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Basic Income and the Quality of Jobs: a Macroeconomic Equilibrium Approach*

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Abstract:

In this paper we develop a model of equilibrium search unemployment extended to deal with differences in the quality of jobs. Wage and job heterogeneity emerge from a random characteristic that is subjectively evaluated by workers once a match is already formed, while in the economy there is a given distribution of that characteristic. We show that the model is tractable and how a single equilibrium emerges in the labor market, and explore several of its features. Second, we consider how the introduction of a Basic Income (BI) may be studied within this framework (in particular its possible effects on the level of unemployment), and argue that the current specialized literature on BI does not provide a single and consistent explanation of the relationship between BI schemes, the quality of jobs and the labor market outcomes. Finally, we propose how this task could be faced up.

Contents

1 Introduction

The debate about poverty, the welfare state and the policies of income support has always taken into account the quite obvious proposal of simply guaranteeing an unconditional and universal rent for each citizen. There is no doubt that such a discussion is still a valid and interesting one, which emerges periodically not only in the academic arena but also in the contexts of public policy, developing strategies or even grass root activism, and usually taking several different names or denominations. In order to facilitate the exposition, in what follows I will only use the term Basic Income (BI) to embrace all sort of public income support schemes that essentially consist in providing an unconditional, universal and individual rent to each citizen, not necessarily at a subsistence level and a priori without any restriction concerning the way to finance it.

We can find the first ideas about a BI in the works of the French utopian socialists, but it was soon translated into the area of economics by the hand of John Stuart Mill. Throughout the twentieth century and under various labels, the same idea was retaken repeatedly by intellectuals working in several research fields and arguing from different political sensitivities: James Meade, Abba Lerner, Milton Friedman, James Tobin, A.B. Atkinson and, in what has possibly been its most recent and successful revival, Robert van der Veen and Philippe Van Parijs[1]. Furthermore, it has attained political relevance at least in two occasions: in the Unites States and Canada during the late sixties and beginning of the seventies, where a number of field experiments where conducted and generated an important public discussion concerning the feasibility and desirability of a Negative Income Tax (NIT)[2],

[1] This brief historical introduction has been adapted from Van Parijs (2000).

[2] There are important differences between a BI and a NIT, that might affect the way both policies influence labor market incentives, but these differences only concern the way they are financed and thus are essentially irrelevant to the questions raised in this paper (where a public sector won't be introduced in the model), while the many more similarities between them justify the inclusion here of the debate about the NIT experiments.

and during the last three decades in several European countries (starting with the Netherlands and Denmark), under the more general debate about how to reform and improve the current welfare state. Today, although some countries have clearly lost interest in the proposal, in some others (like Brasil or Spain) there is an undoubtedly growing movement to support BI as an efficient policy to develop their welfare states and fight poverty or social exclusion.

However one could easily argue that we know very little about the global economic consequences of this sort of policies, especially in terms of its macroeconomic modeling and the achievement of solid analytical or quantitative conclusions. Beyond the obvious difficulties to carry direct empirical research on BI (there are virtually no economies at all that have implemented such a policy, with the exception of the Alaska Permanent Fund), there is a more troublesome phenomenon that may explain this situation: in one hand, the necessary research on BI has been done sporadically during different periods of the last and present century, with totally diverging methodologies and most of the times just as an intellectual or training exercise; on the other, a lot of literature has emphasized a variety of side or indirect effects, together with complicated institutional frameworks that tend to obscure rather than clarify the main economic questions that typically emerge around BI[3].

The outcome of that process becomes evident to anyone who approaches this issue from the point of view of applied economics: admitting that a BI scheme should be a rather easy policy to study (the simplicity of its design and characteristics is undeniable), we nevertheless don't have much research focused on its wide and general effects at the macroeconomic level, while the existent one is usually difficult to compare or summarize in a useful way. In a word, if an hypothetical policy maker would ask for some minimum agreement on the main expected economic effects of the introduction of a BI, it would be extremely difficult to give her an answer (including the answer

[3]That situation is clearly illustrated later, when I review part of the relevant bibliography.

"with the current state of the art we are not able to draw any conclusions", which strictly speaking would be an acceptable one).

The former introduction simply intends to show that there is indeed much scope for relevant research on this topic, but always having in mind the real concerns raised by those interested in such a policy. This paper aims at making a little step in that direction.

2 Why this research question?

Following with the previous argument, one of the most urgent tasks that must be faced is to identify, according to the existent literature about BI, what features of the reality are we interested in and what others might be simplified or just ignored. In order to achieve a useful representation of the effects of the introduction of a BI, I will argue that studying the behavior of the composition of jobs is a key issue for both, its possible impact on macroeconomic variables (as we will see, it might affect the level of employment and the bargained wages), and due to the strategic role it plays in most of the arguments advocating for a BI. My objective is then to disentangle to what extent this is indeed a relevant issue, to what extent one should care about it when attempting to model economies with a BI.

What do we mean by referring to the *quality* or the *composition* of jobs? It is quite common in the literature about BI to emphasize that people (or workers) do indeed take into consideration several specific attributes of job vacancies, features that are evaluated subjectively by the worker and do affect the utility steaming from that job. Van Parijs (1995) argues that if one should expect important effects in the labor market coming from the introduction of a BI (and beyond the fact of increasing people's *real freedom*), that should be to provide the necessary resources and time to look for an acceptable and adequate job, rather than induce a complete downfall in participation. From the point of view of the analysis of welfare policies and the effects of a BI on the labor supply, several authors (Arcarons *el al.*, 2005, Groot, 2004, Pinilla,

2004) also emphasize that jobs have a wide range of specific characteristics which may make them attractive for different people at different stages of their live[4]. And we observe a similar reasoning coming from part of the republican tradition (which identifies freedom with the absence of domination and consequently advocates for emancipating policies like BI): everybody has its own perception about what is a good (or acceptable) and a bad (or unacceptable) job, and the introduction of a BI would enhance people's ability to impose their preferences (Casassas, 2005 and Raventós, 2001), or at least to reduce their "vulnerability" in the labor market (White, 2006).

All these authors share then the same approach to the question, namely to center the discussion on the subjective point of view that workers have about their jobs, while their concerns draw a similar picture about the economic environment faced by those workers, with an ever increasing diversity of jobs and high volatility of the demand for each type of them. This may result in long, unexpected and unavoidable periods of (frictional) unemployment, which might not be critical in aggregate terms but imply a serious drawback in the life of a given worker (this picture is still recalled by BI advocates when facing the usual discussion about BI versus full employment).

When it comes to study the impact of a BI to the general behavior of the economy, the relevance of the previous arguments is twofold. Through a change in the composition of jobs, the usual contractive effect of the labor supply that one observes after an improvement of the fall back position of workers could be sensibly reduced (if not fully canceled), what would affect the final level of employment and output. But this expected change in the nature of jobs is also important for a welfare analysis, because independently of what might happen with economic aggregates, some people would be at-

[4]Just to provide an example, there is the very common argument that a BI would enhance people's ability to accept part-time jobs when these fulfill in a better way their working and economic needs (this claim can be found in almost all the papers that revise the pros and cons of the introduction of a BI). Although we will see later how this way of reasoning might be quite confusing, at this point it is clear that it addresses the subjective perception of workers that we are interested in.

taining higher levels of welfare through an improvement of their working conditions.

The intuition behind the first effect appears to be straightforward: workers would be less willing to accept *some* (bad) jobs, but more willing or able to find and accept *other* (good) jobs; if we abstain from making any assumptions regarding their distribution or productivity, there is room for inquiring about the final reaction of the labor supply and the market outcome. However, we will see in section 7 that the previous discussion does indeed hide several different mechanisms (or hypothesis), which possibly should not always be studied simultaneously or by means of the same model.

On the contrary, the possible gain in welfare belongs to a much wider area of study, which falls far beyond the scope of this paper. It is well known that a given job carries some disutility in addition to the salary paid, and disutility parameters are not strange to welfare economists. But there are intrinsic difficulties to measure and quantify such a concept, which typically impose a substantial degree of arbitrariness: if one hopes to include the disutility derived from work in a global evaluation of the agent's utility (which includes utility derived from money), one should find a way to "compare" both measures, for example computing the extra cost incurred in health care for those who have harmful jobs, or at least one must find a mechanism to deduce or reveal how do people value that disutility. Both issues are too complex to be considered in detail here.

Finally, the label "a macroeconomic equilibrium approach" of our title deserves a little explanation. This thesis was originally intended to be focused on the general equilibrium peculiarities of modeling a BI, and it was the ambition to include those ideas highlighted by the current literature about BI which suggested to first study the question of the composition of jobs in depth. Strictly speaking there won't be general equilibrium features playing a role in the model of this paper (only the labor market will be modeled in detail), but I think that pointing to its macroeconomic and equilibrium "nature" would be relevant for any future extension. After all:

If general equilibrium analysis did not change any of the predictions or conclusions of partial equilibrium analysis, it would be of limited significance when applied to problems amenable to partial equilibrium treatment. It might be of comfort because we would then know that our partial equilibrium conclusions are valid, but it would not change our view of how markets work. However, things are not that simple. The choice of methodology may be far from innocuous. (Mas-Colell, Whinston and Green, 1995)

3 Review of the literature

Several papers have addressed the task of constructing a general equilibrium model to study the implementation of a BI, while a few others have paid attention to the existence of good and bad jobs and the subjective value workers attach to them, but none has explicitly undertaken both.

In a framework of efficiency wages, Groot and Peeters (1997) study the introduction of a BI in the context of a dual labor market, focusing on the role played by the conditional social security system and the effects of the transition to an unconditional system. Although their model does not take into account the composition of jobs, they acknowledge its importance and suggest it could strengthen their main positive conclusions, but they *"postpone for further research the phenomenon of greater compensatory justice, which is likely to occur under unconditional social security"*. Atkinson (1995) also considers a dual labor market and studies a rich institutional framework built on the tax incidence model of Harberger, but any consideration about good or bad jobs is introduced ex post and only as a descriptive feature of the dual market. Bowles (1992) develops a model where an "extraction function" related to the effort spent by workers in their jobs is one of its key characteristics, but despite its possible connection with the intuitions we mentioned before, Bowles' model does not intend to show any light to the is-

sues we are concerned with. Finally, Moutos and Scarth (2003) compare the consequences of several policies (including a BI) while putting their emphasis on the differences between an open and a closed economy.

Dealing with unionized economies, Van der Linden (2002) shows how the introduction of a BI, depending on the specific design of the institutional framework, may have opposite effects on the unemployment rate, but the analysis does not rely in any distinction concerning the characteristics of jobs. With a similar model but focusing on a welfare analysis with participation in the labor market, Van der Linden (2004) includes a disutility parameter that represents the cost of working and which clearly conveys some of the notions we are interested in, but there is a single and identical disutility parameter for all employed workers and it is not easy to evaluate the influence of this feature on the conclusions of the analysis.

Equilibrium search models have also been used to study the effects of the introduction of a BI. Lehmann (1999, 2001) explores respectively the role played by the unemployment benefits and the minimum wage in a framework with heterogeneous agents, where the introduction of this source of heterogeneity does indeed affect the main analytical results and the numerical simulations. Although one could find here a hint of how to face the modeling of the heterogeneity in jobs we are interested in, this sort of division of the labor supply between workers with different skills implicitly requires the ability to distinguish or classify them, and this would not only represent a serious difficulty in the case of different types of jobs, but it would also "conflict" with one of the virtues of a BI attributed by its advocates: it is precisely because of the impossibility to judge between what does really represent a good or a bad job for each person that a BI, being a universal and absolutely unconditional rent, would be the adequate tool to increase people's ability to improve their jobs.

Using the applied general equilibrium model of the Central Planning Bureau in the Netherlands (named MIMIC)[5], De Jager, Graafland and Gelauff

[5]I think this kind of analysis with applied general equilibrium models should be the

(1996) show again how the implementation of a BI may have ambiguous effects to the employment rate (mainly through changes in the replacement rate in opposition to the typical contraction of the labor supply), while more recently De Mooij (2006) simulates a BI with the same model and obtaining similar conclusions but highlighting the important cost in welfare due to labor supply distortions (what indeed supports our view about the relevance of determining whether there might be a reason why the expected labor supply contraction wouldn't be that strong). But of course, the main drawback with these contributions is the impossibility to know the exact characteristics and structure of the model used.

To conclude with this brief revision of the main literature, Acemoglu (2001) does explicitly address the issue of the distribution between "good" and "bad" jobs in the labor market outcomes, also using an equilibrium search model. Although that topic is clearly linked to our research question, the distinction between types of job is made ex post and on the basis of the wage paid for them (good jobs are those which pay high wages, because differentials in wages are explained by means of different creation costs for different types of jobs), an hypothesis that implies a serious limitation for our purposes: in our case, the quality of a job might have an effect in employment through the wage paid or bargained for that job (high wages for bad jobs, and *vice versa*), while in Acemoglu's paper (where wages are decided before one can determine whether a job is a good or a bad one), things go exactly the other way round. Nevertheless, this contribution provides at least an example of how the question about the composition of jobs may be modeled in a useful and tractable way.

ultimate goal of the economic research on BI (that's why I tried to stick myself to a general equilibrium framework also when dealing with the limited topic of this paper).

4 Methodology

I will develop an equilibrium search model under the standard Pissarides' time continuous framework, where an imperfect matching due to search frictions in the labor market is the cause of involuntary unemployment. These models are structured around the idea of an *aggregate matching function*, which describes the efficiency in the process by which workers and firms find each other and where congestion externalities make it possible the simultaneous existence of vacant jobs and unemployed people (the Beveridge curve). The hypothesis of competitive wages is also dropped, because the existence of search externalities generates a positive economic rent that will be shared among the agents; wages are thus bargained between workers and firms, typically solving a Nash bargaining program[6].

There are a number of reasons that support the use of this methodology:

- It emerges as a natural approach for our research question, because search frictions fully reflect the heterogeneity that is necessary to sustain many of the claims of BI advocates. If time, resources and personal considerations are going to be a factor when people look for the right job, the existence of transaction costs in the labor market is a good way to represent it. Involuntary unemployment[7] (also an essential point in most of the BI literature), and especially the fact that it is precisely grounded on the labor market frictions, constitutes another very desirable property of this model.

- Wage formation through individual bargaining[8] is the second important

[6]The detailed characteristics of the model will be listed in the next section. However, through the rest of the paper and whenever no explicit indication is made, I will be always considering the standard features and properties described by Pissarides (2000) and Cahuc and Zylberberg (2004).

[7]Pissarides (2000) emphasizes that his theory is not intended to qualify the unemployment as voluntary or involuntary; however, this does not imply that other researchers shouldn't venture into defining it as involuntary according to their own views of the matching process.

[8]Strictly speaking, to assume a bargaining process carried by individual agents is to

feature of the model which encompasses with the main ideas exposed in section 2. We explained how the subjective perception of workers regarding otherwise identical jobs might influence aggregate outcomes through its influence in wages; this view is not necessarily incompatible with the hypothesis of competitive wages, as it is shown by the "theory of compensating wage differentials". Nevertheless, that approach assumes a structure of different *types* of jobs with the same subjective characteristic and wage for each type, so the heterogeneity emerges *between* types of job. This view would indeed match some of the usual arguments about BI, but here we prefer to put the maximum emphasis on the personal perception of workers for the same type of jobs (and more importantly, for jobs assigned through the same market). This is why a specific bargaining process to share the specific rent created for every match seems a much more suitable mechanism for our purposes.

- Pissarides (2000) and Cahuc and Zylberberg (2004) show how the core of the model is easily extended to deal with several general equilibrium problems (growth, variations in the cost of capital, rigidities in the products market...etc)[9], while its departing point is a small open economy with an exogenous interest rate that summarizes the behavior of aggregate demand and closes the system, what strongly connects with the views exposed in section 2 about the labor demand's volatility as one of the main sources of workers vulnerability to cyclical perturbations.

- Last but not least, this is a very well known framework that has proved to be useful (and tractable) to study a wide range of issues connected

impose a strong institutional design which in many cases would be far from realistic (especially concerning European countries). Nevertheless the vast majority of BI research remains focused on the individual interaction between agents, so it seems reasonable to take this situation just as the departure point of the research.

[9]Following the last argumentation of section 3, Pissarides himself describes his theory as a "macroeconomic" and an "equilibrium" one.

with our topic, including the specific analysis of BI schemes (as we saw in section 3). I think this is an important and remarkable point: the absence of direct empirical research about BI (and the impossibility to do it so far) imposes a serious burden to those who seek to attain a better understanding of its economic implications; while authors may have very good reasons to use a rather unusual methodology (or one specifically developed for the study of BI), to me it seems more urgent to first exploit conventional, well tested models.

5 Building blocks of the model

5.1 Main standard characteristics

We model an economy with only two goods, a produced good (the numeraire) that is consumed by all individuals, and labor, assumed to be homogeneous and which is the only production factor. Each identical firm owns one job which can be filled or vacant, and when it is filled produces an exogenous quantity of the consumption good. Workers are also identical, infinitely lived and risk neutral. Jobs are destroyed at an exogenous rate, while the economy is a small open one with an interest rate also exogenous.

Several of the previous features could be relaxed or extended to make the approach a more rich or realistic one, but in principle there is no imperative need to do so if one tries to concentrate the attention in our research question. Perhaps the presence of homogeneous labor and identical workers might be the only exception: indeed the inclusion of labor heterogeneity could be another possible way to deal with the quality of jobs, if different groups of people look for different sort of jobs (the typical example would be qualified versus unqualified workers). But as we stated in the previous section, in principle our interest is only on the personal views of workers acting in the same labor market[10], although we do acknowledge that labor heterogeneity

[10] After all, nobody expects a BI to increase the chances of a part-time waiter to work as a nuclear engineer.

may be a very interesting way to enrich our model and make it more realistic.

We begin with the aggregate matching function, which we denote $M(V,U)$ and summarizes search externalities both between and within groups. This function produces at every instant a number of matches depending on the number of vacancies and job seekers, and it has some standard properties that parallel those of the aggregate production functions in the neoclassical theory: it is continuous, concave, nonnegative, strictly increasing in both arguments (no match being possibly with zero vacancies or zero job seekers), and has constant returns to scale. In addition, only unemployed people will be seeking for a job (we abstain from on-the-job search). The labor market is then characterized by the concept of tightness θ, which is defined by the ratio between number of vacancies and number of job seekers, while vacant jobs are filled at a rate that diminishes with tightness and job seekers find a new job at a rate that rises with it[11].

Then the rate at which vacant jobs are filled is:

$$\frac{M(V,U)}{V} = M(1, U/V) \equiv m(\theta)$$

And the exit rate from unemployment (called the *hazard rate*) is:

$$\frac{M(V,U)}{U} = \frac{V}{U}\frac{M(V,U)}{V} \equiv \theta m(\theta)$$

Where in the standard framework: $\theta \equiv V/U$ and one can show that $m'(\theta) < 0$ and $[\theta m(\theta)]' > 0$

Labor market tightness and the exogenous rate of job destruction, along with the matching technology, condition the dynamics of flows of jobs and workers. The stationary value of the unemployment rate, the only thing that

[11] For concreteness, I'm summarizing a lot the description of the standard features of the model (which are already very well known and explored in the literature), and this criterion will be maintained along this paper unless any specific detail is necessary to understand the mechanics of our extension. Of course, this doesn't prevent the possibility that some relevant aspects become unnoticed and are left unexplored.

interests us here, is given by:

$$u = \frac{\delta + n}{\delta + n + \theta m(\theta)}$$

Where u is the unemployment rate, δ the job destruction rate and n the rate of growth of the labor force. We will also take the size of the labor force as exogenous and not affected by the policies under study (there are no participation issues)[12]. In addition, if we define $v = V/N$, then the previous expression describes a relationship between the unemployment rate u and the vacancy rate v. This relationship yields the Beveridge curve (BC), which can be shown to be decreasing and convex.

We will build the model taking into account search effort (also one of its well know extensions), defining s as a variable measuring the intensity of search and being su the efficiency units of searching workers. Consequently, tightness now becomes $\theta = v/su$ and the hazard rate will be $s\theta m(\theta)$.

The behavior of agents is affected by the comparison between their situation when a vacant is filled or when not, while their maximization problems are represented by a set of Bellman equations[13]. Firms maximize profits, and compare the expected lifetime discounted value of a filled job with its counterpart when the job is vacant; a *free entry* condition will then be imposed, which allows us to derive a labor demand (LD) curve that equalizes the average cost of a vacant job to the profit expected from a filled job. Similarly, risk neutral workers will compare the expected discounted utility they obtain from a job with that obtained when unemployed, while simultaneously deciding how much search effort they devote to look for a job.

Wage bargaining is the last key feature to describe. The idea is that agents bargain over the total surplus generated from a match, typically following

[12]This is also a strong assumption of the model, despite it's very common in most of the technical literature about BI. Nevertheless we think this assumption should be dropped in a future development of this framework to obtain a more realistic outcome of the model.

[13]In order to make the exposition more clear, the exact equations and conditions for our model will be written down in section 6.

a generalized Nash criterion that produces a specific sharing rule (although this isn't the unique way to formalize the same outcome). A wage equation is obtained, that depends on the exogenous *bargaining power* of firms and workers and which allows to derive a relationship between the negotiated wages and the labor market tightness known as the wage curve (WC).

In equilibrium the labor demand and the wage curve will determine the level of wages and the equilibrium value of tightness, which combined with the Beveridge curve allows to find the unemployment and vacancy rates.

5.2 Our extension to include job differences

We introduce a non-monetary and constant characteristic of jobs, which affects the utility workers draw from them but is randomly distributed across jobs. We will assign to this characteristic a value that may range from $-\infty$ to $+\infty$ and which will be denoted with the letter a. In the economy there is a given distribution of this non-monetary characteristic, but we won't impose the shape of that distribution.

This characteristic represents the subjective value workers attach to each specific vacant job they might find. The range for the value of a has been chosen to avoid any paternalism and to include the following both possibilities: a job whose intrinsic characteristics make it infinitely unacceptable regardless the wage offered (for example torturing, for those who are not sadistic), or a job which reports an infinity amount of pleasure (anyone might choose here its own example)[14].

Clark (2003) shows that this notion does actually play a significant role in labor economics, and provides a simple and clear exposition of the necessary

[14] An alternative would had just been to use a range between zero and $+\infty$, what perhaps would simplify a bit the algebra. But as we will soon see, that would imply that in equilibrium there is possibly a positive value of a below which any job offer is not accepted (if it's not positive then it's zero). This would mean that in equilibrium and for the case of absence of a BI, jobs would always report a strictly positive utility to workers independently of the bargained wage, so they could bargain for a zero wage in order to get the job and be strictly better than when unemployed.

concepts to deal with it. In particular, illustrates how a given measure of "job satisfaction" can be used to test if wage differentials compensate disutilities (exactly the mechanism we are concerned with) and concludes that it may play a role to explain those differences in a given industry, while on the contrary workers ability to capture employment rents would be the explanation for differences between occupations. That can be interpreted as if people do indeed compensate disutility with wages when considering which job offer accept *within* their industry or profession, while they don't behave this way when choosing among different professions. If one sees different occupations as different types of jobs assigned in different markets (while jobs in the same industry correspond to the same type and the same market), this outlines a picture of the labor market which is consistent with our discussion of section 4 about competitive wages.

However our description implies that *all* workers face *the same* distribution of a. This is of course consistent with the hypothesis of identical workers and the rest of the structure of the model, but in some sense conflicts with the main aims of this thesis and is possibly one of its serious weakness. If one is interested in the vicissitudes of people looking among a variety of jobs, assuming that everybody faces the same probability of finding a good or a bad job seems to be a critical simplification. The alternative would require again to introduce some heterogeneity among workers, identifying those groups which clearly face worse (or better) distributions of job offers (like single mothers), but in addition to our previous arguments now if social scientists can differentiate between people according to this non-monetary characteristic it wouldn't make much sense to define it as "subjective". I must admit I couldn't find a solution to this little dilemma.

The second key assumption of the extension is that agents discover the exact value of a *after* the match is formed. This is assumed in part for tractability purposes because it rules out directed search, what would possibly complicate the model. Consequently a can be seen as an "experience good" which is revealed after spending some time working (workers don't

know the specific characteristics of jobs until they accept them)[15], but more importantly that also means that firms cannot take into account the value of a when creating a vacant (what possibly features a good description of reality). Some examples could be the atmosphere or safety in the workplace, the existence of gender discrimination in the firm..., etc.

The modeling technique mimics the one used to study stochastic job matches motivated by differences in the productivity of jobs[16] (also a pretty well known extension of equilibrium search models). Due to the specific value of a for each job, not every contact among agents will result in a match and not every match will have the same wage. We will show how emerges an equilibrium reservation value of a, that we will call a_R, below which no job offers are accepted and which is determined simultaneously with labor market tightness. Finally, the model can be solved recursively for the rest of the unknowns.

6 Equilibrium and comparative statics

6.1 The behavior of agents and the Labor Demand

The model is developed in steady-state only. Work time is exogenous and normalized to 1. Individuals do not save, so consumption equals income.

The behavior of workers is characterized as follows. The inter-temporal discounted value of being employed $V_e(a)$ (that depends on a) is:

$$rV_e(a) = w(a)(1-t) + a + B + \delta[V_u - V_e(a)] \tag{1}$$

Where r is the exogenous interest rate, $w(a)$ is the negotiated wage (also a function of a), t corresponds to the average tax rate paid out of wages by workers themselves[17], δ is the exogenous job destruction rate, and B is the

[15] In our continuous time framework wages are considered to be bargained permanently.

[16] In concrete, I will track the structure exposed in Rogerson, Shimer and Wright (2005).

[17] The tax system has been designed to imitate the usual structure in European countries, where part of them are legally paid by workers while part are paid by firms (we abstain

level of BI.

The inter-temporal discounted value of being unemployed V_u solves the following maximization problem over s:

$$rV_u = \max \left[I_u - d(s) + s\theta m(\theta) \left(\int_{a_R}^{\infty} [V_e(a) - V_u] f(a) da \right) \right] \tag{2}$$

Where I_u is the income received when unemployed (which includes B and any other sort of subsidies or rents, like unemployment benefits), $d(s)$ is the cost of searching, s is the level of search effort, and $f(a)$ is the probability density function of the distribution of a. The expression inside the integral represents the expected gain from finding (and accepting) a job, and is multiplied by the rate of exiting from unemployment. Note how the assumption that a is revealed when people match a vacancy becomes critical when constructing the Bellman equations: agents make their decisions taking into account the entire range of possible values of a, and compute the expected gain they may obtain for each of its possible realizations.

Workers choose optimally their level of search effort, maximizing rV_u over s. The first order condition is[18]:

$$-d'(s) + \theta m(\theta) \left(\int_{a_R}^{\infty} [V_e(a) - V_u] f(a) da \right) = 0 \tag{3}$$

And the optimal level of effort s^* solves:

$$d'(s^*) = \theta m(\theta) \left(\int_{a_R}^{\infty} [V_e(a) - V_u] f(a) da \right) \tag{4}$$

Similar mechanics are at work in the case of firms (who maximize profits), so the inter-temporal discounted value of a vacant job Π_v solves:

$$r\Pi_v = -k + m(\theta) \left(\int_{a_R}^{\infty} [\Pi_e(a) - \Pi_v] f(a) da \right) \tag{5}$$

of the relevant issue about who does really end up paying the taxes).

[18] I assume $d' > 0, d(0) = 0$ and $d'' > 0$ in order to satisfy the second order condition.

Where k is the cost of holding an open vacant. And the inter-temporal discounted value of having a filled job $\Pi_e(a)$ (a function of a as well) solves:

$$r\Pi_e(a) = y - w(a)(1+T) + \delta[\Pi_v - \Pi_e(a)] \tag{6}$$

Where y is the exogenous quantity of good produced by a filled position, and T is the tax rate out of wages directly paid by the employer.

In equilibrium we assume that firms can open as many vacancies as they want[19], so we can impose the free entry condition $\Pi_v = 0$ (profits from owning a vacant job are zero at equilibrium), and obtain the following LD curve:

$$\frac{k}{m(\theta)} = \int_{a_R}^{\infty} \Pi_e(a) f(a) da \tag{7}$$

6.2 Wage bargaining

The negotiated wage solves the following maximization program over $w(a)$:

$$\max \ (V_e(a) - V_u)^{\gamma} (\Pi_e(a) - \Pi_v)^{1-\gamma} \tag{8}$$

Where γ corresponds to the bargaining power of workers[20]and varies between 0 and 1.

From (1) and (6) we get these corresponding two expressions:

$$V_e(a) - V_u = \frac{w(a)(1-t) + a + B - rV_u}{r + \delta} \tag{9}$$

[19]This assumption is absolutely standard in virtually all matching models.

[20]It might be important to point that we choose an interpretation of the bargaining power that excludes the potential direct effects of a BI on it (beyond the fact that the BI empowers the outside option of workers). To make it clear, if one would like to impose that the BI influences this parameter, one should explain how can the extra disposable income influence the ability of people to bargain "in a better way" (for example, one could argue that a BI allows workers to spend more time in union activities, improving their knowledge of how to negotiate a contract).

$$\Pi_e(a) - \Pi_v = \frac{y - w(a)(1+T) - r\Pi_v}{r+\delta} \tag{10}$$

So then taking logs in (8), considering (9) and (10) and operating we can obtain the following first order condition[21]:

$$\gamma \frac{(1-t)}{(1+T)}(\Pi_e(a) - \Pi_v) = (1-\gamma)(V_e(a) - V_u) \tag{11}$$

One can also manipulate this last equation and obtain an expression for what is called the *surplus* of the match, S(a)[22]:

$$V_e(a) - V_u = \gamma \left\{ \frac{(1-t)}{(1+T)}(\Pi_e(a) - \Pi_v) + (V_e(a) - V_u) \right\} \tag{12}$$

Where:

$$S(a) \equiv \left\{ \frac{(1-t)}{(1+T)}(\Pi_e(a) - \Pi_v) + (V_e(a) - V_u) \right\} \tag{13}$$

Substituting (9) and (10) into (13) we get a explicit formula for the surplus:

$$S(a) = \frac{\frac{1-t}{1+T}(y - r\Pi_v) + a + B - rV_u}{r+\delta} \tag{14}$$

For later use, we also express here several of the previous relationships as functions of the surplus $S(a)$. From (2) and taking into account (12) and (4) we get:

$$rV_u = I_u - d(s^*) + s^*\theta m(\theta)\gamma \int_{a_R}^{\infty} S(a)f(a)da \tag{15}$$

Adding $(1-\gamma)\frac{1-t}{1+T}(\Pi_e(a) - \Pi_v)$ to both sides of (11), we get:

[21] The second order condition will be assumed to hold.

[22] From (12) it becomes clear that the gain obtained by workers when accepting a job, $V_e(a) - V_u$, is equal to the surplus weighted by their bargaining power, γ.

$$\Pi_e(a) - \Pi_v = \frac{1+T}{1-t}(1-\gamma)S(a) \tag{16}$$

And combining this last expression with (7) (the LD we derived before) while imposing the free entry condition we get:

$$\frac{k}{m(\theta)} = \left[\int_{a_R}^{\infty} S(a)f(a)da\right](1-\gamma)\frac{1+T}{1-t} \tag{17}$$

Finally, combining (15) and (17) we derive a closed form solution for rV_u:

$$rV_u = I_u - d(s^*) + \frac{s^*\theta k\gamma(1-t)}{(1-\gamma)(1+T)} \tag{18}$$

6.3 Discussion about the Wage Curve

Although it is not strictly necessary to explicitly derive the wage function to solve the model, it turns out that exploring its properties, and specially the reaction of wages to changes in a or B, may provide several preliminary insights. Substituting (9) and (14) in (12), rearranging and imposing the free entry condition we get:

$$w(a) = \frac{\gamma}{1+T}y + \frac{1-\gamma}{1-t}\{rV_u - a - B\} \tag{19}$$

This equation defines a closed form solution for the bargained wage, where substituting rV_u by a proper definition (equation (18) provides the necessary closed form solution of rV_u) one obtains an expression for the WC (a relationship between the bargained wage and tightness):

$$w(a) = \frac{\gamma}{1+T}y + \frac{1-\gamma}{1-t}\left\{I_u - d(s^*) + \frac{s^*\theta k\gamma(1-t)}{(1-\gamma)(1+T)} - a - B\right\} \tag{20}$$

In (20) we clearly see how changes in a (which appears linearly and only inside the brackets) affect the negotiated wage in the expected way: an increase in a (what means finding a job that provides more subjective utility for

the worker) reduces the bargained wage (and *vice versa*). On the contrary, given that by construction the income when unemployed (I_u) will contain B additively, the level of BI does not affect the wage in any way. This is a result that might seem a bit striking, but indeed it is consistent with the logic of this kind of models: given that the BI is paid exactly at the same level whether one is unemployed or not, changes in its level do not affect the total surplus to be shared and thus do not affect wages. However we will discuss this result deeply in section 7.1.

To see the effect of changes in the rest of parameters or variables (which are the usual and intuitive ones) we first take a look at the term in brackets. If for simplicity we assume that the BI is the only income when unemployed, then this term can be negative whenever $\frac{s^*\theta k\gamma(1-t)}{(1-\gamma)(1+T)} < a + d(s^*)$. The right hand of this expression is the instantaneous gain a worker gets from accepting a job net from the wage, while the left one represents how good does the labor market work and the chances of attaining more matches (it is higher when tightness or the search effort increase). Note that if this term in brackets is negative, then for sufficient low bargaining power of workers or low productivity of jobs the wage may become negative: workers have that much to gain from the job (perhaps because a is extremely big), that they indeed are willing to "pay" for it. If we want to be consistent with our non-paternalist view about the quality of jobs, we should not rule out this possibility.

A rise in the productivity of jobs y, raises the surplus and thus raises the wage, while the partial derivative for tightness (θ) is also positive, so an improvement in the labor market conditions (when tightness increases it is easier for workers to find a job) does also motivate a higher bargained wage. Regarding taxes, both sorts of them have also an unambiguous positive effect on wages, except for the case of taxes paid by workers when there would be other sources of income when unemployed in addition to the BI (then $\frac{1-\gamma}{1-t}I_u$ would enter the wage equation additively and thus the final effect of changes in those taxes could be ambiguous).

6.4 Solving the model

First we substitute (18) in the surplus definition (14) and imposing the free entry condition we obtain a closed form solution for the surplus that only depends on the variables and parameters of the model:

$$S(a) = \frac{1}{r+\delta}\left[\frac{1-t}{1+T}y + a + B - I_u + d(s^*) - \frac{s^*\theta k\gamma(1-t)}{(1-\gamma)(1+T)}\right] \tag{21}$$

Next we derive a positive relationship between a_R and θ. We know that in equilibrium $V_e(a_R)$ must be equal to V_u (when facing the reservation value of a, below which any job wouldn't be accepted, a worker must be indifferent between accepting the job or not, thus the discounted value of being employed or unemployed must be the same), so making the additional assumption that $\gamma > 0$ and considering (12) one concludes that $S(a_R) = 0$. Applying this result to (21) we can write:

$$a_R = \frac{s^*\theta k\gamma(1-t)}{(1-\gamma)(1+T)} - d(s^*) + I_u - B - \frac{1-t}{1+T}y \tag{22}$$

However (22) is conditional on s^*, so we need to prove that indeed marginal changes in s^* do not affect it in equilibrium.

Proof:

Compute $\partial a_R \backslash \partial s^*$ and combine it with (4) to obtain:

$$\frac{\partial a_R}{\partial s^*} = \frac{\theta k\gamma(1-t)}{(1-\gamma)(1+T)} - \theta m(\theta)\left(\int_{a_R}^{\infty}[V_e(a) - V_u]f(a)da\right)$$

Then use (11) plus the free entry condition to get:

$$\frac{\partial a_R}{\partial s^*} = \frac{\theta k\gamma(1-t)}{(1-\gamma)(1+T)} - \frac{\theta m(\theta)\gamma(1-t)}{(1-\gamma)(1+T)}\int_{a_R}^{\infty}\Pi_e(a)f(a)da$$

And finally, combining with (7) and simplifying we get:

$$\frac{\partial a_R}{\partial s^*} = \frac{\theta k \gamma (1-t)}{(1-\gamma)(1+T)} - \frac{\theta k \gamma (1-t)}{(1-\gamma)(1+T)} = 0$$

•

The rationale for (22) can be explained as follows (although we will explore in detail the comparative statics of the equilibrium in section 6.5): when it is easiest for workers to find a job (because tightness is rising), they are more willing to turn down a match with a low value of a (so the reservation value, a_R, also rises).

A second step is to obtain now a negative relationship between tightness and a_R, derived from our previous LD curve and which plays its equivalent role in this extended framework. Given (22), equation (21) can be written:

$$S(a) = \frac{1}{r+\delta}(a - a_R) \tag{23}$$

Combining with (17) and rearranging we get:

$$\frac{(1-t)(r+\delta)k}{(1+T)(1-\gamma)m(\theta)} = \int_{a_R}^{\infty} (a - a_R) f(a) da \tag{24}$$

Recalling that $m'(\theta) < 0$, (24) defines a negative relationship between θ and a_R. When a_R raises, the expected gain of filling a vacant job decreases (because it depends on the area of the integral, which decreases for a given value of a when a_R is increasing), so employers will post less vacancies. Here it is important to note that this behavior is strongly linked to the information structure of the model: employers do not know the value of a when posting a given vacancy, but they *do* know the level of a_R present in the economy and thus can take into account that a raise in a_R reduces the chances that a given posted vacancy is acceptable for workers.

Finally, we need to check that (22) and (24) define a single and unique equilibrium.

Proposition: *under the standard assumptions about the matching function, an equilibrium exists and is unique.*

To see it, substitute (22) in (24) to obtain a single equilibrium relationship between a_R and θ:

$$z = \int_{a_R}^{\infty} \left[a - x + d(s^*) - I_u + B + \frac{1-t}{1+T} y \right] f(a) da \tag{25}$$

Where to simplify the notation $z \equiv \frac{(1-t)(r+\delta)k}{(1+T)(1-\gamma)m(\theta)}$ and $x \equiv \frac{s^*\theta k\gamma(1-t)}{(1-\gamma)(1+T)}$.

If we recall that according to (22) a_R is indeed a function of θ, the previous expression can be written as an implicit function of only θ:

$$\Lambda(\theta) \equiv z - \int_{a_R}^{\infty} \left[a - x + d(s^*) - I_u + B + \frac{1-t}{1+T} y \right] f(a) da = 0$$

Then, applying Leibniz rule and recalling that the integrand evaluated at $a = a_R$ is zero we get:

$$\Lambda'(\theta) = z'(\theta) - \int_{a_R}^{\infty} -x'(\theta) f(a) da = z'(\theta) + x'(\theta) \int_{a_R}^{\infty} f(a) da$$

It is easy to check that all the terms in the right hand side of this expression are positive, so (26) defines a monotonous increasing function of θ with only one single equilibrium value where $\Lambda(\theta) = 0$.

•

6.5 Comparative statics

The two relationships (22) and (24) will define the equilibrium values of tightness, θ^* and the reservation level of a, a_R^*. We can recall now the expression for the unemployment rate, this time as a function of the equilibrium values (and with an exogenous rate of growth of the labor force):

$$u^* = \frac{\delta + n}{\delta + n + \theta^* m(\theta^*)}$$

It is easy to study the effect of changes in the parameters: if they affect θ^* (and recalling that $[\theta m(\theta)]' > 0$), the equilibrium level of unemployment will be affected in the opposite way.

Again, the level of BI is innocuous (for the same reasons we argued when discussing the WC), while if there are other sources of unemployment income (like the usual unemployment benefits) their rise only shifts (22) and produces a higher a_R^* and lower θ^*, thus causing higher unemployment. Changes in the productivity of jobs have exactly the opposite effect, thus a rise in y will increase tightness (and reduce unemployment) and decrease a_R^* (now jobs will be productive enough to compensate some more of the "bad" ones).

If the bargaining power of workers γ grows, a_R raises and tightness falls in (22), while in (24) both of them fall, so unemployment raises while the final effect in a_R is ambiguous. In words, workers get a higher part of the surplus and they could impose a higher equilibrium reservation value of a, but given that now firms have a lower incentive for posting vacancies that effect is moderated. Changes in k (the cost of posting vacancies) play the same role in both equations and have the same effects.

The ratio $\frac{(1-t)}{(1+T)}$ has an ambiguous effect in (22), that depends on the relationship between $\frac{s^*\theta k\gamma}{(1-\gamma)}$ and y. If the former is higher than the later, increments in $\frac{(1-t)}{(1+T)}$ raise a_R^* and lower tightness in (22) and the rest of the reasoning parallels the one in the previous paragraph. Then, if any of the agents pays less taxes ($\frac{(1-t)}{(1+T)}$ is bigger), workers will only push for a higher a_R^* in (22) when the expectations from keep on searching are good enough.

Changes in the distribution of a only affect (24), increasing or reducing the value of the integral. If the distribution "deteriorates" (for example due to a change in people's preferences regarding the degree of security in the workplace that now makes the same jobs less attractive than before), a_R^* and tightness fall for (24) to be satisfied, thus unemployment rises. The fall in

a_R^* deserves a little comment. When the distribution of a worsens it basically means that now the surplus of matches will be in general lower, thus agents expect less gain from keep on searching and are more willing to accept a given match. In the example just mentioned part of this reaction corresponds to some workers who will be willing to still accept the same jobs as before, what indeed implies accepting a worse job.

Finally, changes in r or δ only shift (24). In the case of the interest rate, when it raises both a_R^* and tightness fall, and unemployment unambiguously raises. When is δ that is raising the effect in a_R^* and tightness is the same, but now we must recall that δ also affects in a direct way the level of unemployment, so its final change is ambiguous.

We summarize all this information in the following table:

Table 1: Comparative Statics Analysis

Changed Parameter	Sign of change in a_R^*	Sign of change in θ^*	Sign of change in u^*
B	0	0	0
I_u (net of B)	+	-	+
y	-	+	-
γ	ambiguous	-	+
Taxes	ambiguous	ambiguous	ambiguous
$f(a)$ "worsens"	-	-	+
k	ambiguous	-	+
r	-	-	+
δ	-	-	+

Given the distribution of a, the two equilibrium curves determine as well the observed distribution of wages; it is thus interesting to recover the wage function and explore its properties in equilibrium. From (20) and (22) we can write:

$$w^*(a) = \frac{\gamma}{1+T}y + \frac{1-\gamma}{1-t}\left\{a_R^* - a + \frac{1-\gamma}{1+T}y\right\} = \frac{y}{1+T} + \frac{1-\gamma}{1-t}(a_R^* - a)$$

And:

$$w(a_R^*) = \frac{y}{1+T}$$

Curiously enough, for the worse acceptable jobs ($a = a_R^*$) the wage paid to workers amounts to the entire production net of taxes, and does not depend on the bargaining power of workers. As such this result might seem a bit strong, but it can be interpreted as follows: all jobs produce the same amount of output y, so the jobs where the wage paid is the maximum possible (output net of taxes) will precisely be those which carry the minimum acceptable level of a.

Finally, one can also see how as a increases above a_R^* the term $(a_R^* - a)$ becomes more and more negative, so the bargained wage falls and the expected mechanics of the model are confirmed once more.

7 What lessons might be drawn?

7.1 Some tentative results

The very first thing to consider is whether this new framework does affect by itself (independently of policy related issues) the main properties of the matching model. And indeed, it is not difficult to show that the equilibrium level of tightness (and unemployment) in our model differs from the one that would emerge without stochastic job matches (as is the case when wage differentials come from different job productivities rather than job qualities). The reason is that whenever the market conditions change, workers partially react accepting better or worse jobs rather than pushing wages up or down, so part of the effects that would affect tightness are now taken up by a_R. Moreover, by the way the model is constructed agents also take into account the expected consequences of a change in their situation (the respective gains or loses weighted by the rate at which a change of state occurs), what reinforces the role played by a_R.

But this divergence is highly dependent on the rest of the parameters of the model and specially on the assumed distribution of a, which conditions to what extent the surplus of a given match can be higher or lower and thus firms are more or less interested in posting vacancies[23]. For instance, if one would postulate a uniform distribution of a, then the outcome would be the same as in the main basic model.

Second, we were essentially concerned with the study of the introduction of a BI, but we saw how it had no effect at all in the outcome of the model. However now it is not difficult to see why: there is no specific mechanism by which the level of BI influences wages and the surplus to be shared (which is defined as the net gain agents get from filling a vacant position), neither is there an interrelation between the BI and the characteristics or the functioning of a. The intuition pointed by BI advocates seemed clear enough (with the BI paid also when you are employed, there is more income to share with the employer so one can get better jobs), but the way the surplus is constructed in the model does not match that view.

How could one consider some possible effects of a BI? The typical first candidate would be to introduce risk averse workers, so the effect of the same amount of BI in their utility when employed or not is different and the surplus to be shared too[24]. In that case we could theorize about the possible outcome as follows: *a priori* and under risk aversion an increase in the BI grant would basically improve workers fallback position, providing them more utility when unemployed than when they have a job (thus paralleling a rise in unemployment benefits, or more generally in I_u). Then the expected effect would be that the BI only affects (22) and just elevates the reservation level of a, with the consequent raise in unemployment (while again what would really make a difference with the basic framework would be the assumptions

[23]It is interesting to note that in Table 1, the only case where we would observe simultaneously an unambiguous rise in a_R^* and a fall in unemployment would be when $f(a)$ "improves".

[24]We indeed explored this possibility with a constant risk aversion utility function, but the algebra of the model was complicated in extreme.

about the distribution of a). Of course this is highly speculative and must be taken very carefully, because risk aversion would modify the shape of both relationships, (22) and (24), and it could happen that changes in the BI shift both of them.

A more promising alternative would be to consider labor market participation. In our model, we assumed that the labor force was constant (so effects in tightness and unemployment were only coming from variations in the number of vacancies posted by firms), but this is highly unrealistic and controversial in a BI context. In addition, one would like to have a rich and detailed framework to allow for the several subtleties that have emerged in the long debate about BI and participation. Garibaldi and Wasmer (2005) develop a precise and tractable description of the labor market build over the same basic search frictions model we departed from, where unemployment and labor force participation are endogenous and distinct states; although it has not been explored yet, one could possibly exploit such a contribution to improve ours.

An ultimate possibility would be to make hypothesis about the interaction between the BI and the rest of the parameters of the model. A usual example of this sort would be when BI advocates argue that the BI of all the workers from a given firm could be summed up and used as an income reserve in case they begin a strike, what would amount to improve their bargaining power. But one must be careful when turning to this sort of arguments, because they would be obviously introduced *ad hoc* and would also require a high degree of previous research on that specific issue.

7.2 Back to the BI context

It seems clear that if we want to learn something related to BI from the exercise carried in this paper, it is necessary to revisit some of the arguments pointed in section 2 and seek how to interpret or clarify them under the light of the results obtained here.

To me, the key point is that different authors are indeed arguing different

things, while none of them does actually imply a different or specific outcome for our model.

When it is argued that a BI would allow people to accept jobs which are more suitable for them (again the typical example would be the single mother that needs a part time job), it is assumed that under a BI those jobs would be accepted but paying *the same wage* as before, so in fact here we are not talking about any compensatory mechanism between wages and the quality of jobs. Moreover, this argument would simply reflect that under more redistributive schemes people risk less of their income when bargaining for their wages, so that's why they might accept lower ones. This is a well known effect which is detected in various technical papers about BI (Lehmann, 2003 and Van der Linden, 2002), thus I would say that those contributions already provide a good approximation of the relevance and the role played by this issue.

On the contrary, the republican approach seems to draw a clear-cut line between the behavior of workers with or without a BI, in the sense that the compensating mechanism studied here would *only* occur under a (generous enough) BI regime, while in actual economies things are seen as going the other way round (people who get the worse jobs are also paid low wages). This possibly poses an important difficulty to the economic research on BI, because it is not obvious at all how may one study policy implications when the change in policy does affect the way agents' behavior is modeled (said in a more profane way, the introduction of a BI would not affect the equations of the model, but the way those equations were derived and combined). And I fear that those who highlight this interpretation about the effects of a BI cannot really escape to this problem.

There is even a last different way to interpret BI advocates' claims (which possibly matches views like Van Parijs one), where the BI is seen as just providing the necessary material resources *to carry* the searching activities in the labor market. If this is the case, the right way to introduce a BI in our model is through its possible effect on the efficiency of the matching

function[25]: with a BI people can indeed perform a better search (or search at all) , so under the same labor market tightness (the ratio between vacancies and job seekers) it would emerge less unemployment. But this interpretation would require to investigate the microeconomic foundations of the matching function, and to see whether it can be argued or not that a BI may play a role.

For instance, Cahuc and Zylberberg (2004) comment two possible type of models to study the micro-foundations of the matching function: *ranking models* and *stock-flow* matching models. In the first case, where the matching process depends on the preferences of employers and the characteristics of job seekers, it would be difficult to argue how a BI could affect the correspondent search externalities. However in stock-flow models, where agents privilege inflows of new applications, a BI would indeed enhance workers ability to meet new firms they haven't visited before (thanks to a higher geographical mobility, for example).

7.3 Other applications for our framework

We claimed in section 2 that welfare analysis was not the primary objective of our research; paradoxically, it turns out that one of the possible interesting applications for our framework is precisely to explore some of its welfare implications.

Given the observed wage distribution, and with a proper calibration of the rest of the parameters of the model (including tightness), one could try to estimate the distribution of a in the economy[26]. Then it would be possible

[25]This view can also be extended to unemployment benefits, while the difference with a BI would only concern the quantity of people who enjoys the benefits (a BI is always paid universally while unemployment benefits typically require to meet some eligibility conditions).

[26]Although I haven't gone deeply over the empirics of this models, one would have to deal with the usual problems to estimate truncated distributions, like the absence of information regarding the shape of the distribution for those jobs with a below a_R, which are never accepted thus there is no observed wage for them.

to take into account changes in the reservation value of a when considering the global welfare outcome of different policies.

The key issue here is that while all filled vacancies produce the same amount of output they nevertheless carry different levels of utility for workers, so the same level of employment may easily sum up a different value for aggregate welfare. Just to give an illustrative example: let's say we raise unemployment benefits, so u^* is higher but also a_R^*. Some time after, we have a fall in the cost of creating vacancies k, such that the level of employment goes back to its previous value while a_R^* is not affected. Now we have the same number of jobs producing the same amount of output, but the utility correspondent to their a component is globally higher (because those of them which had $a < a_R^*$ have been replaced by jobs with $a \geq a_R^*$). If we know the distribution of a, we can compute this gain (unless a is uniformly distributed, where there would be no change).

Actually, this could be a good description of how societies have partially raised their well-being through a process of improvement in the quality of jobs.

One may also use our model to give some consistency to one of the less well defined ideas usually present in the BI debate. It is commonly argued that from a normative point of view, the level of a hypothetical BI should be the one which "frees the labor market". There is no agreement at all on what does that expression really mean, but one might interpret it as if a free labor market is that one where people do not trade wage for disutility (do not "sell themselves"), but instead they have some genuine reasons to accept a job. In our model, this could be featured as if the labor market would be free when $a_R^* > 0$: nobody accepts a job unless it reports some strictly positive utility. If again we know the distribution of a (and develop a mechanism by which the BI influences the equilibrium, like risk averse workers for instance), we could compute that level[27].

[27] Of course that would be a nice but also futile theoretical exercise, given the impossibility to imagine policy makers deciding on the basis of this sort of criteria.

8 Conclusions and further research

In this paper we develop a model of equilibrium search unemployment extended to deal with differences in the quality of jobs. Wage and job heterogeneity emerge from a random characteristic that is subjectively evaluated by workers once a match is already formed, while in the economy there is a given distribution of that characteristic. We show that the model is tractable and how a single equilibrium emerges in the labor market, and explore several of its features.

Second, we consider how the introduction of a BI may be studied within this framework (in particular its possible effects on the level of unemployment), and argue that the current specialized literature on BI does not provide a single and consistent explanation of the relationship between BI schemes, the quality of jobs and the labor market outcomes. Finally, we propose how this task could be faced up.

Our model could be extended in several ways. Introducing participation decisions of workers would be useful for both, to deliver a more accurate picture of the effects of a BI and to better track the debate and concerns about it. If one intends to carry relevant policy analysis a budget constraint for the state should be considered, while on-the-job search would be another advisable extension (workers have an incentive to search even when they are employed, given the positive probability of finding a better job).

Other interesting possibilities could be considering risk averse workers and introduce some asymmetry in the information structure of the model (in particular, the value of a would be privately known by workers). One might be also tempted to complicate the institutional framework (introducing a minimum wage, unemployment benefits... etc), but my guess is that this should be a secondary objective until a better understanding of this framework and its interaction with a BI is attained.

To conclude, our initial research question could also be addressed by a rather different approach. After assessing empirically whether workers do compensate or not disutility with wages, one could investigate also empiri-

cally if this behavior is affected by the level of income (when employed or unemployed), or by its unconditionality. Marx and Peeters (2006) show how certain natural experiments (lotteries where winners obtain a free life-long wage) may provide the right source of data for this kind of research, while Laurent and L'Horty (2003) provide a good example of how a framework very similar to ours can be studied empirically.

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