From Unemployment to Self-employment: An Evaluation of Self-employment Assistance Programs*

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Abstract

This paper evaluates Self-Employment Assistance (SEA) programs, which are government initiatives extending the unemployment insurance (UI) system to support unemployment to self-employment transitions. Using a general equilibrium model of the US labor market, we show that these programs have important labor market mobility effects and increase the self-employment rate. They also significantly impact the composition and performance outcomes of self-employment: while lump-sum subsidies select low-skilled individuals, SEA programs contingent on previously employed earnings select skilled and wealthier individuals. At the aggregate level, the latter programs mainly real-locate individuals from employment to self-employment, leaving the unemployment rate largely unaffected.

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1 Introduction

Many OECD countries have been implementing labor market policies that financially support unemployment to self-employment transitions, usually as an extension of the existing unemployment insurance (UI) system. In the US, a pilot policy named Self-Employment Assistance Program waives the active job search requirement for regular UI beneficiaries who engage in establishing a business, offering them an allowance equivalent in amount and duration to their regular UI benefits. In Europe, these programs constitute one of the largest self-employment subsidies. In Germany, between 2002 and 2011, around 40 to 50% of new self-employed each year received this type of support. In France, the 2002 Plan d'Aide au Retour à l'Emploi policy concerned almost 50% of all new self-employed individuals. Table 1 provides a non-exhaustive typology of existing or former policies, which we generically refer to as Self-Employment Assistance (SEA) programs. However, despite the widespread implementation of these policies and a few empirical evaluations such as Caliendo and Künn (2011), Ejrnæs and Hochguertel (2014), or Hombert et al. (2020), the implications of these programs remain largely understudied. Which unemployed agents are responsive to these policies, and how well do they perform? Which insurance component of these programs is most beneficial to the target population? What are their aggregate repercussions for the self-employment and unemployment rates? This paper evaluates these programs, aiming to address these gaps in the literature.

Our contribution is a structural approach that systematically evaluates SEA programs extending the UI system. This approach lets us fully decompose the attributes of these programs and capture mobility and selection effects within a controlled environment. We employ the following steps: (i) we build a general equilibrium model of the US labor market with a detailed characterization of self-employment and labor market flows; (ii) using our model, we characterize and decompose the impact of SEA programs on mobility, the composition and performance of the self-employment pool, and aggregate production, unemployment, and welfare.

Our general equilibrium analysis uses an incomplete markets setting with heterogeneous agents. In the model, agents can be employed, unemployed, or self-employed. Employed agents earn a productivity-dependent wage, working either in a corporate or self-employment sector. Unemployed households receive UI benefits based on their previous employed earnings. When households opt for self-employment, they start a business characterized by a decreasing returns to scale technology, stochastic business shocks, and a household-specific entrepreneurial ability. Credit constraints limit the amount of entrepreneurial capital that can be borrowed from financial intermediaries and business failures can lead to default. Agents endogenously transition between the

Conting	Contingent on UI r		Countries implementing the policy
Individual's past earnings	Realized business income	option ^b	
Yes	Yes	Yes	France: Aide aux Chômeurs Créateurs ou Repreneurs d'Entreprises (1998-2006), France: Aide au Retour à l'Emploi (2008-), Finland (current), The Netherlands (current);
Yes	No	Yes	Ireland: Back to Work Enterprise Allowance (1999-), US: Self-Employment Assistance Program (1998-), Sweden: Self-employment Grants, Germany: Bridging Allowance (1986-2006), Germany: New Start-up Subsidy (2006-);
Yes	No	-	Canada: Self-Employment Assistance (1993-), Hungary: Self-Employment Assistance;
No	No	Yes	Finland: Start-up Grant (1988-), UK: Employment and Support Allowance (1983-1991);
No	No	No	Australia: New Enterprise Incentive Scheme (1985-), Germany: Start-up subsidy (2003-2006), UK: New Enterprise Allowance (2010-).

Table 1. Typology of Self-Employment Assistance (SEA) programs.^a

^{*a*} The rules regulating the above programs are, in the detail, more complex than our simplified classification, mainly because many programs are entangled with other unemployment assistance programs. The US *SEAP* is limited to ten states and constrained by quotas. Related papers on European SEA policies include Ejrnæs and Hochguertel (2014) that uses a Danish retirement reform incorporating self-employment UI to study the effects of a form of entrepreneurial insurance. They find that entry into self-employment increases by 1.2-1.8% and that those agents are not any different in terms of performance. Caliendo and Künn (2011) estimate the effects of two different German programs helping unemployed individuals to start businesses: (i) a first program gave a lump-sum startup subsidy each month for three years (with a yearly decline); (ii) in the *Bridging Allowance* (BA) program individuals received their unemployment benefits for six months. The authors find that new entrepreneurs tend to be less qualified in both cases but are relatively more qualified under the BA.

^b Option letting eligible agents return to unemployment upon business failure to claim any outstanding UI rights.

above occupations but face labor market frictions: unemployed agents have to search for a job or a business idea; employed agents can search *on-the-job* for a business idea; and self-employed agents can search *on-the-business* for a wage-paying job. Our calibrated model replicates both micro and macro-level characteristics of the US labor market and the relative income and wealth across occupations, as compared to empirical counterparts in the Current Population Survey (CPS) and the Survey of Consumer Finances (SCF).

In our baseline economy, not subject to any SEA policies, a UI-eligible unemployed household loses its unemployment benefits upon starting a business. We consider SEA reforms in which eligible new self-employed agents can keep receiving UI benefits, at least in part, while running their business. Existing SEA programs vary in their design. The financial aid can be lump-sum transfers or, alternatively, contingent on prior (employed) earnings. They can also specifically target the self-employment risk by covering low business-income situations. Some SEA programs offer an *UI recovery option*: the possibility to recover outstanding UI rights upon business failure by returning to the unemployment pool. In the model, our reference SEA program encompasses the above features: the financial aid is contingent on past earnings and decreases with current business income and a *UI recovery option* can be exercised. A second, alternative SEA program, is similar to our reference one, but the aid is given irrespective of business income. In a final SEA case, the financial aid is lump-sum and, thus, not contingent on either past earnings or business income. These alternatives let us break down the impact of the key characteristics of these programs.

The model predicts that all the SEA programs we study have important mobility effects. Under our reference SEA policy, the share of self-employed agents increases by 1.7% and the fraction of unemployed individuals starting businesses rises by 12% as compared to our baseline. Moreover, a fine decomposition into components reveals that the UI recovery option alone would account for about 35% of the increase in the share of self-employed agents at virtually no extra costs for the economy. This result confirms that business risk is fundamental for aspiring self-employed individuals and that a fallback plan fosters business creation. The two alternative SEA policies have even stronger mobility effects, mostly because benefits are provided systematically and independently of business performance. These results align with the above-cited empirical literature that converges on the fact that these programs alleviate the barriers to self-employment. However, we show that these alternative programs select very different types of self-employed agents, both in terms of ability and wealth. Qualitatively, our findings can be stated as follows: policies contingent on past earnings favor the entry of more skilled and wealthier self-employed agents while lump-sum programs encourage the entry of low-skilled and poorer individuals. Indeed, because they have to give up on relatively higher UI benefits, highly skilled unemployed individuals are less likely to enter self-employment under lump-sum programs.

In terms of performance, we distinguish an intensive margin group composed of individuals who would have entered self-employment even without the policy and an extensive margin group with individuals who entered because of the policy. Post policy, the intensive group invests less leading to a lower production scale and smaller firms, which is indicative of a moral hazard issue. Moreover, when the *UI recovery option* can be exercised, firms in this group bankrupt more often. In the extensive group, the proportion of firms still operating after 5 years is much lower than in the corresponding baseline setup, implying that some entrants fostered by the policy are ill-equipped against adverse shocks. Additionally, once they have exhausted the SEA assistance, they are prone to directly exit self-employment.

At the micro-level, our reference SEA policy generates a substantial response from the unemployment to self-employment gross flow, in line with the empirical literature. However, at the aggregate level, we do not see a significant effect of the policy on the unemployment rate. This is due to the following mechanisms: (i) post policy, the increase in the exit rate out of unemployment is partially offset by a higher entry rate into unemployment from self-employment, notably, because those who exhaust their SEA rights are prone to immediately exit self-employment and because some exercise their *UI recovery* option before that; (ii) the policy primarily causes a shift in occupational choices: the same individuals who would have eventually exited unemployment for paid employment now tend to exit more towards self-employment. These dynamics considerably lessen the policy's impact on the unemployment rate and suggest that at the micro-level the flows into and out of unemployment are both significant in shaping the overall effect.

Comparing partial and general equilibrium dynamics, we find that absent prices and tax adjustments, the effects of our reference SEA policy are much more pronounced and up to 1.5 times stronger. The mitigated general equilibrium response is mostly due to the adjustment of the wage rate. In the post-policy general equilibrium, a larger number of self-employed agents exert upward pressure on wages. In turn, this higher wage makes the employment occupation more attractive, weakening the initial positive effect of SEA on self-employment. Changes in the interest or the tax rates are of second order.

We find that all the SEA reforms we consider generate positive levels of steady-state welfare. However, relatively poor and unskilled individuals with low UI rights are borrowing-constrained and do not benefit from them. As is usual with this type of policy, the short-term costs of implementing them can be large and somewhat mitigate the long-run gains. As a result, the welfare along the transition is on average negative, albeit only very slightly, while around 40 to 50% of the individuals benefit from the reforms. The main driver for this finding is that the vast majority of the agents paying for this policy are already employed and do not directly benefit from it.

Finally, we show that SEA programs interact with the design of the UI system itself to impact the selection into self-employment. A more generous UI system has a negative effect on the propensity of becoming self-employed: increasing UI benefits and/or extending UI duration imply a lower incentive for unemployed agents to start a business, amplified by the rising opportunity costs of abandoning their status. This adverse effect can significantly be mitigated using a SEA program and even reverted in the case of an increase in the UI duration.

Literature Review There is a substantial literature assessing the impact of existing barriers to entrepreneurship on the self-employment share. Landier and Thesmar (2008), Schoar (2010) or

Hurst and Pugsley (2011) show that only focusing on this share might prevent us from understanding the vast amount of heterogeneity in the self-employment pool and the rich composition or selection effects underneath. Our specification is able to capture a number of those effects like, for instance, the high quarterly flow from self-employment to paid employment. While this latter finding is not new (see for instance Cagetti and De Nardi (2006) at a yearly frequency), our model generates this flow as the result of mostly endogenous decisions and, similar to Poschke (2013), it features a positive correlation between paid-employment and self-employment earnings.

This paper is also related to the quantitative literature on self-employment in relation to 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 (Kitao (2008), Cagetti and De Nardi (2009) and Buera and Shin (2013) among others).

Similar to our contribution, some recent papers have started to address the question of insurance mechanisms in models involving self-employment. This literature has mainly focused on the effects of introducing health insurance (Fairlie et al. (2011)) or alternative bankruptcy laws (Mankart and Rodano (2015)) on the fraction of self-employed and their performances. While many papers often argue that improving entrepreneurial conditions might reduce unemployment (for instance, Caliendo and Künn (2011) or Thurik et al. (2008)), our analysis of SEA policies mitigates this argument by showing that the self-employment exit rate of beneficiaries is relatively high, creating a flow back to unemployment. Some authors (Evans and Leighton (1989), Thurik et al. (2008), Røed and Skogstrøm (2013) among others) have studied the relationship between unemployment, UI benefits, and the probability of starting a business. In this regard, Gaillard and Kankanamge (2023) find that the elasticity of the flow from the UI-eligible unemployment pool to self-employment, in response to higher UI generosity, is negative and significantly greater than the corresponding elasticity to paid employment. They also find that increased UI generosity leads to a shift from self-employment to paid employment. In contrast, our analysis demonstrates how SEA programs can mitigate this shift, maintaining a balance between self-employment and paid employment as UI generosity increases.

Finally, our work is closely related to the contributions of Hombert et al. (2020), Ejrnæs and Hochguertel (2014), and Caliendo and Künn (2011). Using an empirical approach based on microdata, they find that extending UI to self-employed agents has a significant impact on the entry into entrepreneurship. According to Hombert et al. (2020), the French 2002 *Plan d'Aide au Retour à l'Emploi (PARE)* policy had increased the number of newly created firms by 12%, while the pool of entrepreneurs and their relative performances remained unchanged. In contrast to their approach,

we use a structural model calibration to systematically compare SEA programs. This methodological divergence allows us to explore the subject from a complementary perspective, decomposing general equilibrium mechanisms and making more explicit intensive and extensive margin effects of these policies.

The remainder of the paper is organized as follows. Our baseline model, its parameterization, and its validation are developed in sections 2 and 3. In section 4, we evaluate and decompose the SEA policies. Section 5 concludes.

2 Model

In this section, we describe a general equilibrium model in incomplete markets with occupational choices. We include risky entrepreneurial investment choices, occupational search frictions, and the possibility of defaulting in equilibrium. Our model accounts for a baseline economy and alternative ones under various SEA programs, as it is our main policy concern.

2.1 Corporate sector

Our economy has two production sectors: a corporate one presented here and a self-employed entrepreneurial one discussed later. The corporate output *Y* is produced by a single competitive representative firm using a Cobb-Douglas technology, with total factor productivity A, capital level *K*, and labor *L*, such that: $Y = F(K, L) = AK^{\alpha}L^{1-\alpha}$, where $\alpha \in (0, 1)$ is the capital share. There is no aggregate uncertainty. Profit maximization produces the competitive prices: $r = A\alpha \left(\frac{L}{K}\right)^{1-\alpha} - \delta$ and $w = A(1-\alpha) \left(\frac{K}{L}\right)^{\alpha}$, with *w* and *r* the wage and interest rates, which by a no-arbitrage condition are identical in the self-employment sector, and δ the depreciation rate in both sectors.

2.2 Households

Occupations and preferences The economy is populated by a continuum of infinitely-lived households of unit mass. Every period, a household falls in one of three occupations $o \in \mathcal{O} \equiv \{o_e, o_w, o_u\}$: self-employment (o_e) ; unemployment (o_u) ; or employment (o_w) (worker in the corporate sector). An agent's occupation can change either exogenously or endogenously. Agents derive utility from consumption and disutility from search. The life-time utility of a household is given by $\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t u(c, s_e, s_w)$, with *c* the consumption, s_e and s_w respectively business and job search efforts, and β the discount factor. We assume that labor is supplied inelastically. We denote $a \in \mathcal{A}$ the agent's wealth. Any wealth saved in the model pays the deposit rate r^d , with $r^d = r - v$.

The competitive interest rate r can thus be interpreted as a lending rate and v as a wedge between the lending rate and the deposit rate.

Insurance status Depending on their previous occupation, agents can either be insured (j = i) or uninsured (j = n). In the baseline economy, only a worker falling into involuntary unemployment (i.e. when laid off) can claim any insurance in the form of a standard UI. In the alternative economy subject to a specific policy discussed below, eligible self-employed are also insured during their entrepreneurial endeavor. Section 2.6 describes this policy in details.

Exclusion status Self-employed individuals can borrow from a creditor subject to an endogenous interest rate and use these amounts in their entrepreneurial venture. The exact nature of the credit contract is explained later on. However, an agent who has defaulted in the past is excluded temporarily from the credit market. Such an agent cannot borrow and is labeled constrained, with credit flag e = C, but can still start a business. Following Chatterjee et al. (2007) and Mankart and Rodano (2015), we model exclusion in a probabilistic way. Upon recovering access to credit, her credit flag is e = A.

Exogenous processes All individuals are endowed with a persistent component of individual productivity $\theta \in \Theta$ that we call ability. This component is initially determined according to the invariant distribution Π_{θ} and then evolves at a very slow rate.¹ Workers are subject to an additional persistent idiosyncratic shock $y \in \mathcal{Y}$ on their labor income that we call match-quality.² If an agent was not a worker in the previous period, she does not know her match quality before receiving a job offer. In that case, this shock is initialized by drawing it from the invariant distribution Π_y associated with the process for y. Otherwise, both individual productivity and match-quality shocks are realized at the beginning of the period before agents take any decision. Self-employed individuals face a within-period persistent idiosyncratic business shock $z \in \mathcal{Z}$. Contrastingly to the other shocks, only its previous value z_{-1} is known at the beginning of the period, and the current shock is realized within the period after self-employed individuals have decided on their business investment. An individual not currently running a business, but starting one next period will initialize her shock z according to the invariant distribution Π_z associated with the process

¹We allow individual productivity to evolve to generate additional saving motives. Our model does not take into account life-cycle aspects, human capital accumulation at work, technological progress, or health risks. Those elements can explain a large productivity dispersion along the life cycle but are unaccounted for here.

²This model does not include an explicit matching process but y can be viewed as a match-quality component because it starts and ends with a specific job while not appearing as a state for the unemployed or the self-employed. Adding this process brings our earnings distribution closer to reality but our results are insensitive to it.

for z.³

In summary, an agent's exogenous states are given by θ and, depending on her occupation, possibly (y, z_{-1}) . Each of these three processes exhibits AR(1) dynamics with orthogonal innovations. But, because ability θ is a common component in the labor income of working households, replacement income of unemployed individuals, and business income of self-employed households, a correlation between incomes across different occupations emerges for the same individual.

Value functions We denote $\mathbf{x} = (a, y, \theta, z, j, e)$ the full state vector of households over all occupations. We will sometimes use a subset \mathbf{x}_o for a specific occupation o. We note W the value function associated with a worker, U with an unemployed individual, and E a self-employed individual. Future value functions are respectively denoted: $W' \equiv W(a', \theta', y', e'), U'_{j'} \equiv U(a', \theta', e', j')$ and $E'_{j'} \equiv E(a', \theta', z, e', j')$. Finally, eligible unemployed individuals benefit from self-employment insurance. The value of being newly self-employed while uninsured is given by $\mathcal{E}'_n \equiv \mathbb{E}_z[E(a', \theta', z, e', j = n)]$. The value \mathcal{E}'_i of being newly insured self-employed depends on the economy considered. We denote this value with the subscript i even if no insurance policy is currently in place in the base-line model. The subscript can thus be interpreted as access to insurance in the alternative economy. We specify this value in section 2.6.⁴

2.3 Workers

In the corporate sector, a worker receives the labor income $h(\theta)yw$, where the function $h: \theta \mapsto \mathbb{R}$ transforms the individual productivity component into working ability. She has a probability $\eta(\theta)$ of getting laid off, depending on her individual productivity. In such a case, she falls into insured unemployment and can expect to get value U'_i .⁵ To finance UI benefits, a worker pays a proportional tax τ_w on their labor income. By providing effort s_e , a worker can search for a business idea *on-the-job* and start a business in the next period with probability $\pi_e(s_e)$.⁶ She then voluntary exits her current occupation, cannot claim UI benefits (i.e., j = n) and can expect to get value \mathcal{E}'_n . If she gets laid off at the same time as getting a business idea, she can claim UI rights and

³We assume that z is observed only after experimenting with the business idea. In our model as in the real world, an important fraction of new self-employed agents experiments with a business activity and exits if the project is not profitable enough.

⁴Note that in section B of the online appendix, we write a more detailed version of the model equations, explicitly including transition probabilities that we omit below for readability.

⁵Notice that in our model, value functions associated with unemployment are always lower than those associated with a worker. Therefore, we exclude any voluntary switch to unemployment. Conversely, an unemployed agent getting a job opportunity always exits.

⁶Business search effort can describe market research on the feasibility of an idea, competition assessment, business education, agency costs or the time needed to fill administrative forms, validate product norms, etc.

start a business with value \mathcal{E}'_i , which depends on the policy status: no insurance in the baseline case and the self-employment insurance otherwise. To simplify notations, let us denote $\eta \equiv \eta(\theta)$ and $\pi_e \equiv \pi_e(s_e)$. The recursive formulation of a worker is given by:

$$W(a, \theta, y, e) = \max_{\substack{c > 0, \ a' \ge 0, \\ s_e \ge 0}} u(c, 0, s_e) + \beta \mathbb{E}_{e', y', \theta'} \left\{ (1 - \eta) \left[(1 - \pi_e) W' + \pi_e \max\{\mathcal{E}'_n, W'\} \right] + \eta \left[(1 - \pi_e) U'_i + \pi_e \max\{\mathcal{E}'_i, U'_i\} \right] \right\}$$
s.t.
$$c = (1 - \tau_w) h(\theta) wy + (1 + r^d) a - a'$$
(2)

where equation (2) is the worker's budget constraint.⁷

2.4 Unemployed individuals

We assume that all unemployed individuals are endowed each period with a fixed amount m, which can be interpreted as domestic production. An unemployed individual can either claim UI (j = i) or not (j = n). Insured unemployed agents receive UI benefits proportional to their individual productivity, with replacement rate μ and lose UI rights with probability ρ . An uninsured unemployed individual cannot claim any UI benefits and remains uninsured until finding a job. Unemployed agents search for a business idea and a job opportunity with respective efforts s_e and s_w and corresponding success probabilities π_e and $\pi_w \equiv \pi_w(s_w)$. Upon finding a job, such an agent becomes a worker with value W'. Similarly, when getting an idea, a business can be started in the next period. An insured agent (j' = i) do so with value \mathcal{E}'_i , while an uninsured agent (j' = n) will have value \mathcal{E}'_n . Finally, exclusion from the credit market evolves similarly to a worker. The recursive program of an unemployed individual is:

$$U(a, \theta, e, j) = \max_{\substack{c > 0, \ a' \ge 0, \\ s_e \ge 0, s_w \ge 0}} u(c, s_w, s_e) + \beta \mathbb{E}_{\theta', y', j', e'} \left\{ \pi_w \left[(1 - \pi_e) W' + \pi_e \max\{\mathcal{E}'_{j'}, W'\} \right] + (1 - \pi_w) \left[(1 - \pi_e) U'_{j'} + \pi_e \max\{\mathcal{E}'_{j'}, U'_{j'}\} \right] \right\}$$
s.t.
$$c = m + \mathbb{1}_{\{j=i\}} (1 - \tau_w) h(\theta) w \mu + (1 + r^d) a - a'$$
(4)

where equation (4) is the budget constraint.

⁷For simplicity, we assume that w already internalizes other taxes not related to the UI financing. Relaxing this assumption would need to account for a more realistic set of taxes.

2.5 Self-employed individuals

A self-employed agent raises revenues from her business venture. She decides to invest resources k, which can either be her own or borrowed, before knowing the current realization of the withinperiod business shock $z \in \mathcal{Z}$ affecting the firm's productivity. Once this shock is realized, she sets the quantity of labor n that she will be hiring in addition to her own labor supply $\underline{\ell}$. The entrepreneurial production function is: $f(k, n, \theta, z) = zg(\theta)(k^{\gamma}(\underline{\ell} + n)^{1-\gamma})^{\nu}$. It is a decreasing returns to scale technology governed by the parameter $\nu \in (0, 1)$. γ controls the intensity of capital in production. The function $g: \theta \mapsto \mathbb{R}$ transforms the individual productivity component into entrepreneurial ability. We define the self-employment income as the entrepreneurial profit. Moreover, by providing effort s_w , a self-employed individual can search for a job opportunity *on-the-business* and change occupation in the next period with probability π_w . The sequence of choices a self-employed agent faces is summarized in Figure 1. We now detail this sequence.

Figure 1. Timing for a self-employed agent.



2.5.1 Non-excluded self-employed agents When a self-employed agent has access to the credit market, she is allowed to borrow from a financial intermediary an amount that can only be invested in her business. Recalling that *a* is the agent's current wealth, she chooses whether to borrow (k > a) or save (k < a). She decides the amount *k* invested in her firm to maximize her expected value with respect to the shock *z*, as expressed below:

$$E(a,\theta,z_{-1},e=A,j) = \max_{k} \left\{ \sum_{z \in \mathcal{Z}} \pi_{z}(z|z_{-1}) \max\{B(a,k,\theta,z,j), R(a,k,\theta,z,j)\} \right\}$$
(5)

The interior max operator in expression (5) corresponds to the choice the self-employed has to make between bankruptcy (B) or repayment (R) options once the realization of the shock z is known.

Repayment The standard behavior of a borrowing self-employed agent is to repay her loan after production. In case of a bad shock, the self-employed will receive a low (possibly negative) entrepreneurial income but can still decide to repay and thus not be excluded from the credit market

in future periods. If she repays, the self-employed agent also has to cover the endogenous interest $r^b(\Delta)$ on her loan. The associated recursive problem is:

$$R(a,k,\theta,z,j) = \max_{\substack{c>0, a' \ge 0\\s_w \ge 0}} u(c,s_w,0) + \beta \mathop{\mathbb{E}}_{\theta',y',j'} \Big\{ \pi_w \max\{W',E'_{j'}\} + (1-\pi_w) \max\{U'_{j'},E'_{j'}\} \Big\}$$
(6)

s.t.
$$c + a' = \pi_r^A + \mathbb{1}_{\{j=i\}} b_e(\theta, \pi_r^A) + a + r^d(a - k) \mathbb{1}_{\{k \le a\}}$$
 (7)

$$\pi_r^A = \max_n zg(\theta)(k^{\gamma}(\underline{\ell}+n)^{1-\gamma})^{\nu} - wn - \delta k - r^b(\Delta)(k-a)\mathbb{1}_{\{k \ge a\}}$$
(8)

where equation (8) is the profit function defined as total production minus depreciation, interests paid on borrowed capital, and labor costs. Equation (7) is the budget constraint. We emphasize that the baseline economy is only populated with uninsured self-employed agents. Contrastingly, there are two groups of self-employed in the alternative economy with SEA: the insured group (j = i) and the uninsured group (j = n). We stress here for clarity that insured self-employed might receive an additional income $b_e(\theta, \pi_r)$ on top of their current entrepreneurial income π_r . Thus this self-employed agent's consumption and saving decision depend on her total income and assets, composed of her entrepreneurial income, possible SEA benefits, interests on savings not invested in her company for an amount $r^d(a - k) \mathbb{1}_{\{k \le a\}}$ and personal assets a.⁸

Bankruptcy When a self-employed agent chooses not to repay the borrowed amount or the interest, she defaults and goes bankrupt. Her firm is liquidated and her business idea is lost. She also has to exit self-employment for at least one period: a new business idea can be searched in that period to open a new business in the subsequent one. We assume, in the spirit of D'Erasmo and Boedo (2012), that after producing and observing her shock *z*, a self-employed can choose to renegotiate what is due through judicial action in a court. Bankruptcy is characterized by the cost of the procedure χ (including court fees and the cost of insolvency practitioners), proportional to the invested business capital and the recovery rate ξ referring to the portion of the original loan that the creditor can recover.⁹ This portion captures what can be recovered using different channels, including liquidation and reorganization. After defaulting, the self-employed agent is excluded temporarily from the credit market in subsequent periods. The recursive formulation of

⁸To see this, recall that the cash on hand of such an agent in the baseline economy can be written: $\max_{n} zg(\theta)(k^{\gamma}(\underline{\ell}+n)^{1-\gamma})^{\nu} - wn + (1-\delta)k - (1+r^{b}(\Delta))(k-a)\mathbb{1}_{\{k \ge a\}} + (1+r^{d})(a-k)\mathbb{1}_{\{k \le a\}}$. Rearranging the terms yields the above profit and household budget constraint equations.

⁹Unlike Mankart and Rodano (2015), we abstract from Chapter 7 bankruptcy exemptions, as we do not distinguish secured and unsecured debt. They generate default with an *iid* investment shock inducing large capital losses. Here, we focus on productivity shocks impacting current profit. We, therefore, need a bankruptcy specification that implies a higher default incentive. Despite this potential limitation, our specification can capture the self-employed agent's income distribution as shown in section 3.2, which is our major concern for our policy experiment to be meaningful.

such a self-employed individual is:

$$B(a,k,\theta,z,j) = \max_{\substack{c>0, \ a' \ge 0\\s_w \ge 0}} u(c,s_w,0) + \beta \mathbb{E}_{\theta',y',j'|\theta,j} \Big\{ \pi_w W' + (1-\pi_w) U'_{j'} \Big\}$$
(9)

s.t.
$$c + a' = \max\{(1 - \chi)k + \min\{\pi_r, 0\} - \xi(k - a), 0\} + \mathbb{1}_{\{j=i\}}b_e(\theta, 0)$$
 (10)

$$\pi_r = \max_n zg(\theta)(k^{\gamma}(\underline{\ell}+n)^{1-\gamma})^{\nu} - wn - \delta k$$
(11)

where we assume that banks recover all the positive profit.¹⁰ In our alternative economy with a SEA program, an insured but bankrupt self-employed agent can claim any outstanding UI rights $b_e(\theta, 0)$. This is consistent with the current bankruptcy law: public benefits, including unemployment compensation, are fully exempted from any debt recovery.

Credit contract Following the literature on the entrepreneurial option to default, the interest rate $r^b(\Delta)$ on an entrepreneurial loan is chosen endogenously by the creditor. We assume the latter has perfect information about the self-employed agent's default probability based on the *observable* characteristics $\Delta = (a, \theta, z_{-1}, j)$.¹¹ We also assume perfect competition and free entry into the credit market. Thus, a self-employed with a zero default probability will pay the competitive rate r. The creditor and the borrowing self-employed agent agree on the terms of the credit contract $\{k - a, r^b(\Delta, k)\}$, detailing the amount loaned and its cost. The interest rate applied to the loan is set such that the creditor makes zero profit in expectation given the self-employed agent's decision to default on a specific loan. When the self-employed agent chooses not to repay the debt, the creditor can recover a fraction ξ of the original loan (plus the positive profit). The zero profit condition includes three elements: (i) the expected return in case of bankruptcy (V_B), (ii) the expected return in case of repayment (V_R), and (iii) on the right-hand side, the amount that the creditor would get by investing the loaned amount in a project paying the safe interest rate of the economy, such that:

$$V_B + V_R \ge (1 + r^d + v)(k - a)$$
(12)

¹⁰The self-employed starts the period with asset *a*, borrows (k - a) and uses k = a + (k - a) in production. She then pays depreciation δk and recovers *k* but decides to default on the borrowed amount. Thus her asset after production is indeed *k*, but she has to pay all her positive profits, cost of bankruptcy χk , and recovery $\xi(k - a)$. Creditor preempting profit is an assumption ensuring a better reproduction of the default rate.

¹¹We assume here that there is a sufficient relation between the creditor (bank) and the self-employed agent. In particular, we argue for instance that the creditor can observe enough elements (past entrepreneurial income, wage income, etc.) about the self-employed agent to infer this value. Concerning the literature see, among others, Herranz et al. (2015), Mankart and Rodano (2015), or D'Erasmo and Boedo (2012).

where V_B and V_R are given by:

$$V_{B} = \sum_{z \in \mathcal{B}(\Delta)} \pi(z|z_{-1}) \left[\min\left\{\xi(k-a), (1-\chi)k + \min\{\pi_{r}, 0\}\right\} + \max\{\pi_{r}, 0\} \right]$$
(13)

$$V_{R} = \sum_{z \in \mathcal{B}^{c}(\Delta)} \pi(z|z_{-1})(1 + r^{b}(\Delta))(k - a)$$
(14)

with $\mathcal{B}(\Delta)$ the set of values *z* for a given state vector Δ for which the self-employed bankrupts and $\mathcal{B}^{c}(\Delta)$ is the complement for which she repays. Note that if the self-employed agent's cash on hand is too low and that $\pi_{r} < 0$, the creditor can only recover what the self-employed has, that is, only the amount $(1 - \chi)k + \pi_{r}$.

Bankruptcy has several roles in this model. First, it prevents poor self-employed agents from entering a credit contract because the charged interest rate would be too high for them to borrow. Second, the option to default generates different behavior among different ability groups of self-employed. Finally, bankruptcy may interact with our policy experiments. In particular, the reforms could modify the default incentive.

2.5.2 Excluded self-employed agents A self-employed agent excluded from the credit market (e = C) runs her business using only her own wealth. She has a probability ϕ of reentering the credit market in the next period. Her recursive program after the realization of the shock *z* is thus:

$$\hat{E}(a,k,\theta,z,j) = \max_{\substack{a' \ge 0, \\ s_w \ge 0}} u(c,s_w,0) + \beta \mathop{\mathbb{E}}_{\theta',y',j',e'} \left\{ \pi_w \max\{W',E'_{j'}\} + (1-\pi_w) \max\{U'_{j'},E'_{j'}\} \right\}$$
s.t. $c + a' = \pi_r^C + \mathbb{1}_{\{j=i\}} b_e(\theta,\pi_r^C) + a + r^d(a-k)\mathbb{1}_{\{k < a\}}$
(15)

$$\pi_r^C = \max_n zg(\theta)(k^{\gamma}(\underline{\ell}+n)^{1-\gamma})^{\nu} - wn - \delta k$$
(16)

Therefore, the excluded self-employed agent decides the amount *k* invested in her firm in order to maximize her expected value with respect to the shock *z*, as expressed below:

$$E(a, \theta, z_{-1}, e = C, j) = \max_{k \in [0, a]} \left\{ \sum_{z \in \mathcal{Z}} \pi(z | z_{-1}) \hat{E}(a, k, \theta, z, j) \right\}$$
(17)

2.6 Policy reforms: insurance and entry subsidy

We now detail the self-employment assistance reform that extends the baseline economy. This policy only concerns eligible agents: formerly unemployed individuals with outstanding UI rights. We recall that a self-employed agent entering this program after a period of unemployment is expected to have a future value \mathcal{E}'_i , such that:

$$\mathcal{E}'_{i} = \begin{cases} E(a', \theta', z, e', j = n) & \text{if baseline} \\ E(a', \theta', z, e', j = i) & \text{if SEA reform} \end{cases}$$
(18)

SEA reform The major policy reform we introduce is a *type-dependent* (i.e. contingent on past individual earnings) entrepreneurial insurance in the spirit of entrepreneurial policies active in France, Germany, and some US states. An eligible self-employed agent entering this program will continue to benefit from her UI rights, even after starting a business activity. The UI provision is also *business income dependent* i.e. contingent on the realized entrepreneurial income. Specifically, the additional amount $b_e(\theta, \pi_r)$ is given to the self-employed agent, depending on her current entrepreneurial income π_r and the UI benefits she could have claimed as an unemployed individual. When the entrepreneurial income is negative (i.e., $\pi_r < 0$), a self-employed agent can fully claim her unemployment benefits. Otherwise, the UI supplement diminishes proportionally with the realized entrepreneurial income. The policy is characterized with a couple of parameters (f, \bar{q}) , where $f \in [0, 1]$ is a downside risk insurance (DRI) replacement parameter and \bar{q} the maximum insurance duration. The rule governing $b_e(\theta, \pi_r)$ is given by:

$$b_e(\theta, \pi_r) = \begin{cases} b(\theta) & \text{if } \pi_r < 0\\ b(\theta) - (1-f)\pi_r & \text{if } 0 \le \pi_r \le \frac{b(\theta)}{1-f}\\ 0 & \text{if } \pi_r > \frac{b(\theta)}{1-f} \end{cases}$$
(19)

where $b(\theta) = (1 - \tau_w)h(\theta)w\mu$ is the full UI benefit that the self-employed agent could have claimed if she was only unemployed. It is clear that *f* lets the entrepreneurial income be larger than her UI payment, but the compensation $b_e(\theta, \pi_r)$ cannot exceed her UI rights. Figure 2 illustrates this policy with an example. The higher the *f*, the higher the amount of insurance provided in case of a positive but low profit. Moreover, the higher the *f*, the higher the fraction of self-employed agents insured. Indeed, the maximum level of entrepreneurial income π_r for which some UI benefits are provided is equal to $\frac{b(\theta)}{1-f}$. By increasing the DRI parameter *f*, entrepreneurial incomes are covered up to a higher threshold value. Therefore the insurance mechanism displays three regions: (i) a supplement that guarantees at least the UI benefits if the entrepreneurial income is greater than the UI benefits; and (iii) in case of a negative entrepreneurial income the full extent of the UI benefit. On top of the above, our benchmark SEA scheme has an *UI recovery option* that lets the insured self-employed agent return to the unemploy-



Note: the red (darkest) region corresponds to a minimal case where f = 0 (the self-employed agent gets at least $b(\theta)$ when $b(\theta) > \pi_r > 0$). Note that if current entrepreneurial income $\pi_r < 0$, this zone will be the same whatever the value of f. The orange (lighter) zone refers to a case where f = 0.3: self-employed agents will get at least the red zone and the extra orange zone depending on their income. The grey (lightest) zone is a case where f = 0.45. Finally, the white zone between the grey zone and the upper dashed line is the case where $f \to 1$ (the self-employed agent always gets $b(\theta)$).

ment pool in case of business failure to keep on claiming outstanding UI benefits.

An unemployed individual starting a business and who does not use all her outstanding UI in the form of SEA payments must keep her UI rights as long as they are unused. To model this feature, we let the probabilistic policy duration $q(\pi_r)$ vary endogenously with π_r , such that:

$$q(\pi_r) = \bar{q} \, \frac{b_e(\theta, \pi_r)}{b(\theta)} \tag{20}$$

In particular, in the case where $\pi_r > \frac{b(\theta)}{1-f}$, the government does not provide any compensation, $b_e(\theta, \pi_r) = 0$, and the probability $q(\pi_r)$ equals zero, a lower bound: the self-employed agent keeps all her remaining UI rights. Contrastingly, a self-employed agent with $\pi_r < 0$ will receive all of her SEA payments and lose her rights with the upper bound probability \bar{q} . When $\pi_r \in (0, \frac{b(\theta)}{1-f})$, this probability, $q(\pi_r)$, lies in $(0, \bar{q})$, depending on the amount of compensation provided.

2.7 Government

In all considered economies, the government runs a UI system that covers the pool of shortterm unemployed individuals. Under the reforms, the government extends the UI program to unemployed individuals starting a business activity and finances the programs using labor income taxes τ_w .¹² Total government revenues (*T*) are (with a slight abuse of notations): $T = \int_{\mathbf{x}_{ow,u}} (\tau_w h(\theta) wy d\Gamma(\mathbf{x}_{o_w}) + \tau_w h(\theta) w\mu d\Gamma(\mathbf{x}_{o_u}))$, with \mathbf{x}_o and $\Gamma(\mathbf{x}_o)$ respectively the individual's state vector and the mesure of individuals in occupation *o*. Total government expenditures *G* are equal to distributed UI benefits plus the reform's cost: $G = \int_{\mathbf{x}_{o_{u,e,eu_i}}} (h(\theta) \mu w d\Gamma(\mathbf{x}_{o_u}) + b_e(\theta, \pi_r) d\Gamma(\mathbf{x}_{o_e^i}))$, where $\Gamma(\mathbf{x}_{o_e^i})$ is the measure of insured self-employed agents coming from the pool of unemployed individuals with outstanding UI rights.

2.8 Equilibrium

Given $\mathbf{x} = (a, y, \theta, z, j, e) \in A \times \mathcal{Y} \times \Theta \times \mathcal{Z} \times \{i, n\} \times \{A, C\}$, a stationary recursive equilibrium in this economy consists of a set of value functions $W(\mathbf{x}), U(\mathbf{x}), E(\mathbf{x})$, policy rules over asset holdings $a'(\mathbf{x})$, consumption $c(\mathbf{x})$, job search effort $s_w(\mathbf{x})$, business search effort $s_e(\mathbf{x})$, business investment $k(\mathbf{x})$, labor demand $n(\mathbf{x})$, bankruptcy decision, occupational choice, prices ($r, w \in \mathbb{R}$), tax parameters ($\tau_w \in \mathbb{R}$) and a stationary measure over individuals $\Gamma(\mathbf{x})$, such that:

(1) Given prices (r, w) and tax τ_w , the policy rules and value functions solve household individual programs and the zero profit condition of competitive creditors is respected; (2) The wage w and the interest rate r are equal to the marginal products of the respective production factor in the corporate sector; (3) Goods and factor markets clear: (a) capital: $\int a'(\mathbf{x})d\Gamma(\mathbf{x}) = K + K^E$, with aggregate entrepreneurial capital $K^E = \int k(\mathbf{x}_{o_e})d\Gamma(\mathbf{x}_{o_e})$, (b) the measure of corporate workers $\int d\Gamma(\mathbf{x}_{o_w})$ is equal to the corporate L and entrepreneurial $L^E = \int n(\mathbf{x}_{o_e})d\Gamma(\mathbf{x}_{o_e})$ labor demands; (4) $\Gamma(\mathbf{x})$ is the stationary measure of individuals induced by the decision rules and the exogenous Markov processes; (5) τ_w balances the government budget (T = G).

This model has no analytical solution and must be solved numerically. We detail our numerical implementation of this problem in section E of the online appendix.

3 Parameterization and Model Validation

3.1 Parameterization strategy

We parameterize the model to be consistent with key features of occupational mobility, selfemployment, and the income and wealth distribution in the US. We compute mobility-related moments using the CPS from 1994 to 2015 and those related to income and wealth distributions using the 1995–2013 SCF waves. The model period is the quarter.

¹²In France, the PARE entrepreneurial insurance program is an extension of the UI system only available after contributing as a former worker (see Code du travail: articles L5421, L5422, L5425). Similar rules apply to the US SEA program.

3.1.1 Fixed parameters The share of capital α and γ in respectively the corporate and entrepreneurial production functions are both set to 0.33. The depreciation rate δ is set to 0.015 and the total factor productivity \mathcal{A} is set to normalize aggregate annual corporate output to 1.

We use the following CRRA and power functions to describe the utility of consumption and the disutility of search: $u(c, s_w, s_e) = \frac{c^{1-\sigma}}{1-\sigma} - s_w^{\psi_w} - s_e^{\psi_e}$. The coefficient of relative risk aversion σ is set to 1.5 and ψ_w and ψ_e are calibrated endogenously below. Each period, a fraction ζ of individuals retires and is replaced by ζ unemployed individuals without UI rights. ζ is set to 0.6%, corresponding roughly to the average entry rate of young individuals into the working population each quarter in the CPS.

The labor income process has persistent components $h(\theta)$ (individual labor productivity) and y (match-quality), each following an AR(1) process in logs. We set the individual productivity component such that $h(\theta) = \theta$ and the persistence ρ_{θ} is 0.975. The variance of the innovation, σ_{θ}^2 , is set to 0.022 in order to generate a Gini index for the earnings distribution of about 0.38 as in Cagetti and De Nardi (2006). For the match quality, the persistence ρ_y is set to 0.80 and the standard deviation of the innovation σ_y is set to 0.032.¹³

The relationship between the transition from employment to unemployment with respect to earnings terciles is decreasing in the CPS. By aligning the earnings terciles within the model, the separation rates, $\eta(\theta)$, are adjusted to match the same transition rate as observed in the CPS. Consequently, for each tercile, we achieve a *W* to *U* transition of 3.0%, 1.94%, and 1.45%, respectively. Home production income *m* is set to 0.04.¹⁴ The US Joint Federal-State Unemployment Compensation program, established under the Social Security Act of 1935, provides regular UI benefits for 26 weeks. Additionally, since 1993, the Federal-State Extended Benefits program has extended the duration up to 20 weeks in states with especially high unemployment. We choose the least generous UI duration and set the probability ρ of falling in uninsured unemployment to 0.5, corresponding to about 26 weeks of benefits. The replacement rate μ is set to 0.4 according to Shimer (2005).¹⁵

The probability ϕ of reentering the credit market after exclusion is set to 4.2%, corresponding to a period of 6 years. The intermediation cost *v* translating the transaction cost banks face when lending is set to 0.4% per quarter, which is in the range of the literature.¹⁶ The recovery rate of a

¹³Those values fall in the range of the transitory and permanent components of earnings estimated in the literature (e.g. Storesletten et al. (2004) using the PSID).

¹⁴By increasing the agent's current income and lowering the incentive to search for either a job or a business idea, this value helps to generate a realistic unemployment rate.

¹⁵In section 4.3.2, we study policy effects under various UI systems with longer durations and higher benefits.

¹⁶For instance, Mankart and Rodano (2015) set a wedge of 1% for secured debt and 4% for unsecured debt. Bassetto et al. (2015) report a spread of about 1.5% annually (i.e. 0.37% quarterly).

bankrupt self-employed agent ξ is set to 77% of the capital invested in the firm, according to data from the World Bank 2009 *Doing Business* report. The bankruptcy cost χ , however, is calibrated endogenously to generate a realistic default rate.

3.1.2 Endogenously calibrated parameters and targeted moments The literature does not provide clear indications as to how entrepreneurial abilities evolve over time. The estimation procedure for such abilities is challenging since: (1) the contribution of the self-employed agent's skills to the business returns is generally unobservable; and (2) entrepreneurial income could be the sum of different income sources (business income, wage, or capital income). Some authors, for instance, Kitao (2008), parameterize this ability using the self-employed agent's income Gini. However, this assumes that entrepreneurial and working abilities are uncorrelated.

We instead stress that working and entrepreneurial abilities are correlated and can generate the observed U-shaped relationship in the transition from paid employment to self-employment by earning quantiles. We use this relation to indirectly infer the mapping between working and entrepreneurial individual productivity. To do so, we divide the labor income distribution into terciles and compute in each the ratio of workers starting a business over the average ratio of workers starting a business in the economy. This measure tells us how likely a worker in a given quantile is to start a business as compared to the average worker. Depending on the period and the definition considered, we find that workers in the bottom tercile are about 15% more likely to start a business than the average worker whereas, in the middle quantile, they are about 15% less likely. In the top tercile, they are about as likely as the average worker. Therefore, we estimate entrepreneurial abilities $g(\theta) = \{g_1, g_2, g_3\}$ such that the resulting transition ratios by earning quantiles in the model are close to their data counterparts.¹⁷

In the model, a persistent business shock generates an incentive to exit self-employment when an individual falls into a bad state. Therefore, exit in our model arises endogenously as an optimal decision. (σ_z , ρ_z) are pinned down endogenously and capture the CPS self-employment exit rate of 7.4% and a fraction of self-employed agents with zero or negative earnings, which we target to be 10% consistent with Hamilton (2000), who uses self-employed individuals and his own annual entrepreneurial earnings measure and controls for under-reporting using the Survey of Income and Program Participation (SIPP).¹⁸

After setting the above parameters, other structural parameters have to be pinned down. The

¹⁷Notice that we could also take the ratio by educational attainment, however, in the model, there is no state variable summarizing education exactly. θ reflects education, but also experience, professional training, etc.

¹⁸Astebro and Chen (2014) report a fraction of self-employed households with zero and negative annual earnings of 7%. However, they do not distinguish household and individual earnings. Moreover, according to the 2016 Annual Survey of Entrepreneurs, 18.5% of businesses with paid employees experienced a profit loss.

Parameters			Targets					
Parameter		Value	Moment	Target	Model			
Discount factor	β	0.974	Annual K/Y	2.65	2.65			
Business return to scale	ν	0.885	Ratio net worth E/W	6.0	5.8			
Matching parameter	κ _e	0.260	Share of self-employed (in %)	10.7	10.7			
Matching parameter	κ_w	0.805	Unemployment rate (in %)	5.1	5.1			
Search elasticities	ψ_e, ψ_w	1.850	New self-employed from unemp. (in %)	20.0	21.4			
z process persistence	ρ_z	0.900	Entrepreneurial exit rate (in %)	7.4	7.1			
z process variance	σ_z^2	0.175	Self-employed with earnings ≤ 0 (in %)	10.0	8.8			
Bankruptcy cost	χ	0.063	Entrepreneurial bankruptcy rate (in %)	0.60	0.62			
Self-emp. labor supply	$\underline{\ell}$	0.220	Share of entrepreneur who are employer (in %)	66.0	66.0			
Entrepreneurial ability	81	0.216	W to E flow $1^{\bar{t}h}$ tercile/avg rate (%)	1.15	1.16			
Entrepreneurial ability	82	0.244	W to E flow 2^{nd} tercile/avg rate (%)	0.85	0.85			
Entrepreneurial ability	83	0.284	W to E flow 3^{rd} tercile/avg rate (%)	1.00	1.00			

 Table 2. Endogenously calibrated parameters and targeted moments.

discount factor β helps to generate a realistic capital-output ratio, excluding public capital, of 2.65 in annual equivalent. The return to scale parameter in the entrepreneurial sector ν lets us fit the ratio of median net worth between workers and self-employed agents. This ratio varies significantly across SCF waves, ranging from 4.5 to 9.6. As a comparison, Cagetti and De Nardi (2006) report a value of 5.5 when considering all self-employed individuals. We target a value of 6.0. The probabilities of getting a business idea or a job opportunity depend on search efforts. Exit probabilities are thus: $\pi_e(s_e) = 1 - e^{-\kappa_e s_e}$ and $\pi_w(s_w) = 1 - e^{-\kappa_w s_w}$. The matching parameters (κ_w, κ_e) and the search elasticities, ψ_w and ψ_e (with the restriction $\psi_w = \psi_e$), are used to obtain consistent masses and transitions between occupations in the model. We define a self-employed agent as any individual who declares being self-employed with an active management role in their business. This definition takes into account the target population of SEA-type policies which is any self-employed agent that could appropriately apply to such a program and, therefore, could be involved enough in the management of the business. In the SCF, this definition yields a selfemployment rate of 9.5%. Unfortunately, in the CPS, we are unable to effectively control for an active management role but the share of individuals that self-report being self-employed in the 20-65 old population is about 10.7% across sample periods, which is close to our SCF number. We retain this target. The unemployment rate target is 5.1%, which is roughly the US average from 1994 to 2015, and the fraction of previously unemployed new self-employed agents is 20%, as observed in the CPS.

The labor supply of self-employed individuals, $\underline{\ell}$, is set to match a share of self-employed individuals with employee(s) (n > 0) of 66%, close to the SCF range: in the SCF, if we consider only individuals who declare being self-employed with an active management role in their business, 64% to 71% of these are employers depending on the period.

Finally, we let the bankruptcy cost χ adjust in order to generate a realistic quarterly default rate among self-employed individuals of 0.60% consistent with Mankart and Rodano (2015).

3.2 Model properties

We now detail the properties of the calibrated quantitative model for occupational mobility and other moments related to self-employment.

Labor market flows emerge here as the aggregation of endogenous optimal decisions to search and exit to a new occupation, with the exception of the flow from worker to unemployment that we pin down to the data. The aggregate flows reported in Table 3 are fairly comparable to their CPS counterparts. In particular, the model captures the fact that unemployed individuals are 4 to 5 times more likely than workers to start a business. The model reproduces the empirically high entrepreneurial exit rate into paid employment. Two forces lead to such a high rate. On the one hand, an adverse business shock generates low future expected profits and encourages self-employed agents to search for a job *on-the-business*. On the other hand, a sizable fraction of unemployed individuals started their business *out-of-necessity*. Since the option to work in the corporate sector is better for those individuals, they continue to search for a job *on-the-business* and exit as soon as a job is found. The model is also able to match the shapes of the flows from a given occupation to another at a more micro level. In section D of the online appendix, we report occupational flows by individual ability levels as compared to SIPP counterparts and verify that these flows are reasonably accounted for.

Masses (%)			Flow: I	Flow: Model (CPS Data) (%)					
	Target	Model	W	Ε	U				
 W	84.2	84.2	97.1 (97.4)	0.77 (0.66)	2.12 (1.96)				
Ε	10.7	10.7	6.17 (5.96)	92.8 (92.6)	0.95 (1.42)				
U	5.1	5.1	44.4 (44.5)	3.43 (3.57)	52.3 (52.0)				

Table 3. Flow between occupations during a quarter (data counterpart between braces).

Data sources: authors' computations using CPS data from 1994 to 2015. We restrict our sample to individuals in the 20 to 65 age bracket.

Individual job search and business search efforts play an important role in shaping the flows between occupations and, in our setup, ability and wealth are two minimal dimensions that drive these efforts. The model is consistent with established results about job search efforts: they are decreasing in wealth for both unemployed and self-employed agents. Moreover, a more able individual will provide a higher effort at all wealth levels. Business search efforts are hump-shaped in wealth. Wealth-poor individuals, most likely to be constrained, do not find it interesting to run very small firms and thus provide very small effort. As wealth increases, individuals are willing to invest larger amounts in their businesses, and the effort increases. At some point, search costs become larger than the benefit of additional capital in the business and search efforts decrease.

The model also captures a number of other moments related to the labor market and selfemployment that are not explicitly targeted but that are still reasonably well matched. The necessity share, which is the fraction of self-employed individuals who started businesses because of a lack of job opportunities is about 5.3% in our model and is evaluated by Ali et al. (2008) in 2008 to be 4.7% of early-stage entrepreneurs for men and 21.4% for women, representing 10% in total.¹⁹ Therefore, in line with Caliendo and Kritikos (2009), among the 21% new self-employed agents who were previously unemployed, a substantial fraction enters self-employment *out-of-necessity*.

Concerning entrepreneurial earnings, 8.8% of the self-employed get zero or negative earnings (profits in the model). But if we consider only those who do not exit self-employment at the end of the period, this fraction is to 8.0%. This means that despite the realization of bad shocks, a substantial number of self-employed agents persist in their activity. As argued by Hamilton (2000) or more recently by Astebro and Chen (2014), a number of self-employed agents (about 50% in the model) create and keep running a business although they would earn more in a paid job. In the model, expectations of a better business shock z and frictions induce some self-employed to keep running a bad business while others search for a job opportunity and exit as soon as possible. The model generates heterogeneity in entrepreneurial earnings through different firm sizes, abilities, and business shocks. The implied Gini coefficient for entrepreneurial earnings in the model is 0.73 against 0.64 in the SCF. Now considering all forms of income (including accrued interests from savings and realized profits), the fraction of self-employed agents with zero or negative income falls to 4% in the model, and between 1% and 4% in the SCF. Finally, concerning the crosssectional variance of earnings between occupations, we find a ratio of the standard deviation of entrepreneurial earnings with respect to wage earners of 3.8 in the model, while it is typically 3 to 4 in the US according to Astebro and Chen (2014), and 4.1 in the SCF.²⁰ The model also closely accounts for the share of workers employed in the small businesses entrepreneurial sector: it is 45% in the model while 46% is documented by the Small Business Administration (SBA). In the model, low-skilled self-employed workers have a lower likelihood of being employers, with an average fraction of 58%, compared to 77% for high-skilled individuals. This is in line with SCF

¹⁹We define the necessity share as unemployed agents starting a business while $\mathbb{E}[W(\mathbf{x})] > \mathbb{E}[E(\mathbf{x})] > U(\mathbf{x})$.

²⁰While the mean and the median ratio of entrepreneurial earnings with respect to wage earners is subject to a debate, it is recognized that the ratio of standard deviations is high, even controlling for mismeasurement. In the model, the median ratio of self-employed earnings (business and wage) over worker's earnings is equal to 1.1, against an average of 1.5 in the SCF, at the household level.

data, where 70% of college-educated self-employed individuals are employers, whereas only 63% of those without college education are employers.

The model also matches well the relative wealth between occupations and the associated saving characteristics. First, it is worth noting that the median ratio of entrepreneurial net worth relative to the one held by the whole population is equal to 4.5 in the model against 4.1 - 8.8 in the SCF. Additionally, the ratio of mean debt to income ranges from 0.80 to 1.50 between SCF waves, whereas it is 1.99 in our model. Moreover, the median ratio of entrepreneurial (resp. worker's) income (including capital gains) to net worth (i.e. total assets minus debt) is 0.12 (resp. 0.63) in the model, while it is between 0.15 and 0.21 (resp. between 0.61 and 1.12) in the data. Finally, the fraction of zero (or negative) net worth is roughly 10% in the SCF, whereas it is 4.5% in our model, and the fraction of total wealth held by self-employed agents is between 39% and 46% in the SCF, against 33% in the model. The model underestimates the wealth Gini: we find 0.64 compared to 0.82 in the SCF. However, we do not target this statistic and our model abstracts from a bequest motive, which has been shown to play an important role in replicating the right tail of the wealth distribution.

Finally, we assess the survival rate of self-employed agents after *n* quarters, which refers to the proportion of self-employed agents who are still in business *n* quarters after entering a selfemployed activity. The survival rate after 2 years and 4 years are respectively 59% and 41% in the model. In the data, available records for surviving establishments show average survival rates of respectively 66% and 44% (see Knaup and Piazza (2007)). However, this empirical data excludes two-thirds of the observations, as it does not account for sole-proprietorship who might survive less.²¹ Overall, we potentially underestimate the true survival rate, however, as evidenced by Figure 3, we capture well its usual shape. That is, the largest exit rates occur during the first and second years and, after the fourth year, the probability of exit is considerably reduced. In the model, as non-self-employed agents have no prior knowledge of their business productivity, some start with an unfavorable business shock and rapidly exit self-employment. The necessityshare group exhibits a much lower survival rate indicating that a large fraction of individuals in this group exits upon having an opportunity, with only the highly successful ones enduring. This dynamic of exits explains why the average size of firms, conditional on survival, observed in the right panel of Figure 3, tends to be larger for this group over time, as only the more successful firms remain.

²¹It is worth noting that establishment dynamics might be somewhat different from the actual firm and entrepreneurial dynamics. As another comparison, using the Panel Study of Entrepreneurial Dynamics (PSED), Reynolds (2017) finds that 48% of firms survive after 4 years, taking the first transaction as a measure for firm birth.



Figure 3. Survival rate (left) and average firm size *k* (right) of new self-employed agents depending on their previous situation.

Note: the survival rate after *n* quarters is the proportion of entrepreneurs who remain in operation *n* quarters after entering entrepreneurship.

Overall, despite the few limitations that we underlined, the model is well suited to capture occupational flow dynamics and provide a consistent setup for the SEA policy experiments.

4 SEA Programs: Evaluation and Decomposition

This section studies the introduction of self-employment assistance programs as an extension to the existing UI policy. For our reference SEA program, denoted **SEA***, we use the US unemployment insurance duration of 26 weeks, corresponding to $\bar{q} = \rho = 0.5$. The DRI replacement parameter is set to f = 0.3, corresponding to the French PARE case. As previously detailed, this SEA policy includes three key features: *type dependency, business income dependency,* and the *UI recovery option*. This policy is compared to two alternative specifications. First, by setting f = 1, we study a *non-business income dependent* SEA policy, denoted **SEA**_{NB}, closely resembling the existing US SEAP or the German *Bridging Allowance* policies. Under that policy, new self-employed agents continue to perceive their type-dependent UI benefits, irrespective of their profit and can exercise their *UI recovery option*. Under the second alternative experiment, denoted **SEA**_{LS}, self-employed agents receive a periodic lump-sum amount that is neither *type dependent* nor *business income dependent dependent*, as in the German *Existenzgrundungszuschuss* start-up subsidy or the UK NEA policy. Here, the DRI parameter remains at f = 1 but $b_e(\theta, \pi_r) = \overline{b_e}$.²² All policies are only available to eligi-

²²We assume, as in the German system, that the lump-sum amount is lower than the lowest possible unemployment benefit such that $\overline{b_e} = \vartheta b(\theta_1)$. We arbitrarily set $\vartheta = 0.9$ but adjust the policy duration \overline{q} in order to generate the same

ble self-employed individuals. We focus on the effects of these alternative insurance reforms on production, unemployment, mobility, entrepreneurial composition, and performances, as well as welfare.

4.1 Equilibrium aggregate outcomes

4.1.1 Mobility effects Table 4 reports the aggregate steady-state effects of the reforms. In all three experiments, the additional support the SEA scheme provides to early-stage eligible self-employed agents leads to significant mobility effects. At the equilibrium, the fraction of self-employed agents insured by the policy over total self-employed is 3.2% for **SEA***, 1.8% for **SEA**_{LS} and 1% for **SEA**_{NB}. The fraction of unemployed individuals starting a business increases between 12 and 19%. Consequently, the fraction of self-employed agents increases by 1.7% for **SEA*** and **SEA**_{LS} and by 2.1% for **SEA**_{NB}, implying that the number of newly created firms per year goes up by respectively 2.8, 3.8 and 4.7%.²³. Mobility effects are thus stronger under **SEA**_{LS} and **SEA**_{NB}, mostly because benefits are provided to self-employed agents independently of their business performances under these policies: the systematic support mechanism of these two policies dominates the downside risk insurance mechanism found in **SEA***. However, these experiments select very different types of self-employed agents, both in terms of ability and wealth, as detailed in the next section.

Interestingly, our mobility results are in line with the empirical literature (see among other Caliendo and Künn (2011), Ejrnæs and Hochguertel (2014) or Hombert et al. (2020)) that studies country-specific SEA policies and focuses on micro-level responses of individuals. All those studies tend to converge on the fact that such programs alleviate the barrier to entrepreneurship, resulting in large inflows into self-employment.

4.1.2 Unemployment and production We now discuss the impact of the policy on aggregate unemployment and production and examine an important departure from the above cited empirical literature that usually solely focus on the response of gross flows and do not capture the full dynamic responses of the labor market. Notably, we find that the emphasis on the unemployment to self-employment gross flow provides an incomplete understanding of a policy's potential to reduce unemployment. Our model shows that both entry and exit rates into self-employment increase, while the transitions into paid employment (the self-employment to employment and unemployment flows) decrease. Ultimately, we find that the equilibrium unem-

share of self-employed agents as in SEA*. We obtain a duration of 1.5 years.

²³We normalize this number in the baseline model to be 500.000 new businesses created as in the US. A firm in the model corresponds to a self-employed agent.

	Baseline	SEA*	SEALS	SEA _{NB}
Type of the reform	-	type-dep	lump-sum	type-dep
DRI replacement rate f	-	0.3	1.0	1.0
A. Main economic statistics.				
Fraction of self-employed (%)	10.69	+1.66	+1.72	+2.12
Unemployment rate (%)	5.15	-0.20	-0.09	-0.27
Fraction unemployed starting businesses (%)	3.43	+12.04	+15.64	+19.40
New firms per year	500000	+2.76	+3.83	+4.73
Self-employment exit rate (%)	7.12	+1.46	+2.41	+2.86
Bankruptcy rate per quarter (%)	0.62	+5.02	+5.52	+6.13
Necessity share (%)	5.28	-26.62	-25.89	-28.04
Total labor	1.09	-0.19	-0.17	-0.23
Share L in corporate sector (%)	55.47	-1.30	-1.04	-1.47
Total capital	5.24	+0.29	+0.21	+0.31
Share K in corporate sector (%)	73.48	-0.39	-0.31	-0.43
Total production	1.98	+0.06	+0.04	+0.06
B. Reform cost and steady state welfare.				
Fraction of insured self-employed (%)	_	3.211	1.754	1.010
Tax rate (%)	0.903	0.931	0.929	0.942
Cost of the policy/GDP (%)	_	0.004	0.003	0.006
Consumption Equivalent Variation (CEV) (%)	-	0.062	0.069	0.081

 Table 4. Summary statistics: steady-states effects of reforms.

Note: In Panel A, **SEA**^{*}, **SEA**_{LS}, and **SEA**_{NB} values are given in percent deviations from the baseline. **Baseline** and all Panel B values are given in their original units as indicated.

ployment rate remains largely unchanged, with the majority of adjustments in self-employment occurring at the cost of a reduced proportion of paid workers. Specifically, we observe two effects. First, the increase in the exit rate from unemployment is partially offset by a higher entry rate into unemployment from self-employment. This increase in the entry rate occurs in part because the policy allows individuals to exercise their *UI recovery option* and return to the insured unemployment pool. Moreover, individuals who exhaust their SEA rights are more likely to directly exit self-employment in case of adverse shocks and become unemployed. Second, the policy primarily causes a shift in occupational choices, rather than significantly increasing the number of unemployed individuals exiting unemployment. Given the opportunity to work, unemployed individuals are more likely to pursue self-employment over paid employment due to the policy. However, in the absence of the policy, these individuals would likely have transitioned out of unemployment by securing a job. These dynamics considerably lessen the policy's impact on the overall unemployment rate but notably reduce the employment rate – effectively creating a crowding-out effect between self-employment and employment.

Concerning production, we find the small impact of SEA policies as reported in Table 4. This is in part because the resulting higher level of capital and labor in the entrepreneurial sector crowds out those in the corporate sector. But it is also because the targeted unemployed population is a relatively small group in the aggregate economy.

Interestingly, all reforms significantly reduce the fraction of necessity self-employed agents, i.e. those that would have been better off working in the corporate sector. Our results suggest a decrease of about 27% in the necessity share. This metric emphasizes that in our baseline economy, absent SEA programs, a significant portion of the necessity share arises due to the presence of a downside risk associated with self-employment.

4.1.3 General equilibrium effect of prices and taxes In Table 5, we clarify the impact of the adjustment of prices and taxes in general equilibrium in the context of **SEA***. To this end, we do the following experiments. When implementing the **SEA*** program, we first arbitrarily block all equilibrium adjustments of prices and taxes by setting those values to the corresponding baseline values. This is the *None* column. The following columns are alternatives where we set either taxes, wages, or the interest rate to their **SEA*** equilibrium value one at a time.

We find that in the absence of any equilibrium prices or tax adjustments, the impact of a **SEA*** type insurance would have been more pronounced, resulting in both lower exit rates out of self-employment and increased entry rates. Consequently, the increase in the self-employment rate would have been almost 1.5 times higher. Interestingly, the general equilibrium dynamics are largely driven by wage adjustments. In the **SEA*** equilibrium, wages are higher due to the increased number of self-employed individuals exerting upward pressure on wages by (i) decreasing the proportion of individuals opting for employment, and (ii) augmenting the labor demand due to newly established self-employed businesses. However, as wages rise, it becomes increasingly more interesting to opt for salaried work relative to self-employment. This feedback effect pushes down the self-employment rate and the wage. Overall, the results indicate that the initial positive incentive effect of SEA on self-employment dominates this feedback effect.

Conversely, implementing **SEA*** increases the tax rate in equilibrium, lowering the relative after-tax income of employees compared to self-employed individuals, and, thus, encouraging a shift towards self-employment and reducing exits. Finally, the adjustment of the real interest rate does not appear to be the key element here: only minor changes to our variables of interest are found when only this price changes.

4.1.4 Steady-state welfare and costs As summarized in Panel B. of Table 4, the implementation of any of the considered SEA programs improves the steady-state welfare measured in terms of consumption equivalent variations (*CEV*), despite the higher labor income taxes (labor income taxes

	SEA*	SEA* with equilibrium adjustment of:					
		None	Tax (τ_w)	Wage (w)	Interest rate (r)		
Fraction of self-employed (%)	1.66	2.33	2.52	1.46	2.37		
Unemployment rate (%)	-0.20	-0.21	-0.22	-0.17	-0.24		
Fraction unemployed starting businesses (%)	12.04	12.37	12.46	11.95	12.36		
New firms per year	2.76	3.22	3.35	2.59	3.24		
Self-employment exit rate (%)	1.46	1.22	1.15	1.49	1.20		
Total labor	-0.19	-0.26	-0.28	-0.16	-0.27		

Table 5. General Equilibrium effects of prices and taxes.

Note: all values are given in percent deviations from the baseline. "None" implements **SEA**^{*} with all prices and tax rates blocked at their baseline values. The following columns respectively sets τ_w , w, and r at their equilibrium value implied by **SEA**^{*} one at a time.

increase between 3% and 4.3%).²⁴ This is explained by the fact that eligible self-employed agents are much better off under the policies since they obtain a minimum income level with **SEA**_{NB} and **SEA**_{LS} or are directly insured against the downside risk under **SEA**^{*}. Moreover, insured unemployed individuals also directly benefit from the policies, but welfare gains mostly go to those with sufficient wealth to run a valuable business. On the other hand, costs are small and spread widely among the masses of corporate workers and the unemployed. The steady-state welfare is higher with **SEA**_{LS} than with **SEA**^{*} but the largest gain comes from **SEA**_{NB}, where benefits are the highest irrespectively of the business outcomes, even if this policy is more expensive.

4.2 Selection effects

4.2.1 Selection by ability To understand selection mechanisms and the change in the composition of the self-employment pool, the crucial element is whether or not the reforms induce the entry of low-skilled self-employed agents. Since regular UI benefits are proportional to working ability, highly productive workers receive higher UI compensation when laid off than those with low productivity. Therefore, the insurance mechanism generated by the compensation $b_e(\theta, \pi_r)$ in the two experiments **SEA*** and **SEA_{NB}** are *type-dependent*. Contrastingly, **SEA_{LS}** provides an additional amount of income that is unrelated to previous earnings and self-employed agents cannot recover UI rights in case of failure. This policy is thus fully independent of an agent's ability θ . Contingent on whether they are *type-dependent* or not, very different self-employed agents are likely to be selected by the policies. Table 6 displays the increase in the share of self-employed agents.

²⁴*CEV* computes the constant percentage change in per period consumption, *c*, that equates the discounted expected sum of lifetime utility under the baseline economy and under the reform. It measures whether an agent, taking into account all the uncertainty, would rather be born in an economy with or without the reform.

Table 6. Increase in the share of self-employed agents by ability groups in percent deviations from the baseline.

Ability	$ heta_1$	θ_2	θ_3
SEA*	+1.30%	+1.82%	+2.03%
SEA _{NB}	+1.98%	+2.16%	+2.35%
SEA _{LS}	+1.98%	+1.68%	+1.27%

Qualitatively, results can be stated as follows: *type-dependent* policies favor the entry of more able self-employed agents while a lump-sum SEA program encourages the entry of low-skilled individuals. Because they have to give up on relatively high UI benefits, highly skilled unemployed individuals are less likely to enter self-employment under **SEA**_{LS} as compared to other reforms. Indeed, the lump-sum amount $\overline{b_e}$ is too low to resorb the opportunity cost coming from the loss of their original UI benefits for this population. These composition effects could also be related to incumbent self-employed agents by maintaining the activity of those who would have left without the reforms. Figure 4 shows that entry effects are undoubtedly a driver of the results. Highly-skilled (resp. low-skilled) unemployed individuals are more likely (resp. less likely) to start a business under both *type-dependent* reforms and less likely to take a job opportunity, while under **SEA**_{LS} the selection into self-employment is closer to what is observed in the baseline economy.

Interestingly, our findings corroborate results in the empirical literature. In Germany, the 2003 start-up subsidy is similar to a lump-sum SEA and has been shown to significantly increase the entry of unemployed individuals into self-employment, especially for lowly educated individuals (see Caliendo and Künn (2011)). Additionally, Hombert et al. (2020) show that the DRI introduced in France in 2002-2003 did not lower the quality of new self-employed agents, especially in terms of education. Finally, in Caliendo et al. (2015), a type-dependent SEA policy implemented in Germany after 2006 is also found to have homogeneous effects across education levels.

4.2.2 Selection by wealth Turning to the wealth distribution, the effects mirror the observations made by ability. The left panel of Figure 5 displays the difference in the mass of self-employed agents with respect to the baseline case under both **SEA**^{*} and **SEA**_{LS}. Compared to a lump-sum SEA, the steady-state distribution under the *type-dependent* policy has richer self-employed agents. These individuals are more likely to run bigger businesses and increase aggregate production. Contrastingly, the small increase in the leftmost bin shows that even under these assistance mechanisms, financial constraints prevent very poor individuals from running valuable businesses. The right panel of Figure 5 shows that both policies lead to a significant and similar reduction in the necessity share. By removing part of the incentives toward job search, the SEA reforms mag-



Figure 4. Flows (relative to the average transition rate) from unemployment toward paid employment and self-employment by ability group.

nify the value of being a self-employed agent and reduce the number of unemployed individuals entering self-employment due to a lack of job opportunities.

Figure 5. Difference in the mass of self-employed agents (left panel) and the necessity share (right panel) relative to the baseline economy for the **SEA**^{*} and **SEA**_{LS} reforms.



4.2.3 Selection and performances A natural question when implementing a program fostering self-employment is how eligible new self-employed agents perform under the policies. In particular, as pointed out by Caliendo and Künn (2011), these self-employed agents could have entered and performed similarly without the reform, resulting in important deadweight losses. These losses are even stronger if the reforms generate moral hazard effects and reduce the incentives to run and expand a business. These effects are usually hard to estimate empirically. We use our

model to evaluate the performance of eligible self-employed agents on production, invested capital, bankruptcy rate, skills, and survival rate, in the quarters and years after their entry under SEA* and SEA_{LS} as compared to the same group under the baseline economy. We, therefore, separate new self-employed agents into two groups: (i) the intensive margin group (IMG) composed of those who would have entered self-employment even without the reforms, and (ii) an extensive margin group (EMG) with those who started a business essentially because the program was available. The IMG lets us compare the performances and behaviors implied by the reforms relative to the baseline economy, without selection effects: we mark individuals becoming self-employed agents in the baseline economy, before providing them with each reform and measuring their average performances. The EMG sheds light on the performance of new eligible self-employed agents that entered due to the reforms. In the model, the share of recipients who would have started a new business even in the absence of the policy is 76% under **SEA*** and 70% under **SEA_{LS}**.²⁵ Table 7 summarizes the average performances of IMG and EMG groups over 5 years.

The IMG shows a reduction in the average capital invested (reported as size), resulting in lower production and accumulated wealth over the five years for both **SEA**^{*} and **SEA**_{LS}. This is indicative of a moral hazard issue and the relative reduction between the two policies depends on the level of insurance provided in each case. However, since **SEA**^{*} allows self-employed agents to claim their remaining UI benefits in case of business failure, recipients tend to bankrupt more often.

5 years average	Baseline	Both groups		IMG		EMG	
		SEA*	SEALS	SEA*	SEA _{LS}	SEA*	SEA _{LS}
Skill	0.237	0.238	0.237	0.237	0.237	0.243	0.235
Wealth	9.997	9.695	9.346	9.924	9.973	8.193	6.141
Production	1.493	1.528	1.469	1.462	1.481	1.716	1.346
Size	10.807	10.815	10.412	10.706	10.768	10.965	8.405
Bankruptcy rate (in %)	1.045	1.207	1.301	1.164	1.043	2.500	2.344
Labor productivity	0.353	0.364	0.351	0.358	0.351	0.419	0.331

Table 7. Performance and quality of self-employed agents after 5 years for the intensive vs. extensive margin groups.

Note: all values are an average over 5 years.

Concerning the EMG, **SEA**^{*} selects higher skilled and richer unemployed individuals than the **SEA**_{LS}, and this persists over the 5 years. This is similar to our previous observation. The re-

²⁵Although empirical measurement poses challenges, our figures appear to align with those reported in the empirical literature across various policies and countries. Caliendo (2016) indicates that the proportion of subsidy recipients likely to have initiated a new business without the subsidy stands at 60% in France through the ACCRE reforms.

sulting average production under **SEA**^{*} is 15% higher than the baseline case and 27% higher than under **SEA**_{LS}. Because this increased entrepreneurial production does not necessarily mean higher aggregate production, we compute the (virtual) average marginal productivity of labor that translates the marginal production that an additional worker in each considered group would have generated if she was employed in the corporate sector.²⁶ We find that the corporate production loss implied by the entry of more skilled individuals under the **SEA**^{*} is largely compensated by the increased productivity of those individuals in the entrepreneurial production sector.



Figure 6. Survival rate for the IMG (left panel) and the EMG (right panel).

Finally, Figure 6 depicts the survival rate of self-employed agents in the IMG (left panel) and the EMG (right panel). Self-employed agents in the IMG group are moderately more likely to survive as compared to the same group in the baseline economy. On the other hand, an average of about 20% of the EMG survives after 5 years. This low survival rate among the EMG group is due to individuals exhausting their SEA rights and exiting in case of adverse shocks. In the end, both policies are able to foster a number of long-lasting businesses.

4.3 Insurance effects and the UI system

4.3.1 SEA decomposition Three reasons explain why insured unemployed individuals would not start a business in the model: it requires some business search effort costly in terms of utility; it is risky, and; it implies losing UI benefits. To support unemployed individuals in starting businesses, the **SEA**^{*} combines three insurance components: (1) the *UI recovery option*; (2) a com-

²⁶We abstract from the additional production coming from the self-employed agent's wealth that would have been also invested in the corporate sector, especially since it represents a very small amount.

pensation that guarantees at least UI benefits in case of low but positive entrepreneurial income; (3) the provision of a supplementary income that, depending on f, can let them earn more than their initial UI rights. In Table 8, we disentangle the various components of this insurance policy by inspecting the effects of two alternative partial entrepreneurial insurances. Provided they were unemployed with UI rights before, the first insurance only lets self-employed agents exercise their *UI recovery option*: they can return to the unemployment pool if necessary to keep claiming any outstanding UI rights. As this insurance does not pay any compensation or supplement, we call it the *0-compensation* case. The second partial insurance is simply a SEA with f = 0: the supplementary income part is removed, much like the Finnish and Dutch SEA programs, where business income is fully deducted from UI benefits.

Table 8. Effect of the entrepreneurial insurance policy under **SEA**^{*} and two partial insurances with respect to the baseline.

	SEA policy				
	SEA*	f = 0	0-compensation		
Fraction of self-employed (%dev)	+1.662	+1.549	+0.589		
Unemployment rate (%dev)	-0.205	-0.175	+0.314		
Fraction unemployed starting businesses (%dev)	+12.035	+10.882	+6.599		
Self-employment exit rate (%dev)	+1.456	+1.251	+1.349		
Fraction of insured self-employed (%)	3.211	3.448	5.463		
Tax rate (%)	0.931	0.929	0.912		
Consumption Equivalent Variation (CEV)(%)	0.062	0.057	0.016		

Note: %dev values are given in percent deviations from the baseline.

Under both partial insurances, the fraction of self-employed agents and the fraction of unemployed individuals starting a new business increase significantly. The effects are smaller in the *0-compensation* case where the fraction of unemployed individuals starting businesses increases by 6.6% relative to the baseline, against 12.0% for the **SEA*** case. Interestingly, the former scenario also shows an increase in the unemployment rate, reflecting the higher rate of exit from self-employed agents affected by adverse shocks are more likely to return to insured unemployment. In the f = 0 case, the government does not provide any extra supplementary assistance when the business income is above UI benefits: the above fraction goes up by 10.9% relative to the benchmark. As a result, the share of self-employed agents is only slightly lower than the one obtained under the **SEA***. Therefore, this subsidy part does not play a crucial role in the total effect. It is rather the insurance compensation component and the *UI recovery option* that make the **SEA*** effective. In particular, we stress that letting self-employed agents exercise their *UI recovery option*

is a substantially beneficial policy for resorbing the distortion generated by a UI system encouraging paid-employment search, with virtually no costs. This single component accounts for 35% of the increase in the share of self-employed agents under the **SEA**^{*}, with significant occupational mobility.

4.3.2 The role of the UI system Beyond the characteristics of SEA programs, the specifications of the UI policy itself can be amended. The US experienced several such reforms, especially during recessions. For instance, in late 2009, the UI duration was extended several times beyond the normal 26 weeks, up to a maximum of 99 weeks. In this context, the interplay between alternative UI systems and the provision of SEA is of significance. In the model, both the duration of UI and the level of benefits directly affect the decision to start a business. First, the more generous the UI system (i.e. longer duration or larger benefits), the lower the incentive to exit unemployment (reflected in lower search efforts). Second, the more generous the UI system, the higher the opportunity cost of starting a business, since previously unemployed new self-employed agents have to give up larger UI claims, reinforcing the incentives to not start a business. Third, a more generous UI system lets unemployed individuals accumulate more wealth in order to start their own business.²⁷ This last effect goes in the opposite direction to the other two but our quantitative results suggest that incentive effects dominate the wealth channel. Table 9 reports the impact of alternative UI systems on occupational decisions: (1) variations of the UI (ρ) and SEA (\bar{q}) durations from 26 weeks to either one year or 99 weeks; (2) variations of the replacement rate (μ) from 40% to either 60% or 80%.²⁸

When the UI duration is extended, most of the resulting unemployment rate increase is compensated by a smaller entrepreneurial fraction while corporate jobs are only very slightly reduced. On top of that, starting a business is also riskier, since it means giving up larger outstanding UI benefits while business profits are still uncertain. Consequently, the number of newly created firms is reduced. Alternatively, increasing UI benefits produces a somewhat different effect: while the unemployment rate increases and the fraction of self-employed agents is reduced, the share of corporate jobs is only very mildly impacted. The incentives to exit unemployment are still high as the UI duration remains at 26 weeks. Under both reforms, taxes considerably increase.

²⁷There are also general equilibrium effects, such as increased taxes and wages.

²⁸26 weeks correspond to a ρ or \bar{q} set at 0.5 while a year is 0.25 and 99 weeks is 0.132. More generous UI systems sometimes lead to $W(a, \theta, y, e) < U(a, \theta, e, i)$ for low values of y. We still assume that an insured unemployed individual receiving a job offer switches to paid employment. This could reflect the fact that they can not refuse a job offer, otherwise, they lose their UI rights and get $U(a, \theta, e, n) < W(a, \theta, y, e)$. Notice also that $\mathbb{E}_{y}[W(a, \theta, y, e)] > U(a, \theta, e, i)$, therefore, they still search for a job with high intensity. Alternatively, we could let agents refuse some offers, and the unemployment rate would be even larger under a very generous UI system. For a simple comparison with the benchmark results, we do not explore this issue.

	Baseline	Extended UI duration				Increased UI benefits			
$(\rho \text{ or } \bar{q}, \mu)$	(0.5, 0.4)	(0.25	5,0.4)	(0.13	2,0.4)	(0.5	,0.6)	(0.5	,0.8)
	_	Ini.	SEA*	Ini.	SEA*	Ini.	SEA*	Ini.	SEA*
Fraction self-employed (%)	10.69	10.59	10.92	10.51	11.09	10.61	10.88	10.52	10.91
%dev	_	_	3.15	_	5.57	_	2.55	_	3.68
% insured	_	_	6.92	_	11.74	_	3.06	_	3.05
Fraction unemployed (%)	5.15	5.35	5.33	5.55	5.54	5.23	5.21	5.33	5.30
Fraction workers (%)	84.16	84.06	83.75	83.94	83.37	84.16	83.91	84.15	83.79
New firms per year (in K)	500	500	518.5	500	522.4	500	523.1	500	535.2
Fraction U to E (%)	3.43	3.23	3.83	3.06	3.89	3.35	3.99	3.30	4.23
Fraction U to W (%)	44.40	42.70	42.23	41.04	40.31	43.65	43.19	42.82	42.18
Tax rate (%)	0.90	1.13	1.21	1.31	1.47	1.36	1.41	1.83	1.91
CEV (%)	-	_	0.12	_	0.19	_	0.10	_	0.14

Table 9. Effects of alternative UI systems with and without SEA*.

Note: Ini. is the baseline economy without the SEA policy but with the considered change to the UI system. %dev are percent deviations from *Ini*.

Figure 7. Effects of a more generous UI system on the self-employment rate, with/without SEA*.



When the SEA is implemented, self-employment and occupational mobility are strongly increased as the UI system becomes more generous. Indeed, the more generous the UI and the stronger the incentives not to establish a business and therefore the larger the effectiveness of the SEA. Figure 7 demonstrates the interplay between the UI design and the SEA implementation. On the left panel, increasing the UI replacement rate first reduces the self-employment rate. At this stage, the disincentive effect of a higher UI generosity is larger than the effect of the additional insurance provided to SEA-eligible newly self-employed agents. But as the replacement rate increases, the benefits of a more generous SEA program incentivize unemployed agents to enter and the self-employment rate increases. On the right panel, the effect of UI duration is somewhat similar but much more sensitive: after a swift decline, the self-employment rate increases significantly with the duration. This suggests that more than the amount of insurance, it is the possibility of obtaining a regular amount over a longer duration that matters the most for entry into selfemployment. Finally, in line with the findings above, implementing a SEA program under the considered UI reforms enhances steady-state welfare in all cases.

The empirical literature also seems to support the larger impact of SEA programs on occupational decisions when UI is more generous. For instance, taking the case of France which has a remarkably more generous UI duration of 2 to 3 years (about 104 to 156 weeks), Hombert et al. (2020) find an increase of about 10% - 25% of newly created firms post-reform. In our model, with a duration of about 99 weeks ($\rho = 0.132$), we find that **SEA*** implies an increase by 7.0% of the number of newly created firms and about 11.5% of the self-employed population are insured (compared to respectively 2.8% and 3.2% in the reference case), corroborating a stronger effect under a higher UI generosity. However, it is important to notice that our numbers are computed after all equilibrium prices have adjusted. As discussed in section 4.1, they would be higher over a shorter horizon when those prices have not yet adjusted. Evidently, aside from differences in UI durations, France features a significantly higher insured unemployment rate and a more substantial UI replacement rate, both of which likely amplify the policy's aggregate impact. Furthermore, apart from the UI system, additional factors contribute to explaining the situation in France. Hombert et al. (2020) points to the notably large pool of high-skilled unemployed individuals and a lower rate of firm creation before the implementation of the French PARE reform.

4.4 Transitional dynamics

We now compute the transition path of the economy between steady states, following a sudden and unexpected introduction of the reforms. Figure 8 depicts the dynamics. At the time of the reform, the share of self-employed agents and labor income taxes sharply rise under all the considered reforms, while the number of corporate jobs is reduced. As previously discussed, the unemployment rate increases only in the *0-compensation* case. After 5 years, almost 90% of the occupational adjustment has taken place under **SEA**_{LS} and the **SEA**^{*}, and production has increased in all reforms except under the *0-compensation* case.

We quantify welfare gains and losses along the transition as the *ex-post* consumption equivalent variation (*CEV_i*): it quantifies whether individuals alive at the time of the reforms and with perfect knowledge about the future would prefer experiencing them or not. Table 10 summarizes the results for **SEA**^{*}, **SEA**_{NB}, **SEA**_{LS} and the *0-compensation* case. Welfare along the transition mirrors the steady-state findings. Under all reforms, richer individuals (and the least constrained to



Figure 8. Transitional dynamics after an unexpected introduction of the policies.

start a business) are better off. Concerning ability, it appears that **SEA_{LS}** favors low-skilled individuals more, while *type-dependent* SEA is more nuanced across abilities but impacts low-skilled individuals slightly more. Under all reforms, workers who suffer from higher taxes are less likely to support the reforms. Interestingly, because they disfavor poor and constrained individuals with a larger marginal propensity to consume, the reforms do not appear to be supported by a majority except in the case of the **SEA_{LS}**. The latter reform benefits the (on average poorer) unskilled group more, and is, thus, better accepted. Overall, relative to steady-state welfare, transitional welfare gains and losses are quite small.

5 Conclusion

In this paper, we evaluate programs that extend the unemployment insurance system to support transitions into self-employment. We examine policies offering lump-sum transfers, as well as those providing *type-dependent* or *business income dependent* financial aid. While all programs increase the self-employment rate, *type-dependent* policies encourage the entry of more skilled and wealthier self-employed agents whereas lump-sum programs tend to attract lower-skilled and less wealthy individuals. A further decomposition of the *type-dependent* policy reveals that the option for individuals to reclaim their outstanding unemployment insurance rights upon business

Туре	Type dependent						Lump	p-sum
	SE	A*	SEA	SEA _{NB}		0-compensation		A _{LS}
Median wealth	\leq med.	>med.	\leq med.	>med.	\leq med.	>med.	\leq med.	>med.
All	-0.024	0.016	-0.024	0.020	-0.007	0.001	-0.013	0.016
A.Occupation								
Worker	-0.024	0.014	-0.025	0.017	-0.007	-0.000	-0.014	0.014
Self-Employed	-0.008	0.021	0.002	0.026	-0.003	0.004	0.007	0.021
Unemployed	-0.022	0.025	-0.018	0.034	-0.007	0.001	-0.008	0.025
B. Ability (θ)								
Low-skilled	-0.026	0.023	-0.025	0.034	-0.007	0.004	-0.012	0.033
Middle-skilled	-0.024	0.013	-0.025	0.018	-0.007	0.001	-0.015	0.016
High-skilled	-0.014	0.016	-0.016	0.017	-0.005	-0.000	-0.011	0.010
Average	-0.	007	-0.003		-0.003		0.000	
<i>Fraction CEV</i> > 0 (%)	43	3.3	47	7.7	30).3	51	0

Table 10. Welfare over the transition (in %*CEV*_{*i*}).

Note: \leq med. and > med. refer to population masses below and above the median wealth level in the economy.

failure—thereby returning to the unemployment pool—accounts for more than a third of the increase in the share of self-employed agents. Regarding performance, individuals who would have pursued self-employment even without the policy tend to invest less due to moral hazard issues, and those encouraged into self-employment by the policy exhibit a lower survival rate compared to our baseline scenario. At the aggregate level, we do not see a significant effect of the policy on the unemployment rate as (i) individuals exiting unemployment shift from employment to selfemployment; (ii) the increased exit rate out of unemployment is compensated by an increase entry rate from people leaving self-employment because of business failure. Overall, these policies effectively mitigate the implicit disincentive for unemployed individuals to pursue self-employment inherent in existing unemployment insurance systems.

Our approach leaves open a number of directions for future research. First, as Kihlstrom and Laffont (1979) emphasizes, aversion to risk plays a crucial role in entrepreneurial selection. Our analysis, like much of the existing macro entrepreneurship literature, does not account for heterogeneity in risk aversion, presenting a promising direction for future studies. Second, although our model accounts for a correlation in productivity between self-employment and paid employment, it overlooks the accumulation of experience, which has been shown to be significant in studies such as Hincapié (2020). Future research could explore the implications of SEA programs on different groups of individuals along the life cycle. Additionally, our model does not capture the strenuousness of self-employed work, which could be integrated into the utility function by valuing leisure, potentially explaining more voluntary unemployment. Finally, investigating

SEA programs as automatic stabilizers throughout the business cycle, with an enhanced model capturing the feedback between self-employment and labor market slackness and frictions, holds potential for fruitful research.

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