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Why Cash Transfer Programs Can Both Stimulate and Slow Down Job Finding

Abstract

This article analyzes the behavioral effects of cash transfer programs when jobless people need to have access to a minimum consumption level. Our model reconciles recent evidence about negligible or favorable effects of cash transfers on job-finding rates and the more standard view of negative effects. When unemployment compensation, if any, is low enough, we argue that cash transfer programs can raise the hiring probability. Our framework is flexible enough to generate the standard conclusion as well. Looking specifically at unemployment compensation, its optimal level is generally higher than when a lower bound on consumption is ignored.

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1 Introduction

Not much is known about the effects of cash transfers on joblessness duration in environments with little outside institutional assistance (see Section 2). In such environments, dealing with subsistence is plausibly a pressing and urgent issue. Our paper puts forward an intuitive extension of the standard job search model that takes seriously into account the presence and consequences of subsistence constraints. In this more general setting, we show analytically that cash transfers to jobless individuals can increase their chances of finding a job. An in-depth numerical analysis indicates that this property generally holds for low enough transfers. For higher levels, we retrieve the standard property that increasing generosity reduces hiring rates. Throughout the paper, we distinguish two types of cash transfer programs. The first one provides cash to eligible jobless people who continue receiving the transfer when they find a job (like in Franklin, 2018; Barrientos and Villa, 2015; Banerjee et al., 2017). The second type of transfer is conditional on joblessness and is an unemployment compensation scheme. In the latter case, we also look theoretically and numerically at the optimal level of the transfer. Compared to a framework where a minimum consumption requirement is ignored, the optimal replacement rate is generally higher.

The income of jobless people is not protected in a large number of countries (Vodopivec, 2013; Bosch and Esteban-Pretel, 2015) and where it is, the coverage and the level of benefits are sometimes low. According to the World Social Security Report (International Labour Office, 2010, p.60), 80% of high-income countries had a statutory program of unemployment protection, but only 39% of all the unemployed were covered. The coverage rates for other countries are substantially smaller. This raises the question of the subsistence of jobless people.

When public income protection against joblessness is low or absent, the unemployment risk is not covered by private insurers[1] and credit markets are imperfect or absent, part of jobless people struggle to make ends meet. They do this for example by looking for discounts in the supermarkets, fixing old clothes, selling home-made food, engaging in subsistence farming, or begging in the streets. These "subsistence activities" introduce a margin of self-insurance against joblessness. However, they also require some effort that in a way or another is detrimental to the chances of finding a job. The first mechanism consists of seeing the latter effort and job search effort as substitutable amounts of time. This interpretation can be seen as a particular case of our general framework. However, it is not the one we put forward, since the available evidence on the time spent on job search suggests that time is not the scarce resource for the population of interest (Krueger and Muller, 2010; Manning, 2011, p.986, Aguiar et al., 2013). We are instead inclined to prefer the following alternative mechanism.

According to Shah et al. (2012), Mullainathan and Shafir (2013), Mani et al. (2013), Shah et al. (2015), and Schilbach et al. (2016), who develop a number of experiments both in the US and in developing countries, the cognitive capacity or "bandwidth" of agents is limited. "Bandwidth measures our computational capacity, our ability to pay attention, to make good decisions, to stick with our plans, and to resist temptations" (Mullainathan and Shafir, 2013, p. 41). Finding a job and dealing with subsistence are processes that are absorbing cognitive resources. Performing the above-mentioned *subsistence activities* makes heavy demands on the cognitive capacity of the agent and automatically leaves less cognitive resources available for

1 For reasons provided by for instance Easley et al. (1985) and Hendren (2017).

job search. Therefore, the effort devoted to *subsistence activities* has a negative impact on the probability of exiting unemployment. This is an intuitive, yet neglected, consideration, whose consequences are at the heart of our analysis.

The rest of the paper is organized as follows. We start with a literature review. Section 3 presents two standard properties in the job search literature. We introduce our baseline model and develop analytical results. Several extensions are also considered. In Section 4, we solve the baseline model and its extensions numerically. Section 5 concludes.

2 Literature review

This section starts by summing up the empirical evidence that is related to our paper. First, the effect of cash transfers (that can be kept when the agent finds a job) on labor outcomes seems to depend on the availability and generosity of other forms of institutional assistance, like unemployment benefits (UB), and more broadly to the amount of wealth people have. Second, even though it is standardly found that higher UB have negative effects on job search, not much is known in setups in which the level of UB is low. We discuss the few papers we found that look at the effects of UB for low-income populations. Next, this section turns to the theoretical literature. First, we look at some extensions of the basic job search framework that are somehow linked to our approach. Finally, we mention some papers that look at the optimal design of unemployment insurance when agents have access to informal jobs.

According to Chetty (2008) for the US, Card et al. (2007) for Austria and Basten et al. (2014) for Norway, providing cash (in the form of a severance payment) increases the duration in unemployment. These analyses are performed in countries where agents, on top of the cash transfer, receive an unemployment compensation that ranges between 43% and 62% of the pre-unemployment wage.

On the other hand, there is recent evidence suggesting that when people are poor and have little or no public protection, providing money may help them to leave unemployment. Franklin (2018) develops an experiment in Ethiopia where he provides young jobless people with money (intended to cover transportation costs). He finds that four months after the start, people who received the subsidy were 7% points more likely to have a permanent work. The effect was stronger for relatively poor and cash-constrained people. Using a regression discontinuity design, Barrientos and Villa (2015) find that a conditional anti-poverty cash transfer in Colombia (conditional on maintaining kids in school) had positive effects on the level of employment of adult males. Banerjee et al. (2017) analyze the effects of seven different cash transfer programs on low-income families in developing countries. When pooling the samples, they do not find evidence of a negative effect on work outside the household. When treating each program separately, in some cases, they find a positive effect. For a recent survey of articles showing that cash transfers could have non-conventional effects on labor outcomes, see Baird et al. (2018).

It is true that Barrientos and Villa (2015) and most of the programs analyzed by Banerjee et al. (2017) impose that the recipient's children attend school, and this could potentially affect their labor supply decisions. Nevertheless, as stated by Banerjee et al. (2017), "in general, it is important to note that there is considerable variation in how stringent conditions are enforced across countries, so that even in programs that are conditional 'on the books', beneficiaries may still receive the full stipend amount regardless of whether they meet them". Mesén Vargas

(2018) focuses on a subsample of the recipients of PROGRESA (a large cash transfer program in Mexico analyzed by Banerjee et al., 2017) that is not affected by the conditionality of the program. She finds that the effects are overall similar to those for the total sample, that is, the transfers do not have negative effects on work outside the household.

Turning to the impact of unemployment compensation, it is typically found that people stay jobless longer when the generosity of UB increases (see e.g. Tatsiramos and van Ours, 2014 for a survey). However, to the best of our knowledge, none of the original studies this paper cites has focused on the effects of UB when they are low and there is little outside institutional assistance.

A limited amount of knowledge is nevertheless available for low-income populations. LaLumia (2013) estimates a hazard model for a sample of people eligible to the earned income tax credit (EITC) in the US. In all, 23% of the unemployment spells in her sample involve the receipt of UB. On average, individuals in her sample are eligible for about $150 weekly UB measured in 2007 real dollars. She finds that the effect of UB on women unemployment spells is not significant. For men, in some of her specifications, the effect of UB on the hazard rate is positive and significant.

Kupets (2006) develops a duration analysis for Ukraine. The level of UB is low, approximately 25%–28% of the official average wage. Only 4.6% of the sample reported UB as their main source of support. In all, 13.9% of the sample states that casual activities or subsistence farming constitute their main source of subsistence. She finds that receiving UB does not decrease the reemployment probability. Moreover, she finds a negative effect of the presence of casual work on the job-finding rate. In other fields than economics, in-depth interviews suggest that cuts in low levels of benefits are harmful to the job search process (see e.g. Morris and Wilson, 2014).

This contrasting empirical evidence suggests that the effect of cash transfers on the probability of finding a job may vary with the wealth of people.

Even though the existence of daily subsistence constraints has been recognized in the economic literature,[2] to the best of our knowledge, these constraints have not been explicitly included in the analysis.[3] This is especially true in the case of the job search framework. Some extensions of the basic job search framework are nevertheless linked to our approach.

The framework in which job search requires both money and effort (or time) has been introduced by Barron and Mellow (1979), Tannery (1983), and Schwartz (2015). The two first papers assume that search requires time and money but assume no complementarity between them. Schwartz (2015) assumes that looking for a job requires effort and an investment in search capital. He develops a theoretical analysis in a two-period setting and numerical experiments.

Ben-Horim and Zuckerman (1987), Decreuse (2002), and Mazur (2016) consider that job search requires only monetary expenditures. These papers, as ours, highlight the positive effect

2 In the literature of development economics, see for instance Dercon (1998) and Zimmerman and Carter (2003) about the role of subsistence constraints on assets accumulation for the poor and Bhalotra (2007) about the link between subsistence constraints and child work. In the literature on social insurance, it has been mentioned by Chetty (2006) and Chetty and Looney (2006).

3 As will soon be clear, this goes beyond the assumption that the marginal utility of consumption becomes huge when the level of consumption tends to zero. Pavoni (2007) analyzes the design of optimal unemployment insurance when the planner must respect a lower bound on the expected discounted utility of the agent. The unemployed agent decides whether to search or not (binary decision) subject to the scheme proposed by the planner.

that UB can have on the duration in unemployment. Nevertheless, with their specification, providing cash to the agents always[4] increases the probability of finding a job. This is at odds with empirical evidence that finds that cash transfers increase duration (Chetty, 2008; Card et al., 2007; Basten et al., 2014) and with empirical evidence that shows that richer agents experience longer unemployment spells (Algan et al., 2003; Lentz and Tranaes, 2005; Lentz, 2009; Centeno and Novo, 2014).

Finally, some papers look at the design of unemployment insurance (UI) when hand-to-mouth jobless people can have access to informal jobs. Alvarez-Parra and Sanchez (2009) study the optimal time profile of UB when job search effort and in-work effort in the hidden labor market are private information and perfect substitutes. A key result of their paper is that at the start of the spell, the optimal level of UB should be generous enough to deter participation to the hidden economy. Gonzalez-Rozada and Ruffo (2016) extend the study of Shimer and Werning (2007) to the case where all insured unemployed have an additional exogenous source of untaxed income. They also develop a sufficient statistics approach. Long and Polito (2017) look at the time profile of UB when the marginal cost of job search is higher if the unemployed work informally. Some other papers adopt a Mortensen–Pissarides framework in the presence of an informal sector and look at the impact of the introduction of UI on equilibrium unemployment and on the share of formal, informal wage employment and self-employment (see e.g. Margolis et al., 2014; Bosch and Esteban-Pretel, 2015; Charlot et al., 2016).

3 Positive analysis

This section first recalls two standard results of the literature obtained in a very stylized setting. Then, we move to our baseline model, which incorporates subsistence requirements and a subsistence activity. We provide conditions under which increasing the generosity of the cash transfer reduces the effort put in the subsistence activity. Finally, we briefly introduce three extensions to our baseline model and discuss an alternative framework that generates properties that are similar to those of our baseline model.

3.1 Standard job search model [SM]

Before introducing our baseline model [BM], let us look at the "standard model" [SM], a simple theoretical setting leading to the standard properties summarized at the end of this section, which are questioned by our [BM]. The [SM] is a partial equilibrium job search model in a stationary discrete-time setting. Infinitely lived, homogeneous, and hand-to-mouth unemployed workers only have one decision variable: their search effort intensity, $s \in \mathbb{R}_+$. The instantaneous utility is separable in consumption and search effort. $\lambda(s)$ denotes the cost of job search effort, and it is assumed that $\lambda(0) = 0$, $\lambda_s > 0$, $\lambda_{ss} \geq 0$.[5] Unemployed workers are entitled to flat UB, if any, $b \geq 0$, with no time limit. Hence, there is no room for an "entitlement effect" (Mortensen,

4 The effect of providing cash to the agent, regardless of the employment status, is in principle ambiguous. Nevertheless, one can show that for a utility function that exhibits constant relative risk aversion (CRRA), providing cash to the agent increases job search effort and therefore decreases the expected duration in unemployment. If the utility function exhibits constant absolute risk aversion, providing cash to the agent has no effect on job search effort. These results are available from the authors upon request.

5 For any function $f(x, y)$, f_x designates the first-order partial derivative and f_{xy} the second-order one.

1977). Moreover, agents are entitled to a cash transfer, if any, $A \geq 0$, which can be kept if the agent finds a job.[6] In each period, the consumption of the unemployed agent, c^u, is equal to $b + A$. It is further assumed that the agent is risk averse, implying that her utility function $u(c)$, $c \in \mathbb{R}_+$, verifies $u_c(c) > 0$ and $u_{cc}(c) > 0$. In each period, job offers arrive with probability $P(s)$ such that $P(0) = 0$, $P_s > 0$, and $P_{ss} \leq 0$. The net wage and hence the consumption level, c^e, associated with a job offer are equal to $w + A - \tau$, where w is the gross wage and τ is the level of taxes if the job is formal.[7] The disutility of in-work effort is normalized to zero. The employed agent loses her job with an exogenous probability ϕ. The agent discounts the future at a rate $\beta = 1/(1 + r)$ where r is the interest rate. The unemployed chooses s in the current period. If she receives an offer, she starts working in the next period.

In the [SM], the lifetime value V^U in unemployment (respectively V^E in employment) verifies the following Bellman equations:

$$[\mathrm{SM}] = \begin{cases} V^U = \max_s \quad u(b+A) - \lambda(s) + \beta\left[P(s)V^E + (1-P(s))V^U\right] \\ V^E = u(w+A-\tau) + \beta\left[\phi V^U + (1-\phi)V^E\right] \end{cases} \qquad (1)$$

Subject to $V^E - V^U \geq 0$, $s \geq 0$.

We recall two standard properties of an interior solution to the [SM]:

(1) Increasing b lengthens the expected unemployment duration $D = 1/P$.
(2) Increasing A lengthens the expected unemployment duration (Chetty, 2008).

3.2 Baseline model [BM]

Our [BM] incorporates four differences into the [SM]. First, we assume a Stone–Geary utility function of consumption $v(c - c_{\min})$, defined for $c \geq c_{\min}$, where $c_{\min} \geq 0$ is the agent's subsistence requirement.[8] Second, we assume that the unemployed agent can carry out a subsistence activity by exerting some effort $a \in \mathbb{R}_+$. This activity is even needed if $b + A < c_{\min}$. Third, we assume that effort a can (but need not) be costly, meaning that a is now a second argument of the cost $\lambda(\cdot)$ with $\lambda_a \geq 0$ and $\lambda_{aa} \geq 0$. Although it is quite natural to assume that the effort a induces some disutility like job search effort does it, the properties mentioned in this section continue to hold if we assume that λ is not a function of a under the maintained assumption introduced below about the role of a on P. We also assume that the marginal cost of job search effort cannot strictly decrease when more effort is devoted to guarantee subsistence: $\lambda_{sa} \geq 0$. Fourth, the job-finding probability P is a function of s and a. Following the scarcity literature mentioned in the introduction, we assume that cognitive capacity is limited. Dealing with subsistence, which is a pressing activity, taxes this cognitive capacity, meaning that less cognitive capacity is left for job search. Formally, the effort devoted to the subsistence activity has a negative effect on the job-finding probability: for the same level of job search effort, the job-finding probability

6 Below we interpret A as a public transfer, but it could also be interpreted as a transfer inside the family.

7 As in Chetty (2008) or Hopenhayn and Nicolini (1997), we consider a degenerate distribution of wage offers. Furthermore, the net wage is high enough so that the probability of acceptance of an offer is 1. These assumptions are relaxed in Subsection 3.3.

8 Imposing a unique daily minimum consumption level is of course a simplification.

is lower the higher the quantity of effort devoted to the subsistence activity, i.e. $P_a < 0$. Furthermore, the marginal effect of job search on the exit probability cannot strictly increase when more effort is devoted to guarantee subsistence: $P_{as} \leq 0$.

We keep the short notation $u(c)$, where $u(c) = v(c - c_{\min})$ and $u_c(c) > 0$, $u_{cc}(c) < 0$. The consumption level when unemployed becomes $c^u = b + A + g(a)$ where $g(a)$ is the subsistence activity, with $g(0) = 0$, $g_a > 0$, and $g_{aa} \leq 0$. We further assume that $g(a) = 0$ when the agent is employed, meaning that the agent does not carry out the subsistence activity when employed.[9]

All along the paper, in accordance with Alvarez-Parra and Sanchez (2009) and contrary to Long and Polito (2017), we assume that a and s are not observable by the UI agency. So, neither the activity a nor a too low level of s can be sanctioned.[10]

In the [BM], the Bellman equations in unemployment and in employment can be written as:

$$[\mathrm{BM}] = \begin{cases} V^U = \max\limits_{s,a} \quad u(c^u) - \lambda(s,a) + \beta\left[P(s,a)V^E + \left(1 - P(s,a)\right)V^U\right] \\ V^E = u(c^e) + \beta\left[\phi V^U + (1-\phi)V^E\right] \end{cases} \tag{2}$$

where $u(c^u) = v(b + A + g(a) - c_{\min})$, $u(c^e) = v(w + A - \tau - c_{\min})$, $\lambda_a \geq 0$, $\lambda_{aa} \geq 0$, $\lambda_{as} \geq 0$, $\lambda_s > 0$, $\lambda_{ss} \geq 0$, $P_a < 0$, $P_{as} \leq 0$, $P_s > 0$, $P_{ss} \leq 0$, and $P(0, a) = 0$

Subject to $b + g(a) \geq c_{\min}$, $w - \tau \geq c_{\min}$, $V^E - V^U \geq 0$, $a \geq 0$, and $s \geq 0$.

Comparative statics in the baseline model

The first-order conditions (FOCs) of this maximization program, if the solution is interior, are:[11]

$$G_a = u_c\left(c^u\right)g_a - \lambda_a + \beta P_a\left[V^E - V^U\right] = 0 \tag{3}$$

$$G_s = -\lambda_s + \beta P_s\left[V^E - V^U\right] = 0 \tag{4}$$

where $V^E - V^U = \dfrac{u(c^e) - u(c^u) + \lambda(s,a)}{1 - \beta\left[1 - P(s,a) - \phi\right]}$.

Let ξ designate either b or A. In general in the [BM], an increment in ξ induces ambiguous effects on s and a, which implies that the standard properties recalled in Section 3.1 are not necessarily met. We now discuss the conditions under which $da/d\xi < 0$, and we explain why $ds/d\xi$ is almost always negative. *This discussion opens the possibility of a hump-shaped relationship between the hiring rate and ξ.*

Marginal effect of *b* and *A* on effort devoted to the subsistence activity

Proposition 1. *The following inequality is a necessary condition to have $da/d\xi < 0$:*

9 Otherwise devoting effort to the subsistence activity would have negative effects on the productivity of the employed agent, and this should also be analyzed. In such a setup, the probability of losing the job, ϕ, would be a function of a. Given our focus on the problem of the unemployed, such an analysis is beyond the scope of this paper.

10 On the difficulty of observing job search effort without errors, see for instance Cockx et al. (2018).

11 Corner solutions are discussed in Appendix A.1.

$$-u_{cc}\left(c^u\right)g_a > \beta\frac{\partial\left(V^E - V^U\right)}{\partial\xi}P_a \tag{5}$$

while the following inequality is a sufficient condition to have $da/d\xi < 0$:[12]

$$-u_{cc}\left(c^u\right)g_a > \beta\frac{\partial\left(V^E - V^U\right)}{\partial\xi}\left(P_a - P_s \cdot \max\left\{\frac{\lambda_{as}}{\lambda_{ss}}, \frac{P_{as}}{P_{ss}}\right\}\right) \tag{6}$$

Proof. See Appendix A.1.

We are fully aware that conditions (5) and (6) typically depend on endogenous variables, so that it is not easily checked whether they are verified.

When ξ increases, two different forces affect a. Consider first the left-hand side (LHS) of inequality (6): when ξ increases, the marginal utility gain of effort devoted to the subsistence activity is smaller. This effect goes in the direction of reducing a. We call this an *income effect*.

Consider now the right-hand side (RHS) of the inequality: $\beta\frac{\partial\left(V^E - V^U\right)}{\partial\xi} < 0$ implies that an increment in ξ distorts the relative value of being employed vs. being unemployed (and even more so if the tax rate is adjusted to balance the public budget). This affects a through two channels, a direct one, $P_a < 0$, and an indirect one through the effect of the change in ξ on s, $-P_s \cdot \max\{\lambda_{as}/\lambda_{ss}, P_{as}/P_{ss}\} \leq 0$. The direct channel is that since employment is less attractive, the negative effect that a has on P is marginally less detrimental for the utility of the agent. The indirect channel is that an increase in ξ can have, and as discussed later on typically has, a negative direct impact on s. When the cross-derivatives λ_{as} and P_{as} are not both nil, this change in s in turn affects the level of a. Two channels are at work. On the one hand, given the reduction of s, the marginal cost of a becomes smaller ($\lambda_{as} \geq 0$). On the other hand, given the reduction in s, a is now marginally less detrimental to the hiring probability ($P_{as} \leq 0$). Both the direct and the indirect effects go in the direction of increasing a. We call this a *substitution effect*. As explained in Appendix A.1, a sufficient condition can be expressed in terms of the strongest of these two channels, hence, the max operator in (6).

Example. *If the cost of effort* λ *is a function of s but not of a, and* $P(a, s)$*,* $g(a)$*, and* $u(c^u)$ *have the functional forms assumed in Table 1 (and justified in Section 4), Condition (6) can be written as an upper-bound on a, namely:*

$$\frac{(1-\beta_1)\sigma\gamma}{\beta_2}\cdot\frac{G}{b - c_{\min} + G} > a \tag{7}$$

Proof. See Appendix A.1. The LHS of this condition makes sense if $b - c_{\min} + G > 0$, where G is the scale parameter of $g(a)$ (see Table 1). The other parameters on the LHS of this condition are the (constant) relative risk aversion (RRA) σ and all the parameters appearing in P and $g(a)$. As b increases, Condition (7) becomes more stringent.

Marginal effect of *b* and *A* on job search effort

The sign of $ds/d\xi$ is given by the sign of (21) in Appendix A.1. All forces in this equation but one pushes it to be negative. The positive effect comes through the interaction between a and s.

12 If $\lambda_{ss} = 0$ or $P_{ss} = 0$, see Appendix A.1.

3.3 Extensions to the baseline model [BM] and monetary costs of job search

This subsection briefly introduces three extensions to [BM], which we use later on in the numerical analysis. These extensions introduce one by one some realistic features that are absent in the [BM]. In all the extensions, time is finite and the agent lives for T periods. Appendix A.1.2 develops the three theoretical frameworks. In the first extension, we model a single unemployment spell during which the agent is entitled to the UB, if any, for $B < T$ periods. We call it the "model with finite entitlement" [FE]. In the second one, we allow for the presence of incomplete financial markets: the agent starts her life with an exogenous level of assets; she can save and get indebted up to a certain limit L, and she has to repay her debt at the end of her life. We call it the "model with incomplete financial markets" [FM]. In the third one, we assume a sequential search model when there is a distribution of wage offers and no recall (McCall, 1970). We call it the model with "stochastic wage offers" [SWO]. The following section simulates these models as well as framework [BM].

Moreover, another setup can generate similar comparative statics properties in the absence of a minimal consumption level $c_{\min}$. Assume the following:

(1) Looking for a job requires both an amount of money m and some effort s.
(2) There is neither subsistence requirement ($c_{\min} = 0$) nor a subsistence activity $g(a)$. Therefore, $c_u = b + A - m$.
(3) The job-finding probability P is a function of s and m, with $P_m > 0$ and $P_{sm} \geq 0$, and standard signs of derivatives with respect to s.
(4) The cost λ is a function of s but not of m.

Then, the lifetime value in unemployment now solves:

$$V^U = \max_{s,m} \quad u(b+A-m) - \lambda(s) + \beta\Big[P(s,m)V^E + \big(1-P(s,m)\big)V^U\Big] \tag{8}$$

It can be checked that the effect of ξ (i.e. b or A) on m and s is analytically ambiguous and that this model can also generate a hump-shaped $b \mapsto P$ profile. See Mesén Vargas and Van der Linden (2018), p. 21, for the numerical properties of this model, which are similar to those of our [BM].

Notice that if $c_{\min}$ was taken into account, the difference between this setup and our [BM] would be relevant, because obviously $b + A - m \leq b + A$ and subsistence could not be guaranteed if $b + A < c_{\min}$.

We do not question the idea that finding a job requires some expenses. However, we do not put forward the setup introduced here for the following reason. The implications of a monetary cost of job search are arguably more substantial among the population that struggles with subsistence. However, if we remove Assumption (2) mentioned above and introduce $c_{\min}$, we have just explained that this setup is unable to deal with the (to us most interesting) cases where b or $b + A$ is low.

4 **Numerical exercise**

Since analytical results are ambiguous, we first take the [BM] and show that the relationship between the exit rate P and the benefit level b is hump shaped. This property turns out to be robust since it holds for a wide range of parameter values and for the extensions introduced in Section 3.3. Second, we show that in our [BM] and in its extensions, providing cash to the agent (A) can increase the probability of finding a job when the level of b is low enough. Finally, we analyze the effect of $g(a)$ and $c_{\min}$ on the optimal level of b.

In this section, contrary to what was done in Section 3.2, we analyze budget-balanced changes in b. The benchmark parameterization adopts the specifications and parameters of Table 1. We choose a specification for $P(s,a)$ such that if the agent devotes no effort to the subsistence activity, i.e $a = 0$, P becomes an often-used function of s only. We later check whether the properties are robust to a change in this specification. We take the time unit to be a week. The values of ϕ and r are taken from Shimer and Werning (2007). We assume a CRRA utility function where the value of σ (the RRA) is taken from Chetty (2008). Owing to a lack of evidence, it is hard to pinpoint the values of the other parameters. Nevertheless, the chosen parameterization applied to the [BM] leads to an expected duration in unemployment of 18.1 weeks

Table 1 Functional Forms and Parameters

Functions	Description	Functional Form	Source
$u(c^u)$	Utility function	$\frac{(c-c_{\min})^{1-\sigma}}{1-\sigma}, \sigma > 0, \neq 1$	Chetty (2008)
$\lambda(s, a)$	Cost of search effort	$e^{(\mu_1 s+\mu_2 a)}-1, \mu_1, \mu_2 \geq 0$	Cockx et al. (2018)
$g(a)$	Subsistence production	$Ga^{\gamma}, G > 0, 1 > \gamma > 0$	Our choice
$P(s, a)$	Probability of finding a job	$E s^{\beta_1} e^{-\beta_2 a}, E > 0$	Our choice
Parameters		**Benchmark**	**Source**
ϕ	Job destruction rate	0.00443	Shimer and Werning (2007)
r	Interest rate	0.001	Shimer and Werning (2007)
β	Discount rate	0.999	$1/1 + r$
E	Coefficient in front of $P(s, a)$	0.2	
β_1	Exponent of s in $P(s, a)$	0.5	
β_2	Exponent of a in $P(s, a)$	0.5	
w	Wage	100	
$c_{\min}$	Subsistence level	20	
σ	Relative risk aversion (RRA)	1.75	Chetty (2008)
μ_1	Parameter of s in $\lambda(s, a)$	0.3	
μ_2	Parameter of a in $\lambda(s, a)$	0.3	
G	Scale parameter of $g(a)$	22	
γ	Exponent if $g(a)$ is isoelastic	0.8	

(if b is set to its optimal value verifying Equation (9)), which is reasonable.[13] A sensitivity analysis considering 43 other sets of parameter values is provided in Fig. 2.

4.1 Impact of the unemployment compensation *b* on unemployment duration

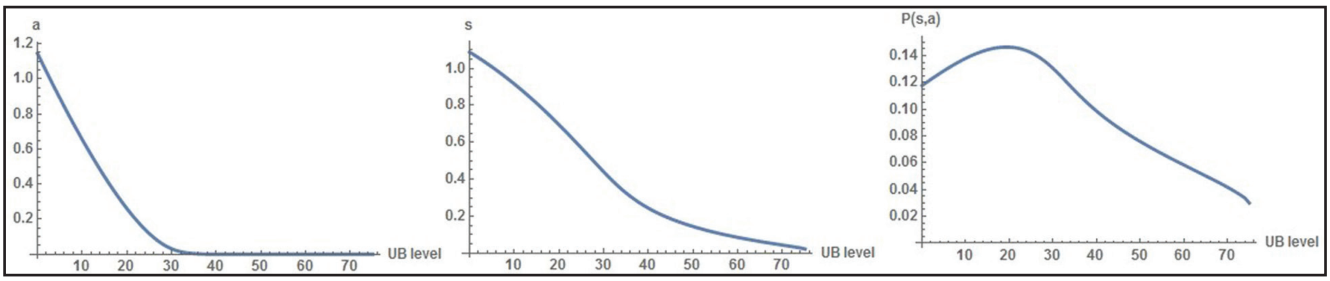
Baseline model [BM]

In the left panel of Fig. 1, when b is nil, the agent devotes a high effort a to the subsistence activity. When b increases, the *income effect* dominates the *substitution effect*, which implies that the agent devotes less effort to subsistence. In the central panel of Fig. 1, the quantity of job search effort s, as expected, monotonically decreases with b. Finally, in the right panel of Fig. 1, $P(s, a)$ is hump shaped. When b is small enough, less than 19 in this graph (i.e. a gross replacement of 19%), the agent devotes a high level of effort to the subsistence activity. This is a pressing activity that consumes attentional resources and leaves less for elsewhere (Shah et al., 2012), in particular, for job search. Putting effort into the subsistence activity is the way through which the agent deals with scarcity, but by doing so, the cognitive capacity is taxed and some of her most fundamental capacities are inhibited (Mullainathan and Shafir, 2013, p. 42). Higher levels of b allow the agent to devote less effort to the subsistence activity. This frees cognitive resources, which allows the agent to be more mindful when looking for a job. This effect is strong enough to outweigh the negative effect of a rise b on job search effort.

For higher values of b, subsistence is no longer a pressing issue. Even if the quantity of effort devoted to subsistence keeps on decreasing, the positive effect that this decline has on the probability of finding a job is mild and thus, overweighted by the entailed reduction in job search.

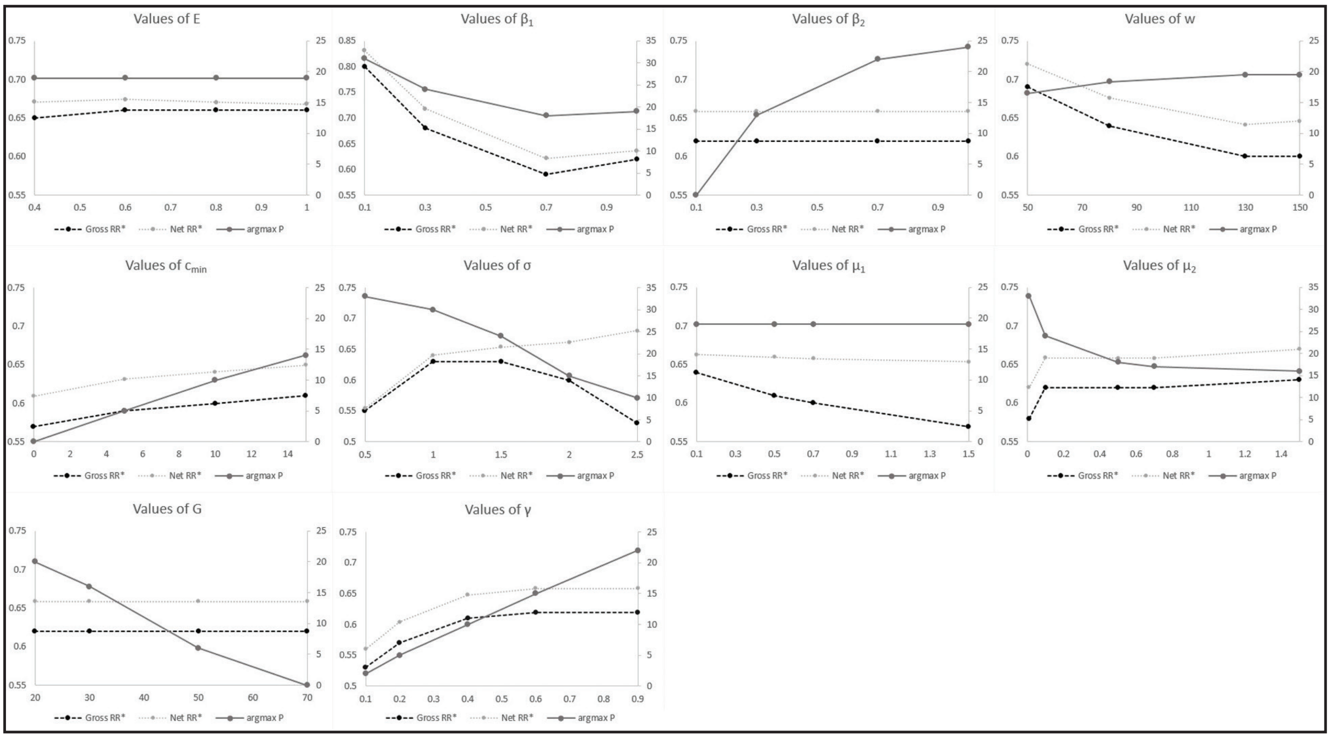
The level of b maximizing $P(s, a)$ can be sensitive to the choice of parameter values. Nevertheless, the *qualitative shape* of Fig. 1 remains the same for a broad set of parameter values. Fig. 2 reports the results for 43 different sets of parameter values. Under heading "argmax P", the reader finds the level of b for which $P(s, a)$ reaches the maximum. For almost all parameter values of Fig. 2, the hump-shaped profile of $P(s, a)$ is preserved when $c_{min} > 0$. It is not the case when the effort devoted to the subsistence activity has a small enough marginal effect on the exit rate (namely, $\beta_2 \leq 0.1$). Then, even if a always decreases with b (strictly for low values of b, weakly for high values of b), this effect is dominated by the

Figure 1 Baseline model [BM]. The three graphs show the level of a, s, and $P(s, a)$, respectively, in the [BM] for different values of b. The functions and parameters are those of Table 1.



13 Chetty (2008) calibrates his model for the US to have an average unemployment duration of 15.8 weeks.

Figure 2 Sensitivity Analysis for the Baseline Model [BM]. These graphs report the results for 43 different specifications, all using the functions of Table 1. We take the parameterization of Table 1 and change one parameter at the time whose values are on the horizontal axis. “argmax P” is the level of *b* on the right vertical axis for which *P*(*s*, *a*) reaches the maximum.“Gross RR*” (respectively, “Net RR*”) gives the corresponding optimal gross (respectively, net) replacement rates on the left vertical axis: *b*/*w* (respectively, *b*/(*w* − *τ*)).



drop in *s*. Nor is *P* hump shaped when *G*, the scale parameter of *g*(*a*), is high enough (≥70). Since self-insurance is relatively easy, devoting a small quantity of effort to the subsistence activity is enough to meet the subsistence requirements even when *b* is negligible. So, the negative effect of this effort on the job-finding probability is very limited. Then, the decline of *a* when *b* rises has an impact on *P*, which is always dominated by one of the reduction in *s*. Fig. 2 confirms that the hump-shaped property of the exit rate *P* is a robust property when $\lambda_a \mapsto 0$, i.e. when parameter $\mu_2 \mapsto 0$.

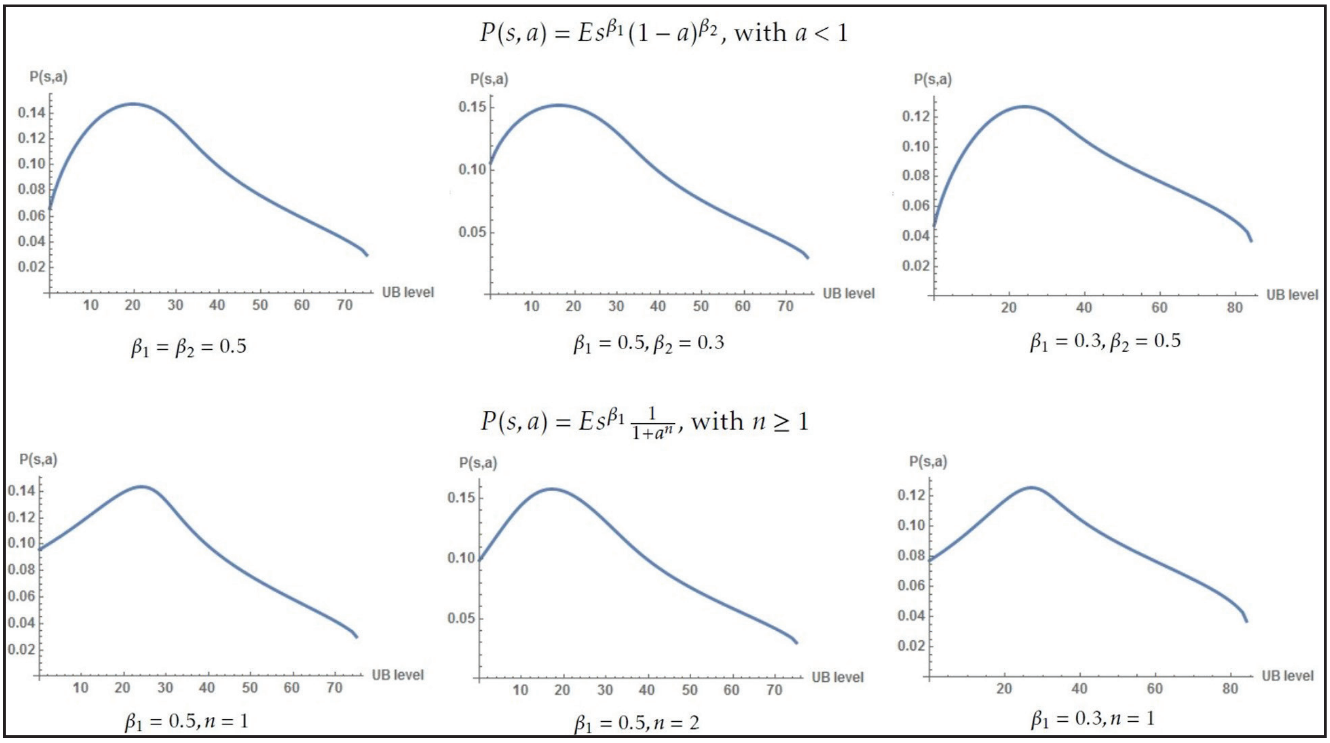
Is the hump-shaped property robust to another specification of *P*(*s*, *a*)? We consider now two alternatives to the specification adopted in Table 1. These specifications are still such that if the agent devotes no effort to the subsistence activity, i.e $a = 0$, *P* becomes an often-used function of *s* only, namely, of the form $s^{\beta_1}, 0 < \beta_1 < 1$. We consider the two following alternative functional forms:

(1) $P(s,a) = Es^{\beta_1}(1-a)^{\beta_2}$, with $a < 1$ and $0 < \beta_1 < 1$.

(2) $P(s,a) = Es^{\beta_1}\dfrac{1}{1+a^n}$, with $n \geq 1$.

Both of them, as well as the one we chose in Table 1, are such that $P_a < 0$, $P_s > 0$, and $P_{as} \leq 0$, which are the theoretical requirements that we imposed in Section 3.2. Fig. 3 shows that the hump-shaped property of *P*(*a*,*s*) is preserved with both specifications.

Figure 3 These graphs show the shape of the job-finding probability $P(s, a)$ for different values of β_1, β_2 and β_1, n, respectively. The other functions and parameters are those of Table 1.



Extensions

In this section we show that the hump-shaped profile of P also holds true for the various extensions presented in Section 3.3. Unless stated otherwise, we use the functions and parameter values specified in Table 1, with one exception: For simplicity (Hopenhayn and Nicolini, 1997; Chetty, 2008; Shimer and Werning, 2008; Schmieder et al., 2012; Kolsrud et al., 2015; Kroft and Notowidigdo, 2016), we consider that employment is an absorbing state ($\phi = 0$). We set $T = 200$. In all cases, the graphs show the levels of a_t, s_t and the exit probability at the beginning of the unemployment spell.[14]

Finite entitlement [FE]

The agent is entitled to a flat benefit b for a number of periods B strictly smaller than T. We set $B = 100$.[15] The choices of the agent are shown in Fig. 4.

Incomplete financial markets [FM]

We assume that the agent starts the unemployment spell with an exogenous level of assets $k_0 = 0$, and we allow her to get indebted up to 200, that is, up to two times the gross wage. The choices of the agent are shown in Fig. 5.

Stochastic wage offers [SWO]

We consider the case in which the distribution of offers is not degenerate. We assume that wage offers follow a Pareto distribution with minimum possible value $w_{min} = 66.66$ and shape

14 The same qualitative profile holds later in the spell.

15 Both B and b could be part of the optimal unemployment insurance design (see for instance Hopenhayn and Nicolini, 1997); nevertheless, in this paper, we look at the level of b conditional on B, as Baily (1978), Chetty (2006), and Chetty (2008) do.

Figure 4 Finite Entitlement [FE]. The three graphs show the level of a_t, s_t and $P(s_t, a_t)$, respectively, at the start of the unemployment spell, in the model [FE] for different values of b. The functions and parameters are those of Table 1, except for ϕ, which is now equal to zero. We set $T = 200$, the total quantity of time, and $B = 100$, the number of periods in which the agent is entitled to the flat benefit b.

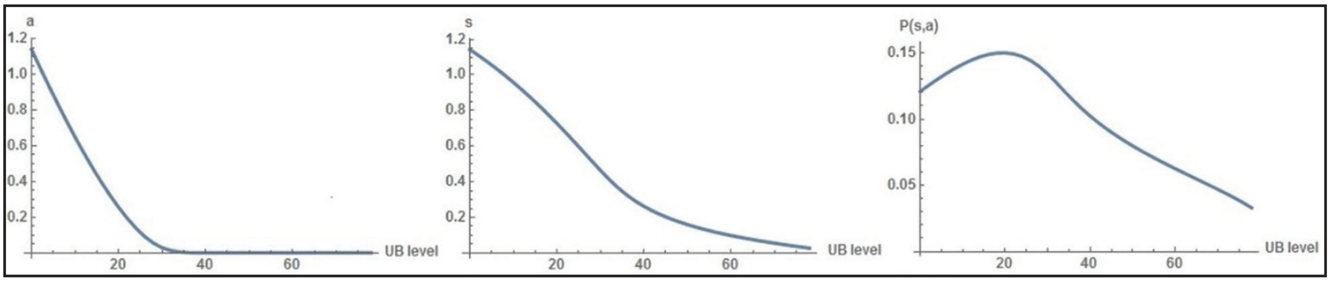
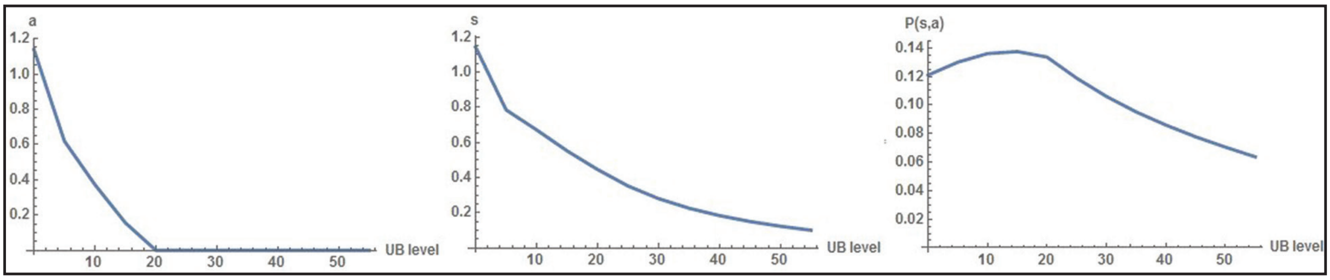


Figure 5 Incomplete Financial Markets [FM]. The three graphs show the level of a_t, s_t, and $P(s_t, a_t)$, respectively, at the start of the unemployment spell in the model [FM] for different values of b. The functions and parameters are those of Table 1, except for ϕ, which is now equal to zero; moreover, we allow the agent to get indebted up to 200 (two times the wage) and we assume that the agent has to repay her debt at the end of the $T = B = 200$ periods.



parameter $\alpha = 3$, so that the average wage is equal to 100. We set the coefficient of relative risk aversion $\sigma = 2$ because an integer allows us to find a closed-form expression for V_t^U, which simplifies the numerical analysis. The choices of the agent are shown in Fig. 6.

The robust hump-shaped exit probability that we find is compatible with the empirical results mentioned in Section 2 (for low levels of b, with the empirical evidence surveyed by LaLumia, 2013 and Kupets, 2006; for higher levels of b, with the empirical evidence surveyed by Tatsiramos and van Ours, 2014).

4.2 Impact of the cash transfer *A* on unemployment duration

As cash transfers of this type are in practice financed by various public means, changes in A are not budget balanced. Moreover, recall that A can be kept if the agent finds a job. For these two reasons, ceteris paribus, A generates less disincentives to look for a job than b. Let us start by analyzing the effect of a cash transfer in the [BM]. Consider Fig. 7, where all the functions and the parameters are those of Table 1. It shows the effect of providing a cash transfer to the agent for each possible budget-balanced level of b. For this purpose, we compare two cases: (1) the only income of the agent is b (the continuous line) and (2) on top of b, the agent receives a transfer $A = 10$, i.e. 10% of w (the dashed line). Both curves intersect when b is close to 15 (i.e. a gross replacement rate of 15%). Above this level, providing cash to the unemployed decreases her expected probability of finding a job. When b is zero or low enough (up to 15), providing cash to

Figure 6 Stochastic Wage Offers [SWO]. The three graphs show the level of a_t and s_t and the exit probability, respectively, at the start of the unemployment spell, in the model [SWO] for different values of *b*. The functions and parameters are those of Table 1, except for ϕ, which is now equal to zero, and $\sigma = 2$. We set $T = B = 200$, the total quantity of time. We assume that wages are Pareto distributed with parameters $w_{min} = 66.66$ and $\alpha = 3$.

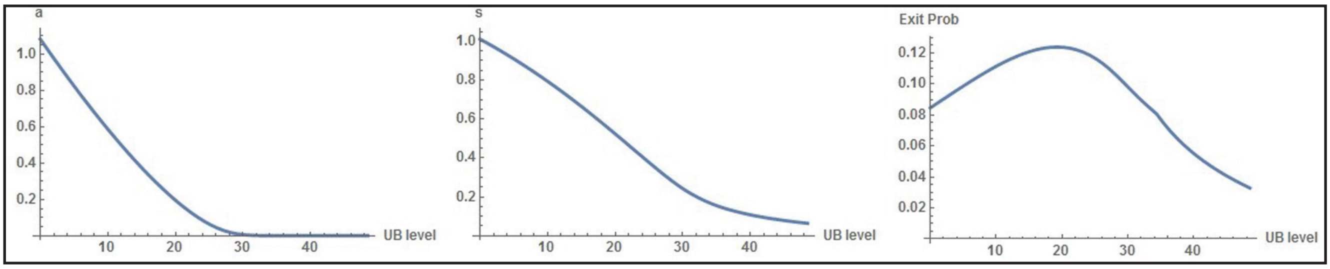
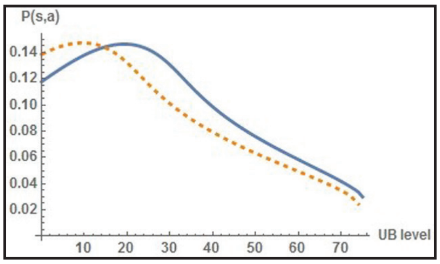


Figure 7 Cash Transfer Effect [BM]. This graph shows the job-finding probability *P*(*s*, *a*) for different values of *b*. The continuous line is generated with the functions and parameters of Table 1. The dashed line uses the same functions and parameters, the only difference being that the agent receives a transfer of 10 regardless of her employment status.



the agent increases her probability of finding a job. In this case, subsistence is only guaranteed by a relatively high level of effort *a*. Then providing cash reduces *a* to an extent that more than compensates the standard negative effect of the cash transfer on *s*. This is no more true when *b* is under but sufficiently close to the subsistence level. Then the effort *a* needed to reach the threshold c_{min} is mild and the impact of providing cash on *a* does no more outweigh its effect on *s*.

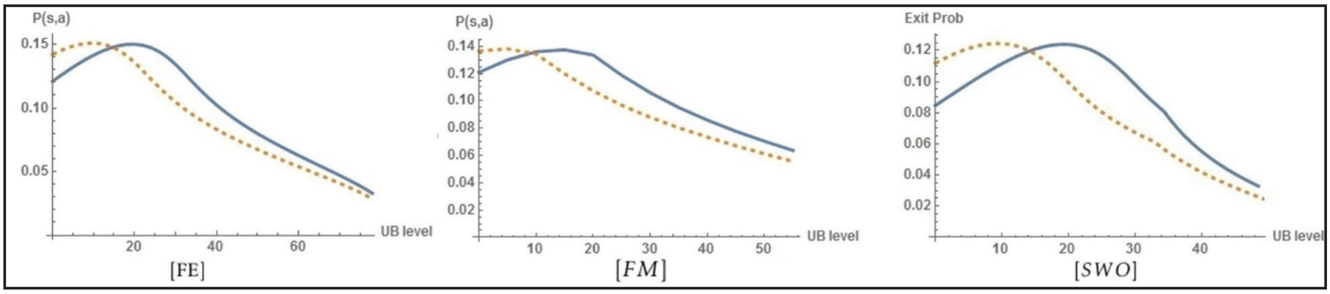
We now check whether the above numerical properties are robust in two senses. First, Fig. 7 has been derived for a cash transfer of 10. Its qualitative properties hold true as long as the transfer to wage ratio A/w is at most equal to 0.35. As A/w increases from zero, the range of *b* values for which rising *A* enhances exits becomes smaller. Second, we check whether Fig. 7 remains valid for extensions [FE], [FM], and [SWO]. The parameterization for each model is the one used in Section 4.1. Fig. 8 shows the results. The intuition is the same as before.

Our findings are consistent with the empirical evidence surveyed in the introduction. When the level of *b* is zero (or low), providing cash increases the probability of finding a job (Franklin, 2018; Barrientos and Villa, 2015; Banerjee et al., 2017; Mesén Vargas, 2018). Instead, when the level of *b* is higher, providing cash increases expected duration in unemployment (Chetty, 2008; Card et al., 2007; Basten et al., 2014).

4.3 Optimal level of *b*

This section characterizes and quantifies b^*, the optimal level of *b*. In particular, we analyze the effects of c_{min} and $g(a)$ on b^*. Finally, we compare the value of b^* obtained in the [BM] with the one in the [SM].

Figure 8 Cash Transfer Effect. These graphs show the job-finding probability *P* for different values of *b*, for the extensions: [FE], [FM], and [SWO]. The continuous line is generated with the functions and parameters discussed in the previous section for each model, and the dashed line is generated with the same parameters except for the fact that the agent receives a transfer of 10 regardless of her employment status.



Appendix A.2 shows that in the setting [BM], b^* is characterized by the following Baily–Chetty formula:

$$\frac{u'\left(b^*+A+g(a)-c_{\min}\right)-u'\left(w+A-\tau-c_{\min}\right)}{u'\left(w+A-\tau-c_{\min}\right)}=\varepsilon_{D(a,s),b^*} \text{ where } \varepsilon_{D(a,s),b^*}=\frac{-b^*}{P(a,s)}\frac{dP(a,s)}{db} \tag{9}$$

Its interpretation is standard. The LHS of the equation is equal to the marginal *gain* of b through consumption smoothing. The RHS captures the moral hazard costs of benefit provision due to behavioral responses. Compared to the standard model [SM], our baseline model [BM] introduces two new components into this formula: $c_{\min}$ and $g(a)$. The effect of $c_{\min}$ on b^* turns out to be ambiguous. The presence of $g(a)$ introduces a margin of self-insurance, which, everything else equal, lowers the level of b^*.[16]

Fig. 2 displays different indicators. "Gross RR*" is the optimal gross replacement rate, b^*/w, where in the simulations, $w = 100$. "Net RR*" is the optimal net replacement rate, $b^*/(w-\tau)$.

Fig. 2 indicates that the optimal gross replacement rate is, in most cases, between 0.55 and 0.72. Several other studies have computed the optimal value of b in different contexts. They tend to find replacement rates close to 0.50–0.60 (see for instance Pavoni, 2007; Chetty, 2008).

Higher levels of $c_{\min}$ increase the LHS of (9) as long as preferences exhibit decreasing absolute risk aversion, which is a common assumption (see for instance Mas-Colell et al., 1995, p. 193). In particular, the constant RRA utility function used in the numerical exercise satisfies this condition. The RHS of (9) can be written as $\varepsilon_{D,b} = (b/P)(dP/ds)(-ds/db)$. The effect of $c_{\min}$ on $-ds/db$ is ambiguous. Numerically, higher levels of $c_{\min}$ turn out to imply higher levels of b^* (see Fig. 2).

To discuss the link between self-insurance $g(a)$ and b^*, consider the four parameters more directly linked to a: β_2, μ_2, G, and γ. The optimal level of b does not change with β_2, μ_2, or G. This is because $a \approx 0$ for levels of b above 60 in these specifications. Therefore, changing the parameters associated with a has no implications on b^*. Instead, when γ changes, b^* varies, because, for low levels of γ, a is not negligible anymore even for high values of b. In this case, b^* increases when γ increases. This is intuitive because the smaller the value of $g(a)$, the higher

16 In a setup with home production, Arslan et al. (2013) find a similar result.

the value of γ (for a given $a < 1$, which turns out to be the case). For such values, a higher value of γ reduces the self-insurance capacity of the agent.

Our numerical exercise shows that the optimal gross replacement rate in the [SM] is 0.57 under the assumptions in Table 1. In all cases but one, the optimal replacement rate is higher or equal in the [BM] as compared with that in the [SM] setting (see Fig. 2). The only exception is the case in which $\gamma = 0.1$. When $\gamma = 0.1$, low levels of a generate a high $g(a)$. As self-insurance is easily guaranteed, the optimal b^* is lower than that in the [SM].

5 Conclusion

It is generally accepted that providing additional cash to jobless people lowers their chances of finding a job. This is the common wisdom whether the cash transfer is conditional on being unemployed or can be kept when a job is found. However, not much is known about the effects of cash transfers in environments with little institutional assistance. There is nevertheless some recent evidence suggesting that cash transfers in these contexts could have negligible or even positive effects on people's probabilities of finding a job. In this paper, by extending the standard job search model, we formalize an intuitive mechanism that helps to rationalize why cash transfers can both stimulate and slow down the recipients' probability of finding a job.

The stylized nature of job search theory sets aside a number of day-to-day problems encountered during joblessness. This paper has put forward the need to consume a minimal amount in an otherwise standard job search problem. Under realistic assumptions such as the absence of private unemployment insurance and imperfect capital markets, a minimal consumption level cannot be guaranteed when benefits are very low or absent (a feature shared by many countries and relevant for various subpopulations in rich countries). Jobless people then depend upon a range of "subsistence activities" to make ends meet. However, performing these activities limits cognitive resources (or time) available for job search. Providing cash can then relax the constraints imposed by these limits.

We have shown that a cash transfer program can raise the hiring probability. This is true whether the funds are transferred conditional on being unemployed (take the form of an unemployment compensation) or whether the person keeps them once a job is found (unconditional transfer). This property is established numerically in a range of job search settings. Qualitatively, it is verified when both the levels of unemployment compensation and the unconditional transfer are low enough (one of them being possibly nil). Common wisdom however holds above some threshold. Finally, in comparison with a standard job search model, our numerical exercise indicates that the optimal replacement ratio is typically higher in our setting.

Declarations

Ethics approval and consent to participate

Not applicable: our manuscript does not have human participants, data, tissue, or animals.

Consent for publication

Not applicable: our manuscript does not contain any details, images, or videos relating to an individual person.

Availability of data and material
Not applicable: our manuscript does not contain any data.

Competing interests
The authors declare that they have no competing interests.

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Authors' contributions
BVdL and JMV contributed equally to the completion of the paper. They designed the model together, performed parts of the numerical analysis, and contributed to write the manuscript.

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A Appendix

A.1 Positive analysis

A.1.1 Baseline model [BM]

Corner solutions

Let us analyze the possibility of having corner solutions:

- Note first that choosing $a = 0$ when $b < c_{\min}$ is not possible. In this case, the agent needs to generate some subsistence consumption.
- If $b > c_{\min}$ and if the agent chooses $a = 0$, then the problem becomes exactly equal to the [SM], and hence (4) is the unique FOC (the only difference with respect to the [SM] being the presence of $c_{\min}$).
- We avoid having $s = 0$ by imposing $\lambda_s(0, a) < \beta P_s(0, a)[V^E - V^U]$ for all possible values of a. Except for the presence of a, this inequality is standardly assumed (explicitly or not) in the job search literature.

Proof of Proposition 1. The FOCs are already stated in the main text (3, 4). The second-order partial derivatives are as follows:

$$G_{ss} = -\lambda_{ss} + \beta P_{ss}\left(V^E - V^U\right) < 0 \tag{10}$$

$$G_{as} = -\lambda_{as} + \beta P_{sa}\left(V^E - V^U\right) \leq 0 \tag{11}$$

$$G_{aa} = u_{cc}\left(c^u\right) g_a^2 + u_c\left(c^u\right) g_{aa} - \lambda_{aa} + \beta P_{aa}\left(V^E - V^U\right) \gtrless 0 \tag{12}$$

$$G_{s\xi} = \beta P_s \frac{\partial\left(V^E - V^U\right)}{\partial \xi} < 0 \tag{13}$$

$$G_{a\xi} = u_{cc}\left(c^u\right) g_a + \beta P_a \frac{\partial\left(V^E - V^U\right)}{\partial \xi} \gtrless 0 \tag{14}$$

$$G_{sw} = \beta P_s \frac{\partial\left(V^E - V^U\right)}{\partial w} = \frac{\beta P_s}{1 - \beta\left[1 - P(a,s) - \phi\right]} u_c\left(c^e\right) > 0 \tag{15}$$

$$G_{aw} = \beta P_a \frac{\partial\left(V^E - V^U\right)}{\partial w} = \frac{\beta P_a}{1 - \beta\left[1 - P(a,s) - \phi\right]} u_c\left(c^e\right) < 0 \tag{16}$$

The following conditions are sufficient to guarantee that a solution, if any, to the system (3, 4) is a unique maximum: $G_{ss} < 0$, $G_{aa} < 0$, and $G_{ss}G_{aa} - G_{as}^2 > 0$. To guarantee that $G_{ss} < 0$, P_{ss} and λ_{ss} cannot both be equal to zero. If $P_{aa} \leq 0$, G_{aa} is negative. This is for instance the case if $P(s,a) = Es^{\beta_1}(1-a)^{\beta_2}$ (with $a < 1$ and $0 < \beta_1, \beta_2 < 1$). If $P_{aa} > 0$, it cannot be too large. For instance, when $P(s,a) = Es^{\beta_1}e^{-\beta_2 a}$ ($0 < \beta_1 < 1$, $\beta_2 > 0$), $P_{aa} = (\beta_2)^2 P(s, a)$ cannot be too large. The last condition, $G_{ss}G_{aa} - G_{as}^2 > 0$, is then obviously met if $G_{as} = 0$. Otherwise, the interaction effects λ_{as} and P_{sa} (taken in absolute value) cannot be too large. Numerically, for all combinations of parameters in Fig. 2, it has been checked that the above sufficient conditions are verified in the solution verifying the FOCs.

Totally differentiating the FOCs (3, 4) leads to

$$\begin{cases} G_{ss}ds + G_{sa}da + G_{s\xi}d\xi = 0 \\ G_{as}ds + G_{aa}da + G_{a\xi}d\xi = 0 \end{cases} \tag{17}$$

Hence,

$$\frac{da}{d\xi} = \frac{-G_{ss}G_{a\xi} + G_{as}G_{s\xi}}{G_{ss}G_{aa} - G_{as}^2} \tag{18}$$

$$\frac{ds}{d\xi} = \frac{-G_{aa}G_{s\xi} + G_{sa}G_{a\xi}}{G_{ss}G_{aa} - G_{as}^2} \tag{19}$$

where the denominator of both expressions is positive by the second-order conditions.

Since the denominator needs to be positive, let us concentrate on the numerator of $da/d\xi$:

$$-\underbrace{[-\lambda_{ss} + \beta P_{ss}\left(V^E - V^U\right)]}_{\text{Gss: }(-)}\underbrace{[u_{cc}\left(c^u\right)g_a + \beta P_a \frac{\partial\left(V^E - V^U\right)}{\partial\xi}]}_{\text{Ga}\xi} + \underbrace{\beta P_s \frac{\partial\left(V^E - V^U\right)}{\partial\xi}}_{\text{Gs}\xi\text{: }(-)}\underbrace{[-\lambda_{as} + \beta P_{sa}\left(V^E - V^U\right)]}_{\text{Gas: }(-)}$$

Having $G_{a\xi} < 0$ is a necessary condition to have $\frac{da}{d\xi} < 0$. In what comes, we look for a sufficient condition for $\frac{da}{d\xi} < 0$. The previous expression can be rewritten as

$$\begin{aligned} &\underbrace{\lambda_{ss}u_{cc}(c^u)g_a}_{1:(-)} + \underbrace{\beta\frac{\partial(V^E - V^U)}{\partial\xi}[P_a\lambda_{ss} - P_s\lambda_{as}]}_{2:(+)} \\ &\underbrace{-\beta P_{ss}[V^E - V^U]u_{cc}(c^u)g_a}_{3:(-)} \underbrace{-\beta^2\frac{\partial(V^E - V^U)}{\partial\xi}[V^E - V^U][P_aP_{ss} - P_sP_{as}]}_{4:(+)} \end{aligned} \tag{20}$$

The expression above is negative if the terms 1 + 2 < 0 and 3 + 4 < 0.

First condition: 1 + 2 < 0

$$\lambda_{ss}u_{cc}\left(c^u\right)g_a + \beta\frac{\partial\left(V^E - V^U\right)}{\partial\xi}[P_a\lambda_{ss} - P_s\lambda_{as}] < 0 \text{ iff}$$

$$-u_{cc}\left(c^u\right)g_a > \beta\frac{\partial\left(V^E - V^U\right)}{\partial\xi}\left[P_a - P_s\frac{\lambda_{as}}{\lambda_{ss}}\right]$$

Second condition: 3 + 4 < 0

$$-\beta P_{ss}\left[V^E - V^U\right]u_{cc}\left(c^u\right)g_a - \beta^2\frac{\partial\left(V^E - V^U\right)}{\partial\xi}\left[V^E - V^U\right][P_aP_{ss} - P_sP_{as}] < 0 \text{ iff}$$

$$P_{ss}u_{cc}\left(c^u\right)g_a + \beta\frac{\partial\left(V^E - V^U\right)}{\partial\xi}[P_aP_{ss} - P_sP_{as}] > 0 \text{ iff}$$

$$u_{cc}\left(c^{u}\right)g_{a}+\beta\frac{\partial\left(V^{E}-V^{U}\right)}{\partial\xi}\left[P_{a}-\frac{P_{s}P_{as}}{P_{ss}}\right]<0 \text{ iff}$$

$$-u_{cc}\left(c^{u}\right)g_{a}>\beta\frac{\partial\left(V^{E}-V^{U}\right)}{\partial\xi}\left[P_{a}-P_{s}\frac{P_{as}}{P_{ss}}\right]$$

Therefore, in order to satisfy both conditions, we need

$$-u_{cc}\left(c^{u}\right)g_{a}>\beta\frac{\partial\left(V^{E}-V^{U}\right)}{\partial\xi}\left(P_{a}-P_{s}\cdot\max\left\{\frac{\lambda_{as}}{\lambda_{ss}},\frac{P_{as}}{P_{ss}}\right\}\right)$$

which is (6) in the main text.

If $P_{ss}=0$, that is, if the probability of finding a job is linear with respect to s, Term 3 of (20) above disappears, and also a part of Term 4. After some simplifications, we are left with

$$-u_{cc}\left(c^{u}\right)g_{a}>\beta\frac{\partial\left(V^{E}-V^{U}\right)}{\partial\xi}\left[P_{a}-P_{s}\frac{\lambda_{as}}{\lambda_{ss}}+P_{as}\frac{\lambda_{s}}{\lambda_{ss}}\right]$$

If $\lambda_{ss}=0$, that is, if the cost of effort is linear with respect to s, Term 1 of (20) above disappears, and also a part of Term 2. After some simplifications, we are left with

$$-u_{cc}\left(c^{u}\right)g_{a}>\beta\frac{\partial\left(V^{E}-V^{U}\right)}{\partial\xi}\left[P_{a}-P_{s}\left(\frac{-\lambda_{as}P_{s}}{\lambda_{s}P_{ss}}+\frac{P_{as}}{P_{ss}}\right)\right]$$

The sign of $\frac{ds}{d\xi}$: since the denominator needs to be positive, let us concentrate on the numerator of $ds/d\xi$.

$$\underbrace{-\beta P_{s}\frac{\partial\left(V^{E}-V^{U}\right)}{\partial\xi}}_{-Gs\xi:(+)}\underbrace{\left[u_{cc}\left(c^{u}\right)g_{a}+u_{c}\left(c^{u}\right)g_{aa}+\beta P_{aa}\left(V^{E}-V^{U}\right)\right]}_{Gaa:(-)} + \underbrace{\left[-\lambda_{as}+\beta P_{sa}\left(V^{E}-V^{U}\right)\right]}_{Gsa:(-)}\underbrace{\left[u_{cc}\left(c^{u}\right)g_{a}+\beta P_{a}\frac{\partial\left(V^{E}-V^{U}\right)}{\partial\xi}\right]}_{Ga\xi} \quad (21)$$

Note that $ds/d\xi>0$ could be possible only when $G_{a\xi}$ is negative, which is a necessary condition to have $da/d\xi<0$. However, even in this case, there are several terms pushing in the direction of having $ds/d\xi<0$.

Proof of the Example. In this case, the sufficient condition to have $\frac{da}{d\xi}$ is

$$-u_{cc}\left(c^{u}\right)g_{a}>\beta\frac{\partial\left(V^{E}-V^{U}\right)}{\partial\xi}\left(P_{a}-P_{s}\cdot\frac{P_{as}}{P_{ss}}\right) \quad (22)$$

If $\xi=b$, the condition can be written as

$$-u_{cc}\left(c^{u}\right)g_{a}>\frac{-u_{c}\left(c^{u}\right)}{r+P+\phi}\cdot\frac{P}{P}\left(P_{a}-P_{s}\cdot\frac{P_{as}}{P_{ss}}\right)$$

A more stringent condition than this one is

$$-u_{cc}\left(c^{u}\right)g_{a}>u_{c}\left(c^{u}\right)\left(-\frac{P_{a}}{P}+\frac{P_{s}}{P}\cdot\frac{P_{as}}{P_{ss}}\right)$$

Given the functional form of $P(a, s)$ (see Table 1), this condition can be rewritten as

$$\frac{-u_{cc}\left(c^u\right)}{u_c\left(c^u\right)} g_a > \frac{\beta_2}{1-\beta_1} \tag{23}$$

If $\xi = A$, then (22) becomes

$$-u_{cc}\left(c^u\right) g_a > \frac{u_c\left(c^e\right)-u_c\left(c^u\right)}{r+P+\phi}\left(P_a - P_s \cdot \frac{P_{as}}{P_{ss}}\right)$$

A more stringent condition than this one is

$$-u_{cc}\left(c^u\right) g_a > u_c\left(c^e\right)-u_c\left(c^u\right) \cdot \frac{-\beta_2}{1-\beta_1}$$

which can be rewritten as

$$\frac{-u_{cc}\left(c^u\right)}{u_c\left(c^u\right)} g_a > \frac{u_c\left(c^u\right)-u_c\left(c^e\right)}{u_c\left(c^u\right)} \cdot \frac{\beta_2}{1-\beta_1}$$

A more stringent condition than this one is (23). Therefore, (23) is a sufficient condition for $(da/d\xi) < 0$.

If the $u(c^u)$ and $g(a)$ are those of Table 1, then (23) can be written as

$$\frac{\sigma}{b+Ga^{\gamma}-c_{min}} \cdot \gamma G a^{\gamma-1} > \frac{\beta_2}{1-\beta_1}$$

which after some manipulations can be rewritten as

$$\sigma\gamma > a^{1-\gamma} \frac{\beta_2}{(1-\beta_1)G}(b-c_{\min}) + \frac{\beta_2}{1-\beta_1} a \tag{24}$$

If $a < 1$, then $a^{1-\gamma} > a$. Given this, a more stringent condition than (24) is

$$\left[\frac{(1-\beta_1)\sigma\gamma}{\beta_2} \cdot \frac{G}{b-c_{\min}+G}\right]^{\frac{1}{1-\gamma}} > a$$

Given that $\gamma < 1$, a more stringent condition is (7) in the main text.

If $a > 1$, then $a^{1-\gamma} > a$. Given this, a more stringent condition than (24) is (7) in the main text.

A.1.2 Extensions to the baseline model [BM]

For simplicity, in the extensions below, we set $A = 0$. If $A > 0$, w should be replaced by $w + A$ and b by $b + A$.

Model with finite entitlement [FE]

The lifetime values in unemployment and in employment solve, respectively, the following Bellman equations:

$$[\text{FE}] = \begin{cases} V_t^U = \max\limits_{s_t a_t} \quad u\left(c_t^u\right) - \lambda\left(s_t, a_t\right) + \beta\left[P\left(s_t, a_t\right) V_{t+1}^E + \left(1-P\left(s_t, a_t\right)\right) V_{t+1}^U\right] \\ V_t^E = u\left(c_t^e\right) + \beta\left[\phi V_{t+1}^U + (1-\phi) V_{t+1}^E\right] \end{cases} \tag{25}$$

where $c_t^u = b + g(a_t)$ if $t \leq B - 1$ and $c_t^u = g(a_t)$ if $B - 1 < t < T$, $c_t^e = w - \tau$.
Subject to $c_t^u \geq c_{\min}$, $V_{t+1}^E - V_{t+1}^U \geq 0$, $a_t \geq 0$, $s_t \geq 0$, and $V_T^U = V_T^E = 0$

The FOCs:

$$G_a = u_c(c_t^u) g_a(a_t) - \lambda_a + \beta P_a \left[V_{t+1}^E - V_{t+1}^U \right] = 0$$

$$G_s = -\lambda_s + \beta P_s \left[V_{t+1}^E - V_{t+1}^U \right] = 0$$

Model with incomplete financial markets [FM]

Denoting by k_t the level of assets in each period, the lifetime values in unemployment and in employment solve, respectively, the following Bellman equations:

$$[\text{FM}] = \begin{cases} V_t^U = \max\limits_{s_t, a_t, k_{t+1}} \quad u(c_t^u) - \lambda(s_t, a_t) + \beta\left[P(s_t, a_t) V_{t+1}^E + (1 - P(s_t, a_t)) V_{t+1}^U \right] \\ V_t^E = \max\limits_{k_{t+1}} \quad u(c_t^e) + \beta V_{t+1}^E \end{cases} \tag{26}$$

where $c_t^u = b + g(a_t) + (1+r)k_t - k_{t+1}$ and $c_t^e = w - \tau + (1+r)k_t - k_{t+1}$.
Subject to $c_t^u \geq c_{\min}$, $V_{t+1}^E - V_{t+1}^U \geq 0$, $a_t \geq 0$, $s_t \geq 0$, $V_T^U = V_T^E = k_T = 0$, and $k_{t+1} \geq L$. This last condition can be interpreted as a capital market imperfection.[17]

Following the literature, let $\phi = 0$; the setup is deterministic when the agent is employed. The optimal consumption path satisfies the Euler equation:

$$u_c(c_t^e) = \beta(1+r) u_c(c_{t+1}^e)$$

With $\beta = 1/(1 + r)$, the agent entering in employment in period t keeps the same level of consumption until T.

In order to find c_t^e, let us consider the budget constraint of the employed agent hired in period t with an initial level of assets of k_t: $c_t^e = w - \tau + (1+r)k_t - k_{t+1}$. This expression can be rewritten as $k_t = [c_t^e - (w - \tau) + k_{t+1}]/(1+r)$. By iterating forward (i.e. by replacing $k_{t+1} = c_{t+1}^e - (w - \tau) + k_{t+2}/(1+r)$ on the previous expression and then replacing k_{t+2}, etc.) and since $k_T = 0$, we have that

$$k_t(1+r) = c_t^e - (w - \tau) + \frac{c_t^e - (w - \tau)}{1+r} + \ldots + \frac{c_t^e - (w - \tau)}{(1+r)^{(T-1)-t}} = \left[c_t^e - (w - \tau) \right] \sum_{j=0}^{(T-1)-t} \frac{1}{1+r}$$

which implies that, as long as r is different from zero,

$$c_t^e = k_t \left(\frac{r}{1 - \left(\frac{1}{1+r} \right)^{(T-1)-t+1}} \right) + w - \tau$$

Now, c_t^e is a function of t because it depends on the moment in which the agent starts working. Moreover, since consumption is constant from the moment in which the agent is employed,

$$V_t^E = \sum_{j=0}^{(T-1)-t} \beta^j u(c_t^e) = u(c_t^e) \frac{1 - \beta^{(T-1)-t+1}}{1 - \beta}$$

17 As highlighted by Chetty (2008), it is easy to show that V_t^E is concave, because there is no uncertainty following reemployment; however, V_t^U could be convex. Nevertheless, this is not the case in our simulations; non-concavity never arises in Chetty (2008) or in Lentz and Tranaes (2005).

In unemployment, the FOCs can be written as

$$G_{a_t} = u_c\left(c_t^u\right)g_a\left(a_t\right) - \lambda_a + \beta P_a\left[V_{t+1}^E - V_{t+1}^U\right] = 0$$

$$G_{s_t} = -\lambda_s + \beta P_s\left[V_{t+1}^E - V_{t+1}^U\right] = 0$$

$$G_{k_{t+1}} = -u_c\left(c_t^u\right) + \beta\left(P\left(s_t, a_t\right)\frac{\partial V_{t+1}^E}{\partial k_{t+1}} + \left(1 - P\left(s_t, a_t\right)\right)\frac{\partial V_{t+1}^U}{\partial k_{t+1}}\right) = 0$$

where

$$\frac{\partial V_{t+1}^E}{\partial k_{t+1}} = u_c\left(c_{t+1}^e\right)\frac{1-\beta^{(T-1)-t}}{1-\beta}\frac{\partial c_{t+1}^e}{\partial k_{t+1}} = u_c\left(c_{t+1}^e\right)\frac{1-\beta^{(T-1)-t}}{1-\beta}\frac{r}{1-\left(\frac{1}{1+r}\right)^{(T-1)-t}} = \frac{u_c\left(c_{t+1}^e\right)}{\beta}$$

and

$$\frac{\partial V_{t+1}^U}{\partial k_{t+1}} = u_c\left(c_{t+1}^u\right)(1+r) = \frac{u_c\left(c_{t+1}^u\right)}{\beta}$$

which allows to rewrite $G_{k_{t+1}}$ as

$$G_{k_{t+1}} = -u_c\left(c_t^u\right) + P\left(s_t, a_t\right)u_c\left(c_{t+1}^e\right) + \left(1 - P\left(s_t, a_t\right)\right)u_c\left(c_{t+1}^u\right) = 0$$

Model with stochastic wage offers [SWO]

Wage offers are now a random draw from a known distribution with support $[\underline{w}, \overline{w}]$, cumulative distributive function (CDF) $H(w)$ and density function $h(w)$. The agent follows a stopping rule: if the wage offer is higher than the reservation wage, x_t, she accepts the offer, otherwise, she rejects it. The exit probability out of unemployment is $P(s_t, a_t)*(1 - H(x_t))$. The lifetime values in unemployment and in employment solve, respectively, the following Bellman equations:

$$[\text{SWO}] = \begin{cases} V_t^U = \max\limits_{s_t, a_t, x_t} \; u\left(c_t^u\right) - \lambda\left(s_t, a_t\right) + \beta\left[P\left(s_t, a_t\right)V_{t+1}^{\theta} + \left(1 - P\left(s_t, a_t\right)\right)V_{t+1}^U\right] \\ V_t^E = u\left(c_t^e\right) + \beta V_{t+1}^E \end{cases} \quad (27)$$

where $V_{t+1}^{\theta} = E_w \max\left\{V_{t+1}^E(w), V_{t+1}^U\right\} = \int_0^{x_t} V_{t+1}^U dH(w) + \int_{x_t}^{\overline{w}} V_{t+1}^E(w)\, dH(w)$.
Subject to $c_t^u \geq c_{\min}$, $a_t \geq 0$, $s_t \geq 0$, and $V_T^U = V_T^E = 0$.

V_t^U can be rewritten as

$$V_t^U = \max_{s_t, a_t, x_t} \; u\left(c_t^u\right) - \lambda\left(s_t, a_t\right) + \beta\left[P\left(s_t, a_t\right)\int_{x_t}^{\overline{w}}\left(V_{t+1}^E(w) - V_{t+1}^U\right)dH(w) + V_{t+1}^U\right]$$

The FOCs can be written as

$$G_{a_t} = u_c\left(c_t^u\right)g_a\left(a_t\right) - \lambda_a + \beta P_a\int_{x_t}^{\overline{w}}\left(V_{t+1}^E(w) - V_{t+1}^U\right)dH(w) = 0 \quad (28)$$

$$G_{s_t} = -\lambda_s + \beta P_s\int_{x_t}^{\overline{w}}\left(V_{t+1}^E(w) - V_{t+1}^U\right)dH(w) = 0 \quad (29)$$

$$G_{x_t} = \beta P\left(s_t, a_t\right)\left(V_{t+1}^E(x) - V_{t+1}^U\right)h\left(x_t\right) = 0 \quad (30)$$

A.2 Optimal unemployment insurance

In this Appendix, we characterize b^* in the [BM] setting. b^* maximizes the lifetime utility of the unemployed subject to a budget-balanced condition.

To construct the budget-balanced condition, we transpose the approach of Shimer and Werning (2007) to a discrete-time setup. Let C^U be the net actualized cost of the UB scheme for a job seeker, and C^E be the net actualized cost of a wage earner written in a recursive way. C^U and C^E solve the following Bellman equations:

$$C^U = b + \beta\left[PC^E + (1-P)C^U\right] \tag{31}$$

$$C^E = -\tau + \beta\left[\phi C^U + (1-\phi)C^E\right] \tag{32}$$

The net actualized cost of the job seeker should be zero. Then, by (32), $C^E = -\tau/[1-\beta(1-\phi)$. Plugging this expression and $C^U = 0$ in (31) yields

$$\frac{b}{\beta P} = \frac{\tau}{1-\beta(1-\phi)} \quad \Leftrightarrow \quad \tau = \frac{1-\beta(1-\phi)}{\beta} bD \tag{33}$$

We are now ready to compute b^*, i.e. the level of b that maximizes V^U subject to (33).

$$\max_b V^U = u(c^u) - \lambda(s,a) + \beta\left[PV^E + (1-P)V^U\right] \tag{34}$$

The problem is stationary; therefore, V^U can be written as

$$V^U = \frac{1-\beta(1-\phi)}{(1-\beta)(1-\beta+\beta\phi+\beta P)}\left(u(c^u) + \frac{\beta P}{1-\beta(1-\phi)}u(c^e) - \lambda(s,a)\right)$$

We need to look only at the direct impact of a change in b, because the envelope conditions eliminate the first-order effects of the behavioral responses (Chetty, 2006). Differentiating the previous expression with respect to b gives

$$\frac{dV^U}{db} = \frac{1-\beta(1-\phi)}{(1-\beta)(1-\beta+\beta\phi+\beta P)}\left(u'(c^u) - \frac{\beta P}{1-\beta(1-\phi)}u'(c^e)\frac{d\tau}{db}\right) \tag{35}$$

Take $\frac{dV^U}{db} = 0$, and note from (33) that

$$\frac{d\tau}{db} = \frac{1-\beta(1-\phi)}{\beta}\left(\frac{-1}{P^2}\frac{dP}{db}b + \frac{1}{P}\right)$$

Plugging this in (35) yields the following implicit equation:

$$\frac{u'(c^u) - u'(c^e)}{u'(c^e)} = \varepsilon_{D,b}, \quad \text{where} \quad \varepsilon_{D,b} = \frac{-b}{P}\frac{dP}{db} \tag{36}$$