Insuring entrepreneurial downside risk

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Abstract

This paper examines the effects of entrepreneurial downside risk insurance on the level and composition of the entrepreneurial pool and to a larger extent on unemployment, production and welfare. We build a rich theoretical framework combining occupational choice, heterogenous agents and incomplete markets to address our main policy concerns. Using CPS, SCF and SBO data, we match our economy to fundamental empirical elements on unemployment, entrepreneurship and mobility and provide contributions on the transition between occupations with respect to individual ability such as matching the U-shaped curve of the transition from worker to self-employed or the hump-shaped curve of the reverse transition. Depending on the downside risk insurance policy considered, we find that this insurance can have a significative impact not only on the level of entrepreneurship but also on the firm size in the entrepreneurial pool and production, although the impact on unemployment is modest.

Keywords: Entrepreneurship, Downside Risk, Unemployment Insurance, Occupational choice
JEL classification: E24, E61, J21, J24

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1. Introduction

Either because of rising unemployment rates, especially in Europe, or due to the benefits in terms of wealth and innovations production attributed to them, policy makers have recently rediscovered the virtues of having a sizable amount of entrepreneurs in the economy. This

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interest has found a large echo in the academic literature, but, among the many questions addressed by the substantial body of papers on entrepreneurs, one important issue has so far drawn relative little attention: the question of insuring the downside risk inherent to any entrepreneurial activity. The downside risk can be defined as the risk supported by the entrepreneur on its income stream because of potential business failure or bad performances. The main trade-off appearing with the opportunity of insuring downside risk can be stated as follows: on the one hand the existence of downside risk could be an important selection mechanism of the most able entrepreneurs. On the other hand, downside risk could prevent many potentially successful individuals from engaging in an entrepreneurial activity. The influential paper by Hombert et al. (2014) has paved the way for empirically addressing this trade-off. Our contribution is to offer a rich theoretical framework to assess the effects of downside risk insurance on the level of entrepreneurship and its composition and, to a larger extent, on unemployment, production and welfare.

The basic building block of our economy is a general equilibrium model with an occupational choice, heterogenous agents and incomplete markets, as it will let us naturally deal with questions such as the composition of the entrepreneurial pool, potentially redistributive policies and mobility across activities. In our economy, agents can either be employed in a corporate sector, self-employed in an entrepreneurial activity or unemployed. Employed agents face an unemployment risk and, provided that they get a business idea, can also exert some effort towards becoming self-employed *on-the-job*. Self-employed agents, that we will commonly call entrepreneurs, face the risk of loosing their business and can exert some effort toward finding a corporate job *on-the-business*. Finally, unemployed agents can exert some effort to find a corporate job and, provided that they get a business idea, can also exert some effort towards becoming an entrepreneur. The government runs a tax financed unemployment insurance (UI) program that partly covers the income loss of short-term unemployed workers. Importantly, entrepreneurs that fall out of business can not claim such UI rights in our benchmark economy. We use Current Population Survey (CPS), Survey of Consumer Finances (SCF) and Survey of Business Owners (SBO) data to carefully match our economy with US empirical data.

As stressed for instance by Kihlstrom and Laffont (1979), a crucial attribute of an entrepreneur is the associated idiosyncratic (and possibly fundamental) risk of starting and continuing his business activity. In their paper, Hombert et al. (2014) describe the large-scale

French reform of 2002 called *Plan d'Aide au Retour à l'Emploi (PARE)*, that introduced a form of downside insurance: in the first three years from starting their businesses, entrepreneurs that started a business after being unemployed could still claim their UI rights in case of business failure. Furthermore, during the same period, they could use their UI benefits to bridge the gap between the original amount of UI benefits and their business income, if it was below. In the US, a related policy called the Self-Employment Assistance (SEA) Program, currently active in 10 states, waives regular UI beneficiaries from active job search and provides a weekly allowance in the same amount and for the same duration as regular benefits, as long as they engage in the establishment of their own small businesses. In the same spirit, we introduce downside risk insurance as two policy experiments. First, similarly to the French reform, we let a formerly unemployed entrepreneur who bankrupts return to the pool of unemployed with UI claims. Additionally, in the case their business activity is still solvent, the government covers the gap for any entrepreneurial income below what would have been their UI benefits. These special privileges given to formerly unemployed entrepreneurs are temporary. Second, in a policy experiment of a somewhat larger extent, we provide downside insurance to any entrepreneur that goes bankrupt. By extending our benchmark economy to account for these policies, we show that for the first policy insuring only formerly unemployed entrepreneurs, the effects are modest: the number of entrepreneurs increase by 0.138% and the composition of the entrepreneurial pool is not modified. Moreover, the impact on production is negligible. The transition adjusted overall welfare impact of this policy is however positive. The second policy that insures any failing entrepreneurial business has more impact: the number of entrepreneurs increase by 1.23% and the average firm size is reduced because newly formed businesses are poorer than incumbents. We also show that the pool of entrepreneurs is modified: the policy increases the amount of averagely and highly-educated entrepreneurs. Production increases by 0.34%. The welfare implications show that this policy is beneficial for most individuals but a decomposition shows that the impact is negative for wealthy individuals. Finally, the impact on unemployment of both policies is negligible because even though these policies increase the incentives to start an entrepreneurial business, they simultaneously reduce the incentives to search for a job. For our policy experiments to be meaningful, it is decisive that our benchmark calibration matches fundamental empirical data on unemployment, entrepreneurship and mobility. We stress here our novel contribution on mobility: using CPS data from 1994 to 2004, we compute transition rates between self-employed, corporate workers and unemployed individuals. We show that the transition from worker to self-employed with respect to ability is described by a U-shaped curve and that the reverse transition is hump-shaped[1]. We argue that self-employment out-of-necessity explains the observed hump-shaped pattern of the transition from self-employment to the paid workforce: we find that averagely-productive unemployed agents switch more often to a temporarily entrepreneurial occupation and then continue to search *on-the-business* a corporate job opportunity. We also use these transitions to indirectly infer the mapping between education attainment and entrepreneurial skill. To the best of our knowledge, our benchmark economy is the first to match those relevant empirical observations on the transitions between these occupations.

The literature on entrepreneurship is wide and has mainly been concerned with the impact of existing barriers to entrepreneurship on its level. Many papers such as Holtz-Eakin et al. (1994), Nanda (2008), Landier and Thesmar (2008), Schoar (2010) or Hombert et al. (2014) have stressed that only focusing on the level might prevent us from understanding the vast amount of heterogeneity in the entrepreneurial pool and the rich composition or selection effects underneath. Our specification is able to capture those rich effects: we for instance highlight a high transition rate from workers to self-employed. This latter finding is not new (see for instance Cagetti and De Nardi (2006) or Rissman (2007a)). The existing literature introduces a distinction between entrepreneurs starting a business out-of-necessity and out-of-opportunity and study how it affects capital misallocation (see Donovan (2014)), the choice of becoming entrepreneur (see Poschke (2013)) and the transition rates (see Visschers et al. (2014)). This literature tend to explain the high transition rate with subsistence entrepreneurs (Donovan (2014), Visschers et al. (2014)), whereas we argue that this alone can not explain the magnitude of this transition. Our contribution is also related to a quantitative literature on entrepreneurship in relation with mobility and wealth inequality issues pioneered for instance by Quadrini (2000) or Cagetti and De Nardi (2006) and to the many policy questions that have been addressed using this framework, for instance in Cagetti and De Nardi (2009) or Kitao (2008) among others. But to the best of our knowledge, none of these contributions have specifically raised the question of the downside risk as we do. Finally, this paper is also related to a very large literature on the effects of unemployment insurance although we focus on a

[1] Regardless on the proxy used for abilities, be it income, wage or educational attainment.

specific margin: the impact of UI on the supply and the composition of the entrepreneurial pool. The role of UI policy in an incomplete markets setting has been first investigated in Hansen and İmrohoroğlu (1992). A substantial number of papers, among which Costain (1997), Acemoglu and Shimer (2000) or Wang and Williamson (2002) have followed. In this respect our paper is closest to Hombert et al. (2014), although their contribution is mostly empirical.

The remaining of the paper is organized as follows. Section 2 presents our benchmark general equilibrium model and section 3 the associated calibration. In section 4, we compare the behavior of our economy with respect to data and report our findings in terms of occupational mobility, entrepreneurial statistics as well as wealth and income indicators. In section 5, we conduct our main policy experiments and finally section 6 concludes.

2. Model

In this section, we describe the general equilibrium in a Bewley (1983) - Huggett (1993) - Aiyagari (1994) model, with labor market frictions and occupational choices in the spirit of Cagetti and De Nardi (2006).

2.1. Technology

There are two sectors of production in this economy: a non-entrepreneurial corporate sector and an entrepreneurial sector. The output in the corporate sector is given by a standard Cobb-Douglas technology with total factor productivity A, capital level K and employed labor L such that:

$$Y(K, L) = AK^{\alpha}L^{1-\alpha}$$

In the entrepreneurial sector, each firm only uses its own workforce and the entrepreneurial capital k invested in the business. The entrepreneurial technology has decreasing returns to scale governed by the parameter ν with $0 < \nu < 1$. The return of the entrepreneurial activity is subject to a productivity shock and thus such a business is either in a good or in a bad state $j \in \{bad, good\}$. Furthermore, the return also depends on an innate individual ability θ through a function $g : \theta \mapsto \mathcal{R}$, such that:

$$f(k, \theta, j) = a_j g(\theta)k^{\nu}$$

2.2. Households

The economy is populated by a continuum of infinitely lived households of unit mass. Each period, a household falls in one of the following three occupations (o): unemployment (o_u), entrepreneurship (o_e) or employment (worker in the non-entrepreneurial corporate sector) (o_w) with $o \in \mathcal{O} \equiv \{o_u, o_e, o_w\}$. These occupations can change exogenously due to random events or endogenously due to an occupational choice from the agent. Each individual (household) is endowed with an innate ability level $\theta \in \Theta$, and, except for the entrepreneur, a business idea $\xi \in \Xi \equiv \{0, 1\}$. Innate abilities are determined early in life, before the individual enter the model[2] . An agent occupied as a worker faces an idiosyncratic shock, noted $y \in \mathcal{Y}$, over his labor productivity. Finally, the current wealth of an agent is noted $a \in \mathcal{A}$.

Household preferences are described by the following function:

$$u(c, s_w, s_e) = \frac{c^{1-\sigma}}{1-\sigma} - s_w^{\psi_w} - s_e^{\psi_e},$$

with c the consumption, s_w the effort provided to search for a job, s_e the effort provided to setup a business idea and ψ_w and ψ_e the elasticity of the respective search efforts. Once they get an idea ($\xi = 1$), a worker or an unemployed individual can choose how much effort to provide in order to get the opportunity to open a business related to this idea[3]. The probability of getting the opportunity of opening a business arrives at a poisson rate that depends on the search effort s_e. Similarly, an entrepreneur or an unemployed individual can choose how much effort to provide in order to find a corporate job opportunity. The probability of getting a job opportunity arrives at a poisson rate function of the search intensity s_w. Thus we have:

$$\pi_e(s_e) = 1 - e^{-\kappa_e s_e}$$

$$\pi_w(s_w) = 1 - e^{-\kappa_w s_w}$$

Under these specifications, we get seven types of different individuals in our economy: entrepreneurs, workers endowed with a business idea and those without, as well as short-run and long-run unemployed individuals with and without a business idea.

[2]We stress that both the worker's labor income and the entrepreneur's business income depend on the same innate ability. Thus, there exists a correlation between the two returns.

[3]This effort can describe the agency costs and/or the time needed to fill administrative forms, respect product norms, etc.

Finally, note that in order to reduce the size of the following value functions, we omit the innate ability in our notations since it does not evolve over time (for instance, $EV(a', y', \xi)$ means $EV(a', y', \theta, \xi)$).

2.2.1. Workers

A worker in the corporate sector without an entrepreneurial idea receives the labor income $wy\theta$, depending on his innate ability level θ and his idiosyncratic productivity level y. Labor productivity follows a first-order Markov process with transition probability $\pi(y'|y)$ describing the probability of switching from a productivity level y to another level y'. This worker has a probability $\eta(\theta)$ to be laid off which depends on his innate ability. He also has a probability ξ of receiving a business idea in the next period but can not currently try to set up any business. Finally, this agent has to pay the tax rate τ_w on his labor income. The recursive program of a corporate worker without an entrepreneurial idea is thus:

$$V^w(a, y, 0) = \max_{c,a'} \Big\{ u(c, 0, 0) + \beta \Big[\xi \big((1 - \eta(\theta)) EV^w(a', y', 1) + \eta(\theta) V^{u_s}(a', 1) \big) + (1 - \xi) \big((1 - \eta(\theta)) EV^w(a', y', 0) + \eta(\theta) V^{u_s}(a', 0) \big) \Big] \Big\}$$

$$\text{Subject to:} \quad c = (1 - \tau_w) wy\theta + (1 + r)a - a' \tag{1}$$

$$a' \geq 0 \qquad c > 0 \tag{2}$$

If a worker has an entrepreneurial idea, he still has to choose the amount of effort s_e to allocate in order to transform his idea into a viable business venture. This happens with the probability $\pi_e(s_e)$. In that case, he chooses between remaining a worker or actually starting his business, after having paid the fixed starting cost c_e, based on the future value of both opportunities. Moreover, if his job is destroyed concurrently with receiving this opportunity (with probability $\eta(\theta)\pi_e(s_e)$), he chooses between starting a business or falling in a short-run unemployment situation. When a worker chooses to start a business, he has to pay a fixed cost c and does not know the future productivity state of his activity which can be either bad or good: we assume that the probability of each state is given by the invariant distribution $\hat{\Pi}_j$. Finally, a worker loses his business idea with probability ζ. The recursive program of a corporate worker with an entrepreneurial idea is thus:

$$
\begin{aligned}
V^w(a,y,1) = \max_{c,a',s_e} \Big\{ & u(c,0,s_e) \\
& + \beta \Big[(1-\zeta) \Big((1-\eta(\theta)) \Big[\pi_e(s_e) EV^w_{w,e}(a',y',1) + (1-\pi_e(s_e)) EV^w(a',y',1) \Big] \\
& + \eta(\theta) \Big[(1-\pi_e(s_e)) V^{u_s}(a',1) + \pi_e(s_e) V^w_{u_s,e}(a',1) \Big] \Big) \\
& + \zeta \Big(\eta(\theta) V^{u_s}(a',0) + (1-\eta(\theta)) EV^w(a',y',0) \Big) \Big] \Big\} \\
& \text{Subject to:} \quad (1), \quad (2) \qquad (3) \\
& \qquad s_e \geq 0
\end{aligned}
$$

$$
V^w_{w,e}(a,y,1) = \max\{V^w(a,y,1), E_j V^e(a-c_e,j)\} \tag{4}
$$

$$
V^w_{u_s,e}(a,1) = \max\{V^{u_s}(a,1), E_j V^e(a-c_e,j)\} \tag{5}
$$

From this, we derive that the optimal search effort s_e to be exerted in order to start a business given an entrepreneurial idea is solution to:

$$
\psi_e (s_e^*)^{\psi_e} = \beta \kappa_e e^{-\kappa_e s_e} \Big((1-\eta(\theta)) EV^w_{w,e}(a',y',1) + \eta(\theta) V^w_{u_s,e}(a',1) \Big) \tag{6}
$$

2.2.2. Unemployed workers

An unemployed worker can be either short-run or long-run unemployed. Similarly to the worker, an unemployed individual is endowed with an innate ability θ and has a business idea or not. We assume that a short-run unemployed worker falls into long-run unemployment with probability p_l. A short-run unemployed worker ($\epsilon = s$) receives unemployment benefits proportional to the wage rate and his innate ability level $w\theta$, with replacement rate z. Contrastingly, the long-run unemployed ($\epsilon = l$) receives the fixed amount m such that $m \leq wz\theta_0$, that is, m is lower than the lowest UI benefits received by a short-run unemployed worker in the economy[4]. It both situations, this individual can search for a job with effort s_w and and the corresponding success probability $\pi_w(s_w)$. Once a job is found, we assume that the future worker's productivity shock level y is drawn from the invariant probability distribution $\hat{\Pi}_y$.

[4]This is mainly to ensure that an individual can always consume and that long-run unemployment is more costly than short-run unemployment.

Given the above specifications, the recursive program of an unemployed worker without an entrepreneurial idea is:

$$
\begin{aligned}
V^{u_\epsilon}(a,0) = \max_{c,a',s_w} \Big\{ & u(c,s_w,0) + \beta\Big[\xi\Big((1-\pi_w(s_w))V^{u_\epsilon}_{u'_\epsilon}(a',1) + \pi_w(s_w)E_{y'}V^w(a',y',1)\Big) \\
& + (1-\xi)\Big((1-\pi_w(s_w))V^{u_\epsilon}_{u'_\epsilon}(a',0) + \pi_w(s_w)E_{y'}V^w(a',y',0)\Big)\Big]\Big\} \\
\text{Subject to:} \quad & (\epsilon = s) \quad c = (1-\tau_w)w\theta z + (1+r)a - a' && (7) \\
& (\epsilon = l) \quad c = m + (1+r)a - a' && (8) \\
& a' \geq 0 && (9) \\
& s_w \geq 0 && (10) \\
& (\epsilon = s) \quad V^{u_s}_{u'_\epsilon}(a,\xi) = p_l V^{u_l}(a,\xi) + (1-p_l)V^{u_l}(a,\xi) && (11) \\
& (\epsilon = l) \quad V^{u_l}_{u'_\epsilon}(a,\xi) = V^{u_l}(a,\xi) && (12)
\end{aligned}
$$

An unemployed worker with a business idea chooses how many effort s_e to allocate in order to transform his idea into a viable business venture. This happens with the probability $\pi_e(s_e)$. Given this opportunity, he can choose either to remain in unemployment or to start a business after paying the fixed cost c_e. Again, the future productivity state of his entrepreneurial venture is currently unknown and it will be drawn according to the invariant probability distribution $\hat{\Pi}_j$. As above, ζ is the probability to lose the entrepreneurial idea. The recursive program of an unemployed worker with an entrepreneurial idea is thus:

$$
\begin{aligned}
V^{u_\epsilon}(a,1) = \max_{c,a',s_w,s_e} \Big\{ & u(c,s_w,s_e) + \beta\Big[(1-\zeta)\Big(\\
& \pi_w(s_w)\big[(1-\pi_e(s_e))E_{y'}V^w(a',y',1) + \pi_e(s_e)V^{u_\epsilon}_{w,e}(a',1)\big] \\
& + (1-\pi_w(s_w))\big[\pi_e(s_e)V^{u_\epsilon}_{e,u'_\epsilon}(a',1) + (1-\pi_e(s_e))V^{u_\epsilon}_{u'_\epsilon}(a',1)\big]\Big) \\
& + \zeta\Big((1-\pi_w(s_w))V^{u_\epsilon}_{u'_\epsilon}(a',0) + \pi_w(s_w)E_{y'}V^w(a',y',0)\Big)\Big]\Big\} \\
\text{Subject to:} \quad & (7), \quad (8), \quad (9), \quad (10), \quad (11), \quad (12) && (13) \\
& s_e \geq 0 \\
(\epsilon = s) \quad V^{u_s}_{e,u'_\epsilon}(a,1) = {} & (1-p_l)\max\{E_jV^e(a-c_e,j), V^{u_s}(a,1)\} && (14) \\
& + p_l V^{u_l}(a,1)\max\{E_jV^e(a-c_e,j), V^{u_l}(a,1)\} && (15) \\
(\epsilon = l) \quad V^{u_l}_{e,u'_\epsilon}(a,1) = {} & \max\{E_jV^e(a-c_e,j), V^{u_l}(a,1)\} && (16) \\
V^{u_\epsilon}_{w,e}(a,1) = {} & \max\{E_yV^w(a,y,1), E_jV^e(a-c_e,j)\} && (17)
\end{aligned}
$$

Note that an unemployed worker can simultaneously provide a search effort in order to establish an entrepreneurial business and to find a corporate job. Provided the effort s_w to find a job, the optimal search effort to start his business is given by the solution to the following equation[5]:

$$1 - \frac{\psi_e (s_e^*)^{\psi_e}}{\beta \kappa_e (1-\zeta) \mathcal{P}(s_w)} = \pi_e(s_e^*) \tag{18}$$
$$\mathcal{P}(s_w) = \pi(s_w)(V_{w,e}(a',1) - E_{y'} V_w(a',y',1)) + (1-\pi(s_w))(V^{u_\epsilon}_{e,u_{\epsilon'}}(a',1) - V^{u_\epsilon}_{u'_\epsilon}(a',1))$$

2.2.3. Entrepreneurs

An entrepreneur raises revenues from his self-employed business venture. When in activity, his revenues are equal to $f(k,j,\theta)$ as defined above. Business productivity follows a first-order Markov process with transition probability $\pi(j'|j)$, describing the probability of switching from a productivity level a_j to another level $a_{j'}$. In order to invest the amount k in his activity, the entrepreneur can borrow the amount $k-a$ over his current wealth a, but then has to pay the interest on this borrowed amount. As in Buera et al. (2011), the entrepreneur is borrowing constrained by an external creditor such that the lender will accept to lend only up to an amount that is expected to be repaid[6]. Due to this, we assume that the fraction of revenues that the entrepreneur can keep if he runs away from the contract with the creditor is equal to f[7].

An entrepreneur can search for a corporate job *on-the-business*. This search will be successful with probability $\pi_w(s_w)$[8]. In such a case, he decides whether to remain an entrepreneur or to switch to a worker situation based on the future value of both opportunities. We assume that the entrepreneur keeps his business idea when he voluntary exits entrepreneurship.

[5] This computation is detailed in Appendix D

[6] We also implemented an endogenous borrowing contraints similar to Cagetti and De Nardi (2006), such that the entrepreneur can borrow only if $V^e > V^{u_l}$, assuming that the entrepreneur first refuses all job offers before deciding whether or not he wants to quit the contract with the creditor. However, this did not change the fundamental behavior of the benchmark economy. The results from this alternative borrowing constraints are available upon request.

[7] In our specification, the higher is f the higher is the tightness of the borrowing constraint.

[8] We allow the parameter κ governing this probability to be different between an unemployed worker and an entrepreneur. This captures the fact that entrepreneurs could have more or less job opportunities than unemployed people.

When the he chooses to become a worker, his productivity level is assumed to be drawn from the invariant distribution $\hat{\Pi}_y$. The entrepreneurial activity can go bankrupt according to the exogenous probability μ. In that case the agent is assumed to fall directly into long-run unemployment and can not get UI benefits. Finally, the entrepreneur pays a corporate tax τ_c. The recursive program of an entrepreneur is thus:

$$V^e(a,j) = \max_{c,a',s_w,k} \Big\{ u(c,s_w,0) + \beta \Big[(1-\mu)\Big(\pi_w(s_w) EV^e_{w,e}(a') + (1-\pi_w(s_w)) EV^e_{u_l,e}(a',j') \Big) + \mu\Big((1-\pi_w(s_w)) V^{u_l}(a',1) + \pi_w(s_w) E_y V^w(a',y',0) \Big) \Big] \Big\}$$

$$\text{Subject to:} \quad c = (1-\tau_c)(a_j g(\theta) k^\nu - (1+r)(k-a) + (1-\delta)k) - a' \tag{19}$$

$$a' \geq 0 \qquad k \geq 0 \qquad s_w \geq 0$$

$$(IC) \quad f\big[a_j g(\theta)k^\nu + (1-\delta)k\big] - (1+r)(k-a) \geq 0 \tag{20}$$

$$V^e_{w,e}(a,j) = \max\{E_y V^w(a,y,1), V^e(a,j)\} \tag{21}$$

$$V^e_{u_l,e}(a,j) = \max\{V^{u_l}(a), V^e(a,j)\} \tag{22}$$

where the optimal level of capital invested in the business according to the Buera et al. (2011) borrowing constraint type is defined as:

$$k = \begin{cases} \text{solve (IC)} & \text{if} \quad k \leq k^* \\ k = k^* & \text{if} \quad k > k^* \end{cases} \qquad\qquad k^* = \left(\frac{\nu g(y)}{r+\delta} \right)^{\frac{1}{1-\nu}} \tag{23}$$

The optimal search effort s_w exerted by an entrepreneur in order to find a job is given by:

$$\psi_w (s^*_w)^{\psi_w} = \beta \kappa_w e^{-\kappa_w s_w} \Big((1-\mu) EV^e_{w,e}(a',j') + E_y V^w(a',y',0) \Big) \tag{24}$$

2.3. Government

The government runs an unemployment insurance system that covers the pool of short-term unemployed workers. The aggregate amount of such benefits is:

$$G = \sum_{\theta \in \Theta} \sum_{\xi \in \Xi} \int_{\underline{a}}^{\overline{a}} w \theta z \Gamma(u_s, \theta, \xi, da) \tag{25}$$

with $\Gamma(u_s, \theta, \xi, da)$ the measure over short-run unemployed workers[9].

[9]From now on, let us denote $\Gamma(s)$ the measure over individuals with occupation s.

The government generates revenues to finance the UI scheme by raising two type of taxes: a corporate tax (τ_c) paid by all entrepreneurs and a proportional labor income tax (τ_w) paid by occupied workers, such that total government revenues are:

$$T = \sum_{\theta\in\Theta}\sum_{y\in\mathcal{Y}}\sum_{\xi\in\Xi}\int_{\underline{a}}^{\overline{a}} wy\tau_w\Gamma(\{w,u_s\},y,\theta,\xi,da) \tag{26}$$
$$+\sum_{\theta\in\Theta}\sum_{j\in\mathcal{J}}\int_{\underline{a}}^{\overline{a}} \tau_c\Big(a_j g(\theta)k^{\nu} - (1+r)(k-a) + (1-\delta)k\Big)\Gamma(e,j,\theta,\xi,da)$$

Finally, we assume that government can issue debt in order to finance his budget. We then have the flow of government debt given by:

$$B_{t+1} = (1+r_t)B_t + T_t + G_t \tag{27}$$

2.4. Stationary Recursive Equilibrium

Given the state vector $\mathbf{x} = (s,y,\theta,j,a)$ with $a\in A$, $y\in\bar{Y}$, $j\in\mathcal{J}$, $\xi\in\Xi$, $\theta\in\Theta$, $s\in S$, where s is the status of the household: entrepreneur, worker, short-run or long-run unemployed worker ($S \mathrel{\widehat{=}} \{e,w,u_s,u_l\}$); a stationary recursive equilibrium in this economy consists of a set of value functions $V_w(a,\theta,y,\xi), V_e(a,\theta,j), V_{u_s}(a,\theta,\xi), V_{u_l}(a,\theta,\xi)$, decision rules with asset holding $a'(\mathbf{x})$, consumption $c(\mathbf{x})$, job search effort $s_w(\mathbf{x})$, business search effort $s_e(\mathbf{x})$, investment level $k(\mathbf{x})$, occupational choices s, prices $(r, w\in\mathbb{R})$, tax parameter $(\tau_w\in\mathbb{R})$ and a stationary measure over individuals $\Gamma(\mathbf{x})$ such that

- the allocation choices $c(\mathbf{x})$, $a'(\mathbf{x})$, $k(\mathbf{x})$, $s_w(\mathbf{x})$ and $s_e(\mathbf{x})$ maximize the household problem given the prices r, w and the fixed tax parameter τ_w.

- $\Gamma(\mathbf{x})$ is the stationary probability measure induced by $a'(\mathbf{x})$ and the first-order Markov chains Π_y, Π_j and Π_ξ.

- the asset and labor markets clear such that capital used in the non-entrepreneurial sector is equal to the difference between the total asset level in the economy minus total investment in the entrepreneurial sector and government debt.

$$K_c = \sum_{s\in S}\sum_{y\in Y}\sum_{\xi\in\Xi}\sum_{\theta\in\Theta}\sum_{j\in\mathcal{J}}\int_{\underline{a}}^{\overline{a}} a(\mathbf{x})\Gamma(s,da) - \sum_{s\in e}\sum_{\theta\in\Theta}\sum_{j\in\mathcal{J}}\int_{\underline{k}}^{\overline{k}} k(\mathbf{x})\Gamma(e,dk) - B \tag{28}$$

For the labor market, total labor supply (L) is given by

$$L = \sum_{s \in S} \sum_{y \in \bar{Y}} \sum_{\xi \in \Xi} \sum_{\theta \in \Theta} \int_{\underline{a}}^{\bar{a}} y \Gamma(w, da) \tag{29}$$

- the wage and the interest rate are equal to the marginal products of the respective production factor. The no arbitrage condition implies that the rate of return in the non-entrepreneurial sector must equate with the risk-free rate that equates savings and investment in the entrepreneurial sector.

- the government budget constraint is balanced, such that at the steady state the government has to finance interest on debt plus government spendings.

$$T = G + rB \tag{30}$$

- The distribution Γ is time-invariant. The law of motion for the distribution of agents over the state space $\mathbf{x}$ satisfies

$$\Gamma = R_{\Gamma}(\Gamma) \tag{31}$$

  where R_{Γ} is a one-period transition operator on the distribution Γ such that $\Gamma_{t+1} = R_{\Gamma}(\Gamma_t)$.

In addition, we define the measure of the total gross domestic product (Υ) in this economy as the sum of the outputs in the entrepreneurial and the non-entrepreneurial sectors.

$$\Upsilon = AK_c^{\alpha} L_c^{1-\alpha} + \sum_{\theta \in \Theta} \sum_{j \in \mathcal{J}} \int_{\underline{k}}^{\bar{k}} a_j g(\theta) k(\mathbf{x})^{\nu} \Gamma(e, dk) \tag{32}$$

The algorithm used to solve the model is described in Appendix B.

3. Calibration

In this section, we describe the calibration strategy that we use. We apply a mix of external calibration combining existing parameter estimates and normalizations and internal parameterization by minimizing the distance between equilibrium moments and their data counterparts. The model period is the year.

3.1. Fixed parameters

Some fixed parameters are set to the observed data (e.g. labor share in the corporate sector, corporate tax rate), normalized to restrict the number of estimated parameters (e.g. the probability to get an idea and to lose an idea, the total factor productivity and the domestic production income) or taken from their estimates in the literature (e.g. the depreciation rate, the replacement rate or the intertemporal elasticity). As a model period is the year, we set the probability of falling into long-run unemployment p_l to one, which corresponds approximately to the US unemployment benefit policy before 2014.

Labor productivity process. In our model, an individual's labor productivity depends on two components: a deterministic innate ability level θ and an idiosyncratic shock y. The natural logarithm of wages of a worker is given by:

$$log(w_t) + log(\theta) + log(y) \quad (33)$$

We consider three innate ability types $\{\theta_1, \theta_2, \theta_3\}$ with population masses equal to the mass of people with less than a high-school (HS) degree , $p_1 = 0.275$, with a HS degree only, $p_2 = 0.45$ and with at least the college level (completed or not), $p_3 = 0.275$. The ability values are chosen so that $E(log(\theta)) = 0$ meaning that $\theta_1 = e^{-\sigma_\theta}$, $\theta_2 = 1.0$ and $\theta_3 = e^{\sigma_\theta}$ with $var(log(\theta)) = \sigma_\theta$.

We specify the stochastic process for the idiosyncratic part of the log-wages with a five states discretized version of a simple AR(1) process with persistence ρ and unconditional variance σ_y^2. This leaves us with three parameters $(\sigma_\theta^2, \rho, \sigma_y^2)$ that we match using CPS data. We use three data moments that measure the cross-sectional labor income dispersion: (i). the average earning dispersion across education level for a given age (of about 0.0718), (ii). the average earning dispersion along the life for a given education level (around 0.0165), (iii). the almost linear earning process along the life (with a persistency of 0.96 as it is common in the literature). Figure E.12 in Appendix E displays the average earning profil at different educational attainments and different ages.

Layoff rate. We calibrate the layoff process $\eta(\theta)$ according to the CPS transition between worker to unemployed worker. This relationship is roughly linear and we run a simple linear regression to estimate the probability to be laid off, such that

$$\eta(\theta) = \alpha_\eta + \beta_\eta \theta \quad (34)$$

Table 1 summarizes the set of fixed parameters used.

Table 1: Fixed Parameters: benchmark model

Parameter		Value	Source
Corporate tax rate	τ_c	0.134	OECD
Return to scale (corp.)	α	0.36	Zeileis (2015)
Inter. Elasticity	σ	1.39	Gandelman and Hernandez-Murillo (2015)
Depreciation rate	δ	0.06	Cagetti and De Nardi (2006)
Replacement rate	z	0.4	Shimer (2005)
UI duration	p_l	1.0	Own computation
TFP	A	1.0	Normalization
Entrepreneurship cost of entry	c_e	0.0	Normalization
Domestic production	m	0.05	Normalization
Getting an entrepreneurial idea	ξ	1.0	Normalization
Losing an entrepreneurial idea	ζ	0.0	Normalization
Layoff rate: intercept	α_η	0.05	own calculation
Layoff rate: slope	β_η	-0.015	own calculation

3.2. Estimated parameters

Entrepreneur' states. As explained above, we divide the business outcome into a good and a bad state. We normalize the productivity in the good state to unity (e.g. $a_{good} = 1.0$). This leaves us only a_{bad} to estimate. We also assume that the probability to switch from a_j to $a_{j'}$, given by $\pi(j|j')$, is symmetric.

Job finding rate. We allow a distinction between the probability of finding a job when the household is occupied as an entrepreneur and as an unemployed worker. This distinction lets us capture the fact that individuals in an entrepreneurial situation are more likely to find a job than unemployed workers. The job finding rate for an entrepreneur is given by κ_w^e. For the unemployed workers, we use a parametric form which depends on the educational attainment to compute the rate κ_w. In this sense, we use a linear relationship (which fits approximately the transition from unemployed worker to a worker situation such that:

$$\kappa_w(\theta) = \alpha_w + \beta_w \theta \quad (35)$$

Our calibration strategy leaves us with 15 parameters to pin down 16 moments relative to the transitions between and within occupations, wealth and income distribution characteristics, the unemployment rate, the fraction of entrepreneurs and the capital-output ratio. The outcome of our internal calibration is displayed in table 2.

Table 2: Estimated Parameters

Parameter		Value
Discount rate	β	0.869
Job search effort elasticity	ψ_w	1.854
Business search effort elasticity	ψ_e	2.064
Business idea matching par.	κ_e	0.56
Job matching par. (when E)	κ_w^e	6.49
Job matching par. (when U)	α_w	1.2
Job matching par. (when U)	β_w	0.2
Bankruptcy rate	μ	0.025
Borrowing constraint par.	f	0.847
Entrepreneur's return to scale	ν	0.86
Entrepreneurial ability	$g(\theta)$	[0.481, 0.527, 0.715]
Entrepreneurial state	$[a_{bad} \quad a_{good}]$	[0.415 1.0]
Probability to switch	$\pi_{a_j,a_{j'}}$	0.185

3.3. Calibration targets and generated moments

Table 3 display some of the targets of our calibration.

Table 3: Observed and generated moments

Moment	Model	Value (U.S.)	Source
K/Y Ratio*	3.12	3.04	Zeileis (2015)
Entrepreneurs*	10.9%	10.9%	Own calculation
Ratio of med. worth E/W	8.73	8	Cagetti and De Nardi (2006)
Labor Market			
Unemployment rate*	5.32%	4 - 6 %	Bank (2016)
Worker exit rate*	5.83%	3 - 6.5%	Shimer (2012) and Rissman (2007b)

Unemployment exit rate*	56%	40 - 65 %	Ibid.
Entrepreneurial exit rate*	24.5%	24 - 25 %	Own calculation
Necessity share*	12.4%	20%	Fairlie (2015)
Wealth and Income distributions			
1%wealth*	22	30	Cagetti and De Nardi (2006).
5% wealth	52	54	Ibid.
10% wealth	68	67	Ibid.
Wealth Gini*	0.76	0.8	Ibid.
Income Gini*	0.39	0.36	Kenworthy and Smeeding (2013)

(*) Targeted.

Using the CPS data from 1994 to 2014, we compute an average fraction of entrepreneurs in the US economy of 10.9% which is in the range of the existing literature. For instance, Quadrini (2000) finds 12% and Gentry and Hubbard (2004) report a fraction of entrepreneurs (households who reported owning active business assets without restriction) of 11.5% using various definition using SCF in 1989. The exit rate out of entrepreneurship is estimated using CPS data as well. We find a value between 22% to 25% depending on the time period considered. This is close to the findings of Cagetti and De Nardi (2006) and Rissman (2007a).

Transitions by productivity level within transition from worker to entrepreneur (W - E) and from entrepreneur to worker (E - W) occupations are also targeted (we show the resulting transitions in the next section). As described later, lowly-educated and highly-educated individuals are less likely to switch to a worker situation when they are in business. In addition to the 10 targeted moments above, we thus target transition probabilities by educational attainment in (E - W) to match respectively 0.22, 0.24 and 0.22 depending on the condition that the individual has an education level lower than high-school, a high-school degree or has attended college. We do the same for the transition (W - E) and we match respectively the values 0.03, 0.022 and 0.03 according to the same educational attainment groups. We can then indirectly infer the entrepreneurial abilities using these transitions.

Overall, our overidentified simulated method of moments provides results close to the observed data. The flow of individuals between occupations is either in the considered range or slightly outside. We also match the mass of people in each occupation as well as the wealth and the income distributions. We obtain an interest rate of 5.5% and a tax rate parameter τ_w equal to 1.1%.

4. Results: benchmark economy

In this section we compare our model outcomes to the data. We use three sources of data. First, we compute the transition rates between and within occupations as well as the fraction of entrepreneurs by educational attainment using the Current Population Survey (CPS) from 1994 to 2014. We average all the transitions over the time period considered so that our steady state values are comparable to the true data. Second, we use the Survey of Consumer Finance (SCF) and the Survey of Business Owners (SBO) to compare our model distributions (firm sizes, as well as wealth and income) to the actual ones.

4.1. Entrepreneurship and educational attainment

As discussed before, the model generates a fraction of entrepreneurs (10.9%) similar to the data. Table 4 displays the rate of entrepreneurship by educational attainment from different sources. It shows that our benchmark model is able to reproduce the observed U-shaped curve between education level (or innate ability in our context) and the fraction of entrepreneurs within that group. For instance, 11.02% of the individuals with high-school education level or less are entrepreneurs. As mentioned in Poschke (2013), this fact is observable in most of the developed countries and seems to be consistent regardless of the definition used for an entrepreneur.

From an empirical point of view, this U-shaped relationship is also pretty robust. For instance, using 19 OECD countries, Blanchflower (2000) find that even if we control for many demographic covariates (age, education, gender, household size, specific country unemployment rate, the number of children as well as their age and their educational attainment) this relationship persists in discrete choice models. LeMaire and Schjerning (2007), using Danish data with detailed education levels and a number of controls, also find the statistically significance of this U-shaped relationship.

4.2. Transitions between and within occupations

4.2.1. Transitions between occupations.

Using CPS data, averaged from 1994 to 2014, we compute and report in table 5 the year-to-year transition probabilities between our three occupations (worker (W), entrepreneur (E)

Table 4: Entrepreneurship rates (%) by education category

	data source	E	Educational attainment <HS	HS	<C	C	>C
Own calculations	U.S., 1994 - 2014 CPS	10.9		6.73	6.4	8.71	9.78
Hamilton (2000)	U.S., 1984 SIPP	-		12.6	11.1	12.6	15
Hippie (2010)	U.S., 2010 CPS	-	12.0	11.8	11.8	12.4	13.9
Lin et al. (2000)	Canada, 1994	18.4	13.5	11.4	10.1	11.1	13.2
LeMaire and Schjerning (2007)	Denmark, 1980-96	10.9	-	10.9	7.4	3.6	12.9
Borjas and Bronars (1989)	U.S., 1980 Census	-		4.8	4.2	4.6	6.5
Benchmark	-	10.9	-	11.15	10.22	11.99	-

Source: (Poschke, 2013) and own calculations. The definition of an entrepreneur is someone who is self-employed in the sense of (Cagetti and De Nardi, 2006). That is, someone who does not always own his business but actively manages it. Self-employed can also have employees, so that the term entrepreneur seems more adapted.

and unemployed worker (U)). With respect to our calibration strategy, the benchmark model is able to reproduce the transitions between occupations quite accurately.

When compared to the existing literature on this subject, our model does a better job than, for instance Rissman (2007a), who finds E - W transition outcomes quite far from their data equivalents. Our model is able to fit well this transition since a fraction of existing entrepreneurs, who falls into a bad business state, search for a job *on-the-business* in order to get a higher labor income as a corporate worker than their current returns to entrepreneurship.

4.2.2. Transitions within occupations by productivity level.

Our model also reproduces the transition by productivity level for a given transition between occupations. To the best of our knowledge, our contribution is the first to report the transition probabilities within occupations and therefore the first to build a model able to match them. A common issue in the literature with entrepreneurship is the absence of a clear proxy to identify the link between the entrepreneurial ability and the individual characteristics. In our calibration strategy, we indirectly estimate how the entrepreneurial ability is mapped from educational attainment using the transition W - E and E - W by productivity level. Figure 1

Table 5: Year to year transition matrix between occupations

	W	E	U
W	0.941 (0.9417)	0.027 (0.0263)	0.032 (0.0320)
E	0.758 (0.7559)	0.226 (0.2107)	0.016 (0.0335)
U	0.562 (0.5039)	0.060 (0.0584)	0.377 (0.4376)

Source: CPS data and own calculations.

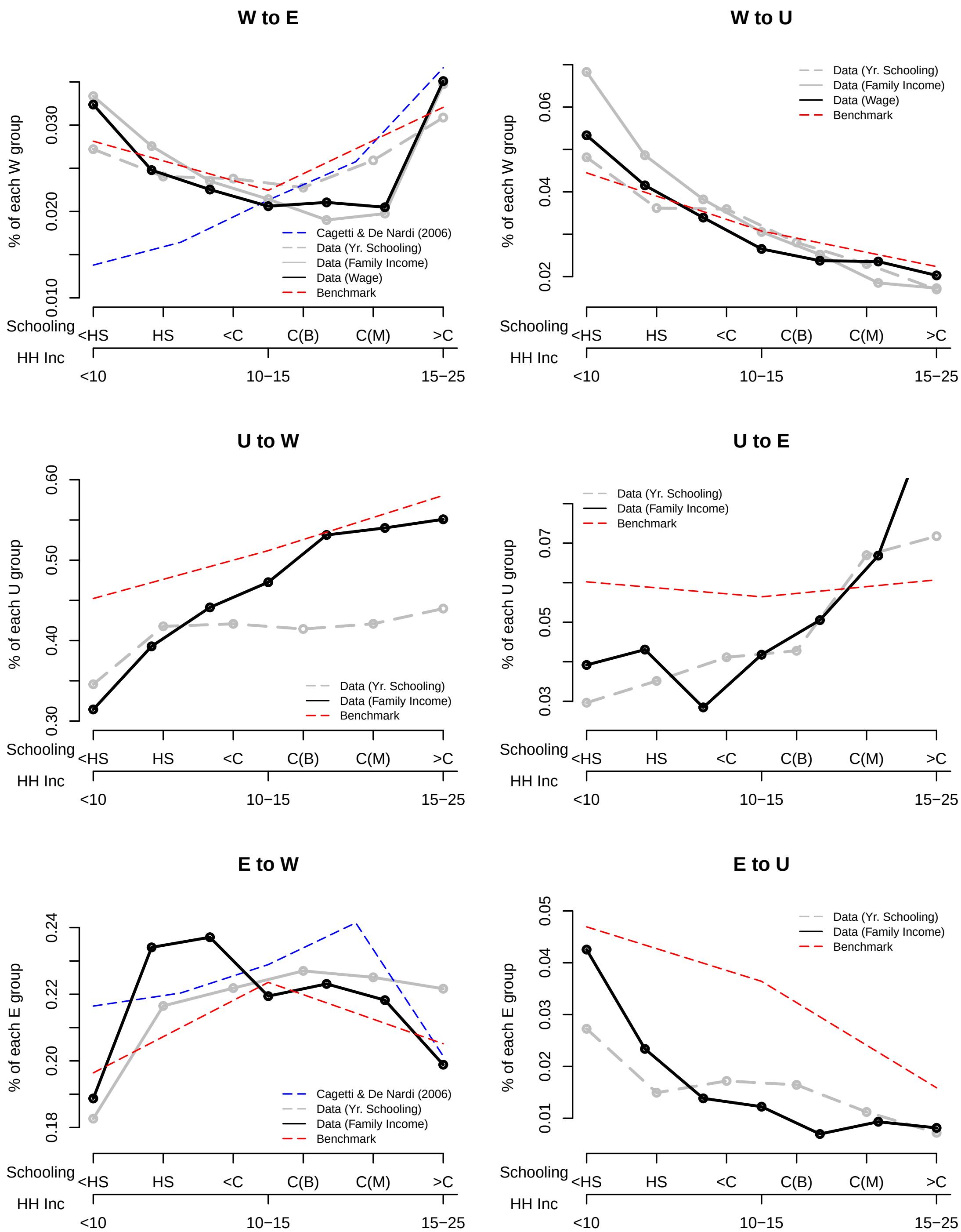
Benchmark model results are in parenthesis.

reports the transition probabilities between occupations for each productivity level. From the data, we use three different proxies for productivity level: educational attainment (or years of schooling), wage level (which is only available when the individual was previously a worker) and the family income.

Worker to Entrepreneur (W - E) transition. In the data, a U-shaped relation between productivity levels and the probability to switch occupations is found and it is quite robust regardless of the proxy used within the W - E transition. Our model is able to replicate this empirical finding for two reasons. First, highly-qualified workers tend to be on average richer than other categories. Therefore, they can accumulate more wealth (or collaterals) than middle or low-qualified individuals. These workers are then on average less financially constrained by an external creditor. At the opposite end, lowly-educated workers can borrow less as entrepreneur but their return at work is also lower than other categories. Thus, the wealth threshold at which they switch to entrepreneurship is below the ones of the two other education categories. Hence, lowly-qualified and highly-qualified workers are more likely to switch to entrepreneurship than say *averagely-qualified* workers. Notice also that different productivity groups start different type of firms (for instance if we proxy for size with capital invested in the business). As shown in figure 2, lowly-qualified workers tend to open relatively small businesses as compared to highly-qualified workers[10].

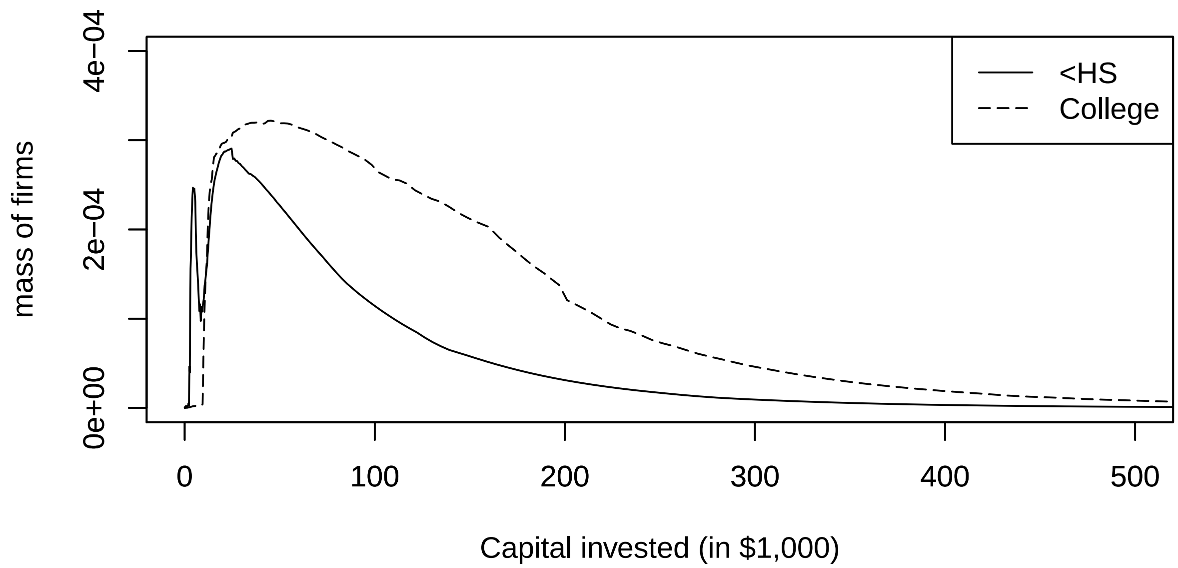
[10]Previous models in the literature are unlikely to replicate this feature since they introduce only one of the dimensions we consider. For instance, Visschers et al. (2014) introduce only abilities and abstract from wealth.

Figure 1: Transition probability by productivity level within occupations



Source: transitions are computed using averaged transitions between occupations over twenty years from 1994 to 2014. Similar patterns can be found for quarterly and monthly data. We also report here the transitions generated by the Cagetti and De Nardi (2006) model which does not account for correlation between returns to entrepreneurship and labor income of a given individual.

Figure 2: Firm size

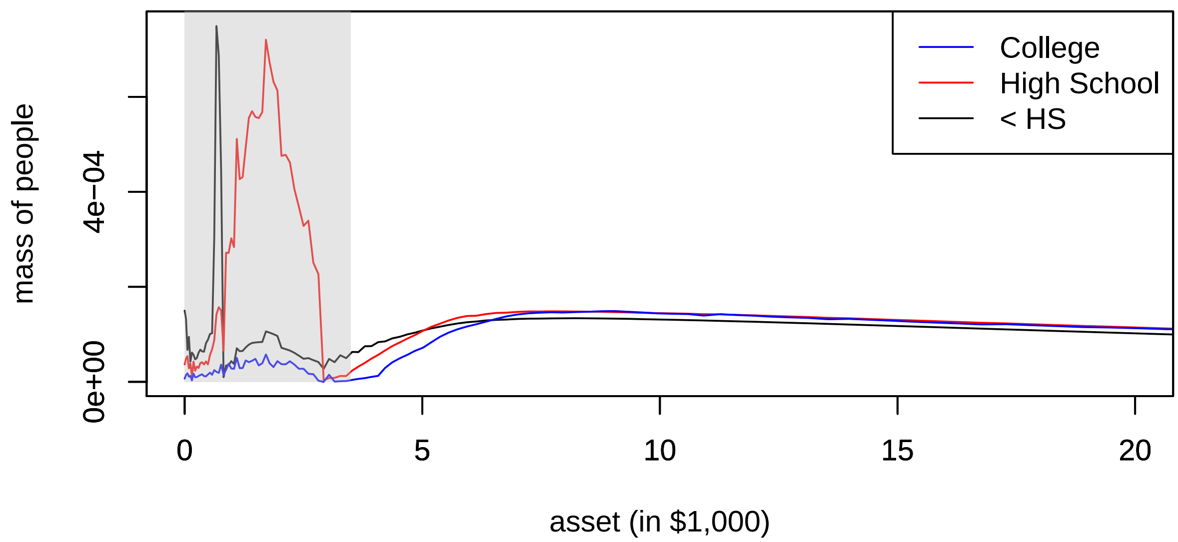


This U-shaped relationship within the W - E transition is also found in Campbell and De Nardi (2009) using the Panel Study of Entrepreneur Dynamics (PSED), taking years of schooling as proxy for productivity level. In Appendix C, we estimate this relationship using discrete choice models controlling for age, education, gender, marital status, unemployment situation and time fixed effect. We find that this relationship is statistically significant.

Entrepreneur to Worker (E - W) transition. A hump-shaped relation between the probability to switch from entrepreneurship to the traditional workforce and productivity levels is also found in the data. Again, our model is able to match this empirical finding closely. It can be explained by the fact that lowly-educated and highly-educated entrepreneurs find it more profitable to expand their businesses than switching to a worker situation, at least when the productivity state is good. Then, since averagely-qualified workers would switch to entrepreneurship when they get high level of collaterals, we should expect that only those with large returns to entrepreneurship start a business and that only few of them would want to switch back to a worker situation, even in a bad business state. However, most of the averagely-educated entrepreneurs that search for a job are those who entered entrepreneurship out-of-necessity when they were unemployed due to a lack of job opportunity. Figure 3 shows the distribution of entrepreneurs switching to a worker situation by educational attainment.

Entrepreneurs located on the left side (in the grey area) are necessity entrepreneurs in the sense that they choose to become entrepreneurs during an unemployment spell while their returns at work was greater[11] but did not find a job.

Figure 3: Transition E - W relative to the mass of each education category in entrepreneurship.



Other within transitions. The Unemployed to Worker (U - W) and the W - E transitions are targeted with our calibration strategy, in the fixed parameters part and are therefore quite close to the true data. The key thing, which is largely known, is that the probability to be laid off is decreasing in education and that the probability of finding a job is increasing with education. Transitions from Unemployment to Entrepreneurship (U - E) are overstated in the model as compared to the data for lowly-qualified unemployed workers. This is because in reality, some entry costs to entrepreneurship exist that affect low-collateralized individuals in particular. Such costs are not currently considered in our model.

4.3. Wealth, income and firm size distributions

Wealth distribution. It is now well known that the right tail of the wealth distribution can be well replicated using entrepreneurs as in Quadrini (2000) or Cagetti and De Nardi (2006). In

[11]Formally, they chose to be entrepreneur while $V^w > V^e > V^u$.

a similar framework, our model generates a considerable degree of inequality that matches the data quite well. Table 6 displays statistics concerning wealth inequality and entrepreneurship.

Table 6: Entrepreneurship and wealth distribution

top	US data		Benchmark model	
	% of wealth held	% of entrep.	% of wealth held	% of entrep.
1%	30	62	22	49
5%	54	47	52	47
10%	67	38	69	46
20%	81	26	84	42
100%	100	10.9	100	10.7

Source: US data are from Cagetti and De Nardi (2006).

Income distribution. The income distribution is calibrated to match the true data. In the model, the income gini coefficient is equal to 0.39 which is close to its data counterpart (0.36). In fact, this is due to two things: first the presence of entrepreneurs generate substantially high income, but not as large as compared to the wealth differences. Also, the two dimensions of income heterogeneity: the innate ability θ (which is related to the education level) and the productivity shock y, contribute to the generation of volatility and differences in income and therefore help in producing a fairly unequal income distribution.

Firm size distribution. In our model, there are substantial firm size differences over the entrepreneurs' education categories as well as cross-sectional differences within a given education group. Four elements explain the benchmark model's ability to generate an empirically relevant distribution of firms. First, entrepreneurs are borrowing constrained depending on their amount of collaterals (e.g. their wealth levels). Second, the decreasing returns to scale technology in the entrepreneurial sector, which endogenously determines the optimal firm size. Third, different entrepreneur productivity levels correlated with their innate abilities generate differences in returns to entrepreneurship. Lastly, the introduction of two business states (good and bad) increases even more the cross-sectional differences within a given education group. Table 7 reports various indicators concerning the entrepreneurial activities by innate ability level. As education level increases, the average firm size is higher since entrepreneurs become less financially constrained and are on average richer.

Table 7: Benchmark model: entrepreneurial activities by education level

θ grid	θ value	% in pop.	% in educ. grp	% in entrep.	avg. invest. in $1,000	avg. assets in $1,000	avg. lev. ratio %
θ_1	0.481	2.79	11.15	25.59	345	233	44.8
θ_2	0.527	5.11	10.22	46.91	481	298	48.3
θ_3	0.715	3	11.99	27.5	769	341	58.5
total	-	10.9	-	100	-	-	-
average	-	-	-	-	53	29	50.2

Source: US data are from Cagetti and De Nardi (2006).

5. Insuring entrepreneurial downside risk: policy experiments

In this section, we conduct two policy experiments in order to study the incidence of Downside Risk Insurance (DRI) in our model economy. In the first experiment, we study the effects of introducing two types of DRI in the spirit of the French *PARE* reform of 2002 as reported by Hombert et al. (2014) and related to the currently active US Self-Employment Assistance (SEA) program: we let a formerly unemployed entrepreneur who bankrupts return to the pool of unemployed with UI claims. Additionally, in the case their business activity is still solvent, the government covers the gap for any entrepreneurial income below what would have been their UI benefits. These special privileges given to formerly unemployed entrepreneurs are temporary. The second experiment is the introduction of a DRI to all entrepreneurs who bankrupt, regardless of their unemployment status, by giving them rights to UI benefits upon bankruptcy. Even though Hombert et al. (2014) have clearly laid out important empirical elements of DRI, our contribution assess the general equilibrium effects induced by price changes supported by an empirically relevant benchmark model.

For each of the experiments, we conduct three sets of analysis. First, we compute and focus on the new steady state implied by the reform. Second, we describe the transition dynamics: (i) we assume that period 0 is characterized by the steady state of our benchmark economy; (ii) in period 1, the reform is implemented while being unanticipated by agents in the economy; (iii) the economy then converges to the new steady state corresponding to the new reform. Throughout the transition, we consider two ways for the government to balance its budget: only using the proportional labor income tax τ_w or by government debt. The computation method of the transition path is described in Appendix B. Third and finally, we study the welfare consequences of the two experiments. In order to compare the welfare effects, we compute the consumption-equivalent variation (CEV). It measures the constant increment in percentage of consumption in every state that has to be given to each agent, so that he is indifferent between remaining in the benchmark economy or moving to another economy. We compute it along the transition path and at the steady state implied by the reforms.

5.1. Self-Employment Assistance program

We first implement a large scale SEA program in the spirit of the policy introduced in France in 2002. To this end, we compute a new value function for an entrepreneur entering in the program (that is, a previously unemployed worker). Now, if such an entrepreneur goes bankrupt, he falls in the short-run unemployment pool and can claim UI benefits, instead of the long-run unemployment pool as in the benchmark economy. Moreover, if he does not go bankrupt, the government provides him an income complement if his current returns to entrepreneurship is lower that what he would get as unemployed worker (i.e. his UI benefits). This insurance is temporary and the entrepreneur has a probability p_l to fall in a normal entrepreneurial regime. The recursive program of an entrepreneur benefitting from the SEA is thus:

$$V^{e_{UI}}(a,j) = \max_{c,a',s_w,k} \Big\{ u(c,s_w,0) + \beta \Big[(1-\mu) \Big(\pi_w(s_w) E V^e_{w,e'}(a',j') + (1-\pi_w(s_w)) E V^e_{u,e'}(a',j') \Big) + \mu \Big((1-\pi_w(s_w)) V^{u_s}(a',1) + \pi_w(s_w) E_y V^w(a',y',0) \Big) \Big] \Big\}$$

Subject to: (22)

$$c = \max\{(1-\tau_c)(a_j g(\theta)k^\nu - (1+r)(k-a) + (1-\delta)k), w\theta z\} - a'$$

$$a' \geq 0 \qquad k \geq 0 \qquad s_w \geq 0$$

$$(IC) \quad f\left[a_j g(\theta)k^\nu + (1-\delta)k\right] - (1+r)(k-a) \geq 0$$

$$V^e_{w,e'}(a,j) = p_l \max\{E_y V^w(a,y,1), V^e(a,j)\} + (1-p_l)\max\{E_y V^w(a,y,1), V^{e_{UI}}(a,j)\}$$

$$V^e_{u,e'}(a,j) = p_l \max\{V^e(a,j), V^{u_l}(a)\} + (1-p_l)\max\{V^{e_{UI}}(a,j), V^{u_s}(a)\}$$

And the optimal searching effort s_w to find a job is given by:

$$\psi_w(s_w^*)^{\psi_w} = \beta\kappa_w e^{-\kappa_w s_w}\Big((1-\mu)EV^e_{w,e'}(a',j') + E_y V^w(a',y',0)\Big)$$

Steady state results. Results comparing the steady states of the benchmark economy and with the SEA program are reported in table 8[12].

First, a SEA that insures only unemployed workers in their entrepreneurial activity has relatively small effects on macroeconomic variables. Production and capital levels in the corporate and the entrepreneurial sectors are slightly higher than in the benchmark economy, but this is negligible. Indeed, the reform impacts only a small fraction of the population (unemployed workers who manage to start a business) and therefore induces relatively small change in aggregates and prices. From an utilitarian welfare perspective, the change is also quite small in average for all occupations.

As displayed in figure 4, this policy encourages unemployed workers to search for a business idea and therefore affect the incentive to search for a new job. After the reform, unemployed workers lower their job search effort intensity and increase their efforts to exploit their business idea. The fraction of entrepreneurs in the economy is slightly higher but there is almost no change in the unemployment rate[13]. This is because by reducing their search effort intensity to get a corporate job, unemployed workers are less likely quit unemployment this way. Thus, all reduction in unemployment due to the policy is almost offset by the increased disincentive to find a job. Figure 5 reports the absolute negative change in the probability to find a job and the positive change in the probability to switch to an entrepreneurial situation, taking into

[12] We do not distinguish between debt or tax adjustments since the results are very close.

[13] Notice also that the fraction of workers in the economy is lower than before the implementation of the reform because unemployed workers tend to search less for a job.

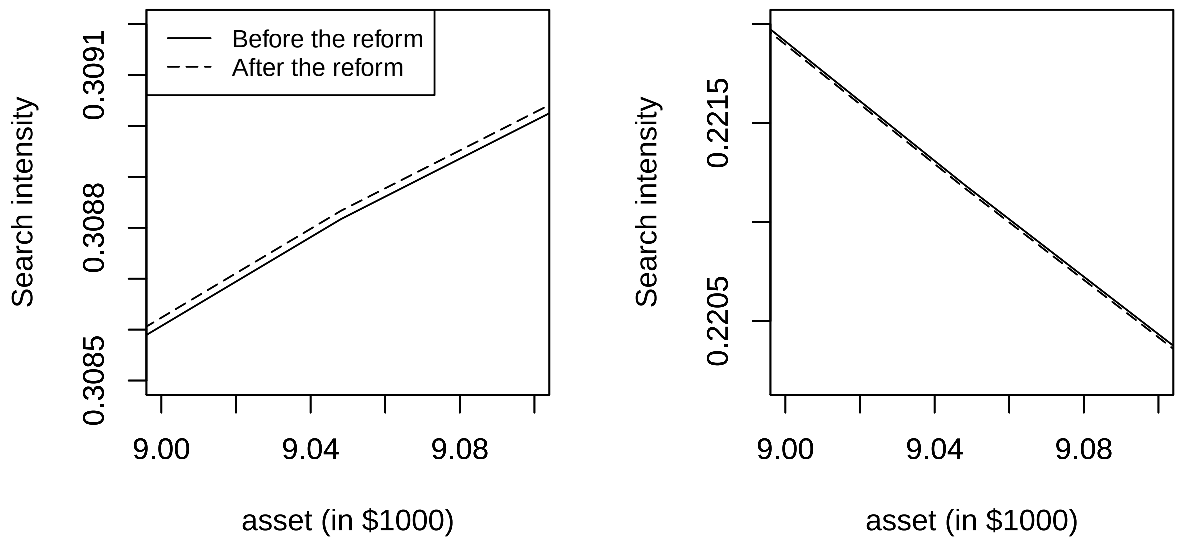
Table 8: Large scale Self-Employment Assistance (SEA) program

	Benchmark	With SEA	Variation
Fraction of entrep. (%)	10.897	10.912	0.138%
Unemployment rate (%)	5.316	5.315	$< 0.05\%$
Fraction of workers (%)	83.787	83.773	$< 0.05\%$
Avg Welfare (tot.)	-18.025	-18.034	$< 0.05\%$
Avg Welfare (Work.)	-18.699	-18.698	$< 0.05\%$
Avg Welfare (Ent.)	-12.38	-12.385	$< 0.05\%$
Avg Welfare (Unemploy.)	-21.390	-21.395	$< 0.05\%$
Total Production	2.645	2.647	0.08%
Entrep. Production	1.101	1.102	0.09%
Corp. Capital	4.536	4.538	$< 0.05\%$
Entrep. Capital	3.714	3.717	0.08%

account the implied search effort. For most of the individuals, the decrease in the probability to find a job is higher than the increased probability to switch to an entrepreneurial situation. This is consistent with the last point. Indeed, unemployed worker have in average a lower probability to find a job ($-3.9x10^{-}6$) and a higher probability to switch to entrepreneurship ($+3.4x10^{-}6$), which explains why unemployment rate does not decrease so much with that reform.

Table 9 reports the change in the pool of entrepreneurs. The increase in entrepreneurship rate due to the reform is uniform among all education groups. This is consistent with the finding of Hombert et al. (2014) in France. In contrast, the average firm size and the average entrepreneurial asset level increase. This is because the policy has encouraged the wealthiest unemployed workers to start their business relative to others, mainly due to the less stringent

Figure 4: Search effort intensity to get a business idea (left) and to find a job (right): short-run unemployed worker



borrowing constraint that they face.

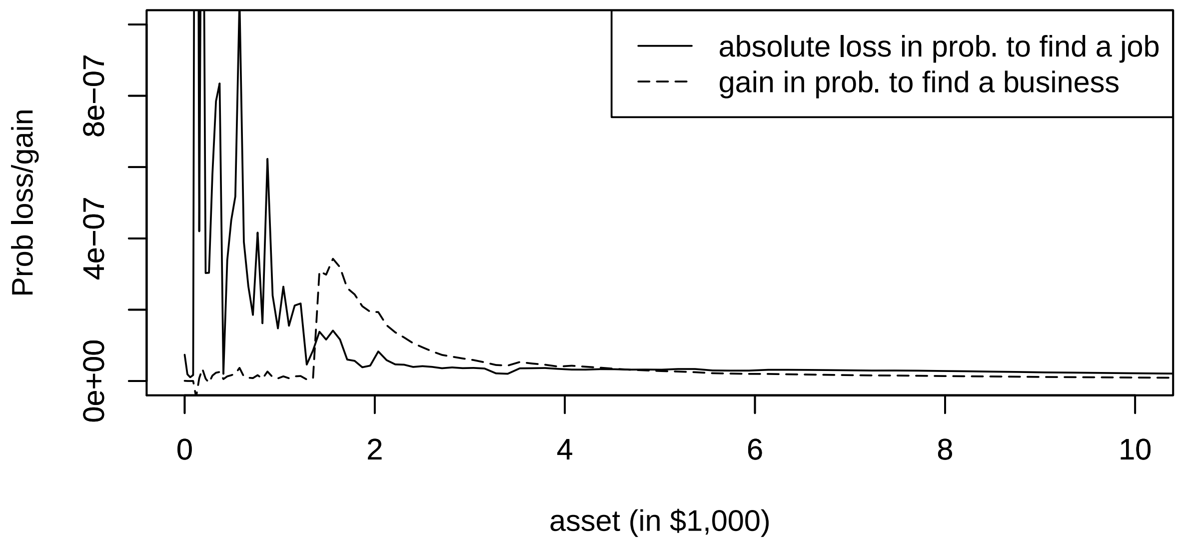
Transition dynamics. As shown in figure 6, when the policy is implemented in period 0, unemployment rate falls because some unemployed workers find it interesting to start a business.

With the additional insurance implied by the program, the unemployed are better off. This reduces the precautionary incentive to save for workers as well as for short-run unemployed workers in the economy. As a result, individuals dissave at period 0, lowering the capital and the wage levels and increasing the interest rate.

As time goes by, new entrepreneurs accumulate more capital and invest in their firms. The capital stock and the wage level increase steadily until reaching the new steady state whereas the interest rate is reduced. Moreover, after the first periods, the unemployment rate tends to increase because the lower interest rate decrease the cost for borrowing in the purpose of starting a business: business search intensity increase and job search intensity decrease.

Note that the two instruments used by the government (debt and taxes) have similar effects. Indeed, even if the government provides additional insurance, the fraction of individuals concerned is so small as compared to the whole population that the effect of the adjustment

Figure 5: Probability to find a job and probability to start an entrepreneurial business



is almost absent.

Welfare analysis of the reform. Table 10 shows the welfare consequences, evaluated with the CEV, induced by the transition to the new steady state as well as between the benchmark economy and the reformed economy[14].

At a steady state level, recall that the SEA program provides additional insurance to short-run unemployed workers which directly translate into a higher utility to all workers (in the case where they are laid off) and short-run unemployed workers (if they enter the program). This higher valuation also appears in the entrepreneur's valuation of outcomes since such an individual is now better off when choosing to switch to a worker situation. Also, note that the wage is higher after the implementation of the reform, which increases even more the returns of working. In contrast, the lower interest rate benefits the entrepreneurs.

During the transition, workers bear a slight cost due to the sudden fall in the wage level. Finally, the bottom 50% unemployed workers, who face the most stringent borrowing constrains and therefore those who often prefer to work, face the same utility cost as the

[14]Notice again that in the case of a SEA program, the two instruments used to close the government budget have small effects on macroeconomic variables, so that all welfare effects go in the same direction.

Table 9: Downside risk insurance in a Self-Employment Assistance (SEA) program

	benchmark			with SEA (tax adj.)		
	θ_1	θ_2	θ_3	θ_1	θ_2	θ_3
% of entrep.	11.157	10.219	11.978	11.169	10.231	11.992
% change	-	-	-	0.11%	0.12%	0.12%
(rlv. to bench.)						
Avg.firm	267.21	339.65	410.65	267.27	339.67	410.69
Avg.asset	233.37	297.66	341.29	233.42	297.69	341.33

workers. This is because the UI is proportional to the wage level and fluctuates in the same direction.

Figure 7 summarizes the welfare consequences of the reform for the two instruments and the three occupations. In evaluating welfare, we take into account the costs associated with the transition. As the benefits from the new reform largely offset the cost of the transition, all categories are now better off. The reform provides large welfare gains to wealth poor people as compared to wealth rich ones: as mentioned before, poor people are less collateralized and can only start relatively small firms with low profits. Thus, those individuals directly benefit from the policy through the complement distributed by the government when the returns to entrepreneurship is lower than UI benefit[15].

Table 10: Consumption-equivalent variation with SEA

	CEV (debt adjust.)		CEV (tax adjust.)	
	Trans.	SS	Trans.	SS
Entrep.	0.002%	0.006%	0.002%	0.007%
bottom 50%	-(<0.001%)	0.011%	-(<0.001%)	0.012%

[15] Again, this result holds for the two types of instruments used to balance the government budget.

top 50%	0.005%	0.001%	0.004%	0.002%
Workers	-0.003%	0.025%	-0.003%	0.027%
bottom 50%	-0.005%	0.033%	-0.005%	0.035%
top 50%	-(<0.001%)	0.017%	-(<0.001%)	0.019%
Unemp. Workers	0.001%	0.034%	0.001%	0.037%
bottom 50%	-0.009%	0.058%	-0.009%	0.061%
top 50%	0.011%	0.011%	0.0106%	0.0128%

5.2. Larger Downside Risk Insurance policy

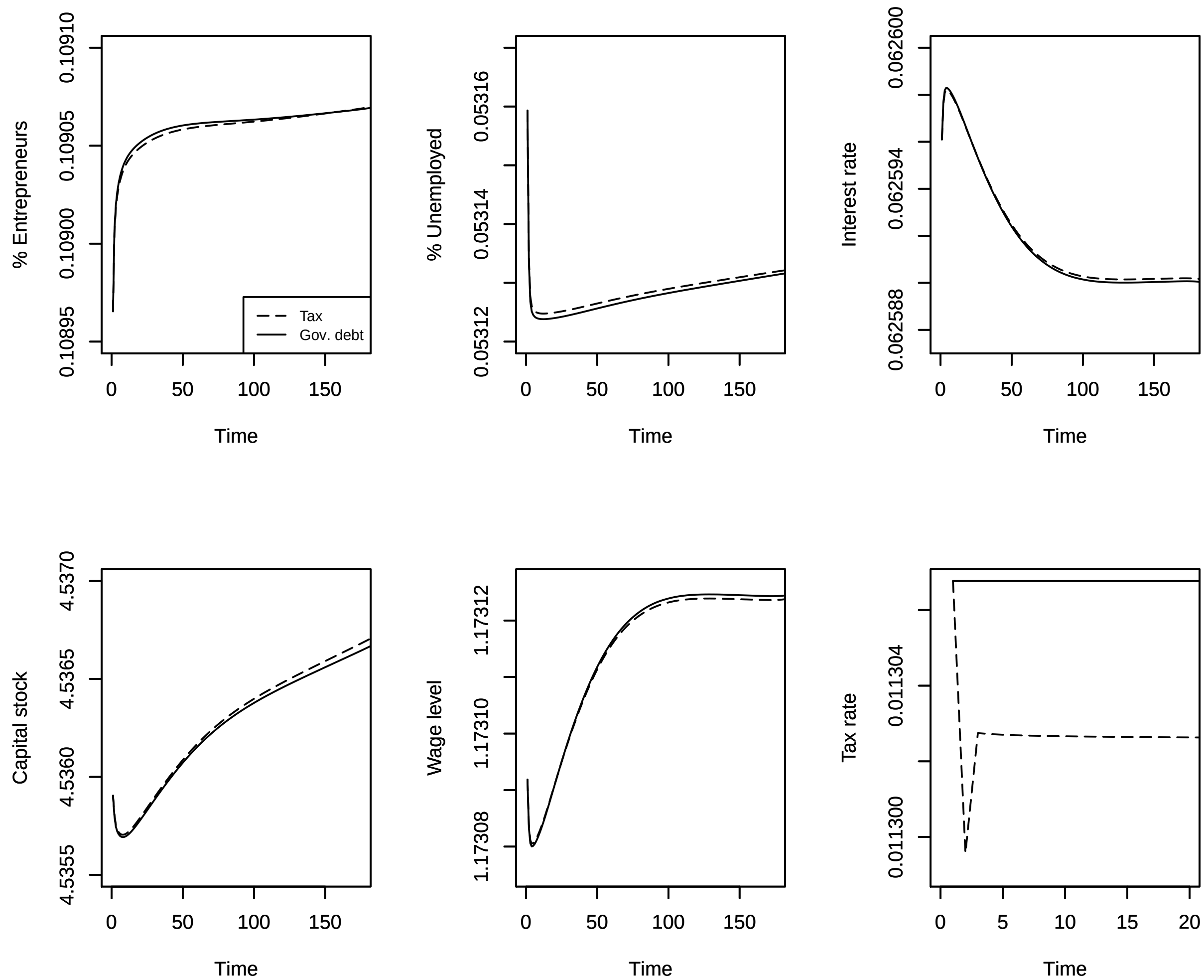
In this second experiment, we introduce DRI to all entrepreneurs who bankrupt. We assume now that the entrepreneur gets UI benefits proportional to his education level in case of a bankruptcy. That is, now, when the entrepreneur falls in the unemployment pool with probability μ and does not find any job opportunity, he joins the short-run unemployment pool.

Steady states.. When the DRI is implemented, the fraction of entrepreneurs in the economy increase by more than 1% as shown in table 11. As a result, total production and capital in the two sectors are higher mostly because entrepreneurs are more numerous and accumulate more.

After the reform, unemployment rate increases by a very small amount, suggesting that the lower matching between the corporate sector and the unemployed workers (due to the induced disincentive to search for a job) is stronger than the contribution of new entrepreneurs who started their activity after an unemployment situation[16]. First, because it is easier to find a job while being unemployed than finding a business idea. Second, because unemployed workers tend to be on average poorer than other occupations and thus face more stringent borrowing constrains and can not immediately switch to entrepreneurship. In the end, most of the change in the fraction of entrepreneurs comes from workers who now find it interesting to start their business because of the DRI policy. Since entrepreneurship is more valuable, all

[16] To be more precise, the higher entrepreneurial value effect is not sufficient enough to offset the effect of a lower incentive to search for a job

Figure 6: Evolution of aggregate quantities

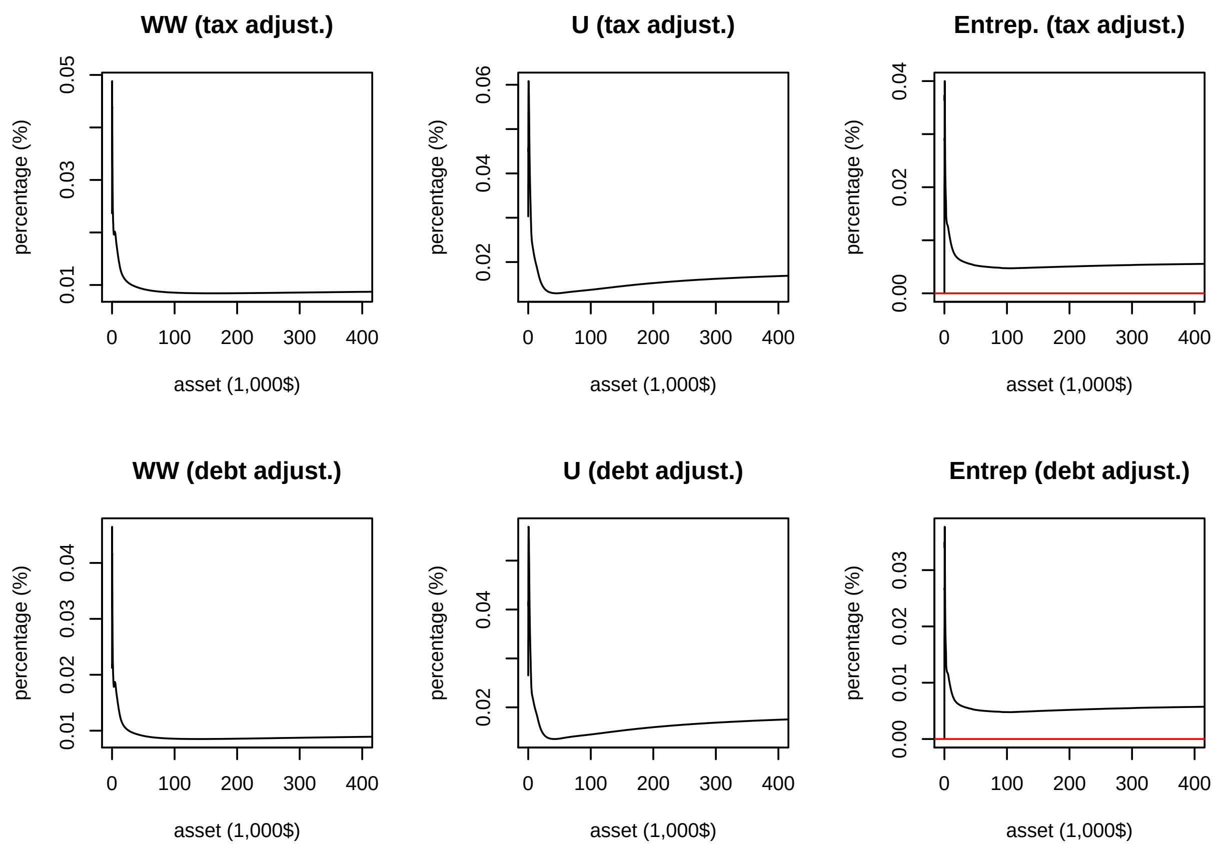


people is the economy accumulate more assets in the perspective of opening their business later. Hence, the capital stock increases as well as the corporate production.

When we distinguish between the two government budget adjustment policies, the effects on macroeconomics variables is low. Tax adjustment increases the fraction of entrepreneurs as well as the production as compared to a debt adjustment policy. However, the difference is less than 0.1%. The lower outcomes when using debt adjustment is mainly due to the higher interest rate which impacts negatively entrepreneurial investment.

From a purely utilitarian welfare perspective, on average, all occupations benefit from this

Figure 7: Consumption Equivalent Variation



additional insurance[17]. However, note that because workers does not have to pay any tax with debt adjustment policy, the benefits from the reform provides higher welfare in that case than when government uses labor income taxes.

Table 12 displays the changes in the pool of entrepreneurs between the benchmark economy and the reformed one. Individuals with middle and high-education levels more likely enter entrepreneurship after the DRI reform. This is again because low-qualified individuals are on average poorer and only few of them own enough collaterals in order to start a profitable business[18]. In addition, the policy lowers the average firm size since new entrepreneurs are

[17]The reason why the average welfare of the entrepreneurs is lower than before can be explained by the new entries. In fact, new entrepreneurs are on average poorer than incumbents which reduces the average asset level held by the whole population of entrepreneurs and the average welfare.

[18]In the sense that the returns to entrepreneurship is higher than the return to work.

Table 11: Downside risk insurance (DRI) to all entrepreneurs

		Tax adjustment		Debt adjustment	
	Benchmark	With DRI	Variation	With DRI	Variation
Fraction of entrep. (%)	10.897	11.031	1.23%	11.024	1.165%
Unemployment rate (%)	5.316	5.318	$< 0.05\%$	5.318	$< 0.05\%$
Fraction of workers (%)	83.787	83.651	-0.162%	83.658	-0.154%
Avg Welfare (tot.)	-18.025	-18.010	0.083%	-18.009	0.089%
Avg Welfare (Work.)	-18.699	-18.691	$< 0.05\%$	-18.688	0.059%
Avg Welfare (Ent.)	-12.38	-12.39	-0.08%	-12.389	-0.073%
Avg Welfare (Unemploy.)	-21.390	-21.177	1.01%	-21.174	1.01%
Total Production	2.645	2.654	0.34%	2.653	0.302%
Entrep. Production	1.101	1.110	0.817%	1.109	0.727%
Corp. Capital	4.536	4.544	0.176%	4.543	0.154%
Entrep. Capital	3.714	3.744	0.808%	3.741	0.727%

on average poorer than incumbents. Indeed, the asset (or wealth) threshold at which an individual find it profitable to start a business is lower than before the reform implementation, so that the distribution of asset held by entrepreneurs shift to the left. Hence, introducing a DRI to all entrepreneurs affect the pool of entrepreneurs in two ways. First, it increases the fraction of averagely and highly-educated entrepreneurs and second, it lower the average firm size.

Transition dynamics. We present in figure 8 the evolution of macroeconomic variables along the transition path for the two instruments used to close the government budget.

When the DRI reform is implemented in period 0, every individuals in the economy dissave

Table 12: Downside risk insurance to all entrepreneurs

	benchmark			with DRI (tax adj.)			with DRI (debt adj.)		
	θ_1	θ_2	θ_3	θ_1	θ_2	θ_3	θ_1	θ_2	θ_3
% of entrep.	11.15	10.22	11.99	11.27	10.35	12.14	11.27	10.35	12.13
% change (rlv to bench.)	-	-	-	1.08%	1.27%	1.25%	1.08%	1.27%	1.17%
Avg.firm	267.21	339.65	410.65	266.63	338.09	409.04	266.60	338.08	409.01
Avg.asset	233.37	297.66	341.29	231.99	296.38	340.21	231.96	296.36	340.19

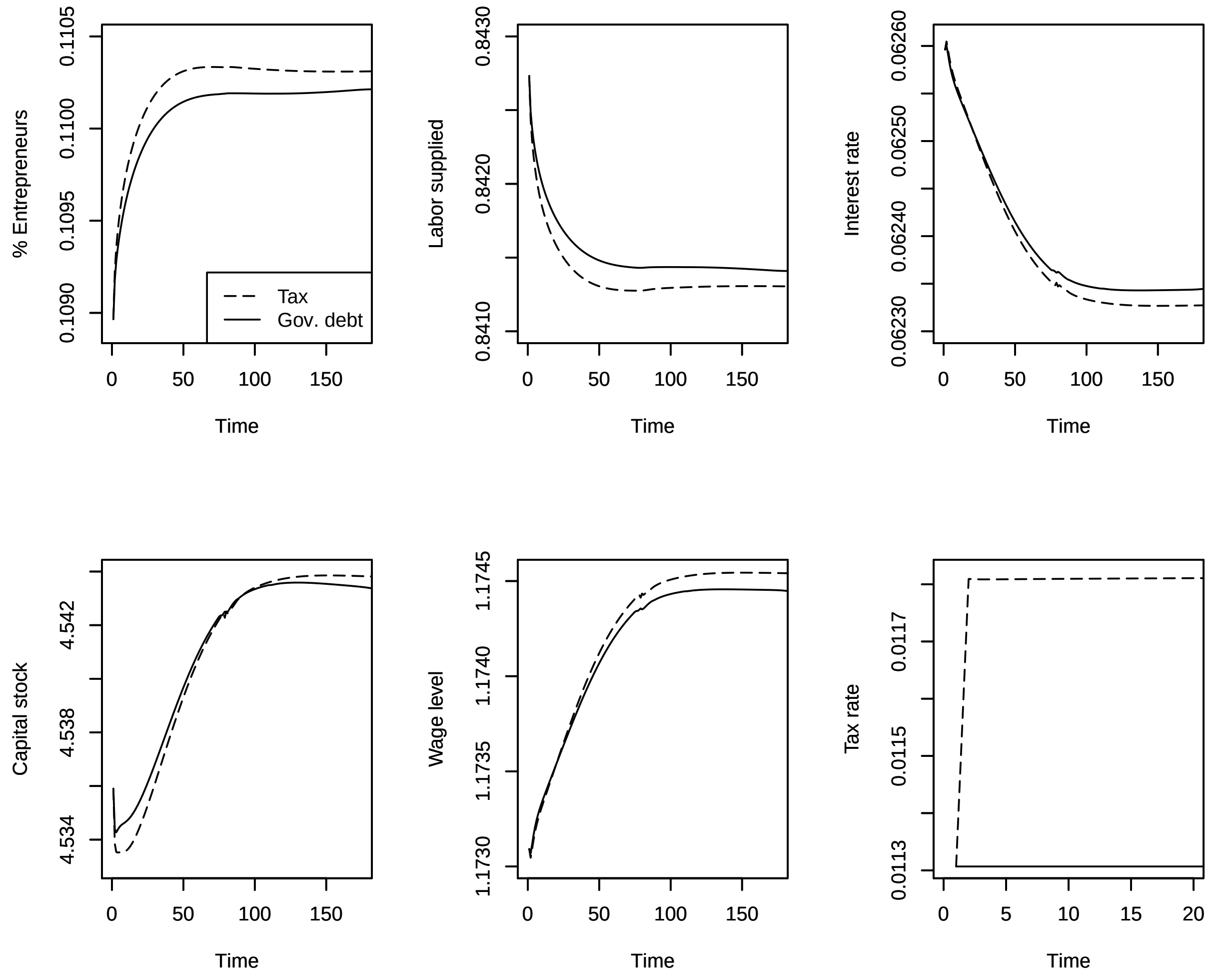
due to a lower precautionary motive. The effect is stronger when the government uses taxes since individuals dissave to counterbalance their lower after tax income reduction. In total, this lowers the capital stock and the production in the corporate sector. In subsequent periods, bother the the growing fraction of entrepreneurs that save more and higher capital accumulation from the whole population in the hopes of becoming entrepreneurs lower the interest rate. This impacts the entrepreneur's cost of borrowing and therefore increase even more the incentive to start a business.

When the government uses debt to balance its budget, the demand for assets is higher in that economy than in the tax financed economy. Thus, it turns out that the cost at which entrepreneurs finance their investment is higher in the debt financed economy as evidenced by the higher interest rate and this affects negatively the fraction of entrepreneurs as compared to the tax adjustment case.

Finally, as the number of workers decreases in the economy and that the capital level increases, the wage level steadily increases. This improves the worker's value and lower the effect of the DRI. In total, this general equilibrium effect is too small to counterbalance the effect of the additional insurance on the fraction of entrepreneurs in the economy.

Welfare consequences of the reform. Table 13 summarizes the welfare impact, along the transition and between the two steady states,of introducing a DRI when it is financed either

Figure 8: Evolution of aggregate quantities



by government debt or by taxes.

Table 13: Consumption-equivalent Variation

	CEV (debt adjust.)		CEV (tax adjust.)	
	Trans.	SS	Trans.	SS
Entrep.	<0.05%	0.419%	0.176%	0.185%
bottom 50%	-0.219%	0.763%	<0.05%	0.454%
top 50%	0.209%	0.079%	0.347%	-0.079%
Workers	-0.591%	0.752%	-0.204%	0.142%
bottom 50%	-0.805%	0.939%	-0.369%	0.234%
top 50%	-0.386%	0.573%	-0.046%	0.055%
Unemp. Workers	-0.522%	0.777%	0.087%	-0.114%
bottom 50%	-1.339%	1.545%	-0.555%	0.32%
top 50%	0.261%	0.038%	0.702%	-0.531%

At the steady state, for the two adjustment policies, all agents are better off except wealthy unemployed workers if the tax rate is used to balance the government budget. Indeed, because such individuals are wealthier, their incentive to search for a job or a business idea is lower than others and are therefore less likely to exit unemployment. Moreover, they are directly affected by the lower interest rate induced by the reform, which is stronger when the government uses taxes. In total, when the government debt is used to balance the budget, the steady state welfares increases by more than 2 relative to the welfare gain when using tax adjustment. This is because when the government rises taxes on labor income, this mainly lowers the worker's value and this translates to all other occupations in the economy.

During the transition, workers are the most affected by the reform. First, due to the price changes, which modifies the consumption-saving tradeoff. The transition costs are higher when government debt is used than when taxes are raised. This is due to the fact that capital adjustment is smoother in the former case.

Note that the DRI does not improve the welfare of the bottom 50% unemployed workers along the transition since these agents face more stringent borrowing constrains and are thus less likely to enter entrepreneurship. These individuals are thus linked to the cost incurred by the workers. Finally, we point out the bottom 50% entrepreneurs's losses during the transition when debt is used. Indeed, poor-entrepreneurs are those who are more likely to switch to a worker situation and therefore directly benefit / lose from an increase / decrease in the value as worker. Also, when debt is used, entrepreneurs accumulate capital at a lower rate as compared to a tax adjustment case since the cost of borrowing is higher along the transition path. Hence, the transitional gains are reduced.

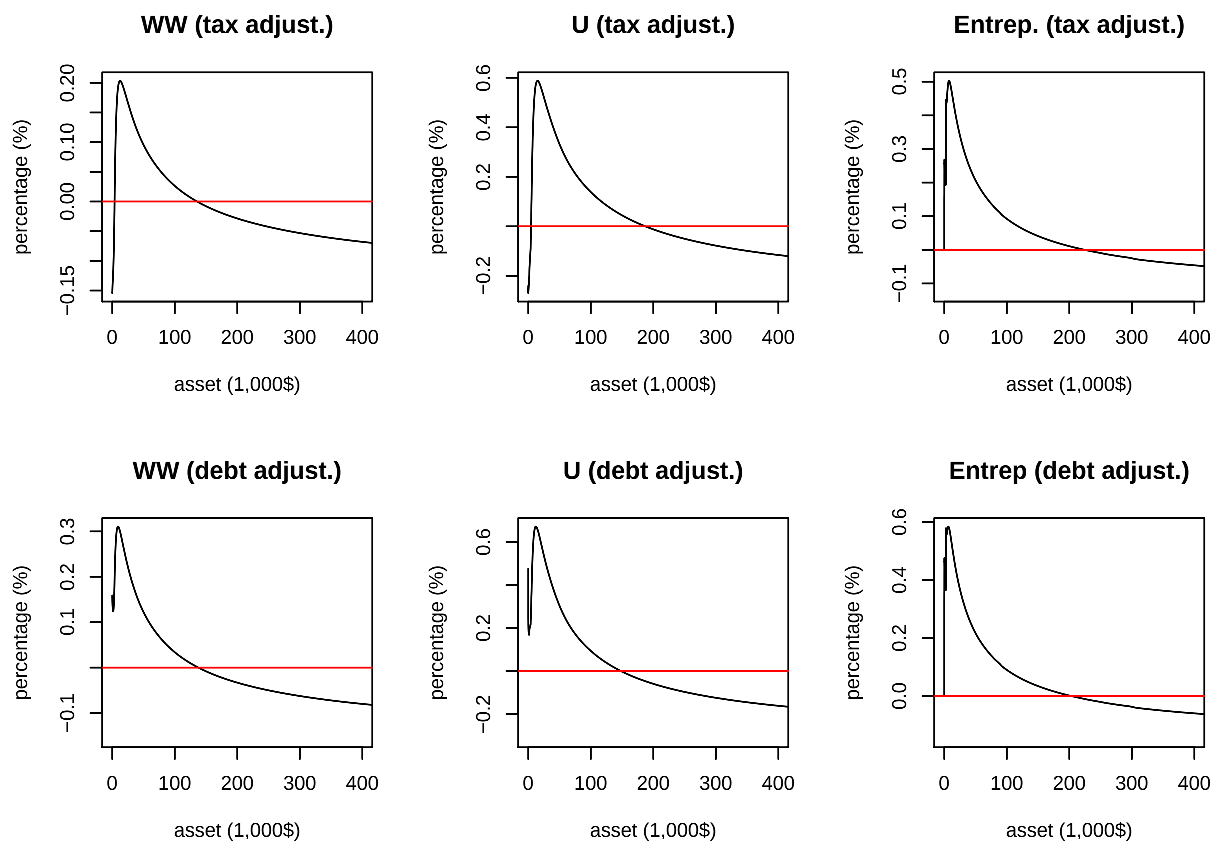
Figure 9 displays the welfare gains by education and asset level. As wealth increases, the policy becomes costly for each occupation since wealthy individuals draw a large amount of their income through interests on their accumulated asset. As the interest rate is now lower, they are worse off. For people with lower wealth levels, except for those who are very poor when the policy is financed through taxes, they are all better off. This is because the rise in the entrepreneur's value affect positively all other occupations as well. Finally, welfare benefits are higher when government finances the reform through debt while macroeconomic outcomes (production and capital stocks) are lower.

6. Conclusion

We studied the effects of introducing downside risk insurance in an economy where agents can start their business and become entrepreneur. Our model considers three types of occupation: worker, entrepreneur and unemployed worker and endogenous occupational choices. We show that our augmented Bewley (1983) - Huggett (1993) - Aiyagari (1994) model with labor market frictions is able to reproduce many observed facts in the data, most notably those related to mobility between occupations and wealth and income statistics.

In such an environment, we assess the effect of two downside risk insurance reforms: a large scale Self-Employment Assistance (SEA) program and a Downside Risk Insurance (DRI) given to all entrepreneurs in the economy. We show that the two reforms induce relatively low changes in the unemployment rate since unemployed workers respond by lowering their incentive to find a job. For the SEA, we get that the macroeconomic effects are negligible and that the cost of the policy is quite small. The pool of entrepreneurs is not affected by the reform which is consistent with the empirical study conducted by (Hombert et al.,

Figure 9: Consumption Equivalent Variation



2014). Welfare inspections provide insights on the benefits of such a reform. We notably get that the SEA is beneficial when taking into account all transition costs for all occupations, independently of the individual's state. The larger DRI reform has stronger macroeconomic effects. We show that when the reform is financed through taxes, the production is higher than when it is financed through debt. When such a reform is implemented, the fraction of middle and highly-educated entrepreneurs increase relative to lowly-educated entrepreneurs. Moreover, average firm size is reduced since relatively poorer individuals find it interesting to start their business. Finally, the welfare analysis of that reform shows that the cost in terms of consumption is negative for wealthy people due to a lower interest rate, but it is beneficial for most of the individuals. Finally, welfare gains are stronger when the government uses debt adjustment to balance its budget. From a political point of view, there is a tradeoff between using the debt instrument or the tax instrument to balance the government budget in our experiment. Indeed, labor income taxes tend to lower the welfare gains induced by the reform but increase the macroeconomic outcomes, relative to the case where the debt adjustment is used.

For future research, a better bankruptcy specification in which the entrepreneur could voluntary choose to default or to remain in business is under consideration. Also, it would be interesting to explicitly account for endogenous labor, so that entrepreneurs could hire workers. That extension could substantially increase the effects of our policy experiments, by lowering the unemployment rate through entrepreneurial sector labor demand.

Appendix A. Data sources

[CPS description here]: to get transition data.

[SCF description here]: to compare wealth distribution.

[SBO description here]: to compare firms' size distribution.

Appendix B. Algorithms

Steady state.. The algorithm is organized as follows.

1. Initialize a full dimension grid space composed of all different possible asset values (a), productivity level (y), innate ability (θ) and entrepreneurial state (j). The maximum asset level is chosen sufficiently large to get ergodicity of the policy functions, so that the household's saving decision is not binding.
2. Guess an initial tax parameter τ_w in addition to prices (w and r).
3. Given these parameters, solve the value functions using value function iteration following the method in Stokey et al. (1989). Appendix D show how we solve for the optimal searching effort in the unemployed worker case.
4. Construct the transition matrix $\mathbf{M}$ generated by Π_y, Π_j, the saving decision and the search effort intensity decisions. Compute the associated stationary measure of individuals $\Gamma(\mathbf{x})$, by first guessing an initial mass of one of households with zero asset (for instance, $\Gamma(yw, y_0, \theta_0, a) = 1$) and then by iterating on $\Gamma'(\mathbf{x}) = \mathbf{M}\Gamma(\mathbf{x})$ until $|\Gamma'(\mathbf{x}) - \Gamma(\mathbf{x})| < \mu$, with μ very small.
5. Compute the resulting total asset level and total labor supplied in the economy and total investment level and total labor hired in the entrepreneurial sector. Total capital

invested and in the non-entrepreneurial sector is given as the difference between total savings net of government debt and total capital invested in the entrepreneurial sector. Total labor used in the non-entrepreneurial sector is given by total labor supplied by workers.

6. Update prices (r, w) using the marginal productivities in the non-entrepreneurial sector and the tax rate (τ_w) to close the government budget up to a relaxation.

Transition dynamic.. We assume that the economy is in the initial steady state in period 0 and the reform is announced and implemented in period 1. The economy makes a transition to reach the final steady state in period T. We choose T large enough so that the resulting stationary distribution in period T is close enough to the steady state distribution after the reform.

1. Guess a path for the level of capital, labor as well as τ_w (or B in case where we close the budget using government debt). Compute the resulting prices r and w.
2. Use the value function of the final steady state after the reform and solve the households' problem backwards starting from T until period 1.
3. Use the distribution of the initial steady state before the reform and the policy functions computed in step 2 and compute the path of the distribution.
4. Given these distributions, compute a new path for capital, labor and the tax rate (or government debt), and the resulting prices. Iterate from step 2 until the difference between the initial path is close enough to the final path.
5. When converge is achieved, check if the final distribution in period T is close enough to what should be the steady state in period T after the reform up to a criterion. If the two distributions are similar, then stop, else, increase the number of periods T.

Appendix C. Estimation of the transitions between occupations

Wage level is a better proxy for working skills, we use it when available (when the individual is currently in employment). Otherwise, we use the family income. These are CPS basic data.

Below are reported discrete choice model results (OLS and Probit) between the probability to switch and various explanatory variables.

[ADD NON-PARAMETRIC ANALYSIS]

Table C.14: OLS regression on the probability to switch from a given state to another

	E - WW	E - U	WW - E	WW - U	U - E	U - WW
Sexe*	$-.034^{***}$	$.003^{***}$	$.013^{***}$	$.006^{***}$	$.006^{***}$	.001
	(.004)	(.001)	(.001)	(.001)	(.002)	(.007)
Age	$-.002^{***}$	$-.0004^{***}$	$.001^{***}$	$-.0004^{***}$	$.001^{***}$	$-.002^{***}$
	(.0002)	(.00004)	(.00002)	(.00002)	(.0001)	(.0002)
Family inc.	$.022^{*}$	$-.002^{***}$			$.002^{***}$	$.014^{***}$
	(.011)	(.0002)			(.0003)	(.001)
Family inc.^{2}	$-.003^{**}$					
	(.001)					
Family inc.^{3}	$.0001^{**}$					
	(.0001)					
Wage			$-.003^{***}$	$-.001^{***}$		
			(.0003)	(.0001)		
$Wage^2$			$.0001^{***}$			
			(.00004)			
$Wage^3$			.000001			
			(.000001)			
Unemp. dur.					$-.0003^{***}$	$-.002^{***}$
					(.00005)	(.0001)
Agg. Unemp.					$.006^{***}$	$-.005$
					(.002)	(.006)
Constant	$.317^{***}$	$.047^{***}$	$-.005^{***}$	$.039^{***}$	$-.057^{***}$	$.527^{***}$
	(.027)	(.003)	(.001)	(.001)	(.010)	(.032)
Observations	40,051	40,051	381,443	381,443	23,150	23,150

Note: *p<0.1; **p<0.05; ***p<0.01

Source: estimation using CPS data from 1994 to 2015.

(*) dummy variables

Table C.15: Probit regression on the probability to switch from a given state to another

	E - WW	E - U	WW - E	WW - U	U - E	U - WW
Sexe*	$-.114^{***}$	$.082^{**}$	$.184^{***}$	$.163^{***}$	$.183^{***}$	$-.038^{**}$
	(.015)	(.038)	(.009)	(.008)	(.039)	(.017)
Age	$-.010^{***}$	$-.009^{***}$	$.010^{***}$	$-.008^{***}$	$.013^{***}$	$-.006^{***}$
	(.001)	(.001)	(.0003)	(.0003)	(.001)	(.001)
Family inc.	.003	$-.037^{***}$			$.023^{***}$	$.029^{***}$
	(.034)	(.005)			(.005)	(.002)
Family inc.^{2}	$-.004$					
	(.004)					
Family inc.^{3}	$.0003^{*}$					
	(.0002)					
Wage			$-.061^{***}$	$-.012^{***}$		
			(.005)	(.001)		
$Wage^2$			$.004^{***}$			
			(.001)			
$Wage^3$			$-.0001^{***}$			
			(.00002)			
Unemp. dur.					$-.002^{***}$	$-.006^{***}$
					(.001)	(.0003)
Agg. Unemp.					$-.015$	$-.057^{***}$
					(.010)	(.005)
Constant	$-.186^{**}$	-1.473^{***}	-2.488^{***}	-1.675^{***}	-2.726^{***}	$.389^{***}$
	(.082)	(.090)	(.017)	(.014)	(.094)	(.040)
Observations	40,051	40,051	381,443	381,443	23,150	23,150

Note: *p<0.1; **p<0.05; ***p<0.01

Source: estimation using CPS data from 1994 to 2015.

(*) dummy variables

Appendix D. Optimal searching effort: unemployed worker case

The derivative of the unemployed individual program with respect to the searching effort types are given by these two equations

$$\frac{\partial V_\epsilon^u(y,a,1)}{\partial s_w} = -\psi_w(s_w)^{\psi_w} + \beta\kappa_w e^{-\kappa_w s_w}\Big[(1-\zeta)\big[(1-\pi_e(s_e))(EV_w(1)-EV_u(1)) + \pi_e(s_e)(EV_{w,e}(1)-EV_{e,u}(1))\big] + \zeta(EV_w(0)-EV_u(0))\Big] = 0 \tag{D.1}$$

$$\frac{\partial V_\epsilon^u(y,a,1)}{\partial s_e} = -\psi_e(s_e)^{\psi_e} + \beta\kappa_e e^{-\kappa_e s_e}(1-\zeta)\Big[(\pi_w(s_w)(EV_{w,e}(1)-EV_w(1)) + (1-\pi_w(s_w))(EV_{e,u}(1)-EV_u(1))\Big] = 0 \tag{D.2}$$

Using the notation $\mathcal{P}(s_w) = \pi(s_w)(EV_{w,e}(1)-EV_w(1)) + (1-\pi(s_w))(EV_{e,u}(1)-EV_u(1))$ then we have for fixed s_w

$$1 - \frac{\psi_e(s_e^*)^{\psi_e}}{\beta\kappa_e(1-\zeta)\mathcal{P}(s_w)} = \pi_e(s_e^*) \tag{D.3}$$

Several cases can be study to analyse the effect of increasing s_w on the optimal searching effort s_e^*.

- The case where the unemployed individual is too poor that he always find optimal to not invest to start a business (i.e $EV_w(1) > EV_u(1) > EV_e(1)$), we have $\mathcal{P}(s_w) = 0 \quad \forall s_w$. In that case $\pi(s_e^*) = 0$ and $s_e^* = 0$.

  Given that the individual receive an idea, he never find it optimal to search for opening the business. The idea is completely loss.

- When the unemployed individual is in the necessity share, so that $EV_w(1) > EV_e(1) > EV_u(1)$, then we obtain $\mathcal{P}(s_w) = (1-\pi(s_w))(EV_e(1)-EV_u(1)) > 0 \quad \forall s_w \geq 0$.

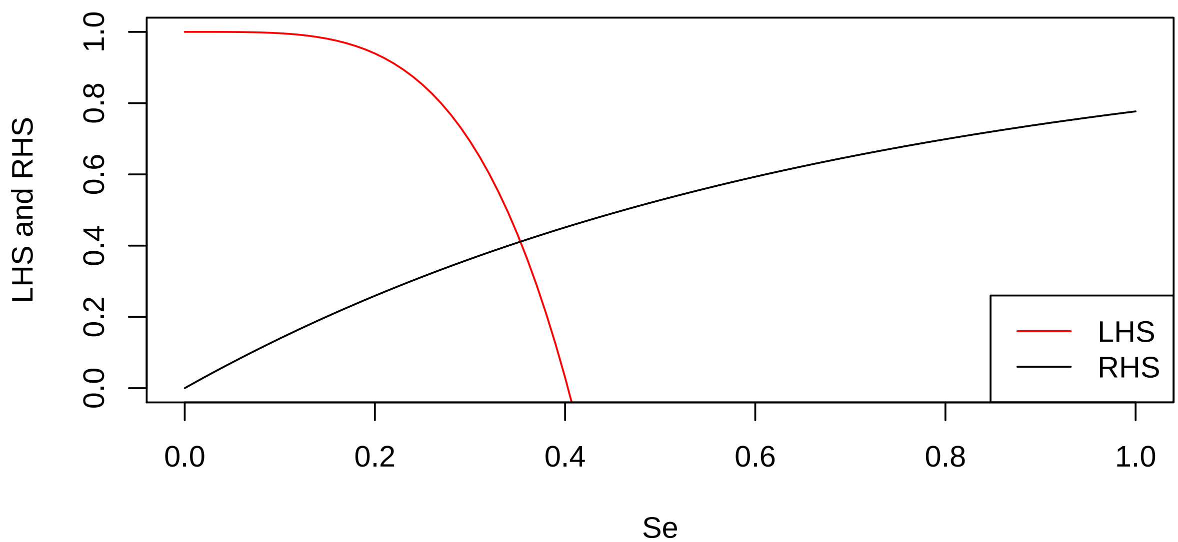
  In that case, $\mathcal{P}(s_w)$ is decreasing with s_w so that when s_w increases then $\pi_e(s_e^*)$ decreases. There is a tradeoff between searching a job and searching to get the opportunity to open the business.

- When the unemployed individual is in the opportunity share, so that $EV_e(1) > EV_w(1) > EV_u(1)$, then we obtain $\mathcal{P}(s_w) = \pi(s_w)[EV_u(1) - EV_w(1)] + EV_e(1) - EV_u(1) > 0 \quad \forall s_w \geq 0$.

Moreover, $\mathcal{P}(s_w)$ is decreasing with s_w and thus $\pi_e(s_e^*)$ is decreasing with an increase of s_w. There is again a tradeoff between searching a job and searching for opening a business.

The figure below report the three cases depending on the case considered above.

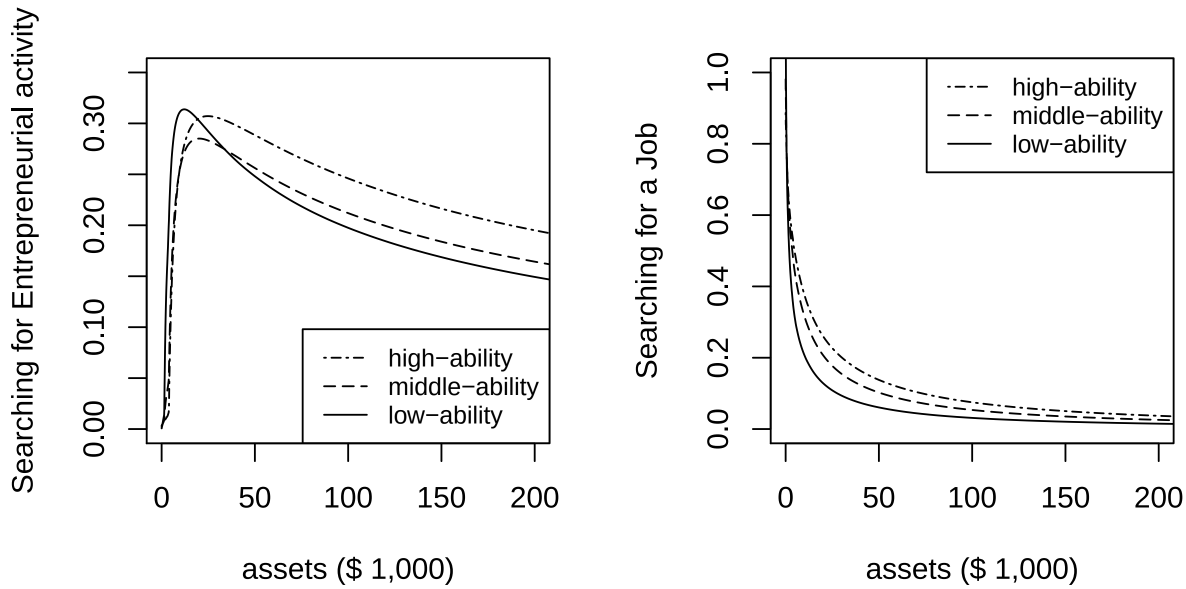
Figure D.10: Optimal searching effort for getting the opportunity to open a business.



To resolve the problem of the unemployed individual, we then use sequential 1D solver. That is, for any value s_w we compute the associated optimal level s_e^* determined by equation (3).

Figure D.11 below reports the solutions of the algorithm.

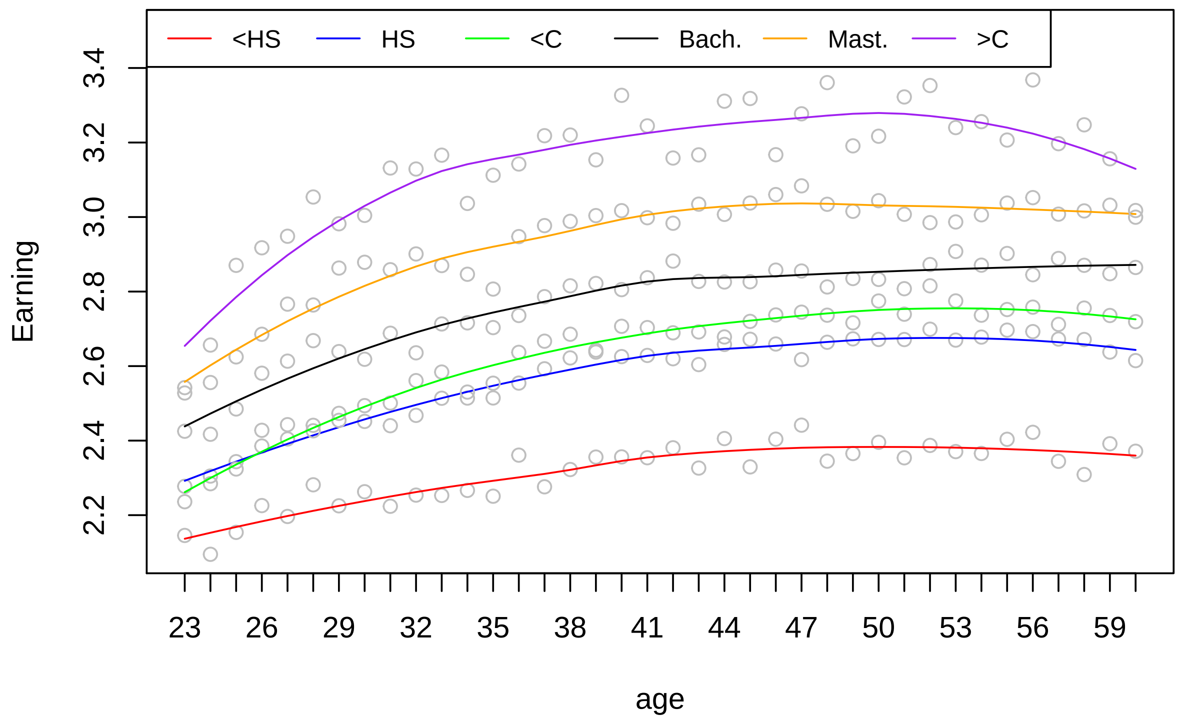
Figure D.11: Optimal searching effort: unemployed workers



Appendix E. Earning profile

We plot in figure E.12 the earning profile between educational attainment at different ages using CPS data averaged from 1994 to 2014.

Figure E.12: Earning profil between educational attainment



Acemoglu, D. and R. Shimer (2000). Productivity gains from unemployment insurance. *European Economic Review 44*(7), 1195–1224.

Aiyagari, S. (1994). Uninsured idiosyncratic risk and aggregate saving. *The Quarterly Journal of Economics 109*(3), 659–684.

Bank, W. (2016). Unemployment rate.

Bewley, T. (1983). A difficulty with the optimum quantity of money. *Econometrica 51*(5), 1485–1504.

Blanchflower, D. G. (2000). Self-employment in oecd countries. *Labour economics 7*(5), 471–505.

Borjas, G. J. and S. G. Bronars (1989). Consumer discrimination and self-employment. *Journal of political economy 97*(3), 581–605.

Buera, F., J. Kaboski, and Y. Shin (2011). Finance and development: A tale of two sectors. *American Economic Review 101*(5), 1964–2002.

Cagetti, M. and M. De Nardi (2006, October). Entrepreneurship, Frictions, and Wealth. *Journal of Political Economy 114*(5), 835–870.

Cagetti, M. and M. De Nardi (2009, March). Estate taxation, entrepreneurship, and wealth. *American Economic Review 99*(1), 85–111.

Campbell, J. and M. De Nardi (2009). A conversation with 590 nascent entrepreneurs. *Annals of Finance 5*(3), 313–340.

Costain, J. (1997). Unemployment Insurance with Endogenous Search Intensity and Precautionary Saving. Technical report, Department of Economics and Business, Universitat Pompeu Fabra.

Donovan, K. (2014). Subsistence Entrepreneurs and Misallocation. 2014 Meeting Papers 771, Society for Economic Dynamics.

Fairlie, R. (2015). The kauffman index: Startup activity — national trends. Santa cruz department of economics, working paper series, Department of Economics, UC Santa Cruz.

Gandelman, N. and R. Hernandez-Murillo (2015). Risk Aversion at the Country Level. *Review 97*(1), 53–66.

Gentry, W. M. and R. G. Hubbard (2004). Entrepreneurship and household saving. *Advances in economic analysis & policy 4*(1).

Hamilton, B. H. (2000). Does entrepreneurship pay? an empirical analysis of the returns to self-employment. *Journal of Political economy 108*(3), 604–631.

Hansen, G. and A. İmrohoroğlu (1992). The role of unemployment insurance in an economy with liquidity constraints and moral hazard. *Journal of political economy 100*(1), 118–142.

Hippie, S. (2010). Self-employment in the United States. *Monthly Labor Review 133*(9), 17–32.

Holtz-Eakin, D., D. Joulfaian, and H. S. Rosen (1994). Entrepreneurial decisions and liquidity constraints. *The RAND Journal of Economics 25*(2), 334–347.

Hombert, J., A. Schoar, D. Sraer, and D. Thesmar (2014, November). Can unemployment insurance spur entrepreneurial activity? Working Paper 20717, National Bureau of Economic Research.

Huggett, M. (1993). The risk-free rate in heterogeneous-agent incomplete-insurance economies. *Journal of Economic Dynamics and Control 17*(5-6), 953–969.

Kenworthy, L. and T. Smeeding (2013). Gini country report: Growing inequalities and their impacts in the united states. Gini country reports, AIAS, Amsterdam Institute for Advanced Labour Studies.

Kihlstrom, R. E. and J.-J. Laffont (1979). A general equilibrium entrepreneurial theory of firm formation based on risk aversion. *Journal of Political Economy 87*(4), 719–48.

Kitao, S. (2008, January). Entrepreneurship, taxation and capital investment. *Review of Economic Dynamics 11*(1), 44–69.

Landier, A. and D. Thesmar (2008). Financial contracting with optimistic entrepreneurs. *The Review of Financial Studies 22*(1), 117.

LeMaire, D. and B. Schjerning (2007). Earnings, uncertainty, and the self-employment choice. *document de travail, Centre for Economic and Business Research*.

Lin, Z., G. Picot, and J. Compton (2000). The entry and exit dynamics of self-employment in canada. *Small business economics 15*(2), 105–125.

Nanda, R. (2008). Cost of external finance and selection into entrepreneurship. Harvard Business School Working Papers 08-047, Harvard Business School.

Poschke, M. (2013). Who becomes an entrepreneur? labor market prospects and occupational choice. *Journal of Economic Dynamics and Control 37*(3), 693–710.

Quadrini, V. (2000, January). Entrepreneurship, Saving and Social Mobility. *Review of Economic Dynamics 3*(1), 1–40.

Rissman, E. R. (2007a). Labor market transitions and self-employment. Working Paper Series WP-07-14, Federal Reserve Bank of Chicago.

Rissman, E. R. (2007b). Labor market transitions and self-employment. Working Paper Series WP-07-14, Federal Reserve Bank of Chicago.

Schoar, A. (2010, February). *The Divide between Subsistence and Transformational Entrepreneurship*, pp. 57–81. University of Chicago Press.

Shimer, R. (2005, March). The cyclical behavior of equilibrium unemployment and vacancies. *American Economic Review 95*(1), 25–49.

Shimer, R. (2012). Reassessing the ins and outs of unemployment. *Review of Economic Dynamics 15*(2), 127 – 148.

Stokey, N., R. Lucas, and E. Prescott (1989). *Recursive methods in economic dynamics.* Harvard University Press.

Visschers, L., A. Millan, and M. Kredler (2014). Great opportunities or poor alternatives: self-employment, unemployment and paid employment over the business cycle. (597).

Wang, C. and S. D. Williamson (2002). Moral hazard, optimal unemployment insurance, and experience rating. *Journal of Monetary Economics 49*(7), 1337 – 1371.

Zeileis, A. (2015). *pwt8: Penn World Table (Version 8.0)*.