alpha, q\right)\phi_t(\omega)d\omega} \quad (16)$$

Taking expectations of (16) over q and α yields the predicted observable distribution of size among all surviving firms. Before doing so, however, it is useful to delineate some basic properties of the conditional distribution (16).
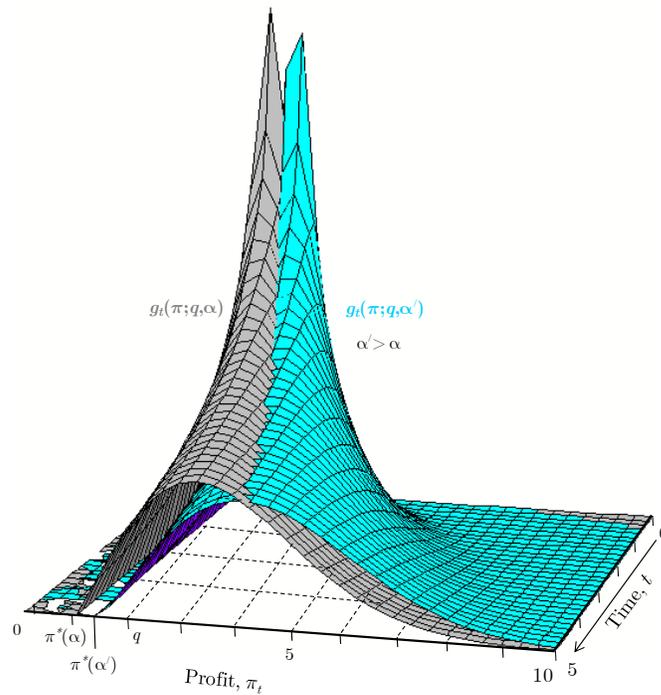
PROPERTIES OF THE CONDITIONAL SIZE DISTRIBUTION. (a) *For any $t > 0$, $g_t[\pi \mid q, \alpha)]$ is positively skewed, with both mean and skewness rising over time.* (b) *For any $\alpha' > \alpha$, $E[\pi_t \mid q, \alpha')] - E[\pi_t \mid q, \alpha)]$ is increasing over time.*

These properties are each the direct result of the slower growth and selective exit of underperforming firms. Figure 4 illustrates for the case $\theta = 0.25$. At $t = 0$, all firms begin with profits of q. Subsequently, expected profits rise, as does their variance. Selection eliminates firms from the lower tail of the distribution, raising its mean and inducing skewness. Because the exit threshold, $\pi^*(\alpha)$, is increasing in α, these selection effects are stronger among more able operators of firms with given business quality q. As a result the profit distributions for the α-type and α'-type entrepreneurs diverge over time.
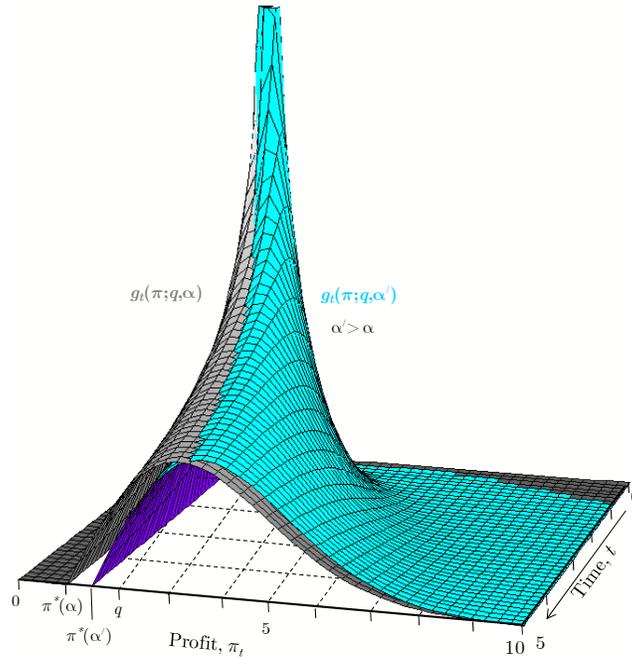
Figure 4. *Conditional size distribution of surviving firms with constant business quality. $q = 2$, $\pi^*(\alpha) = 1$, $\pi^*(\alpha') = 1.5$, $\sigma = 1$, $\theta = 0.25$.*

Figure 4 holds business quality constant, and the evolving differences in the two distributions they each depict are driven entirely by the stronger selection effects on high-ability owners. Put another way, low-ability owners of businesses with a given business quality survive longer on average than high-ability owners of similar businesses. Empirical evidence, however, shows that survival is increasing in ability. In our calibrated model, we achieve consistency with empirical evidence because business quality is increasing in ability, sufficiently so as to offset the

Figure 5. *Conditional size distribution of surviving firms with varying business qualities.* $q(\alpha) = 2$, $q(\alpha') = 2.5$, $\pi^*(\alpha) = 1$, $\pi^*(\alpha') = 1.5$, $\sigma = 1$, $\theta(\alpha) = 0$, $\theta(\alpha') = 0.25$.

stronger selection effects coming from the higher exit threshold.[2] Figure 5 provides an illustration of the way the profit distributions can evolve when business quality is (deterministically) greater for the more able entrepreneur. Profits in this case begin at different initial values, and then the difference in mean growth rates induce more rapid diverge than in the previous case.

The observable distribution of profits is, of course, an average of the separate distributions, weighted by the fraction of each business type, defined by the pair $\{q,\ \alpha\}$, surviving at each point in time. In the case of this second example, the weight on the distribution for high-quality businesses monotonically increases over time (see Figure 6). Eventually all low-quality businesses fail, so the distribution of profits among surviving firms converges on the distribution for high-quality businesses. However, because *some* low-ability entrepreneurs do very well, the rate of convergence may be very slow.

3.2 *Parameterization*

The effects of a surge in opportunity entrepreneurship on the subsequent size distribution of young firms depends on a number of features of the model: (i) differences between the initial earnings of necessity and opportunity entrepreneurs[3], (ii) differences between the average growth rates of earnings of necessity and opportunity entrepreneurs, (iii) the variance of profit growth, and (iv) the relationship between entrepreneurial type and the exit threshold. To determine the effect of recessions, we will also need information on the effect of unemployment on entry into self-employment. We review the existing literature to derive some plausible parameterizations for these components of the model.

Business Duration. Our baseline for differences in survival between opportunity

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[2] A plausible alternative modeling choice would be to assume that the drift term is increasing in ability rather than business quality. In this case, if $\theta'(\alpha)$ is large enough, high-ability owners of a given business quality will survive longer than low-ability owners.

[3] Recall that there are two degrees of necessity entrepreneurs: those that begin to create a business immediately upon becoming unemployed (necessity I), and those that do so only after losing unemployment benefits (necessity II).
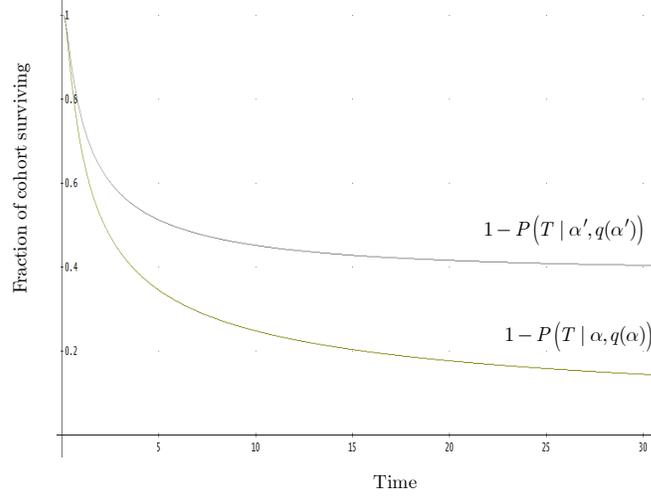
Figure 6. *Survival rates.* $q(\alpha) = 2, \ q(\alpha') = 2.5, \ \pi^*(\alpha) = 1,$
$\pi^*(\alpha') = 1.5, \ \sigma = 1, \ \theta(\alpha) = 0, \ \theta(\alpha') = 0.25 \ .$

and necessity entrepreneurs comes from a recent study by Caliendo and Kritikos (2009). They study a sample of over 1,850 German males, all of whom entered self-employment from unemployment in the third quarter of 2003 and received official assistance during their start-up phase. Two surveys were conducted. The first, conducted at the time of startup, obtained information about personal characteristics as well as motivations for business creation. This survey enabled Caliendo and Kritikos to distinguish between respondents who only identified positive factors that pulled them into business, those who identified a mixture of pull and push factors, and those who only identified push factors. The last two groups were much more likely than the first to have been unemployed for more than six months, to have earned less in unemployment benefits, to be less educated and less skilled, and to be an immigrant.

The second survey, conducted about 28 months later, identifies exit times of failed businesses. Figure 7 shows the Kaplan-Meier plots of business survival estimated by Caliendo and Kritikos. After one year, the survival rates were 92 percent for pull entrepreneurs, 79 percent for push entrepreneurs, and 84 percent for the intermediate group. After around 28 months, the corresponding survival rates
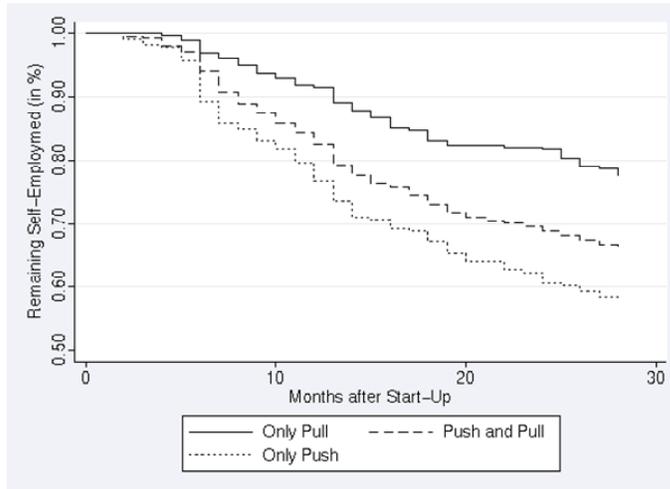
Figure 7. *Business survival rates of 1,855 German men entering self-employment, according to self-reported motivational factors.* From Caliendo and Kritikos (2009).

were 77, 58, and 66 percent, respectively. At each point in time, the survival rate of push entrepreneurs was about 80 percent of the survival rate of pull entrepreneurs; the rate for the push-pull types was about 90 percent of the rate of pull types.

Although all of the respondents in Caliendo and Kritikos' sample were previously unemployed, we shall apply their estimated relative survival rates to our opportunity, necessity I and necessity II groups. These numbers are not out of line with other studies. Block and Sandner (2009), using a sample from the German Socio-Economic Panel Study (GSEPS) with annual frequency, distinguish between opportunity and necessity entrepreneurs according to whether they had voluntary or involuntary separations from wage work prior to business creation, They find that the hazard of business failure among opportunity entrepreneurs is about 75 percent of the hazard among necessity entrepreneurs.[4] Carrasco (1999)

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[4] We exponentiate the appropriate coefficient in column 1 of their Table 3. They subsequently conclude that much of this difference between the two groups is attri-

estimated quarterly exit hazards using data from a large Spanish panel. She finds an unusually high rate of immediate exit (40 percent within three months) for those who had entered from unemployment, but after nine months the likelihood of surviving an additional quarter was 89 percent for opportunity entrepreneurs and 75 percent for necessity entrepreneurs. Finally, using annual Portuguese data, Baptista and Karaöz (2006) report failure odds ratios between previously employed and previous unemployed entrepreneurs ranging from 60 percent to 90 percent.

Self-Employment Earnings. A number of studies provide estimates of the effect on earnings of previous unemployment immediately prior to self-employment entry. Among the best known is the evidence from the NLSY offered by Evans and Leighton (1989). They report that each week of unemployment during the year prior to a respondent's first report of self-employment earnings is associated with a 0.8 percent decline in average earnings. Suppose that necessity I entrepreneurs enter self-employment after 13 weeks of unemployment (unemployment benefits typically expire after 26 weeks), and suppose necessity II entrepreneurs enter after 26 weeks. Then Evans and Leighton's estimate implies that $\pi(q \mid \alpha)$ is on average 10.4 percent lower for necessity I entrepreneurs, and 20.8 percent lower among necessity II entrepreneurs, than it is for opportunity entrepreneurs.

These numbers are in line with estimates from some recent studies. Using a larger sample from the Korean Labor and Income Panel Study (KLIPS), Åstebro, Chen and Thompson (2011, Table 9) find that transitioning into self-employment from unemployment reduces earnings in the first year by between 14.7 percent and 17.5 percent, depending on specification, compared with those who transition from paid work.[5] Similarly, Block and Wagner find in the GSEPS that surviving necessity entrepreneurs earn on average 15.7 percent less than opportunity entrepreneurs.

Block and Wagner also provide separate estimates of the average growth rates of

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butable to differences in education levels and industry choice.

[5] Entering self-employment after being economically inactive the previous year has an even larger effect on earnings, ranging from 28.4 percent to 32.5 percent.

earnings. They report that earnings of necessity entrepreneurs decline on average at an annual rate of 2.7 percent, while those of opportunity entrepreneurs increase on average by 0.9 percent per year.

Calibration. We now have enough information to carry out some calibrations. Table 1 summarizes the target moments. The survival rates are taken from Figure 7, and relative average initial profits are taken from Evans and Leighton's estimates. The average trend growth rates of earnings are based on Block and Wagner, allowing for somewhat better trend growth among necessity I entrepreneurs than among necessity II entrepreneurs. Turning to the parameters to be calibrated, we shall for simplicity assume that initial profits is the same for all entrepreneurs of a given type; the growth rate of profits also has a common variance across each type. Finally, we assume the exit threshold within each entrepreneur group is constant.

Table 1. *Target Moments and Parameters*

	Opportunity	Necessity I	Necessity II
Survival rates:			
$t = 1$	0.91	0.85	0.79
$t = 2$	0.84	0.70	0.64
$t = 2.5$	0.74	0.65	0.57
Initial profits, q	π_0	$0.9\pi_0$	$0.8\pi_0$
Average profit growth, θ/q	$+1.0\%$	-2.0%	-3.0%
Variance of profit growth	σ^2	σ^2	σ^2
Exit threshold	π_1^*	π_2^*	π_3^*

We have five free parameters, $\sigma^2, \pi_0, \pi_1^*, \pi_2^*,$ and π_3^*, to match to nine mean survival rates (we will impose the conditions on initial profits and average profit growth). In matching survival rates, however, only the differences $\pi_0 - \pi_i^*$ matter, so we arbitrarily set $\pi_0 = 100$. The resulting calibrated values, along with their implied survival rates, are summarized in Table 2. We are able to match the empirical survival rates very well. Moreover, the implied exit thresholds satisfy $\pi_1^* > \pi_2^* > \pi_3^*$, as predicted by the model.

Table 2. *Calibrated Parameters and Implied Survival Rates*

	Opportunity	Necessity I	Necessity II
q	100	90	80
θ	$+1.0$	-1.8	-2.4
σ	24.7	24.7	24.7
π_i^*	56.0	51.7	45.9
Implied survival rates:			
$\quad t = 1$	0.93	0.87	0.81
$\quad t = 2$	0.81	0.70	0.63
$\quad t = 2.5$	0.76	0.64	0.57

Recessions and Necessity Entrepreneurship. The final preparatory task is to devise a reasonable scenario for the effects of a recession-induced change in the mix of entrepreneurs in a cohort. We begin with estimates from Evans and Leighton's (1989) analysis of the Current Population Survey, that found a 4.7 percent rate of entry into self-employment among unemployed white males, and a rate of 2.4 percent among white male wage workers. We compare the effects of two scenarios. In the first, baseline, scenario, we assume that five percent of wage workers lose their jobs involuntarily in any given year, with ten percent of these newly unemployed agents remaining without wage work into the second year. In the second, recession, scenario, we assume a ten percent rate of involuntary job loss, with 25 percent of the unemployed failing to find wage work within the first year.

Figures 8 and 9 calculate the implied rates of entry by type of entrepreneur over a two-year period. In the baseline scenario, the total entry rate over a two-year period is 4.9 percent, of which 89.8 percent are opportunity entrepreneurs. Of the reminder, 9.8 percent are necessity I entrepreneurs and a negiligble 0.4 percent are necessity entrepreneurs. The recession scenario induces only a modest rise, to 5.19 percent, in the total entrepreneurship entry rate. However, there is a marked rise in the fraction that are necessity I and II entrepreneurs, who now account for 15.4 percent and 2.3 percent of total entrants respectively.
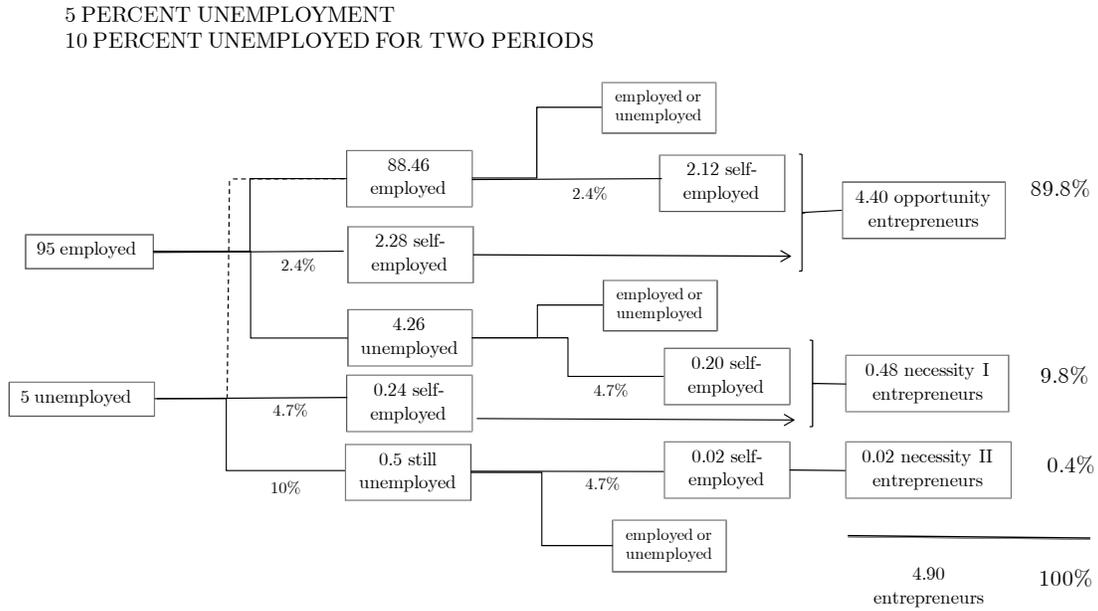
5 PERCENT UNEMPLOYMENT
10 PERCENT UNEMPLOYED FOR TWO PERIODS

Figure 8. *Baseline scenario.*

10 PERCENT UNEMPLOYMENT
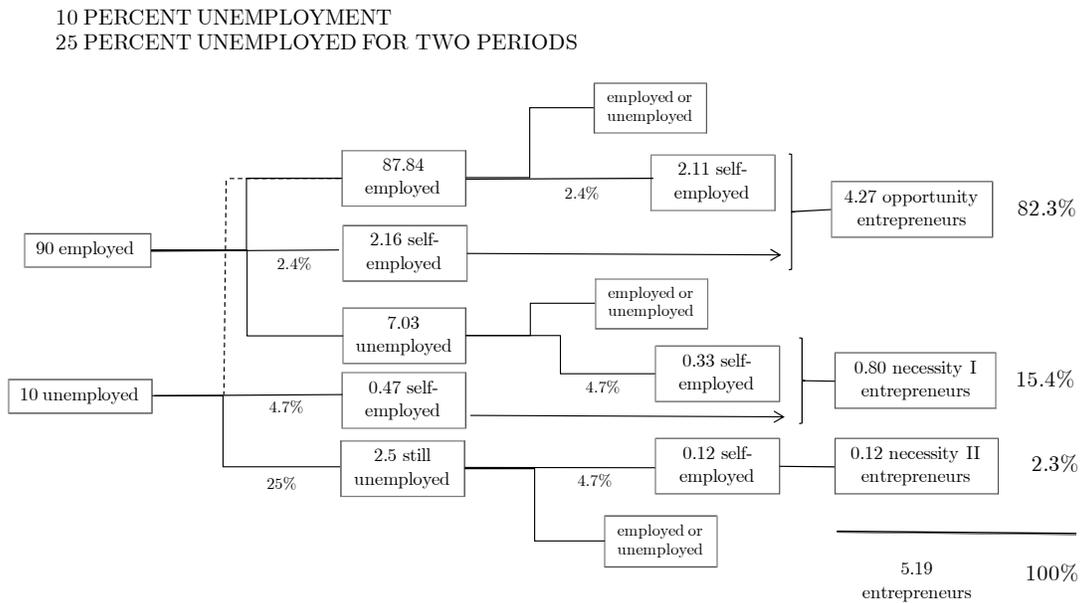25 PERCENT UNEMPLOYED FOR TWO PERIODS

**Figure 9.** *Recession scenario.*

These scenarios seem reasonable. Glocker and Steiner (2007) estimate that the transition rate into self-employment for German men [women] rises by 0.1 percent points [0.06 percentage points] for each one-percent increase in the one-year lagged unemployment rate. Thurik *et al.* (2008) estimate a VAR for 23 OECD countries, and find that a permanent one percent increase in the unemployment rate raises the self-employment rate by between 0.06 percent and 0.24 percent, depending upon lag length. Our scenarios yield an increase in the transition rate of 0.058 percentage points for each percentage point increase in the unemployment rate.

3.3 *The Persistence of Low-Quality Cohorts*

We study the evolution of the earnings distributions of two cohorts. Each cohort combines opportunity, necessity I and necessity II entrepreneurs in the proportions indicated in the previous subsection. The baseline cohort consists of 89.8 percent opportunity, 9.8 percent necessity I and 0.4 percent necessity II entrepreneurs. In the recession cohort, the corresponding proportions are 82.3 percent, 15.4 percent, and 2.3 percent. The two cohorts differ only by the proportion of each entrepreneur type they initially contain: within each type, the process of firm growth and exit is the same for both cohorts.

Figures 10 through 12 summarize our results. Figure 10 plots the earnings distributions of surviving firms for the two cohorts at three different points in time. The baseline cohort, as expected, first-order stochastically dominates the recession cohort, but differences are apparently modest at every earnings level. In both cohorts, the mean and variance are increasing with the passage of time: the positive trend growth of opportunity entrepreneurs and the exit of underperforming firms together outweigh the negative trend growth of necessity entrepreneurs.

Figure 11 plots earnings over time at different percentiles of the distributions. For percentiles above the median, earnings rise monotonically over time. In contrast, earnings at low percentiles decline before establishing a positive trend. At these lower percentiles, negative shocks to the stochastic component of growth are at first sufficient to dominate the average positive trend growth of the cohort.
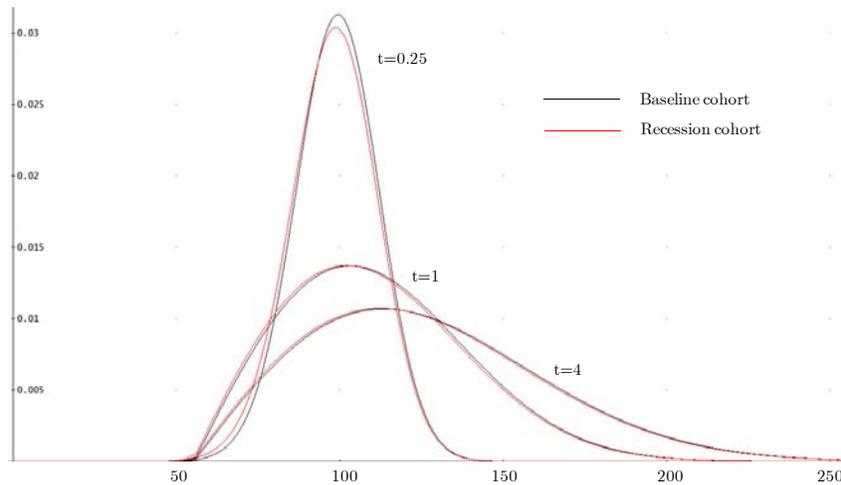
Figure 10. *Earnings distributions by cohort type and age.*

Eventually, however, exit of the worst performers enables the trend growth to dominate even at the lower percentiles.

Finally, Figure 12 plots the proportional difference between earnings of the two cohorts at different percentiles and over time. At $t = 0$, all firms of a given type earn the same; the difference between the two cohorts is a modest 0.95 percent. Two features of Figure 12 are particularly noteworthy. First, the largest proportional differences emerge in the tails of the distribution. Second, at every percentile, the proportional difference grows over time. For example, the gap between median earnings of the two cohorts rises to 2.22 percent by $t = 4$, and to 2.37 percent by $t = 10$. Given our calibration, the appropriate interpretation of a unit of t is a year. Consequently, our calibrated model yields results consistent with our conjecture that excess entry of necessity entrepreneurs during recessions can have highly persistent effects on the earnings distribution of young firms.

4. Conclusions

This paper developed a simple model of occupational choice in the presence of involuntary unemployment. Our model predicts that high-ability agents choose business creation regardless of their employment status, while low-ability agents
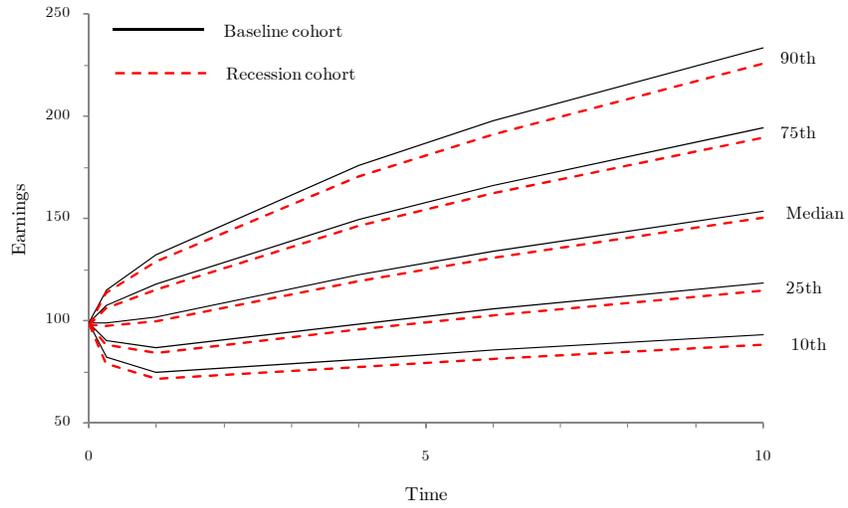
Figure 11. *Evolution of earnings by percentile and year after entry.*
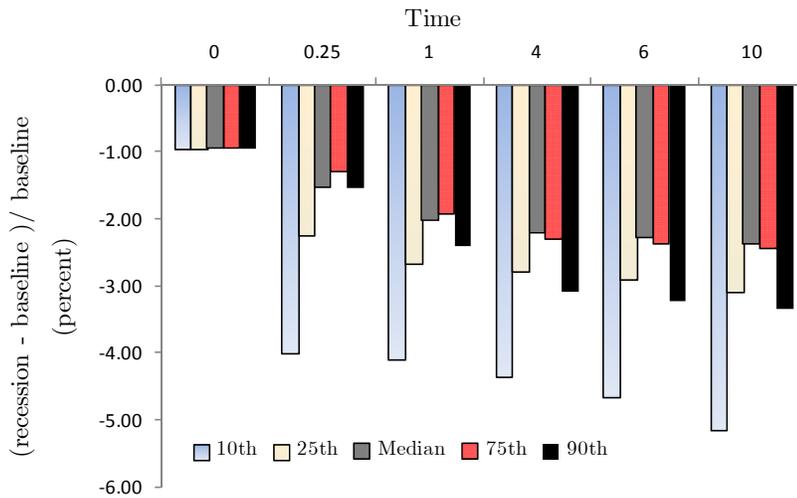
Figure 12. *Baseline and recession cohort earnings differentials, by percentile and year after entry.*

choose to create a business only after involuntary job separation. Reflecting recent literature on the motivations for business creation, we refer to the former group as opportunity entrepreneurs and to the latter group as necessity entrepreneurs.

We exploited existing empirical evidence distinguishing the post-entry performance of necessity and opportunity entrepreneurs to calibrate a standard model of firm growth and survival. Necessity entrepreneurs are more common during recessions. They also have lower initial earnings, lower growth, and higher exit rates. We showed that, despite their higher exit rates, enough necessity entrepreneurs survive over long periods of time to create highly persistent effects of even short-lived recessions.

Our modeling, both of occupational choices and firm performance, is rather stylized. For example, we have assumed that occupational choice depends on the state of the economy only thoughts its effect on an agent's employment status. We do not consider the likelihood that both business earnings and the opportunity cost of remaining in business are lower during recessions.[6] As a second example, we have modeled firm performance as then outcome of arithmetic Brownian motion with drift. It is likely that alternative assumptions, such as the inclusion of mean reversion or treating growth as the process of learning about ability in the presence of a stationary process for the stochastic component [*cf.* Jovanovic (1982)], may produce quantitatively different results. Nonetheless, the paper raises a plausible mechanism, that seems to have been overlooked, by which transitory economics fluctuations can have long-term consequences on firm performance.

References

Åstebro, Thomas, Jing Chen, and Peter Thompson (2011): "Stars and misfits: Self-employment and labor market frictions." Working paper, Florida International University.

Bates, Timothy (1990): "Entrepreneur human capital inputs and small business lon-

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[6] Of course, these two omissions have countervailing effects on business survival over the business cycle.

gevity." *Review of Economics and Statistics*, **72**(44):551-559.

Baptista, Rui, and Murat Karaöz (2006): "Entrepreneurial human capital and the early survival chances of new start-ups: opportunity-based vs. necessity-based entrepreneurship." Working paper, Instituto Superior Técnico,, Lisbon.

Blanchflower, Danny and Bruce Meyer (1994): "A longitudinal analysis of young entrepreneurs in Australia and the United States." *Small Business Economics*, **6**(1):1-20.

Blau, David M. (1987): "A time series analysis of self employment in the United States." *Journal of Political Economy,* **95**(3):445-467.

Block, Jörn H., and Philipp Sandner (2009): "Necessity and opportunity entrepreneurs and their duration in self-employment: evidence from German micro data." *Journal of Industry, Competition and Trade*, **9**(1):117-137.

Block, Jörn H., and Marcus Wagner (2010): "Necessity and opportunity entrepreneurs in Germany: Characteristics and earnings differentials." *Schmalenbach Business Review*, April 2010, pp. 154-174.

Bruhn, Miriam (2008): "License to sell : the effect of business registration reform on entrepreneurial activity in Mexico." Policy Research Working Paper Series 4538, The World Bank.

Caliendo, Marco, and Alexander S. Kritikos (2009). "'I want to, but I also need to': Start-ups resulting from opportunity and necessity" IZA DP No. 4661.

Carrasco, Raquel (1999): "Transition to and from self-employment in Spain: an empirical analysis." *Oxford Bulletin of Economics and Statistics*, **61**(3):315-341.

Cox, David R., and H.D. Miller (1965): *The Theory of Stochastic Processes*. New York: Wiley.

Evans, David S and Boyan Jovanovic (1989): "An estimated model of entrepreneurial choice under liquidity constraints." Journal of Political Economy, 97(4):808-827.

Evans, David S., and Linda S. Leighton (1989): "The determinants of changes in U.S. self-employment, 1968-1987." *Small Business Economics*, **1**(2):111-120..

Fletcher, Michael A., and Dana Hedgpeth (2010): "Are unemployment benefits no longer temporary? " *Washington Post*, March 9, 2010.

Gimeno, Javier, Timothy B. Folta, Arnold C. Cooper, and Carolyn Y. Woo (1997): "Survival of the fittest? Entrepreneurial human capital and the persistence of underperforming firms." *Administrative Science Quarterly*, **42**(4):750-783.

Glocker, Daniela, and Viktor Steiner (2007): "Self-employment - a way to end unem-

ployment? Empirical evidence form German pseudo-panel data." German Institute for Economic Research (Berlin), discussion apper 661.

Gort, Michael, and Seong-Hoon Lee (2007): "The rewards to entrepreneurship." Working paper, SUNY Buffalo.

Hamilton, Barton (2000): "Does entrepreneurship pay? An empirical analysis of the returns to self-employment." *Journal of Political Economy*, **108**(3):604-631.

Hobijn, Bart, and Aysegül Sahin (2007): "Job-finding and separation rates in the OECD." Federal Reserve Bank of New York Staff Report no. 298.

Hopenhayn, Hugo (1992): "Entry, Exit, and Firm Dynamics in Long Run Equilibrium." Econometrica, 60(5):1127-50,

Jovanovic, Boyan (1994): "Firm formation with heterogeneous management and labor skills." *Small Business Economics*, **6**(3):185-191.

Kelley, Donna J., Niels Bosma, and José Ernesto Amorós (2011): *Global Entrepreneurship Monitor, 2010 Global Report*. Babson College.

LaRochelle-Côté, Sébastien (2010): "Self-employment in the downturn." *Perspectives on Labour and Income* (Statistic Canada), **11**(3):5-12

Ohyama, Atsushi (2007): "Entrepreneuship and advanced technical knowledge." Working paper, University of Illinois at Urbana-Champaign.

Preisendörfer P. and T. Voss (1990). "Organizational mortality of small firms: The effects of entrepreneurial age and human capital." *Organizational Studies*, **11**:107-129.

Rosen, Sherwin (1981): "The economics of superstars." *American Economic Review*, **71**(6):845-858.

Santarelli, E., and M. Vivarelli (2007): "Entrepreneurship and the process of firms' entry, survival and growth." *Industrial and Corporate Change*, **16**(3):455–488.

Scheike, Thomas H. (1992): "A boundary-crossing result for Brownian motion." Journal of Applied Probability, **29**(2):448-453.

Shane, Scott (2009): "Why encouraging more people to become entrepreneurs is bad public policy." *Small Business Economics*, **33**:141–149.

Shane, Scott (2010): "Recent trends in self-employment." *Small Business Trends.*, April 26. http://smallbiztrends.com/2010/04/page/3. Accessed Feb 19, 2011.

Thurik, A. Roy, & Martin A. Carree, André van Stel, and David B. Audretsch (2008): "Does self-employment reduce unemployment?" *Journal of Business Venturing*, **23**(6):673-686.