Equilibrium Unemployment Insurance.*

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Abstract

In this paper, we incorporate a positive theory of unemployment insurance into a dynamic overlapping generations model with search-matching frictions and on-the-job learning-by-doing. The model shows that societies populated by identical rational agents, but differing in the initial distribution of human capital across agents, may choose very different unemployment insurance levels in a politico-economic equilibrium. The interaction between the political decision about the level of the unemployment insurance and the optimal search behavior of the unemployed gives rise to a self-reinforcing mechanism which may generate multiple steady-state equilibria. In particular, a European-type steady-state with high unemployment, low employment turnover and high insurance can co-exist with an American-type steady-state with low unemployment, high employment turnover and low unemployment insurance. A calibrated version of the model features two distinct steady-state equilibria with unemployment levels and duration rates resembling those of the U.S. and Europe, respectively.

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1 Introduction

This paper analyzes the interaction between social preferences for insurance and labor market performance, with the aid of a dynamic general equilibrium model. The generosity of the unemployment insurance (UI) system differs substantially across countries. According to the summary measure provided by the OECD Data-base on Benefit Entitlements and Gross Replacement Ratios, unemployment benefits in Western Europe (with the exception of Italy and the U.K.) have been about three times as large as those in the United States and Japan during the last decade. Recent papers by Ljungqvist and Sargent (1998), Mortensen and Pissarides (1999) and Marimon and Zilibotti (1999) argue that unemployment insurance is an important factor in explaining the large differences in unemployment rates and earnings inequality observed in Western Europe and the United States during the last twenty-five years. UI is argued to affect the search behavior of the unemployed, both by reducing their incentive to search intensively for a new job and by making them more reluctant to accept low-paid job opportunities (see e.g. Hansen and İmrohoroğlu (1992)). It is also argued to affect the quality of the jobs which are created, with a non-monotonic effect on output and efficiency (see Acemoglu (1997) and Acemoglu and Shimer (1999)).

While the link between replacement ratios and labor market performance has been widely studied, most of the existing literature treats UI as an exogenous institution and few authors have attempted to build a positive theory explaining why such different UI levels are observed across countries. Among these, Di Tella and MacCulloch (1995*a*), Hassler and Rodríguez Mora (1999), Pallage and Zimmermann (1999a,1999b), Saint Paul (1993, 1996 and 1997) and Wright (1986) have studied the issue of social preferences over unemployment insurance.

Hassler and Rodríguez Mora (1999), in particular, construct a model where agents can self-ensure through savings against the risk of experiencing unemployment and show that preferences for unemployment insurance are decreasing with the expected rate of turnover between employment and unemployment. While this recent literature has made a valuable contribution in explaining unemployment benefits as the endogenous political choice of fully rational and informed agents, its main limitation is its ignorance of other general equilibrium effects, and, in particular, the feedback of UI on the performance of the labor markets.

The scope of this paper is to close the circle. We construct a formal model with the property that different societies populated by rational agents and endowed with the same preferences may choose very different UI levels. The important innovation is that in our model, agents take the dynamic effects of UI on the performance of the labor market into consideration when they vote over the benefit rate. Using this model, we show that a "European" equilibrium with high unemployment, low employment turnover and high unemployment insurance can coexist with an "American" equilibrium with low unemployment, high employment turnover and low unemployment insurance. We show that a calibrated version of the model has two sustainable steady-state equilibria, where the former equilibrium has an unemployment rate of 12.7%, an average duration of unemployment of 23 months and a replacement ratio of 76%, while the latter equilibrium features an unemployment rate of 6.4%, an average duration of unemployment of 4.5 months and a 24% replacement ratio.

The model economies are characterized by search frictions in the labor market. Workers acquire sector-specific skills through on-the-job learning-by-doing. Job destruction is stochastic, and the probability of losing a job depends on the worker's human capital in the sector where she is working. Agents are risk averse, and can self-ensure through precautionary savings. Since markets are incomplete, an actuarially fair UI would be regarded as valuable by all workers, employed as well as unemployed. But, depending on their current labor market conditions, some agents attach more value than others to UI, and this incurs divergent political views in society about the degree of income taxation for financing unemployment benefits. Since agents are impatient, the unemployed tend to prefer a more generous UI than the employed. More interestingly, preferences over UI also differ across groups of employed workers. In particular, more *specialized* workers, i.e. those with a pronounced comparative advantage for working in a particular activity, will tend to value insurance more highly than workers whose skills are of a more general nature. When a specialized worker is displaced, she faces a trade-off between accepting *any* job – and suffering a wage cut with respect to her pre-displacement wage – or waiting for a job offer where she has a comparative advantage – implying a longer unemployment spell. Specialized workers, therefore, tend to pursue picky search strategies which, endogenously, entail more risk. In order to hedge this risk, they prefer a more generous UI. The selective search, in turn, reinforces the degree of specialization among workers. If a worker has held the same job in a particular industry for a long time, she is likely to have developed a more pronounced comparative advantage than a worker who has frequently changed jobs and industries. For example, a mature miner who has only been working in mining activities is bound to suffer large wage losses if she switches to a different sector, as her human capital is very industry-specific.

It is precisely this reinforcing interaction between specialization and preference for insurance which can give rise to multiple steady-state equilibria. In particular, two economies with small or even no differences in preferences or technology may end up with very different political choices over social insurance and therefore large differences in their economic performance. Consider an economy where highly specialized workers are politically preponderant. On the one hand, this economy features a strong political pressure for high insurance. On the other hand, given a generous UI, the unemployed workers tend to be picky, in order to retain their skills in the sector where they have an initial comparative advantage. This will, in turn, increase the proportion of highly specialized workers and sustain the demand for high insurance. Hence, this economy may have a stable equilibrium outcome with low employment turnover, low mobility between industries (or occupations), small post-displacement wage losses (since job-searchers are "picky"), and high unemployment. Conversely, consider an economy where most workers have little specialization. The majority of workers then attach a low value to UI, so that low benefits will be chosen in equilibrium. Less insurance reduces the incentive for unemployed workers to be picky, which, in turn, suppresses the proportion of narrowly specialized workers, and undermines the support for a generous UI system. Thus, this economy may have another stable equilibrium outcome with a high employment turnover, large post-displacement wage losses (since job-searchers are "non-picky"), and low unemployment, where the majority is content with low benefits.

This mechanism illustrates our general point that social insurance affects economic behavior, which, in turn, feeds back on preferences over social insurance. The notion of *specialization* goes beyond "human capital accumulation," however. Alternative interpretations include e.g. the type of education (vocational schools versus general university education), and house ownership (affecting geographical mobility). In these cases, the "specialization" entails costs of mobility, inducing specialized agents to demand higher UI. In turn, the presence of insurance fosters investments that are specific in nature and other types of behavior making agents less mobile, and reduce the incentives for agents to engage in investments that are general in nature.

A large body of empirical literature has studied various aspects of displaced workers' behavior of relevance for our analysis. The effect of switching industries on the wage earning of displaced workers – a central building block in our paper – is well documented. For the United States, Neal (1995) finds that workers switching industries after losing their previous job, usually suffer much larger losses than observationally equivalent workers remaining in the same industry. On average, the wage loss for a male worker changing industries is in the order of 15%, while if staying, he would only suffer a loss in the order of 3%. Moreover, wage losses increase with experience and tenure, and at a much more pronounced rate for those changing industries than for those remaining. Using the Displaced Workers Survey (DWS), Topel (1990) shows that the wage fall associated with job displacement increases with 1.3% for each extra year of tenure in the job from which the worker was displaced. General labor market experience is substantially less important for the size of the wage loss. This evidence supports our view that there is a significant accumulation of human capital on-the-job and that part of this human capital is lost if a workers switches industries.

A central mechanism in our theory is that workers suffering large wage losses upon accepting certain job offers would reject these offers if the UI were more generous. It is therefore a key empirical prediction that post-displacement wage losses should, in equilibrium, be lower in Europe than in the U.S. This implication is confirmed by the data. A range of empirical studies suggest that displacement leads to 10–25% wage losses in the United States (see e.g. Jacobson, LaLonde and Sullivan (1993), and Hamermesh (1989) and Fallick (1996) for reviews of the literature). In contrast, post-displacement wage losses upon re-employment seem to be relatively small in Europe. Leonhard and Audenrode (1995) document that displaced workers experience no wage loss in Belgium, and Burda and Mertens (1998) find very low post-displacement wage losses in Germany (i.e. full-time employed men displaced in 1996 and re-employed in 1997 suffered an average wage reduction of 3.6% in comparison with those with no unemployment spell in that period).

Turning to the effects of UI on search behavior, Meyer (1990) – using U.S. data from the Continuous Wage and Benefit History – finds support for another important aspect of our model; i.e. that higher benefits have a strong negative effect on the probability of exiting unemployment. As concerns the issue whether UI affects the degree of sectoral mobility of workers, Fallick (1991), using the DWS, documents that higher unemployment benefits "retard the mobility of displaced workers between industries" (p. 234), i.e., reduce the rate at which displaced workers become employed in other sectors than the one in which they where laid off. In contrast, unemployment benefits have little effect on reemployment rates in the same industry. As concerns the relationship between the accumulation of "specific" human capital and search behavior, Thomas (1996) finds, using Canadian micro-data, that workers' average unemployment spells increase with tenure for UI recipients (increasing tenure to 5 years increases the unemployment spell by 18%). Using the DWS, Addison and Portugal (1987) report similar findings. Since tenure is correlated with specialization in our model, these findings are in line with our idea that more specialized (high tenure) displaced workers tend to be more selective in the search process, since they have more to lose from switching to jobs for which they are not qualified.[1]

[1]This interpretation is at odds, however, with another of Thomas' (1996) findings: that longer tenure

There are, however, other empirical observations which are harder to reconcile with our stylized model. In particular, the duration of unemployment is found to be higher among industry changers than among stayers in the U.S. (see Murphy and Topel (1987), and, again, Thomas (1996)). This evidence is at odds with the prediction of standard search models and with the hypothesis of "wait unemployment", and in this respect our model is no exception. A more sophisticated version of the basic search model (i.e. assuming that displaced workers have imperfect knowledge of the value of their human capital and learn about it throughout their unemployment experience) can reconcile the theory with these observations. However, the complexity of the main objective of this paper – endogenizing social preferences over insurance in a general equilibrium model with individual asset accumulation – constrains us to keep the analysis of the search behavior simple and parsimonious. In an extension, however, we assume that workers lose skills during unemployment. In this case, the predictions of our model are consistent with this empirical evidence on the relative duration of unemployment for switchers versus stayers (see footnote 13).

Besides the literature on unemployment insurance already mentioned, other papers concerning the issue of social preferences over insurance include Bénabou (1998), Piketty (1995) and Saint Paul (1994). Bénabou (1998), in particular, notes that in the data, more (less) equal societies seem to choose more (less) redistributive policies. He constructs a voting model with multiple steady-state equilibria consistent with these facts, without relying on inherent differences in preferences or technology. His mechanism is, however, very different from ours. The driving force in his model is the assumption that richer agents are more politically active, and therefore more preponderant than poorer agents.

The plan of the paper is as follows. Section 2 presents the model. Section 3 characterizes the optimal decisions (savings and search) of agents, given an exogenous UI. Section 4 characterizes the political equilibrium. Section 5 presents the results of a calibrated version of the model and shows the existence of multiple steady-state equilibria with endogenous choice of UI. Section 6 considers an extension of the benchmark model where specialization is associated with low general human capital. Section 7 concludes. All formal proofs and some additional simulation results are found in the Appendix.

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increases the mobility across industries for displaced workers with UI. The same author finds, however, that tenure decreases mobility between *occupations*. Although specialization has here been labeled *industry*- or *sector*-specific, we could, alternatively, consider *occupation* as more relevant than industry for capturing the specific components of the skills accumulated on-the-job. Under this alternative interpretation, the mechanism of our model would be consistent with the micro evidence of Thomas (1996).

2 Model environment

2.1 Preferences

The economy is populated by a continuum of overlapping generations of non-altruistic workers. Agents are risk averse, with preferences parameterized by a CARA function, and face a positive constant probability δ of dying in any time period, with $\delta \in [0,1]$. The population is assumed to remain constant over time: while δ agents die each period, an equal number of agents are born in the same period. Following Blanchard (1985), we assume that there is a perfect annuities market, such that the living agents receive a premium rate of return on their wealth in exchange for the promise to leave their stock of wealth to the insurance company whenever they die. Newborn agents hold no assets, and there are no borrowing constraints. In this framework, the problem of maximizing expected utility subject to uncertainty about the length of the life horizon is identical to a model where infinitely lived agents maximize expected utility, discounting the future at the rate $\beta(1-\delta)$ instead of β only, where β is the time discount factor. We assume that $\beta(1-\delta) < 1$. Preferences are assumed to be of the constant absolute risk aversion class (CARA). Thus, the agents maximize

$$\tilde{V}_i = -E_0 \sum_{t=0}^{\infty} \beta^t e^{-\sigma c_{i,t}} \tag{1}$$

subject to a standard transversality condition and a sequence of dynamic budget constraints,

$$a_{i,t+1} = (1+r)a_{i,t} + \omega_{i,t} - c_{i,t} \tag{2}$$

where a denotes financial assets and $\omega_{i,t}$ denotes income, net of taxes but including potential transfers. As we will describe below, $\omega_{i,t}$ will depend on the labor market situation of the individual and on the tax/transfer system in place. We assume that agents live in a small open economy with no aggregate risk, and that the risk-free interest rate is $(1+r)(1-\delta)-1$ (so the r includes the premium annuity return of surviving). Moreover, we assume that $(1+r) = \frac{1}{\beta(1-\delta)}$. Under this assumption, if labor income $\omega_{i,t}$ were not random, each agent would choose a flat consumption path with no savings. However, individual income is stochastic in our economy and, with the annuity being the only asset available to the agents, agents cannot fully insure against the labor income risk. The risk can, however, be mitigated through self-insurance (precautionary saving), which we see as a crucial part of any realistic search model of unemployment insurance. The choice of CARA utility has the important advantage that the labor market behavior is independent of the wealth distribution (see e.g. Acemoglu and Shimer (1999)). More general preferences (e.g. constant relative risk aversion) would imply that the wealth distribution enters as a state variable, which would severely complicate the analysis (see e.g. Gomes, Greenwood and Rebelo (1998) for an example of a search model with self-insurance). The empirical impact of individual wealth on job search pickyness is ambiguous and still an open issue in the literature (Rendon (1997)). Although we believe that wealth effects on search behavior would not change our main findings, the extension to more general preferences is left for further research.

2.2 Labor income process

We will now describe the stochastic process for labor income and how individual search behavior affects income risk.[2]

We assume that all agents are born identical. Individual labor market experience, however, will make workers differ over time. There are N identical sectors where job opportunities arise. In every period, a worker can either be unemployed or work in one of the N sectors. Her labor income consists of a wage if she works and unemployment benefits if she is unemployed. Due to frictions in the labor market, job offers arrive at a stochastic rate. The probability of a job offer in each of the N sectors is equal to π and is *i.i.d.* across sectors, agents and time. There is no on-the-job-search, so an employed worker will never receive outside job offers before going into the unemployment pool. Workers acquire and lose skills throughout their labor market experience. We assume that human capital is sector-specific and can only be accumulated through learning-by-doing while employed. For simplicity, we operate with only two levels of human capital; *high* or *low.* In addition, we will rely on the following assumptions:

1. a worker who is employed in sector j and has low human capital in that sector acquires high sector j-human capital with probability α in each period of employment;

2. a worker employed in a sector $k \neq j$ cannot accumulate sector j -human capital;

3. a worker with high sector j-specific human capital loses this human capital instantaneously when accepting a job in any other sector than j;

4. an unemployed worker cannot accumulate human capital, but may lose it.

[2] Albrecht, Storesletten and Vroman (1998) explore a similar process for labor income, except that they have endogenous (sector-specific) arrival rates of job offers.

These four assumptions capture the idea that sector-specific skills become outdated or forgotten when the agent has not worked in that sector for some time. The assumption that an unemployed worker loses her sector-specific skills when changing sectors is not essential, but is introduced for the sake of tractability. What is crucial, however, is that the expected time to re-gain specialized employment is longer for those who accept unspecialized jobs than for those who stay unemployed.[3] This gives an unemployed worker with a sector-specific comparative advantage an incentive to decline offers from other sectors, which may outweigh the opportunity cost of continued unemployment. Note that under this set of assumptions, agents have low human capital in all sectors, except possibly in the one where they were most recently employed. Thus, since all sectors are identical, the label of the sector where the agent has accumulated human capital is essentially irrelevant. From now on, we will refer to agents with high human capital in a particular sector as *specialized*, and refer to agents with low human capital in all sectors as *unspecialized*.

Specialization entails higher wages and a smaller probability of job displacement. Formally, the productivity (gross wage) of an employed worker is w_s if she is specialized and works in the sector where she has high human capital, and $w_n < w_s$ otherwise. The probability of job separation is γ_s if she is specialized and works in the sector where she has high human capital, and $\gamma_n > \gamma_s$ otherwise.[4] The non-capital income of an employed worker is given by her gross wage net of tax payments, and τ denotes the tax rate on labor income. The non-capital income of an unemployed worker is given by her unemployment compensation, which is equal to a fraction $b \in [0, 1]$ of her pre-displacement wage.

In summary, an agent's labor market characteristics are described by her employment status (employed (e) or unemployed (u)) and human capital (specialized (s) or unspecialized (n)). Let $\Omega \equiv \{es, en, us, un\}$ denote the set of possible characteristics. The wage in period t for the various types of agents is then $\omega_{i,t} \in \{(1-\tau_t)w_s, (1-\tau_t)w_n, b(1-\tau_t)w_s, b(1-\tau_t)w_n\}$.

[3] Assumption 3 can be generalized by allowing the agents to (with some probability) retain their sector i-human capital while working in sector j. The analysis of the political equilibrium becomes more involved, however. As we shall see, the agents' preferences for UI are not single-peaked, so keeping the number of types of agents in the economy to a minimum is very convenient.

[4] Given these assumptions, specialization is always good. If offered a job in the "right" sector, the specialized worker earns a higher wage than the unspecialized. But if she accepts to work in the "wrong" sector, her earnings will be as high as those of the unspecialized workers. This absolute advantage of specialization is not an essential feature of our theory. In section 6, we discuss an extension where specialization is a comparative advantage but an absolute disadvantage; specialization implies a lower wage than that of the unspecialized for a worker employed in the "wrong" sector, and the same wage as the unspecialized if the worker is employed in the "right" sector. As we shall see, our results are largely invariant to this alternative specification.

Moreover, an agent's labor market characteristics follow a Markov process $\hat{\Gamma}$, where

$$\hat{\Gamma}(\nu) \equiv (1-\delta) \begin{bmatrix} 1-\gamma_s & 0 & \gamma_s & 0 \\ \alpha(1-\gamma_n) & (1-\alpha)(1-\gamma_n) & 0 & \gamma_n \\ \pi & \nu(1-\pi-(1-\pi)^N) & (1-\pi)-\nu(1-\pi-(1-\pi)^N) & 0 \\ 0 & 1-(1-\pi)^N & 0 & (1-\pi)^N \end{bmatrix} \tag{3}$$

To understand the structure of the individual transition matrix $\hat{\Gamma}(\nu)$, consider transitions conditional on survival. An employed specialized (first row) maintains her status with probability $(1-\gamma_s)$ and becomes an unemployed specialized with probability γ_s. An employed unspecialized (second row) loses her job with probability γ_n; conditional on remaining employed, she learns and becomes specialized with probability α, and fails to learn and retains her status with probability $1-\alpha$. An unemployed unspecialized (fourth row) receives a job offer in at least one sector with probability $1-(1-\pi)^N$, in which case she always accepts this offer, and with probability $(1-\pi)^N$ she retains her status.

Now, we turn to the key group – the unemployed specialized (third row). In contrast to Hansen and İmrohoroğlu (1992), the government cannot take away benefits from unemployed agents who turn down job offers. An individual in this group will always accept a job in the sector where she has her comparative advantage. However, the choice of accepting or turning down offers from other sectors entails a trade off between remaining unemployed and accepting a low-paid job, thereby relinquishing her sector-specific skills. We will denote the probability that she will accept a low-paid job offer by $\nu \in [0,1]$, where ν is a choice variable. Her behavior will be referred to as "picky" if she chooses $\nu = 0$ (rejecting unskilled offers with probability one), and "non-picky" if she chooses $\nu = 1$ (rejecting unskilled offers with probability one). Picky behavior implies that she will become employed specialized with probability π and remain unemployed with probability $(1-\pi)$. Non-picky behavior implies, in contrast, that she still becomes employed specialized with probability π, but also that she will relinquish her specialization and become employed unspecialized with probability $1-\pi-(1-\pi)^N$. Note that the definition of ν allows for mixed strategies. Finally, observe that in our benchmark model, the unemployed specialized have a zero probability of losing skills (i.e. become unspecialized) while unemployed. The general case with loss of skills during unemployment is analyzed in section 5.6.

3 Asset accumulation and search behavior

Given the model environment, it is now time to analyze the agents' private decisions. To this end, we take the political choice of unemployment insurance as given. Employed workers make no decisions other than what to consume and save. Unemployed workers, however, also decide which job to take, if any, among those possibly offered in each period.

3.1 Consumption and savings decisions

For an infinite sequence of constant tax rate τ and benefit rate b, the *state* of an agent consists of her asset holdings, a_t, and her labor market characteristics $i \in \Omega$. Due to the CARA utility specification, the value function is separable in asset holdings and labor market characteristics. This is formally stated in the following proposition:

Proposition 1 *The value function $\tilde{V}$ of an agent with asset holdings $a_t \in \mathbf{R}$ and labor market characteristics $i \in \Omega$, is given by*

$$\begin{aligned} \tilde{V}(a_t, i, b, \tau) &= -\frac{1+r}{r} e^{-\sigma \frac{r}{1+r} a_t} e^{-\sigma c_i(b,\tau)} \\ &\equiv \frac{1+r}{r} e^{-\sigma \frac{r}{1+r} a_t} V_i(b, \tau) \end{aligned} \tag{4}$$

where $\{c_i(b,\tau)\}_{i\in\Omega}$ solve the system of equations

$$-\tfrac{1+r}{r} e^{-\sigma(\frac{r}{1+r}a + c_i(b,\tau))}$$
$$= -e^{-\sigma(\frac{r}{1+r}a + c_i(b,\tau))} - max_\nu\{\tfrac{1}{r(1-\delta)} \textstyle\sum_{i'\in\Omega} \hat{\Gamma}_{i,i'}(\nu) e^{-\sigma(\frac{r}{1+r}a + r(\omega_i - c_i(b,\tau)) + c_{i'(b,\tau)})}\}.$$

Her consumption is then given by

$$c_{i,t} = \frac{r}{1+r} a_t + c_i(b, \tau), \tag{5}$$

where V_i is independent of asset holdings.

It follows directly from Proposition 1 that the search decision is independent of asset holdings; given the constants $\{c_i\}_{i\in\Omega}$ the picky behavior, $\nu = 0$, is optimal if and only if $c_{us} \geq c_{en}$. Similarly, preferences over different combinations of taxes and benefit rates are fully described by V_i. In other words, all individuals with the same labor market characteristics i have identical preferences over taxes and benefits, regardless of their assets. From here on we will thus refer to V_i as the value functions.[5]

[5]We have defined V_i as a function of taxes and benefits, under the assumption that τ and b are exogenous and unrelated. When we introduce the government's budget constraint, however, τ will depend on b and the distribution of agents, μ_0. Hence, we will write $V_i = V_i(b, \tau(b, \mu_0)) = V_i(b, \mu_0)$, which will be the notation used in the remainder of the paper. Moreover, as the main part of our analysis is independent of individual asset holdings, we will, with some abuse of terminology, refer to $V_i(b, \mu_0)$ as the value function or the expected discounted future utility of an agent with status i, ignoring the term $\frac{1+r}{r} e^{-\sigma \frac{r}{1+r} a_t}$.

3.2 Distribution of employment and specialization

The aggregate state of the economy is described by the distribution of agents across specialization and employment status, and by the wealth distribution. Since CARA preferences rule out any interaction between asset holdings and the labor market behavior, we can ignore the dynamics of the wealth distribution and focus on the distribution of specialization and employment status. The distribution of agents across labor market characteristics at time t is labeled $\mu_t = (\mu_{es,t}, \mu_{en,t}, \mu_{us,t}, \mu_{un,t})$.

The focal point of our model is the search behavior of the unemployed specialized. The job market behavior of other types of agents are straightforward: the employed always want to keep their jobs (since unemployment benefits are restricted to less than or equal to full insurance), and the unemployed unspecialized always accept any job offers. Conditional on the *aggregate* search behavior ν_a, the law of motion of the distribution of agents, μ_t, is entirely deterministic, and is given by:

$$\mu_t = \Gamma(\nu_a)\mu_{t-1} \tag{6}$$

where

$$\Gamma(\nu_a) \equiv \hat{\Gamma}(\nu_a) + \begin{bmatrix} 0 & 0 & 0 & \delta \\ 0 & 0 & 0 & \delta \\ 0 & 0 & 0 & \delta \\ 0 & 0 & 0 & \delta \end{bmatrix} \tag{7}$$

Note that to characterize the law of motion of μ, the only modification to the individual transition matrix $\hat{\Gamma}$ is that δ, the proportion of all types $i \in \Omega$ who die and are replaced by (young) unemployed unspecialized workers, must be added to the last column of $\hat{\Gamma}$.

Conditional on ν_a, standard theorems ensure the existence and uniqueness of an ergodic distribution, $\mu^s(\nu_a)$. This long-run distribution is given by the eigenvector associated with the matrix $\Gamma(\nu_a)$, with the restriction that μ^s is a vector of probability measures, i.e.:

$$\mu^s(\nu_a) = \Gamma(\nu_a) \cdot \mu^s(\nu_a) \quad s.t. \quad \mu^s(\nu_a) \cdot e = 1 \tag{8}$$

where $e = (1, 1, 1, 1)$. We will now analyze how ν_a affects the long-run distribution when agents pursue pure strategies, so $\nu_a \in \{0, 1\}$. The results are summarized in the following proposition (the proof is omited, but it is available upon request):

Proposition 2 *Define* $\mu^s(0) = (\mu^0_{es}, \mu^0_{en}, \mu^0_{us}, \mu^0_{un})$ *and* $\mu^s(1) = (\mu^1_{es}, \mu^1_{en}, \mu^1_{us}, \mu^1_{un})$.

(A) Assume that $\pi > \alpha(1-\gamma_s)$. *Then:*

a) $\mu_{es}^0 > \mu_{es}^1$;

b) $\mu_{en}^0 < \mu_{en}^1$;

c) $\mu_{us}^0 > \mu_{us}^1$;

d) $\mu_{un}^0 < \mu_{un}^1$;

(B) Assume, additionally, that $\gamma_n < \bar{\gamma}_n$, *where*
$\bar{\gamma}_n \equiv \frac{(\alpha+\gamma_s+\delta(1-\delta))\left(1+\left(1-(1-\pi)^N\right)+\delta(1-\delta)\right)}{\pi+\alpha}\left(1+\left(1-(1-\pi)^N\right)+\delta(1-\delta)\right)$. *Then:*

e) $\mu_{es}^0 + \mu_{en}^0 < \mu_{es}^1 + \mu_{en}^1$.

Assumption (A) requires that the expected time before an unemployed specialized regains her specialized employment status increases if she accepts to switch sectors and give up her skill. Assumption (B) requires that the average employment spell in unspecialized jobs is sufficiently long. These assumptions, which will be maintained throughout the rest of the paper, ensure that picky behavior of the employed specialized induces more unemployment and less mismatch of skills.

Finally, note that Proposition 1 implies that individual wealth may grow or fall without bounds. However, since the distribution of agents across employment states and age converges to a stationary distribution, the *aggregate* wealth in this economy will converge to a finite level (because of mortality). In fact, one can show that the law of motion of aggregate wealth A_t is $A_{t+1} = (1-\delta)A_t + (1+R)\sum_{i\in\Omega}\mu_{i,t}(w_i - c_i(b,\tau))$.

3.3 Equilibrium search behavior with exogenous UI

The purpose of this subsection is to define an *equilibrium search behavior* (ESB). In particular, we will study how the optimal search behavior, i.e., the choice of ν, varies with the benefit rates and taxes, once the interdependence between taxes and benefits through the fiscal budget is taken into account.

Taxes and benefits are interdependent through an intertemporal budget constraint, faced by the agency running the unemployment insurance system – which we will call *government*. Although our definition of ESB will allow for non-steady state employment dynamics, it is convenient to restrict our attention to sequences of tax and benefit rates which are constant over time. In order for this to be feasible, the government is allowed to run temporary deficits or surpluses, although the present discounted value of revenues and expenditures must be equal. The government exclusively collects revenues through a proportional labor income tax, while its expenditures are given by the unemployment benefits plus what will be labeled *administration costs*, $\xi \in [0,1]$, proportional to the unemployment benefit rate b. More precisely, for each dollar of tax revenues, $(1-\xi)$ dollars are transferred to the unemployed. The remainder is a stand-in for a number of inefficiencies typically associated with the UI system, like the reduction of incentives to search, the deadweight loss of taxation, or the direct cost of administrating the system (see e.g. Hopenhayn and Nicolini (1997)). The only role of the administration cost ξ is a contribution to the realism of the model (so we could set $\xi = 0$ and the main results would remain valid). We denote by $\tau(b, \mu_0, \nu_a)$ the tax rate satisfying the government's intertemporal budget constraint for a benefit rate b, an initial distribution μ_0 and aggregate search behavior $\nu_a \in [0,1]$. Formally, τ can be expressed as

$$\tau(b,\mu_0,\nu_a) = \left(1 + \frac{1-\xi}{b} \frac{\sum_{t=0}^{\infty}(1+R)^{-t}(w_s\mu_{es,t}(\nu_a,\mu_0) + w_n\mu_{en,t}(\nu_a,\mu_0))}{\sum_{t=0}^{\infty}(1+R)^{-t}(w_s\mu_{us,t}(\nu_a,\mu_0) + w_n\mu_{un,t}(\nu_a,\mu_0))}\right)^{-1} \tag{9}$$

where $R = (1+r)(1-\delta) - 1$, $\mu_t(\nu_a, \mu_0) \equiv \Gamma(\nu_a)^t \mu_0$ and $\Gamma(\nu_a)$ is as defined by (7). Note that a shift in ν_a from picky to non-picky behavior can imply a higher or a lower tax rate, depending on the parameters (recall that picky behavior implies higher unemployment, but less mismatch). For expositional convenience, however, we restrict our attention to the case we regard as empirically more plausible, where a switch from non-picky to picky search behavior will increase the tax rate satisfying (9). It is straightforward to extend the analysis to the opposite case. Formally:

Assumption 1 $\frac{\partial \tau(b,\mu_0,\nu_a)}{\partial \nu_a} < 0$.

We can now provide a formal definition of an equilibrium search behavior;

Definition 1 *Let $\bar{V}_i(\nu, \tau, b)$ denote the value function of an agent whose current employment status is $i \in \Omega$, conditional on choosing search strategy ν. An* ***equilibrium search behavior (ESB)*** *$\nu^*(b, \mu_0) \in [0,1]$, is defined by the following conditions;*

1. $\nu^*(b,\mu_0) = \arg\max_\nu \bar{V}_i(\nu, \tau(b,\mu_0,\nu_a), b)$,
2. $\nu^*(b,\mu_0) = \nu_a$,
3. *given b and μ_0, there exists no $\nu^{**} \neq \nu^*$, such that the following conditions are satisfied:*

a) $\nu^{**} = \arg\max_\nu \bar{V}_i(\nu, \tau(b, \mu_0, \hat{\nu}_a), b)$,

b) $\nu^{**} = \hat{\nu}_a$,

c) $\tau(b, \mu_0, \nu^{**}) < \tau(b, \mu_0, \nu^*(b, \mu_0))$.

The value functions under equilibrium search behavior are then defined by;

$$V_i(b, \mu_0) \equiv \bar{V}_i(\nu^*(b, \mu_0), \tau(b, \mu_0, \nu^*(b, \mu_0)), b). \tag{10}$$

On the one hand, our definition of ESB requires that tax and benefit rates satisfy the government intertemporal budget constraint and, on the other hand, that workers follow an optimizing search strategy (parts 1 and 2). This is, however, not sufficient to pin down a unique tax rate for any given b and initial distribution μ_0. Part 3 of Definition 1 provides a selection criterion, establishing that the lowest tax rate is selected, whenever the tax rate consistent with parts 1 and 2 is not unique. This selection can be justified by assuming the following sequence of events. *First*, the government announces the benefit and tax rates. *Then,* workers decide their search behavior. The government must restrict itself to credible announcements, i.e., (b, τ) must be such that its intertemporal budget constraint is satisfied given the optimizing workers' behavior, according to parts 1 and 2 of Definition 1. When there is more than one such credible tax rate, the government will choose the (Pareto superior) lowest tax rate.[6]

Having defined the equilibrium concept, we can now study how the equilibrium search behavior changes as a function of the benefit rate b. For expositional convenience, we will restrict our attention to parameter sets such that the value functions exhibit single-crossing properties. This means that, conditional on aggregate behavior, the value functions of the unemployed specialized and of the employed unspecialized, as functions of b, cross once and once only. More formally:[7]

[6] Multiple credible tax rates for a given b originate from the fact that, in generic economies, when there are shifts in search behavior behavior, the tax rate required to finance a given benefit rate shifts. This may reinforce the shift in behavior, in which case we have a range of benefits with multiple credible tax rates. Alternatively, it might work in the opposite direction. In that case, there would be an intermediate range of benefit rates, such that the only credible announcement of the government, (b, τ), makes the unemployed specialized indifferent between picky and non-picky behavior. Given this indifference, some of the unemployed specialized would adhere to picky and some to non-picky behavior, the proportions being such that the announced pair (b, τ) is consistent with (9) (in other terms, we allow for mixed strategies). In this case, the equilibrium consistent with Definition 1 would always be unique. Although this is possible in theory we have never encountered parameters where the ESB involves mixed strategies in our numerical analysis (see section 5) .

[7] An explicit characterization of the parameter set such that Assumption 2 is guaranteed is very complex.

Assumption 2 *Let* $U^{i}_{\nu,\nu_a}(b,\mu_0)$ *denote the present discounted expected utility (net of the asset component) of an agent in state* $i \in \Omega$*, conditional on aggregate search behavior* $\nu_a \in [0,1]$*, benefits* b*, initial distribution* μ_0*, and the agent pursuing search strategy* $\nu \in [0,1]$*. Given* μ_0*, the structural parameters are such that the following conditions hold:*

1. $U^{en}_{0,0}(0,\mu_0) > U^{us}_{0,0}(0,\mu_0)$;
2. *Whenever* $U^{us}_{\nu,\nu_a}(b,\mu_0) = U^{en}_{\nu,\nu_a}(b,\mu_0)$*, then* $\frac{d}{db}U^{us}_{\nu,\nu_a}(b,\mu_0) > \frac{d}{db}U^{en}_{\nu,\nu_a}(b,\mu_0)$.

Since the unemployed specialized will always be picky under full insurance ($b = 1$), the first part of Assumption 2 rules out the uninteresting possibility that picky behavior is optimal for any benefit rate, by ensuring that the unemployed specialized are non-picky when $b = 0$. The second part ensures that a marginal increase in the benefit rate (taking the associated change in τ into account) is more beneficial for the unemployed specialized than for the employed unspecialized, whenever $U^{us}_{\nu,\nu_a}(b,\mu_0) = U^{en}_{\nu,\nu_a}(b,\mu_0)$. This guarantees single-crossing of the value functions. In particular, it ensures that, holding aggregate search behavior constant, there exists a unique threshold such that, being employed unspecialized is preferable to (worse than) being unemployed specialized for all b lower (higher) than the threshold.

This property is illustrated by Figure 1. In the upper (lower) part of the figure, we plot four schedules representing the agents' utility associated with alternative employment status (us,en) and individual search strategies ($\nu \in \{0,1\}$), for the case where $\nu_a = 1$ ($\nu_a = 0$), i.e., non-picky (picky) aggregate behavior. Assumption 2 ensures that $U^{us}_{0,1}$ and $U^{en}_{0,1}$ ($U^{us}_{0,0}$ and $U^{en}_{0,0}$) cross once and once only. The benefit rate where they cross is denoted by $\bar{b}^1$ ($\bar{b}^0$). At the threshold benefit $\bar{b}^1$ ($\bar{b}^0$), being unemployed specialized yields the same utility as being employed unspecialized, so the unemployed specialized are indifferent between any choice of ν. Hence, at $b = \bar{b}^1$ ($b = \bar{b}^0$), we have that $U^{us}_{0,1} = U^{en}_{0,1} = U^{us}_{1,1} = U^{en}_{1,1}$ ($U^{us}_{0,0} = U^{en}_{0,0} = U^{us}_{1,0} = U^{en}_{1,0}$). When $b < \bar{b}^1$ ($b < \bar{b}^0$), employment status "en" is preferred to employment status "us". Thus, individuals find it optimal to be non-picky and to accept unspecialized offers. The opposite holds when $b > \bar{b}^1$ ($b > \bar{b}^0$), in which case picky behavior is optimal.

<Figure 1 about here>

We can now characterize the equilibrium, which requires consistency between individual and aggregate search behavior. It is useful to distinguish between two possible cases; either

This assumption holds in all numerical simulations we have explored (and, in particular, in the benchmark calibration of section 5).

$\bar{b}^0(\mu_0) \leq \bar{b}^1(\mu_0)$, or $\bar{b}^0(\mu_0) > \bar{b}^1(\mu_0)$. In the former case, the selection criterion of Definition 1 (part 3) applies. In equilibrium, mixed strategies will be pursued in the latter case, but not in the former.

Proposition 3 *Let Assumptions 1 and 2 hold. Let $\nu^*(b, \mu_0)$ be an equilibrium search behavior as in Definition 1, and let $\bar{b}^{\nu_a}(\mu_0)$ denote the threshold benefit conditional on aggregate behavior, ν_a. Then:*

1. *If $\bar{b}^0(\mu_0) \leq \bar{b}^1(\mu_0)$, then:*

   (a) $b > \bar{b}^1(\mu_0) \Rightarrow \nu^*(b, \mu_0) = 0$, and (b) $b \leq \bar{b}^1(\mu_0) \Rightarrow \nu^*(b, \mu_0) = 1$.

2. *If $\bar{b}^0(\mu_0) > \bar{b}^1(\mu_0)$, then $\nu^*(b, \mu_0)$ is such that:*

   (a) $\nu^*(b, \mu_0) = 1$ for $b \leq \bar{b}^1(\mu_0)$, (b) $\nu^*(b, \mu_0) = 0$ for $b \geq \bar{b}^0(\mu_0)$, and (c) $\nu^*(b, \mu_0) \in \langle 0, 1 \rangle$ for $b \in \langle \bar{b}^1(\mu_0), \bar{b}^0(\mu_0) \rangle$,

The following corollary of Proposition 3 documents a general property of agents' preferences over benefit levels; the value function is continuous except for a possible discontinuity at $\bar{b}^1(\mu_0)$.

Corollary 1 *If $\bar{b}^0(\mu_0) \leq \bar{b}^1(\mu_0)$, then, $\forall i \in \Omega$, the value function $V_i(b, \mu_0)$ is continuous in b, $\forall b \in [0, 1]$, except for a discontinuous fall at $\bar{b}^1(\mu_0)$.*

Figure 1 also serves the purpose of illustrating Proposition 3 and its Corollary. For any $b < \bar{b}^0$, irrespective of the aggregate behavior, the unemployed specialized find it optimal to be non-picky (since $U^{en}_{\cdot,\nu_a} > U^{us}_{\cdot,\nu_a}$ for all ν_a). Conversely, when $b > \bar{b}^1$, the unemployed specialized find it optimal to be picky (since $U^{us}_{\cdot,\nu_a} > U^{en}_{\cdot,\nu_a}$ for all ν_a). In the intermediate range where $b \in [\bar{b}^0(\mu_0), \bar{b}^1(\mu_0)]$, the credible tax rate is not unique ($U^{en}_{\cdot,1} > U^{us}_{\cdot,1}$, whereas $U^{us}_{\cdot,0} > U^{en}_{\cdot,0}$). In this case, the selection criterion of part 3 of the Definition 1 implies that, in equilibrium, agents adhere to a non-picky behavior. Thus, the ESB features picky behavior whenever $b > \bar{b}^1$ and non-picky behavior whenever $b \leq \bar{b}^1$. The figure also shows that the value function of all agents falls discretely at the threshold $\bar{b}^1$ (Corollary 1). When $\bar{b}^0 < \bar{b}^1$, the value function of an agent is given by:

$$V_i(b, \mu_0) = \begin{cases} U^i_{1,1}(b, \mu_0) & if \quad b < \bar{b}^1(\mu_0) \\ U^i_{0,0}(b, \mu_0) & if \quad b \geq \bar{b}^1(\mu_0) \end{cases}$$

In the figure, the value function of the unemployed specialized is drawn in bold face, and one can see that $V_{us}(b, \mu_0)$ is continuous in b except for a discontinuous fall at $\bar{b}^1(\mu_0)$. The discontinuity is due to the fact that a shift in the aggregate search behavior causes a shift in the relation between taxes and benefits induced by the intertemporal budget constraint of the insurance system.

4 Political Equilibrium

So far, the benefit rate has been taken as exogenous. The main purpose of this paper is, however, to study the determination of b as the endogenous outcome of a political mechanism, based on majority voting.

The determination of the voting outcome is complicated by the generic non-single-peakedness of agents' preferences, originating from the interaction between individual search behavior and the government's budget constraint. In general, this prevents the application of standard median voter theorems from ruling out Condorcet voting cycles. To circumvent this difficulty, we restrict our attention to initial distributions such that a group of voters with homogeneous preferences is in absolute majority and can impose its will on the rest of the society.[8] We define the value function of the *decisive* agent as $V_d(b, \mu_0) \equiv V_i(b, \mu_0)$ for i such that $\mu_{0,i} \geq 0.5$. The decisive agent chooses benefit rates without any concern for other individuals.

We now introduce a general definition of Political Equilibrium, conditional on the existence of a politically *decisive* agent.

Definition 2 *A* ***political equilibrium****, conditional on an initial distribution* μ_0*, is an allocation* $\{\nu^*, \{c_i^*, a_i'(a)\}_{i \in \Omega}, b^*\}$ *such that:*

1. *All agents choose search policies maximizing their expected discounted utility. In particular, the unemployed specialized choose* $\nu^* = \nu^*(b^*(\mu_0), \mu_0)$*, where* $\nu^*(b^*(\mu_0), \mu_0)$ *is an ESB (as in Definition 1).*

2. *All agents choose consumption and savings so as to maximize their expected discounted utility, i.e., according to equations (2) and (5), with* $c_i^* = c_i(b^*(\mu_0), \tau(b^*(\mu_0), \mu_0)) \equiv c_i^*(b^*(\mu_0), \mu_0)$.

[8] Weaker assumptions are, in most cases, sufficient to ensure that the political equilibrium is well defined. For instance, under reasonable parameters, the employed specialized prefer higher insurance than the employed unspecialized. Then, a coalition between the specialized agents (employed and unemployed) arises, supporting the preferred outcome of the employed specialized. It can, in fact, be shown that the unemployed specialized always support the preferred benefit rate of the employed specialized against any lower benefit rates.

3. The politically decisive agent sets b^* so as to maximize her expected discounted utility. Formally: $b^*(\mu_0) = \arg\max_b V_d(b, \mu_0)$, where V_d denotes the value function of the politically decisive agent.

Definition 3 *A* ***steady-state political equilibrium (SSPE)*** *is a political equilibrium with the additional requirement that $\mu_0 = \mu^s(\nu^*(b^*(\mu_0), \mu_0))$, i.e., μ_0 is the ergodic distribution associated with the ESB $\nu^*(b^*(\mu_0), \mu_0)$.*

According to Definition 2, the equilibrium unemployment benefit rate, b^*, maximizes the value function of the decisive voter at time zero. Note that agents decide on UI once-and-for-all at time zero. This assumption is important, and needs to be explained and defended. It is well-known that the main mechanism of this paper – i.e. politically decisive (or preponderant) employed workers vote for unemployment benefits on the basis of their insurance value, even though they suffer a loss of permanent income – cannot be sustained with short voting cycles, since the insurance value of UI falls as the interval between elections is shortened (see Hassler and Rodríguez Mora (1999) for a detailed discussion). To sustain a high level of UI, it is therefore necessary to assume the voting cycles to be sufficiently long. Although the assumption of once-and-for-all voting - infinitely long cycles - is introduced simplify the analysis, we believe that the loss of realism implied by this simplification should not be exaggerated. Major welfare state reforms are typically difficult and divisive processes, and their outcomes are normally perceived by agents as structural and highly persistent changes. Therefore, we believe that abstracting from repeated voting can be regarded as a reasonable simplification for studying why Europe and the US choose so different levels of UI.[9]

The major shortcoming of once-and-for-all voting is that, as the distribution of agents changes, the political preferences might change, too. This would imply that the level of UI chosen at time zero could become an irrational historical inheritance in the future, which no longer reflects the preferences of the living agents. By restricting our attention to steady-state political equilibrium (SSPE), however, we avoid this possibility. In this case, even if we let agents decide once-and-for-all, the outcome of the election would not change if the ballot were to be (unexpectedly) repeated some time in the future. The institutions inherited from the past will therefore always reflect the preferences of the current generation.

[9] The assumption of once-and-for-all voting is common in the literature. An alternative approach would have been to use the equilibrium concept of Krusell, Quadrini and Ríos Rull (1997), which enables rational voting behavior with repeated voting. We conjecture that, in our economy, repeated voting will decrease the equilibrium level of UI, relative to the once-and-for-all voting case, as the employed have little utility of UI in the short run.

5 Results.

In this section, we construct two fictitious economies, whose labor income processes are calibrated to match some key features of American and European labor markets (assumed to be in non-picky and picky steady states, respectively). We then proceed to investigate under which subset of the remaining parameters both economies are sustained as SSPE.

Before going into details, recall the mechanism generating multiple SSPE: high (low) benefit rates make the unemployed specialized picky (non-picky). Picky (non-picky) behavior, in turn, implies that, in the long run, the mass of specialized workers, and, therefore, their political influence, will be large (small). The multiplicity of SSPE originates from the different intensity of preferences for UI across different potential decisive voters (which will be, in all cases, employed agents). In particular, the specialized workers, who do not want to jettison their comparative advantage when unemployed, tend to prefer a generous UI system in order to make picky behavior affordable. The unspecialized, in contrast, have no comparative advantage, and gain less from unemployment insurance. Thus, under some parameters, the specialized vote for high insurance and induce search picky behavior and high taxes, whereas the unspecialized vote for low insurance and induce non-picky search behavior and low taxes.

In all cases we consider here, the condition in Corollary 1 holds. For simplicity, we denote the (unique) threshold as $\bar{b}(\mu_0)$. Then, from Definitions 1-3 and Proposition 3, it follows that a "picky" SSPE exists if, and only if, $b^*(\mu^s(0)) > \bar{b}\left(\mu^s(0)\right)$, while a "non-picky" SSPE exists if and only if $b^*(\mu^s(1)) \leq \bar{b}\left(\mu^s(1)\right)$. When both conditions are satisfied multiple SSPE exist.

5.1 Parameterization of the model economy.

We start by parameterizing the population transition matrix Γ, which has six parameters. The mortality rate, δ, is set to give an expected lifetime of 43 years. The hiring probabilities, given by π and N, determine the duration of the unemployment spells. We set these to match the observation that the share of unemployed with unemployment duration longer than 12 months was about 5% in the U.S. and 50% in Europe in the late 1980's (Ljungqvist and Sargent (1998)). The monthly separation rates for specialized and unspecialized jobs are set to $\gamma_s = 0.0056$ and $\gamma_n = 0.0194$, respectively. This implies that the average duration of an unspecialized job is 4.3 years, while a specialized job lasts 15 years on average. The learning rate, α, is such that it takes 15 years of employment, on average, to become specialized. The choices of γ_s, γ_n and α yield long-run unemployment rates

	$\mu^S(0)$	$\mu^S(1)$
employed specialized (μ^S_{es})	0.618	0.421
employed unspecialized (μ^S_{en})	0.255	0.514
unemployed specialized (μ^S_{us})	0.096	0.011
unemployed unspecialized (μ^S_{un})	0.031	0.054
Unemployment rate (%)	12.7	6.4
Share long term unempl. (%)	50	5.0
Avg. unempl. duration (months)	23.4	4.6
Avg. monthly separation (%)	0.96	1.32

Table 1: Some characteristics of the steady-state distributions.

under picky and non-picky behavior of 12.7% and 6.4%, respectively. These figures are close to the average unemployment rates observed in Europe and the U.S. over the last two decades. As concerns separations, the parameters chosen yield average monthly inflows into unemployment of 0.96% and 1.32%, respectively. Although the actual differences observed in the data are larger (in 1988, the average unemployment inflow was around 0.3% in the European Union and around 1.9% in the U.S.; see OECD, 1994), our figures fall in between the real observations. With a highly stylized model environment, e.g. only two skill levels, we regard this approximation as a satisfactory compromise.

To sum up, the chosen transition parameters are: $\delta^{-1} = 43$ years, $\gamma_n^{-1} = 4.3$ years, $\pi^{-1} = 2.46$ years, $N = 7.19$, $\alpha^{-1} = 15$ years and $\gamma_s^{-1} = 15$ years. Some key statistics of the steady state distributions conditional on picky (first column) and non-picky (second column) behavior are reported in Table 1. Note that in accordance with Proposition 2, picky behavior increases the proportion of employed specialized, unemployed specialized and the unemployment rate. Moreover, the assumption of the existence of a majority group is satisfied; the employed specialized are in absolute majority in the picky steady-state while the unspecialized are in majority in the non-picky steady-state.

5.2 Multiple SSPE in calibrated economies.

Given these long-run distributions, we now investigate in which region of the parameter space both economies are sustained as SSPE (multiple equilibria). In particular, we set the interest rate (net of the survival premium) to 4% per year, normalize $w_n = 1$, and explore combinations of the remaining parameters, (w_s, σ, ξ). Figure 2 presents the results for three different values of the administration cost, $\xi \in (0, 0.2, 0.4)$. For each case, we plot the range of (w_s, σ) combination such that $w_s \in [1, 2.5]$ and $\sigma \in [0, 250]$. For the case of intermediate administration cost ($\xi = 0.2$), we also present a more detailed plot of the region of parameters we regard as the most relevant (lower right panel).

<Figure 2 about here>

The first observation is that the region of multiple SSPE is quite large. Multiple SSPE can, in no case, be sustained for very large or very small risk aversion, but, as long as the wage premium is not too small, they can be sustained for a range of intermediate risk aversions. For instance, in the zero administration cost case, multiple equilibria are sustained in the region where the wage premium is between 37-42% for any absolute risk aversion level between 1.25 and 105. Moreover, multiple SSPE are sustained for all $\sigma \in [3, 152]$, if the wage premium is 30%. With an absolute risk aversion coefficient equal to 8, multiple SSPE are sustained for any wage premium above 28% in the case of 20% administration cost, and for any wage premium above 22% in the case of zero administration cost.

The interpretation of the results is the following. When both the wage premium and risk aversion are low (south-west region of each plot), picky search behavior is optimal only for very large benefit rates. Financing such large benefit rates would imply, however, large costs in exchange of small gains. Thus, all employed groups prefer to live in a regime of low insurance, non-picky behavior, and low taxes. Even if the employed specialized are in majority, they choose low UI, and a "European" SSPE cannot be sustained. Conversely, for combinations of high wage premium and high risk aversion UI is highly valuable for all groups, and, thus, any potential politically decisive group would choose a high benefit rate inducing picky search behavior, even though this choice implies high taxes. Therefore, in the north-east region of the plots, an "American" SSPE fails to be sustained. For a belt of intermediate combinations of risk aversions and wage premia, however, the nature of the prevailing equilibrium (picky versus non-picky) depends on which group is politically decisive. If the employed specialized are in majority, they will choose a high benefit rate inducing picky behavior, and enjoy high insurance. Alternatively, if the employed non-specialized are in majority, they will choose a benefit rate which is sufficiently low to induce non-picky behavior, in order to enjoy low taxes. Thus, both an European and an American SSPE are sustained. The region of multiple SSPE corresponds, therefore, to the area where the different intensity of preferences for insurance between the two potentially decisive voters causes qualitative differences in equilibrium outcomes.

Note that for a large set of combinations of high wage premium and low risk aversion (south-east region of each plot) only the European equilibrium is sustained. The reason is that, although the decisive voter typically chooses a low UI (due to low risk aversion), the threshold benefit rate above which picky behavior is chosen is even lower (since the present discounted value of being picky exceeds that of being non-picky for these wage premia). Therefore, picky behavior always prevails for low enough σ. As σ increases, however, the American SSPE begins to be sustained, due to the fact that the unemployed specialized fear the long unemployment spells associated with picky behavior and would, with low benefits, decide to be non-picky. Thus, when the political choice is in the hands of the employed non-specialized who, caring little about insurance, choose low benefits, the American equilibrium can be sustained.

Finally, a comparison across the different plots shows that the results are not very sensitive to the introduction of administration costs. When unemployment benefits cause large inefficiencies, the region in which the American equilibrium is sustained increases, while the region in which the European equilibrium is sustained shrinks, and the effect on the size of the region of multiple equilibria is ambiguous.

5.3 A particular example of multiple SSPE.

Figure 2 contains large parameter variations. The most "reasonable" region of the parameter space include, in our mind, absolute risk aversions between 1 and 8, wage premia between 20% and 50% and an administration cost around 20%.[10] As the lower right panel of Figure 2 shows, a significant portion of this region sustains multiple SSPE.

In order to study the properties of the equilibria in more detail and to illustrate the central mechanisms in the model, we find it useful to narrow down the analysis and explore a particular, reasonable calibration of the model economy. To this end, we choose a wage premium of 37.5%, a risk aversion of 4 and an administration cost of 20%. With this parameterization, the steady-state GDP is 1.5% larger in the American than in the European equilibrium.

[10] In order to assess the region of realistic risk aversions, we note that empirical estimates of the relative risk aversion typically fall in the range between 1 and 10. In our model, the relative risk aversion is equal to $\sigma \cdot c_{i,t}$, where $c_{i,t} = \frac{r}{1+r} a_t + c_i^*(b, \mu_0)$. For an employed unspecialized agent with assets equal to 200% of her annual income, we obtain – for $w_s = 1.375$, $R = 4\%$, and $b = 0.24$ – that $c_{i,t} = 0.06 \cdot 2 + 1.02 = 1.14$. Thus, absolute risk aversion between 1 and 8 translates, in this case, to relative risk aversions between 1.1 and 9.

5.3.1 The European equilibrium.

We start by examining the value functions in the European case (Figure 3).[11] Note that all value functions take into account the effects of benefits on equilibrium search behavior and taxes, including possible transitional dynamics. The dashed lines represent the discounted value of individual deviations from the optimal search behavior. The threshold benefit triggering a change in the search behavior is $\bar{b}(\mu^s(0)) = 0.24$. The value functions of all agents have a discontinuous fall at $b = 0.24$ (Corollary 1), indicating that picky search behavior increases the tax burden (Assumption 1).

<Figure 3 about here>

The key plot is the top left one, which represents the value function of the politically decisive employed specialized. The expected utility declines monotonically to the trigger benefit rate, where it drops discontinuously. For benefits higher than the threshold, the value function increases and reaches a global maximum at 76%. Since $b^*(\mu^s(0)) = 0.76 > 0.24 = \bar{b}(\mu^s(0))$, a picky SSPE with $b^* = 0.76$ and $\nu^* = 0$ exists. The implied tax rate is $\tau^* = 0.179$.

Observe that the value function is twin-peaked. Insurance is of low value to the employed specialized when $b \in [0, \bar{b}]$, i.e. in the range where she will be non-picky in the event of becoming unemployed. In this case, she faces (i) short future unemployment spells and, (ii) a low probability of losing her current job. Since the employed specialized suffers a loss in permanent income from UI (a negative "transfer effect"), and the gain from insurance is small in the entire range of non-picky behavior, the value function is downward sloping, and her preferred replacement ratio is zero. In the range $b \in (\bar{b}, 1]$, the picture is different. When picky behavior is optimal, insurance is more valuable, as the employed specialized anticipate longer unemployment spells. Thus, the value function increases up to $b = 0.76$ where the negative transfer effect again exceeds the insurance effect. Note that agents with a negative transfer effect will never prefer full insurance (b=100%), since the marginal value of insurance approaches zero as $b \to 100\%$.

Finally, let us comment on the demand for UI for the non-decisive groups. The unemployed unspecialized prefer $b = 0.24 = \bar{b}(\mu^s(0))$, the largest benefit rate inducing non-picky ESB and lower taxes. In contrast, the unemployed specialized (bottom left plot) prefer full insurance, as they benefit from both the transfer and insurance effects. The preferences

[11] Figures 3-4 consist of multiple plots, depicting $c_i^*(b, \mu_0)$ as a function of b for each group $i \in \{es, en, us, un\}$, respectively. Since $V_i(b, \mu_0) = -e^{-\sigma c_i^*(b,\mu_0)}$, the figures can be interpreted as representing value functions (net of the asset component) up to a monotone transformation.

of the unemployed unspecialized (bottom right plot) are almost aligned with those of the employed unspecialized, since their expected unemployment duration is low.

5.3.2 The American Equilibrium.

Now, consider the value functions in the American case (Figure 4). The value function of the decisive voter, in this case the employed unspecialized (top right plot), increases monotonically until the threshold benefit rate, where it falls discontinuously. Subsequently, the value function increases, and reaches a local maximum at 41%. However, the global maximum is at the threshold level, $\bar{b}\left(\mu^s(1)\right) = 0.24$, which implies a tax rate of 1.8%. Thus, the employed unspecialized prefer a low insurance high-mobility equilibrium, and an American non-picky SSPE prevails. Although the employed specialized, who now are in minority, would like to switch to a European-type high UI equilibrium, they still prefer $b = 0$ to the American UI level.

<Figure 4 about here>

5.4 Remarks.

As discussed above, agents' preferences for UI are driven by two motives: transfer and insurance. In our parameterization, the value functions of all employed agents are downward sloping when agents are risk-neutral, so all employed suffer a loss of permanent income from UI, like in Wright (1986). Hence, there cannot be multiple SSPE when $\sigma = 0$ (see Figure 2).[12] Moreover, in this case, the equilibrium benefit rate is always zero, i.e., the transfer motive alone would imply no UI in equilibrium. It is the heterogeneity across employed groups in the trade-off between insurance and transfer which drives our multiple SSPE results.

One reason for this heterogeneity is that self-insurance through precautionary savings is more effective to hedge the risk of frequent, but less persistent, unemployment shocks than that of infrequent, but more persistent, shocks (see Hassler and Rodríguez Mora (1999)). In our model, specialized agents anticipating picky search behavior face infrequent but highly persistent employment shocks, whereas unspecialized agents face more frequent but less persistent employment shocks. Thus, the employed specialized value insurance more than the employed unspecialized.

[12] Examples where multiple SSPE exist under risk neutrality can, however, be constructed. In these cases, a transfer motive – that the decisive voter receives a net transfer in discounted net expected income terms – is driving the multiplicity. However, we do not view this as a convincing explanation for the high replacement ratios observed in many European countries.

5.5 Constrained Social Planner solution.

The political mechanism in this economy is based on majority voting, and the choice of benefit rate maximizes the utility of the decisive voter. From a normative standpoint, it seems natural to ask how the political equilibrium allocations differ from the choice of a constrained social planner who chooses a benefit rate *subject to the search behavior chosen by the agents* . In particular, can we have multiple steady-states even when a social planner chooses the benefit rate, so as to maximize some weighted average utility of all living individuals? We will show that this may be the case. In particular, a large initial proportion of specialized workers can make the planner choose a high benefit rate, inducing the unemployed to be picky, whereas a large initial proportion of unspecialized workers can make the planner choose a low benefit rate, inducing the unemployed to be non-picky. An alternative interpretation of this social planner solution is in terms of a political mechanism – which we do not explicitly model – taking the desires of all social groups, including those in minority, into account. This can be regarded as the polar opposite to the case of the simple majority rule.

Characterizing the (constrained) social planner's solution is very hard, since, in general, the joint distribution of employment status and wealth across agents needs to be taken into account (this is the case, for instance, if one tries to solve the standard utilitarian planner's problem). However, the solution simplifies when the planner maximizes a *geometric* average utility of all living agents, with, say, equal weight on each agent (a Cobb-Douglas welfare aggregator). Formally, this social welfare function can be expressed as

$$U = -e^{\int_0^1 \log\left\{-\tilde{V}(a(j),\omega(j);b,\tau(b,\mu_0,\nu^*(b,\mu_0))\right\} dj} \tag{11}$$

where $a(j)$ and $\omega(j)$ denote, respectively, the wealth holding and employment status of agent $j \in [0,1]$, and $\tau\left(b,\mu_0,\nu^*(b,\mu_0)\right)$ is the equilibrium tax rate satisfying the government budget constraint. This welfare function implies a stronger aversion to inequality than the standard utilitarian case. To solve for the social optimum, note that the wealth distribution aggregates out once we perform a monotone transformation of U:

$$\begin{aligned} -\frac{1}{\sigma}\log\left(-U\right) &= -\frac{1}{\sigma}\int_0^1 \log\left\{\frac{1+r}{r}e^{-\sigma\frac{r}{1+r}a_j}e^{-\sigma c_{\omega(j)}(b,\tau(b,\mu_0,\nu^*(b,\mu_0)))}\right\} dj \\ &= \frac{1+r}{r}A + \sum_{i\in\Omega}\mu_{i,0}\cdot c_i(b,\tau(b,\mu_0,\nu^*(b,\mu_0))), \end{aligned} \tag{12}$$

where A is aggregate wealth. Consequently, maximizing aggregate consumption out of labor income, or, equivalently, to minimize precautionary savings, yields the solution to the planner's problem.

Consider figure 5. In the south-west region (low risk aversion and low wage premium) labelled "American optimum" the planner chooses a low benefit rate inducing non-picky search behavior, irrespective of whether the initial distribution is $\mu^S(1)$ or $\mu^S(0)$. Thus, under the planner's choice of b, the steady-state is unique. Conversely, in the north-east region, labelled "European optimum", the unique steady-state features a high benefit rate and picky search behavior for any initial distribution $\mu^S(\nu_a)$. There is however, still a belt of points where overlap occurs, and the European and American steady-states can co-exist. In this area, the planner's choice depends on the initial distribution. If there is a large (small) proportion of specialized workers, the planner will put a higher (lower) weight on their preference for high insurance, and the resulting allocation features high (low) benefits, picky (non-picky) search behavior, and high (low) unemployment. Overall, the range of parameters for which the planner chooses an American-type steady-state is much smaller than the range for which the American SSPE is sustained (figures 2 and 5). The reason is that the planner also cares about the unemployed who, on average, want more insurance than the employed. Moreover, note that the belt of multiple steady-states is thinner than the corresponding area of multiple SSPE in figure 2, since the choice of UI is no longer imposed by just one type of agent. Accordingly, a change in the initial distribution from $\mu^s(0)$ to $\mu^s(1)$ does not change the planner's preferences so dramatically as in the political equilibrium case. Nevertheless, note that our particular calibrated economy of section 5.3 ($\xi = 0.2, w_s = 1.375$ and $\sigma = 4$) falls inside the region of multiple steady-states. In this case, having high insurance and high unemployment in Europe as well as having low insurance and low unemployment in the U.S is socially efficient.

5.6 Loss of skills during unemployment.

In section 2.2, we assumed that the human capital of specialized individuals does not depreciate during spells of unemployment. This might be perceived as a stark assumption. In the public policy debate on unemployment, a major concern has been that long periods of unemployment may lead to a depreciation of the human capital of the individual, which is sufficiently large to impede her future labor market prospects (Pissarides (1992)). We will therefore document the consequences of allowing such human capital depreciation in the model.[13]

[13] One advantage of this case is that the predictions of the model, at least for the long-run unemployed, would agree more closely with the empirical evidence, discussed in the introduction, that "stayers" have, on average, shorter unemployment spells than "switchers". To see why, assume that specialized workers are "picky", but will lose their human capital, with some probability, in each period. Then, if workers

The most important change is a reduction in the overall value of being specialized and choosing a picky strategy. This means that for a sufficiently high rate of skill loss during unemployment, the politically decisive employed specialized in a potential European SSPE will prefer voting for low benefits and using a non-picky search strategy in case she becomes unemployed. Our overall quantitative finding is that allowing for reasonable rates of loss of specialization during unemployment does not rule out the possibility of multiple SSPE. The main difference is that the range of parameters sustaining the European equilibrium shrinks. This feature is illustrated in figure 6, where we plot the case where $\xi = 0.2$ and the expected duration of specialization while unemployed is four years. For instance, if we go back to the calibrated economy of section 5.3, the European equilibrium ceases to exist. There are, however, still reasonable parameters sustaining multiple SSPE (for instance, $w_s = 1.4$ and $\sigma > 5$).

6 Extension: specialization as loss of general skills.

In order to keep the argument transparent and the model parsimonious, we have, so far, assumed that specialization is associated with high human capital, productivity and wages. Thus, employed workers earning high wages prefer higher unemployment benefits than employed workers earning low wages. This may seem counterintuitive and is inconsistent with the survey evidence reported by Di Tella and MacCulloch (1995*b*). The point of our paper, however, is not that high UI relies on the political support of high-skilled workers, but, rather, on the support of highly *specialized* workers, who are subject to larger wage losses if *mismatched* (i.e. work in a sector where they do not have a comparative advantage). For instance, workers with a very specialized profile in sectors where it is hard to find new employment (e.g., miners), seem likely to support high insurance. In our benchmark model, workers with a pronounced comparative advantage (specialization) also have an *absolute* advantage over the rest of the workers, since their productivity is at least as high as that of unspecialized workers. Our theory, however, predicts that UI is more valuable to workers with a stronger comparative advantage, irrespective of whether they have an absolute advantage or not. Moreover, the benchmark model implies that human capital is higher in the European than in the American SSPE, due to workers retaining their sector-specific

are randomly sampled, those with the longest average unemployment spells will be ex-specialized workers who have in vain been waiting for an opportunity in their own sector and, finally, having lost their skills, have switched industries. Their average unemployment spell will be longer than that of "stayers" who have succeeded in finding a job in their own sector before losing their human capital.

skills by remaining unemployed rather than accepting mismatched opportunities. This is a dispensable part of our theory which stems, once again, from specialization entailing an absolute productivity advantage.

In order to substantiate these claims, we construct an alternative simple model where being specialized is an absolute disadvantage. In particular, the specialized earn the same wage as the unspecialized, if working in the sector where they have a comparative advantage, whereas they earn lower wages if working in other sectors. In this case, specialization can be interpreted as a lack of general human capital. By working in a particular sector for a long time, a worker can lose skills which are useful in other sectors.[14]

We extend the state space with one additional state, the *mismatched* employed specialized workers, who work in a different sector than in the one where they have a comparative advantage. The gross wages of the employed workers are w_h, both for unspecialized and (*well-matched*) specialized workers, and $w_l < w_h$ for mismatched specialized workers (working at the low wage w_l can, alternatively, be interpreted as "retraining"). To simplify the analysis, we will assume that all unemployed workers receive the same benefit, equal to bw_h. The transition matrix of all unspecialized agents is the same as in the benchmark model (note, though, that the learning probability α should now be interpreted as the probability of losing general skills). The transition matrix of well-matched specialized workers is the same as that of specialized workers in the benchmark model (a worker can remain employed specialized or lose her job and become unemployed specialized). The unemployed specialized, however, cannot become employed unspecialized, but can either become employed specialized (with probability π) or employed mismatched (with probability $\left(1-\pi-(1-\pi)^N\right)\nu$). The employed mismatched, in turn, can either get laid off (and become unemployed specialized) with probability γ_n (the same probability with which an unspecialized worker gets laid off) or – through learning-by-doing – regain general skills and become an unspecialized worker with probability $\tilde{\alpha}$. More formally, the set of possible characteristics is, in this case $\Omega \equiv \{es, en, em, us, un\}$, where em stands for employed mismatched. An agent's labor market characteristics follow a Markov process $\hat{\Gamma}$, where

[14] Ideally, one should be able to incorporate this mechanism into the benchmark model by expanding the state space, and explicitely allow for both general and sector-specific human capital. This approach, however, would substantially complicate the analysis of the political mechanism, and will not be pursued here.

$$\hat{\Gamma}(\nu) \equiv (1-\delta) \begin{bmatrix} 1-\gamma_s & 0 & 0 & \gamma_s & 0 \\ \alpha(1-\gamma_n) & (1-\alpha)(1-\gamma_n) & 0 & 0 & \gamma_n \\ 0 & \tilde{\alpha} & 1-\tilde{\alpha}-\gamma_n & \gamma_n & 0 \\ \pi & 0 & \nu(1-\pi-(1-\pi)^N) & (1-\pi)-\nu(1-\pi-(1-\pi)^N) & 0 \\ 0 & 1-(1-\pi)^N & 0 & 0 & (1-\pi)^N \end{bmatrix}$$

We set $\tilde{\alpha} = 0.0278$, so that it takes, on average, three years for mismatched specialized workers to regain skills. All other parameters of the transition matrix are identical to the benchmark calibration of section 5, except for the average duration of specialized jobs, which is now reduced from 17 to 12.5 years ($\gamma_s = 0.0667$). The reason for choosing a larger γ_s is to preserve the feature that one group with homogeneous preferences is in absolute majority.

Figure 7 represents the parameter regions that sustain different types of SSPE for economies with $w_h = 1.375$ and $\xi = 0.2$. We put the low wage of the mismatched worker, w_l, on the horizontal axis, and σ on the vertical axis. In this model, the European (American) equilibrium is sustained for combinations of high (low) risk aversion and low (high) w_l. When both the cost of mismatch and risk aversion are high (north-west region), all agents demand a relatively generous UI since they fear that the low wage is associated with "retraining". In particular, even if the employed unspecialized are initially in majority, they choose relatively high UI (inducing picky search behavior), and an American SSPE fails to be sustained. Similarly, with low wage differentials and low risk aversion, agents attach a low value to UI, and, thus, an European SSPE fails to be sustained. Once again, for a belt of intermediate combinations of risk aversion and wage differentials, the equilibrium outcome depends on which group is politically decisive, and we have multiple SSPE. Note that, as should be expected, the lower the cost of mismatch (i.e., the higher w_l), the higher the range of risk aversion sustaining multiple SSPE.

Note that in this model, the "rich" workers with high general human capital prefer lower UI than the "poor" workers, who are stuck with a particular specialization. In non-picky SSPEs, the politically decisive employed unspecialized choose low benefit rates, and, due to the low safety net, the unemployed specialized accept mismatched low wage jobs. This implies that many workers "retrain" themselves in a different sector and regain general skills. Thus, in the American-type society there is, in a sense, more human capital accumulation (differently from the benchmark model), although at a high cost for the "poor" workers.

7 Conclusion.

The level of unemployment benefits affects search behavior in the labor market. In this paper, we have shown how changes in search behavior can alter the future preferences of a society towards insurance, thus giving rise to multiple steady-states with high (low) unemployment insurance and low (high) employment turnover. We believe this to be an important, but nevertheless largely ignored, link. The accumulation or loss of sector-specific skills is the driving mechanism in our model . Low (high) insurance reduces (increases) the accumulation of sector-specific skills by increasing (reducing) turnover between sectors. Switching sectors entails larger losses for workers with a sector-specific comparative advantage. This, in turn, makes the employed less (more) vulnerable to unemployment risk and hence less (more) willing to vote for high replacement ratios. We believe this argument to shed light on important differences in institutions and economic performance between Europe and the U.S. observed in recent history.

We have discussed how the accumulation of sector-specific skills can generate a two-way causality between the economic behavior induced by social insurance and the political preferences supporting social insurance. The schooling system could be an alternative channel. When unemployment insurance is high, a specific (risky) educational system, like the European vocational schools or college degrees aimed at a specific profession, becomes more attractive. If a large number of workers have acquired specific skills, the willingness to pay for unemployment insurance is likely to be high. Geographical mobility is another potential channel, since buying a house and building a local network of social relations serve as region-specific human capital investments, which are lost when migrating (see Oswald (1997)).

A general message of our paper is that existing social institutions affect preferences over these institutions. There is a small emerging literature on this topic, see Lindbeck, Nyberg and Weibull (1996) and Saint Paul (1993). One conclusion from our results is that strong inertia in changing social institutions may emerge endogenously, even if no exogenous cost of change is involved. There is, for example, strong political support for a generous unemployment insurance in Europe, despite a growing consensus that it causes high unemployment. If the insurance system were dismantled, though, the political support for restoring it might erode over time, which is a positive conclusion. The results from the social welfare maximization case suggest , however, that it might even be *socially* optimal for Europe and the U.S. to retain their respective status quo UI systems. Since their respective institutions have been sustained over a long time, they have, we believe, led to distributions of voters where many would lose, in both economies, from changes in the status quo.

References

Acemoglu, D. (1997), Good jobs versus bad jobs, CEPR Discussion Paper, no. 1588.

Acemoglu, D. and Shimer, R. (1999), 'Efficient unemployment insurance', *Journal of Political Economy*. forthcoming.

Addison, J. and Portugal, P. (1987), 'On the distributional shape of unemployment duration', *Review of Economics and Statistics* **69**, 520–526.

Albrecht, J., Storesletten, K. and Vroman, S. (1998), A model of structural unemployment, Unpublished Manuscript.

Bénabou, R. (1998), Unequal societies: Income distribution and the social contract, Mimeo, New York University.

Blanchard, O. (1985), 'Debt, deficits, and finite horizons', *Journal of Political Economy* **93**, 223–247.

Burda, M. and Mertens, A. (1998), Wages and workers displacement in germany, CEPR Discussion Paper No. 1869.

Di Tella, R. and MacCulloch, R. (1995*a*), The determination of unemployment benefits, Oxford Applied Economics Discussion Paper Series: 180.

Di Tella, R. and MacCulloch, R. (1995*b*), An empirical study of unemployment benefit preferences, Oxford Applied Economics Discussion Paper Series: 179.

Fallick, B. C. (1991), 'Unemployment insurance and the rate of re-employment of displaced workers', *Review of Economics and Statistics* **73**(2), 228–235.

Fallick, B. C. (1996), 'A review of the recent empirical literature on displaced workers', *Industrial and Labor Relations Review* **50**(1), 5–16.

Gomes, J., Greenwood, J. and Rebelo, S. (1998), Equilibrium unemployment, NBER working paper.

Hamermesh, D. S. (1989), 'What do we know about worker displacement in the United States?', *Industrial Relations* **28**(1), 51–59.

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

Hassler, J. and Rodríguez Mora, J. V. (1999), 'Employment turnover and the public allocation of unemployment insurance', *Journal of Public Economics*. forthcoming.

Hopenhayn, H. A. and Nicolini, J. P. (1997), 'Optimal unemployment insurance', *Journal of Political Economy* **105**(2), 412–438.

Jacobson, L. S., LaLonde, R. J. and Sullivan, D. G. (1993), 'Earnings losses of displaced workers', *American Economic Review* **83**(4), 685–709.

Krusell, P., Quadrini, V. and Ríos Rull, J. V. (1997), 'Politico-economic equilibrium and economic growth', *Journal of Economic Dynamics and Control* **21**(1), 243–272.

Leonhard, J. and Audenrode, M. V. (1995), The duration of unempoyment and the persistence of wages, CEPR Discusison Paper No. 1227.

Lindbeck, A., Nyberg, S. and Weibull, J. W. (1996), Social norms, the welfare state and voting, IIES Working paper No. 608.

Ljungqvist, L. and Sargent, T. (1998), 'The european unemployment dilemma', *Journal of Political Economy* **106**, 514–550.

Marimon, R. and Zilibotti, F. (1999), 'Unemployment vs. mismatch of talents. reconsidering unemployment benefits', *Economic Journal.* forthcoming.

Meyer, B. D. (1990), 'Unemployment insurance and unemployment spells', *Econometrica* **58**, 757–782.

Mortensen, D. and Pissarides, C. (1999), 'Unemployment responses to skill-biased shocks: The role of labor market policies.', *Economic Journal.* forthcoming.

Murphy, K. and Topel, R. (1987), 'The evolution of unemployment in the united states: 1968-1985', *NBER Macroeconomics Annual* **1**, 11–58.

Neal, D. (1995), 'Industry-specific human capital: Evidence from displaced workers', *Journal of Labor Economics* **13**(4), 653–677.

Oswald, A. J. (1997), The missing piece of the unemployment puzzle, Mimeo, University of Warwick.

Pallage, S. and Zimmermann, C. (1999*a*), Heterogenous labor markets and the generosity towards the unemployed: An international perspective, CREFE Working paper no. 88.

Pallage, S. and Zimmermann, C. (1999*b*), Voting on unemployment insurance, Mimeo, Université du Québec à Montréal.

Piketty, T. (1995), 'Social mobility and redistributive politics', *Quarterly Journal of Economics* **110**(3), 551–584.

Pissarides, C. A. (1992), 'Loss of skill during unemployment and the persistence of employment shocks', *Quarterly Journal of Economics* **107**(4), 1371–1391.

Rendon, S. (1997), Job search under borrowing constraints, Ph.D. Thesis, New York University.

Saint Paul, G. (1993), 'On the political economy of labor market flexibility', *NBER Macroeconomic Annuals.*

Saint Paul, G. (1994), The dynamics of exclusion and fiscal conservatism, CEPR Discussion Paper No. 998.

Saint Paul, G. (1996), 'Exploring the political economy of labor market institutions', *Economic Policy* **23**, 265–300.

Saint-Paul, G. (1997), Voting for jobs: Policy persistence and unemployment, CEPR Discussion Paper No. 1428.

Thomas, J. M. (1996), 'An empirical model of sectoral movements by unemployed workers', *Journal of Labor Economics* **14**, 126–153.

Topel, R. (1990), 'Specific capital and unemployment: Measuring the costs and consequences of job loss', *Carnegie Rochester Conference Series on Public Policy* **33**, 181–214.

Wright, R. (1986), 'The redistributive roles of unemployment insurance and the dynamics of voting', *Journal of Public Economics* **31**(3), 377–399.

A Appendix

A.1 Proof of Proposition 1

Guess that the value functions have the following form

$$\tilde{V}(a,i) = -\frac{1+r}{r} e^{-\sigma(\frac{r}{1+r}a + c_i)} \tag{13}$$

where $i \in \Omega = \{es, en, us, un\}$ denotes the employment state and $\{c_i\}_{i\in\Omega}$ are constants to be determined later. Furthermore, guess that optimal the consumption in each state is the annuity of assets plus c_i

$$c(a,i) = \frac{r}{1+r}a + c_i. \tag{14}$$

Since $a_{t+1} = a_t + (\omega_i - c_i)(1+r)$, the Bellman equation must be

$$-\frac{1+r}{r} e^{-\sigma(\frac{r}{1+r}a + c_i)} = -e^{-\sigma(\frac{r}{1+r}a + c_i)} - \max_{\nu}\{\frac{1}{r(1-\delta)} \sum_{i'\in\Omega} \hat{\Gamma}_{i,i'}(\nu) e^{-\sigma(\frac{r}{1+r}a + r(\omega_i - c_i) + c_{i'})}\}, \tag{15}$$

where $\hat{\Gamma}_{i,i'}(\nu)$ is the individual probability of switching from state i to i' given ν. By dividing though with $e^{-\sigma\frac{r}{1+r}a}$ and rearranging terms we get

$$e^{-\sigma c_i} = \max_{\nu}(1-\delta)^{-1} \sum_{i'\in\Omega} \hat{\Gamma}_{i,i'}(\nu) e^{-\sigma(r(\omega_i - c_i) + c_{i'}))}. \tag{16}$$

Proof of existence and uniqueness of the solution to (16) is provided upon request. The system of equations (16) defines $\{c_i\}_{i\in\Omega}$, independently of the asset level a_t. Note that (16) are the first order conditions for maximizing the Bellman equation (15) over consumption in the different states. Thus, $\{c(a,i)\}_{i\in\Omega}$ must be the unique optimal decision rules, which verifies that the guesses (13) and (14) were correct. **Q.E.D.**

A.2 Proofs of Proposition 3 and Corollary 1

The following two Lemmas will be convenient when proving Proposition 3 and Corollary 1. Their proofs are omitted here, but can be provided upon request.

Lemma 1 *The value functions $\{V_i\}_{i\in\Omega}$ are continuous in the benefit rate b and the tax rate τ for a given aggregate behavior ν_a.*

Lemma 2 *Suppose Assumption 2 is satisfied. Then, $\exists\ \bar{b}^0(\mu_0) \in \langle 0,1\rangle$ and $\bar{b}^1(\mu_0) \in \langle 0,1\rangle$ such that:*

1. *given $\nu_a = 0$, the individual optimal search strategy is $\nu = 1$ (non-picky) if $b < \bar{b}^0(\mu_0)$, $\nu = 0$ (picky) if $b > \bar{b}^0(\mu_0)$ and $\nu \in [0,1]$ if $b = \bar{b}^0(\mu_0)$.*
2. *given $\nu_a = 1$, the individual optimal search strategy is $\nu = 1$ (non-picky) if $b < \bar{b}^1(\mu_0)$ and $\nu = 0$ (picky) if $b > \bar{b}^1(\mu_0)$ and $\nu \in [0,1]$ if $b = \bar{b}^1(\mu_0)$.*

A.2.1 Proof of Proposition 3

Start by proving part 1 of proposition 3.

Suppose $\bar{b}^0(\mu_0) \leq \bar{b}^1(\mu_0)$. This implies that the selection criterion (Definition 1, part 3) chooses the (lower) tax rate associated with non-picky aggregate search behavior for all $b \in \left[\bar{b}^0(\mu_0), \bar{b}^1(\mu_0)\right]$. Then, given $\nu_a = 1$, Lemma 2 says that $b < \bar{b}^1(\mu_0)$ implies $\nu^*(b,\mu_0) = 1$, so the ESB must be $\nu^*(b,\mu_0) = 1$ for $b \leq \bar{b}^1(\mu_0)$. Moreover, given $\nu_a = 0$, Lemma 2 and $\bar{b}^0(\mu_0) \leq \bar{b}^1(\mu_0)$ together imply that $b > \bar{b}^1(\mu_0) \Rightarrow \nu^*(b,\mu_0) = 0$, so the ESB must be $\nu^*(b,\mu_0) = 0$ for $b > \bar{b}^1(\mu_0)$. This finishes the proof of part 1 of proposition 3.

Suppose $\bar{b}^0(\mu_0) > \bar{b}^1(\mu_0)$. Parts 2 (a) and 2 (b) of proposition 3 then follow directly from Lemma 2, since picky aggregate search behavior imply picky individual behavior for $b > \bar{b}^0(\mu_0)$ (so the ESB is $\nu^* = 0$), and since non-picky aggregate search behavior imply non-picky individual behavior for $b \leq \bar{b}^1(\mu_0)$ (so the ESB is $\nu^* = 1$).

When $b \in \left[\bar{b}^1(\mu_0), \bar{b}^0(\mu_0)\right]$, neither of the pure strategies can be an equilibrium since a picky aggregate behavior ($\nu_a = 0$) implies that non-picky behavior is individually optimal, and vice versa for $\nu_a = 1$.

To show existence of a mixing strategy ESB in this case, note that the value function is continuous in τ and therefore in aggregate search behavior ν_a (see equations (3), (6), (7), and (9)). Individual search behavior is $\nu = 1$ ($\nu = 0$) if the unemployed specialized agents strictly prefer to be non-picky (picky). If indifferent, any $\nu \in [0,1]$ is equally good. Hence, individual search behavior is upper hemi-continuous in aggregate search behavior ν_a. Obviously, there must exist at least one $\nu^*(b,\mu_0) \in [0,1]$ such that for $\nu_a = \nu^*(b,\mu_0)$ than $\nu^*(b,\mu_0)$ is a (weakly) optimal individual search strategy. Applying the selection criterion of Definition 1, part 3, this defines the unique ESB for this case.

Q.E.D.

A.2.2 Proof of Corollary 1

From Proposition 3 it follows directly that aggregate search behavior is constant except at the threshold. Hence, from Lemma 1 the value function must be ontinuous everywhere, except at the threshold $\bar{b} = \max\{b^0\bar{(}\mu), b^1\bar{(}\mu)\}$. **Q.E.D.**

B Addendum to the Appendix, with additional proofs.

B.1 Proof of the existence and uniqueness of a 4-tuple, $\{c_{ES}, c_{EN}, c_{US}, c_{UN}\}$ that solve the FOC for consumption

Denoting $X_j \equiv e^{-\sigma c_j}$, $g \equiv \frac{w_{EN}}{w_{ES}}$ and $W \equiv e^{\sigma r(1-\tau)w_{ES}}$, we can write the first order condition for the consumption choice, as given in (16), as

$$
\begin{aligned}
(X_{ES})^{1+r}\, W &= (1-\gamma_s)X_{ES} + \gamma_s X_{US} \\
(X_{EN})^{1+r}\, W^{g} &= \alpha(1-\gamma_n)X_{ES} + (1-\alpha)(1-\gamma_n)X_{EN} + \gamma_n X_{UN} \\
(X_{US})^{1+r}\, W^{b} &= \pi X_{ES} + (1-\pi)^N \cdot Min\left\{X_{US}, X_{EN}\right\} \\
&\quad + \left[(1-\pi) - (1-\pi)^N\right] X_{US} \\
(X_{UN})^{1+r}\, W^{gb} &= \left[1-(1-\pi)^N\right] X_{EN} + (1-\pi)^N X_{UN}
\end{aligned}
$$

Next, define $R_j \equiv e^{\sigma(c_{ES}-c_j)}$ and $Q \equiv e^{\sigma(c_{EN}-c_{UN})}$ and rewrite the above system as:

$$
(X_{ES})^{1+r} W = (1-\gamma_s) + \gamma_s R_{US} \tag{17}
$$

$$
(X_{EN})^{r}\, W^{g} = \alpha(1-\gamma_n)Q\,(R_{UN})^{-1} + (1-\alpha)\,(1-\gamma_n) + \gamma_n Q \tag{18}
$$

$$
\begin{aligned}
(X_{US})^{r}\, W^{b} &= \pi\,(R_{US})^{-1} + (1-\pi)^N \cdot Min\left\{1, R_{EN}\,(R_{US})^{-1}\right\} + \\
&\quad \left[(1-\pi) - (1-\pi)^N\right]
\end{aligned} \tag{19}
$$

$$
(X_{UN})^{r}\, W^{gb} = \left[1-(1-\pi)^N\right] Q + (1-\pi)^N \tag{20}
$$

Hence:

$$
\begin{aligned}
W^{g(1-b)} &= Q^r \frac{\alpha(1-\gamma_n)\frac{1}{R_{EN}} + (1-\alpha)(1-\gamma_n) + \gamma_n Q}{\left[1-(1-\pi)^N\right]\frac{1}{Q} + (1-\pi)^N} \\
&= \mathcal{A}(R_{EN}, Q)
\end{aligned} \tag{21}
$$

$$
\begin{aligned}
W^{1-g} &= (R_{EN})^r \frac{(1-\gamma_s) + \gamma_s R_{US}}{\alpha(1-\gamma_n)\frac{1}{R_{EN}} + (1-\alpha)(1-\gamma_n) + \gamma_n Q} \\
&= \mathcal{B}(R_{EN}, Q;\, R_{US})
\end{aligned} \tag{22}
$$

$$
\begin{aligned}
W^{1-b} &= (R_{US})^r \frac{(1-\gamma_s) + \gamma_s R_{US}}{\pi\frac{1}{R_{US}} + (1-\pi)^N Min\left\{1, \frac{R_{EN}}{R_{US}}\right\} + (1-\pi) - (1-\pi)^N]} \\
&= \mathcal{C}(R_{US};\, R_{EN})
\end{aligned} \tag{23}
$$

where (21) is obtained by dividing (18) by (20) and rearranging terms; (22) is obtained by dividing (17) by (18) and rearranging terms; (21) is obtained by dividing (17) by (19) and rearranging terms.

We will now show that (21)-(22)-(23) implicitely define a unique solution for the endogenous variables R_{US}, R_{EN} and Q. From the system of equations (17)-(18)-(19)-(20) it follows immediately that the existence and uniqueness of R_{US}, R_{EN} and Q implies the existence and uniqueness of $X_{ES}, X_{EN}, X_{US}, X_{UN}$, hence, since $X_j \equiv e^{-\sigma c_j}$,the existence and uniqueness of $c_{ES}, c_{EN}, c_{US}, c_{UN}$.

To start with, observe that (23) defines the implicit relationship $R_{EN} = R^{\mathcal{C}}_{EN}(R_{US})$. Let $\overline{R_{US}} = R_{US}$ such that (23) is satisfied when $R_{EN}/R_{US} \leq 1$. Standard analysis of equation (23) shows that (i) $\overline{R_{US}} > 1$), (ii) for all $R_{US} < \overline{R_{US}}$, $R^{\mathcal{C}}_{EN}(R_{US})$ is strictly increasing, and (iii) $\exists \underline{R_{US}} > 0$ such that $R^{\mathcal{C}}_{EN}(\underline{R_{US}}) = 0$ (see Figure 7).

Next, observe that (21) and (22), jointly, define two implicit relationships, $Q = Q^{\mathcal{A},\mathcal{B}}(R_{US})$ and $R_{EN} = R^{\mathcal{A},\mathcal{B}}_{EN}(R_{US})$. We now claim and will later prove that both relationships are one-to-one mapping and that, for all $R_{US} > 0$, $Q^{\mathcal{A},\mathcal{B}}(R_{US}) > 0$, $R^{\mathcal{A},\mathcal{B}}_{EN}(R_{US}) > 0$, $\frac{dQ^{\mathcal{A},\mathcal{B}}}{dR_{US}} < 0$, $\frac{dR^{\mathcal{A},\mathcal{B}}_{EN}}{dR_{US}} < 0$, (see, again, Figure 7). Furthermore, $Q^{\mathcal{A},\mathcal{B}}(0) = \bar{Q}$, $R^{\mathcal{A},\mathcal{B}}_{EN}(0) = \overline{R_{EN}}$ and $\lim_{R_{US}\to\infty} R^{\mathcal{A},\mathcal{B}}_{EN} \geq 0$. As Figure 7 shows, the properties of the functions $R^{\mathcal{A},\mathcal{B}}_{EN}(R_{US})$, where $\bar{Q}$ and $\overline{R_{EN}}$ are positive, finite terms which only depend on parameters, and $R^{\mathcal{C}}_{EN}$ imply that the system (21)-(22)-(23) determines a unique solution for R_{EN}, R_{US}. Once R_{EN} and R_{US} are determined, given the properties of the function $Q^{\mathcal{A},\mathcal{B}}$, there exists a unique solution for Q, as well. Thus, we have a unique solution for R_{EN}, R_{US}, Q.

To prove the above claim about the characterization of $Q^{\mathcal{A},\mathcal{B}}(R_{US})$ and $R_{EN}^{\mathcal{A},\mathcal{B}}(R_{US})$, observe that

$$\frac{\partial \mathcal{A}}{\partial R_{EN}} < 0; \quad \frac{\partial \mathcal{A}}{\partial Q} > 0 \tag{24}$$

$$\frac{\partial \mathcal{B}}{\partial R_{EN}} > 0; \quad \frac{\partial \mathcal{B}}{\partial Q} < 0; \tag{25}$$

$$\frac{\partial \mathcal{B}}{\partial R_{US}} > 0 \tag{26}$$

(21) implicitly defines an increasing function, $Q = Q^{\mathcal{A}}(R_{EN})$, that is independent of R_{US}. Furthermore, $Q^{\mathcal{A}}(R_{EN})$ is compact-valued in the range $R_{EN} \in [0,\infty]$, with $\lim_{R_{EN}\to 0} Q^{\mathcal{A}}(R_{EN}) = 0$ and $\lim_{R_{EN}\to\infty} Q^{\mathcal{A}}(R_{EN}) < \infty$, and $Q^{\mathcal{A}}(R_{EN}) > 1$ whenever $R_{EN} > 1$. Next, (22) implicitly defines the function $Q = Q^{\mathcal{B}}(R_{EN}, R_{US})$, such that $\frac{\partial Q^{\mathcal{B}}}{\partial R_{EN}} > 0$, $\lim_{R_{EN}\to 0} Q^{\mathcal{B}}(R_{EN}, R_{US}) = -\infty$ and $\lim_{R_{EN}\to\infty} Q^{\mathcal{B}}(R_{EN}, R_{US}) = \infty$. Finally, standard differentiation shows that $\frac{\partial Q^{\mathcal{B}}}{\partial R_{EN}} > \frac{dQ^{\mathcal{A}}}{dR_{EN}}$. This implies that, given R_{US}, $Q^{\mathcal{A}}(R_{EN}) = Q^{\mathcal{B}}(R_{EN}, R_{US})$ for one and only one value of R_{EN} (see Figure 8). Increasing (decreasing) R_{US} does not affect the $Q^{\mathcal{A}}(R_{EN})$ schedule, while it shifts the $Q^{\mathcal{B}}(R_{EN}, R_{US})$ schedule to the left (right). Thus, increasing (decreasing) R_{US} implies a fall (increase) of both Q and R_{EN}, while both values are always non negative. Finally, it is easy to see that there exists a unique pair $\overline{R_{EN}} \in \langle 0,\infty\rangle$ such that $Q^{\mathcal{A}}(\overline{R_{EN}}) = Q^{\mathcal{B}}(\overline{R_{EN}}, 0)$. This establishes the characterization and concludes the proof. **Q.E.D.**

B.2 Proof of Proposition 2

Define:

$$\begin{bmatrix} p_{11} & 0 & p_{13} & p_{14} \\ p_{21} & p_{22} & 0 & p_{24} \\ p_{31} & Z & p_{33} & p_{34} \\ 0 & p_{42} & 0 & p_{44} \end{bmatrix} \equiv \begin{bmatrix} 0 & 0 & 0 & \delta \\ 0 & 0 & 0 & \delta \\ 0 & 0 & 0 & \delta \\ 0 & 0 & 0 & \delta \end{bmatrix} +$$

$$+ (1-\delta) \begin{bmatrix} 1-\gamma_s & 0 & \gamma_s & 0 \\ \alpha(1-\gamma_n) & (1-\alpha)(1-\gamma_n) & 0 & \gamma_n \\ \pi & \nu(1-\pi-(1-\pi)^N) & (1-\pi)-\nu(1-\pi-(1-\pi)^N) & 0 \\ 0 & 1-(1-\pi)^N & 0 & (1-\pi)^N \end{bmatrix} \tag{27}$$

Let $\mu^S = (\mu^S_{es}, \mu^S_{en}, \mu^S_{us}, \mu^S_{un})$ denote a long-run distribution. By the properties of long-run distributions, the following system of linear equations must be satisfied:

$$\begin{bmatrix} p_{13}+p_{14} & -p_{21} & -p_{31} & 0 \\ 0 & p_{21}+p_{24} & -Z & -p_{42} \\ -p_{14} & -p_{24} & -p_{34} & p_{42} \\ 1 & 1 & 1 & 1 \end{bmatrix} \begin{bmatrix} \mu^S_{es} \\ \mu^S_{en} \\ \mu^S_{us} \\ \mu^S_{un} \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \end{bmatrix} \tag{28}$$

where the first three linear equations are steady-state flow equilibrium for $\mu^S_{es}, \mu^S_{en}, \mu^S_{un}$, respectively, while the fourth equation guarantees that μ^s is a vector of probability measures. The solution to the system (28) yields:

$$\begin{bmatrix} \mu^S_{es} \\ \mu^S_{en} \\ \mu^S_{us} \\ \mu^S_{un} \end{bmatrix} = \frac{1}{\Delta} \begin{bmatrix} p_{21}p_{42}(p_{34}+Z) \\ p_{13}p_{21}p_{42} \\ p_{42}\left(p_{13}\left(p_{34}+Z\right)+p_{14}\left(p_{31}+p_{34}+Z\right)\right) \\ p_{14}\left(p_{21}+p_{24}\right)\left(p_{31}+p_{34}+Z\right)+p_{13}\left(p_{21}p_{34}+p_{24}\left(p_{34}+Z\right)\right) \end{bmatrix} \tag{29}$$

where:

$$\begin{aligned} \Delta \equiv \; & p_{21}p_{42}\left(p_{31}+p_{34}+Z\right)+p_{14}\left(p_{21}+p_{24}+p_{42}\right)\left(p_{31}+p_{34}+Z\right)+ \\ & p_{13}\left(p_{21}p_{34}+p_{24}p_{34}+p_{21}p_{42}+p_{34}p_{42}+Zp_{24}+Zp_{43}\right) \end{aligned} \tag{30}$$

Recall now that $Z \equiv \nu(1-\delta)(1-\pi-(1-\pi)^N)$ and that $\nu \in \{0,1\}$. Since no other term which appears in the right hand- side of (29) depends on ν, then the Proposition can be proves by just calculating and signing the derivatives of the expressions in (29) with respect to Z. In particular, to prove (a), (b), (c), (d) and (e), we need to show, respectively, that $\frac{\partial \mu_{es}^S}{\partial Z} < 0$, $\frac{\partial \mu_{en}^S}{\partial Z} > 0$, $\frac{\partial \mu_{us}^S}{\partial Z} < 0$, $\frac{\partial \mu_{un}^S}{\partial Z} > 0$, $\frac{\partial \mu_{es}^S}{\partial Z} + \frac{\partial \mu_{en}^S}{\partial Z} > 0$. Standard calculus shows that:

$$\begin{bmatrix} \frac{\partial \mu_{es}^S}{\partial Z} \\ \frac{\partial \mu_{en}^S}{\partial Z} \\ \frac{\partial \mu_{us}^S}{\partial Z} \\ \frac{\partial \mu_{en}^S}{\partial Z} \end{bmatrix} = \frac{p_{13}p_{21}p_{42}}{\Theta^2} \begin{bmatrix} -(p_{31}(p_{24}+p_{42}) - p_{21}(p_{34}+p_{42})) \\ (p_{31}p_{42} + p_{13}(p_{34}+p_{42}) + p_{14}(p_{31}+p_{34}+p_{42})) \\ -(p_{21}p_{42} + p_{13}(p_{24}+p_{42}) + p_{14}(p_{21}+p_{24}+p_{42})) \\ (p_{24}-p_{14})p_{31} + (p_{24}-p_{34})(p_{13}+p_{14}) + (p_{14}-p_{34})p_{21} \end{bmatrix} \tag{31}$$

where Θ is a term which depend on all probabilities and which is unimportant to sign derivatives. That $\frac{\partial \mu_{en}^S}{\partial Z} > 0$ and $\frac{\partial \mu_{us}^S}{\partial Z} < 0$ follows by mere inspection of (31) and this establishes parts (b) and (c). Now, consider $\frac{\partial \mu_{es}^S}{\partial Z}$. To prove part (a) – namely that $\frac{\partial \mu_{es}^S}{\partial Z} < 0$ – we need to show that $p_{31}(p_{24}+p_{42}) > p_{21}(p_{34}+p_{42})$. From (27), this is equivalent to show that $\pi(\gamma_n + \frac{\delta}{1-\delta} + 1 - (1-\pi)^N) > \alpha(1-\gamma_n)(\gamma_n + \frac{\delta}{1-\delta} + 1 - (1-\pi)^N)$. That the last inequality is true follows immediately from the assumption that $\pi > \alpha(1-\gamma_n)$. This establishes part (a). To prove part (d) – namely that $\frac{\partial \mu_{en}^S}{\partial Z} > 0$ – it is sufficient to observe that $p_{24} - p_{14} = p_{24} - p_{34} = (1-\delta)\gamma_n > 0$ while $p_{14} - p_{34} = \delta - \delta = 0$. Finally, to prove (e), observe that, from (27) and (31), it follows that $\frac{\partial \mu_{es}^S}{\partial Z} + \frac{\partial \mu_{en}^S}{\partial Z} = \frac{p_{13}p_{21}p_{42}}{\Theta^2}\left[(\alpha(1-\gamma_n) + \gamma_s + \delta(1-\delta))\left(1-(1-\pi)^N + \delta(1-\delta)\right) - \pi\gamma_n\right]$. It is easy to check that the expression in square brackets is positive if and only if $\gamma_n \leq \hat{\Gamma}_n$ where the latter is defined as in the text. This concludes the proof. **Q.E.D.**

B.3 Proof of Lemma 1

The continuity of $\{c_i\}_{i\in\Omega}$ with respect to b and τ follow from the fact that the functions $R_{EN}^{\mathcal{C}}(R_{US})$, $R_{EN}^{\mathcal{A},\mathcal{B}}(R_{US})$ and $Q^{\mathcal{A},\mathcal{B}}(R_{US})$ (in B.1) are all continuous and differentiable with respect to b and τ, as long as the aggregate behavior ν_a is held fixed. Then continuity of the value functions $\{V(i,b,\tau)\}_{i\in\Omega}$ in b and τ follows directly from Proposition 1. **Q.E.D.**

B.4 Proof of Lemma 2

Let $\hat{V}_i(b, \mu_0, \nu_a)$ denote the value functions of individual agents, conditional on aggregate behavior ν_a. Start by proving part 1.

Suppose the aggregate search behavior is non-picky ($\nu_a = 0$). Since $w_s > w_n$, then in the full insurance case ($b = 1$) individual agents will always prefer to be picky. (so $\hat{V}_{us}(1,\mu_0,0) > \hat{V}_{en}(1,\mu_0,0)$). Part 1 of Assumption 2 yields non-picky behavior at $b = 0$ (so $\hat{V}_{us}(0,\mu_0,0) > \hat{V}_{en}(0,\mu_0,0)$). From Lemma 1 $\hat{V}_i$ is continuous, so by Brouwer's fixed point theorem, the value functions must cross at least once. Part 2 of Assumption 2 guarantees that $\hat{V}_{us}$ always crosses $\hat{V}_{en}$ from below. Hence, by the continuity of $\tilde{V}_i$, it must be that these functions cannot cross more than once.

Let $\bar{b}^0(\mu_0) \in \langle 0, 1\rangle$ denote the unique crossing-point. Then, since picky (non-picky) behavior is optimal for $b = 1$ ($b = 0$), it must be that the individual optimal search strategy is $\nu = 1$ (non-picky) if $b < \bar{b}^0(\mu_0)$ and $\nu = 0$ (picky) if $b > \bar{b}^0(\mu_0)$. At $b = \bar{b}^0(\mu_0)$ the agent is indifferent, so $\nu \in [0,1]$.

Part 2 of the lemma follows an identical proof. Note, however, that Parts 1 and 2 in Assumption 2 together imply that $\hat{V}_{us}(0,\mu_0,1) > \hat{V}_{en}(0,\mu_0,1))$. **Q.E.D.**

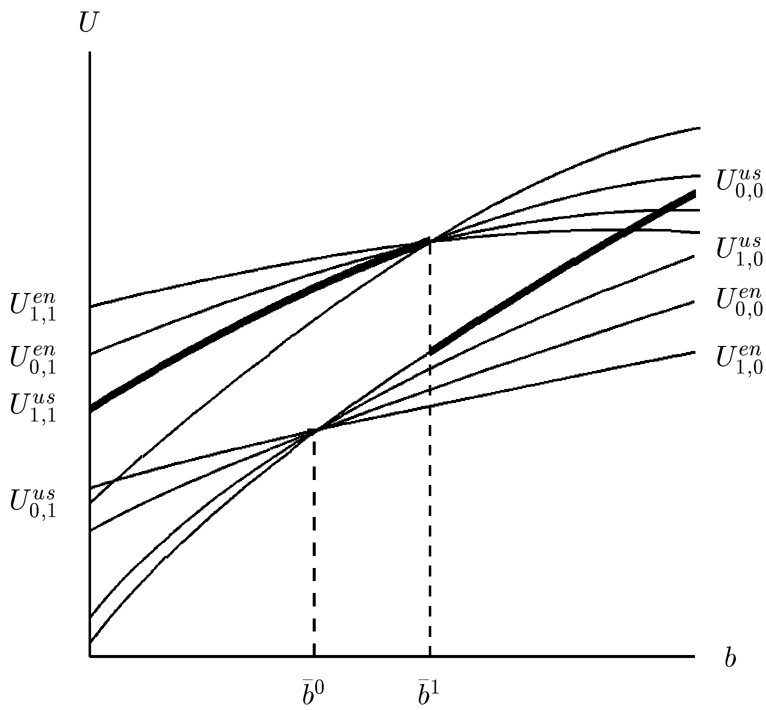


Figure 1: Assumption 2 and Proposition 3

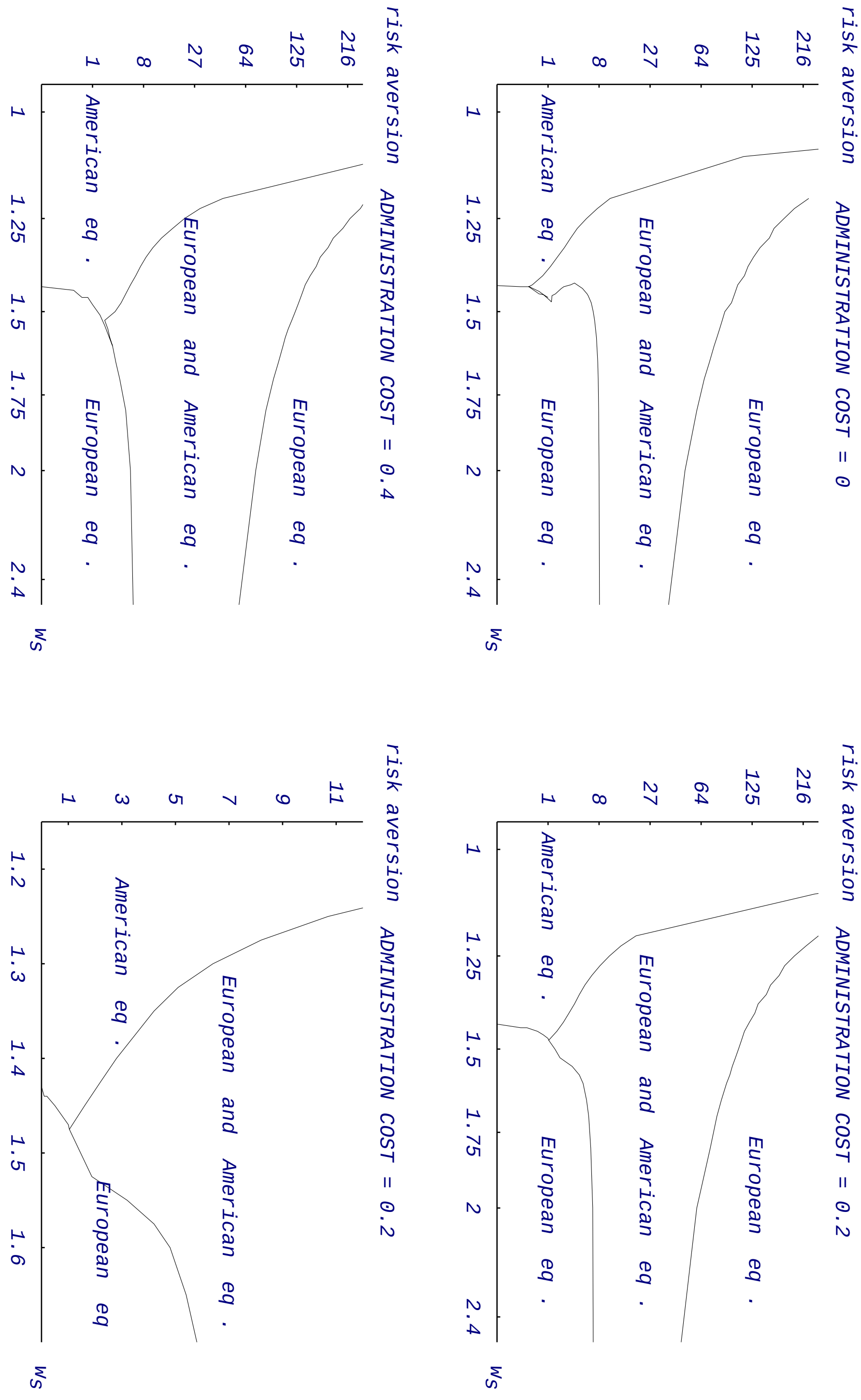


Figure 2: Region of parameter space where multiple SSPE are sustained.

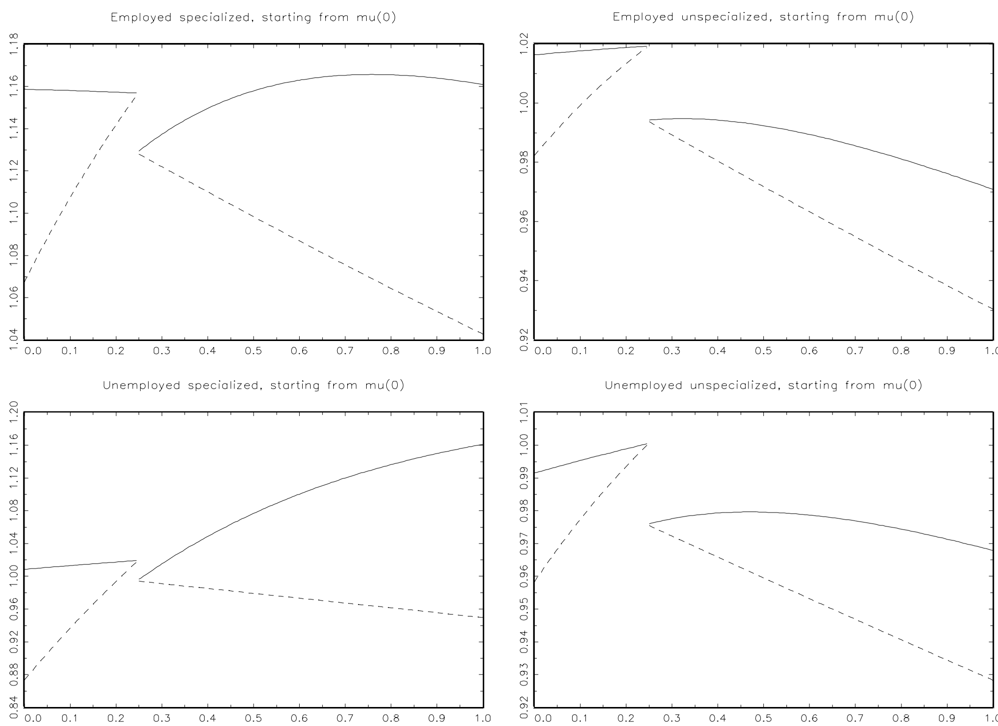


Figure 3: Value functions in the "European Equilibrium".

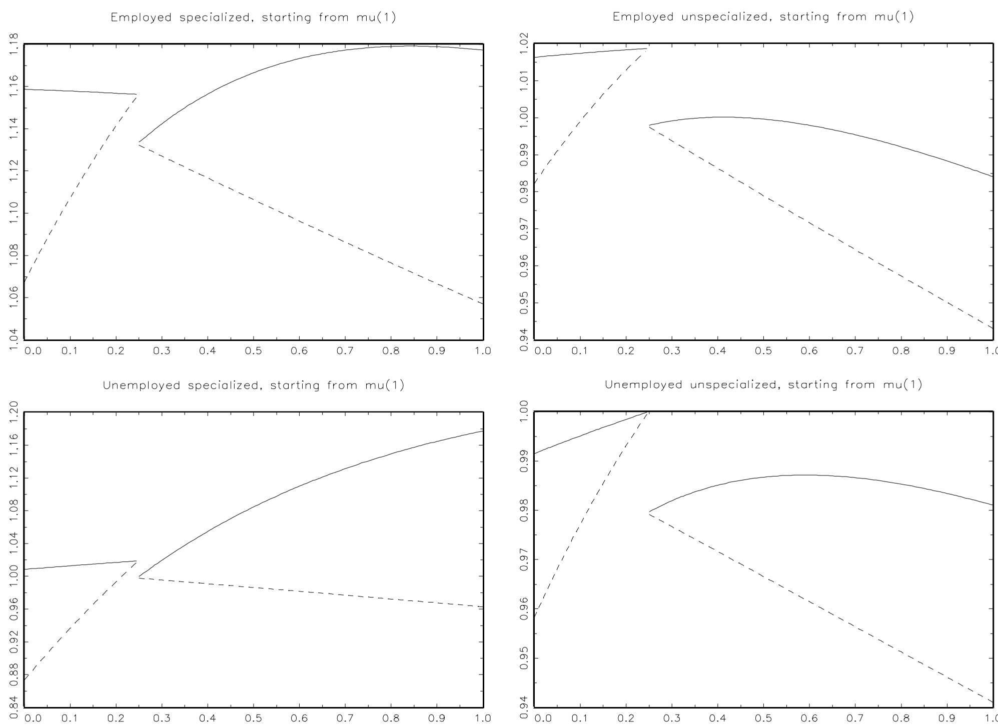


Figure 4: Value functions in the “American Equilibrium”.

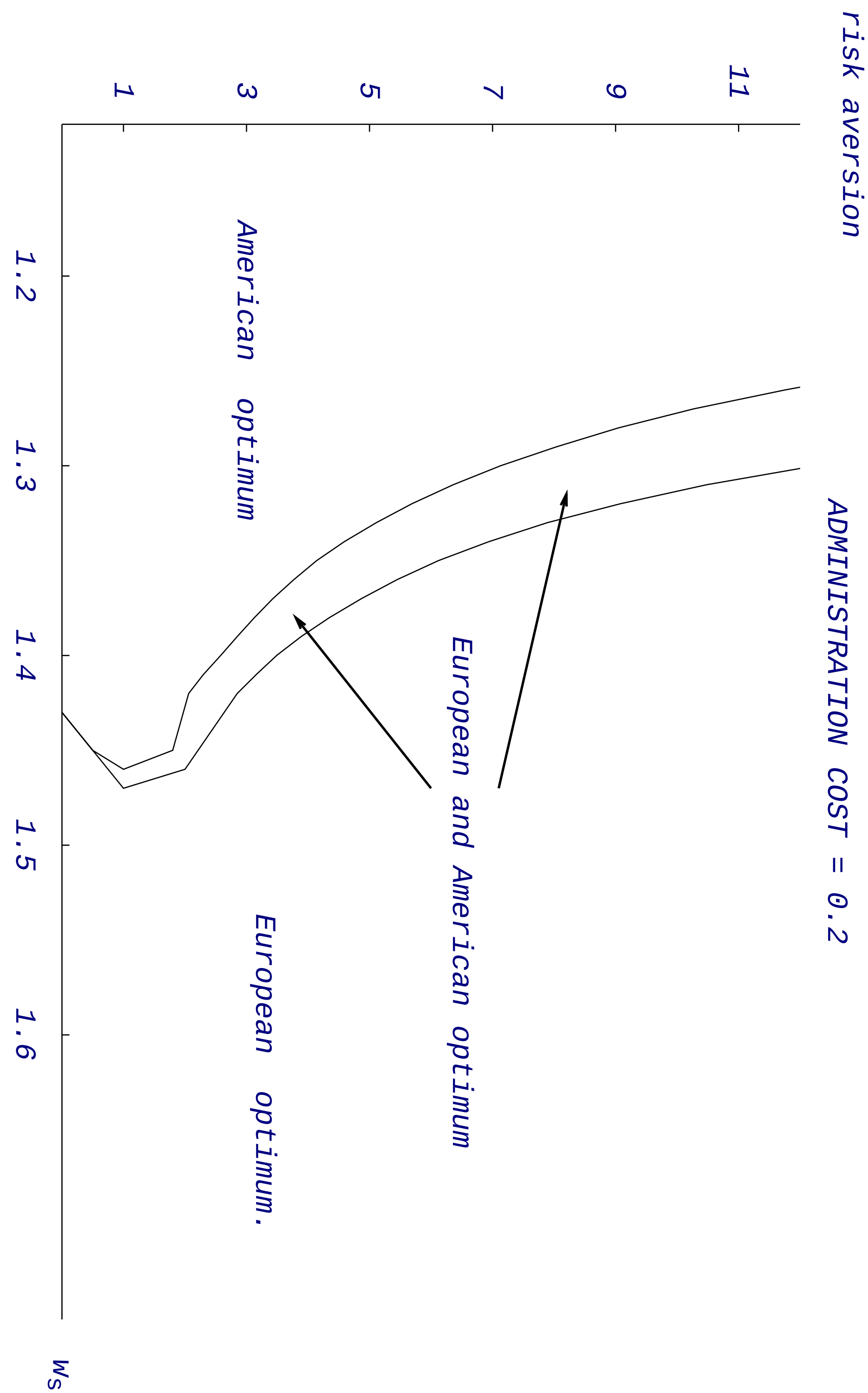


Figure 5: Region of parameter space where the social planner chooses multiple steady states.

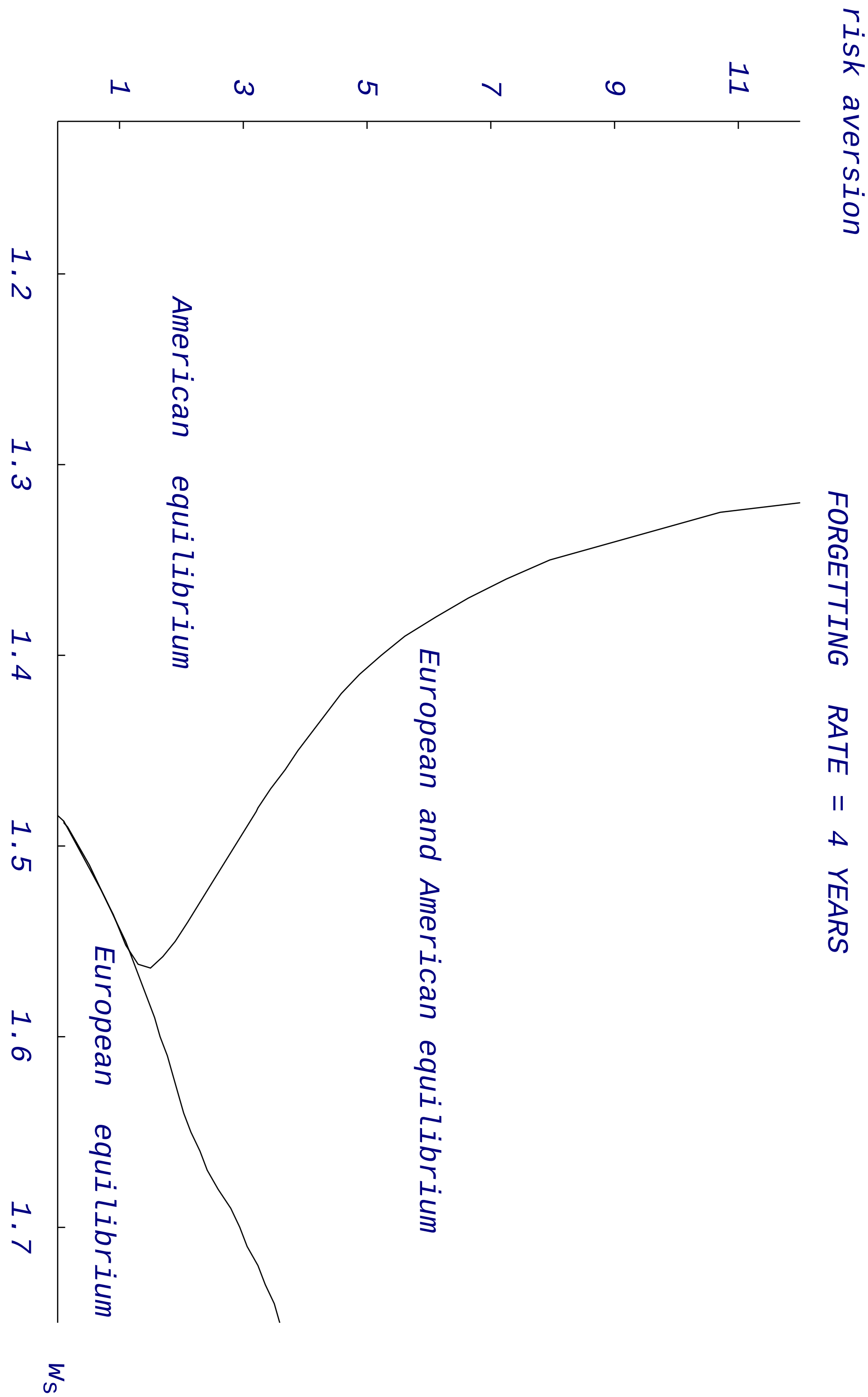


Figure 6: Region of parameter space where multiple SSPE are sustained in the case where agents can loose skills during unemployment (section 5.6).

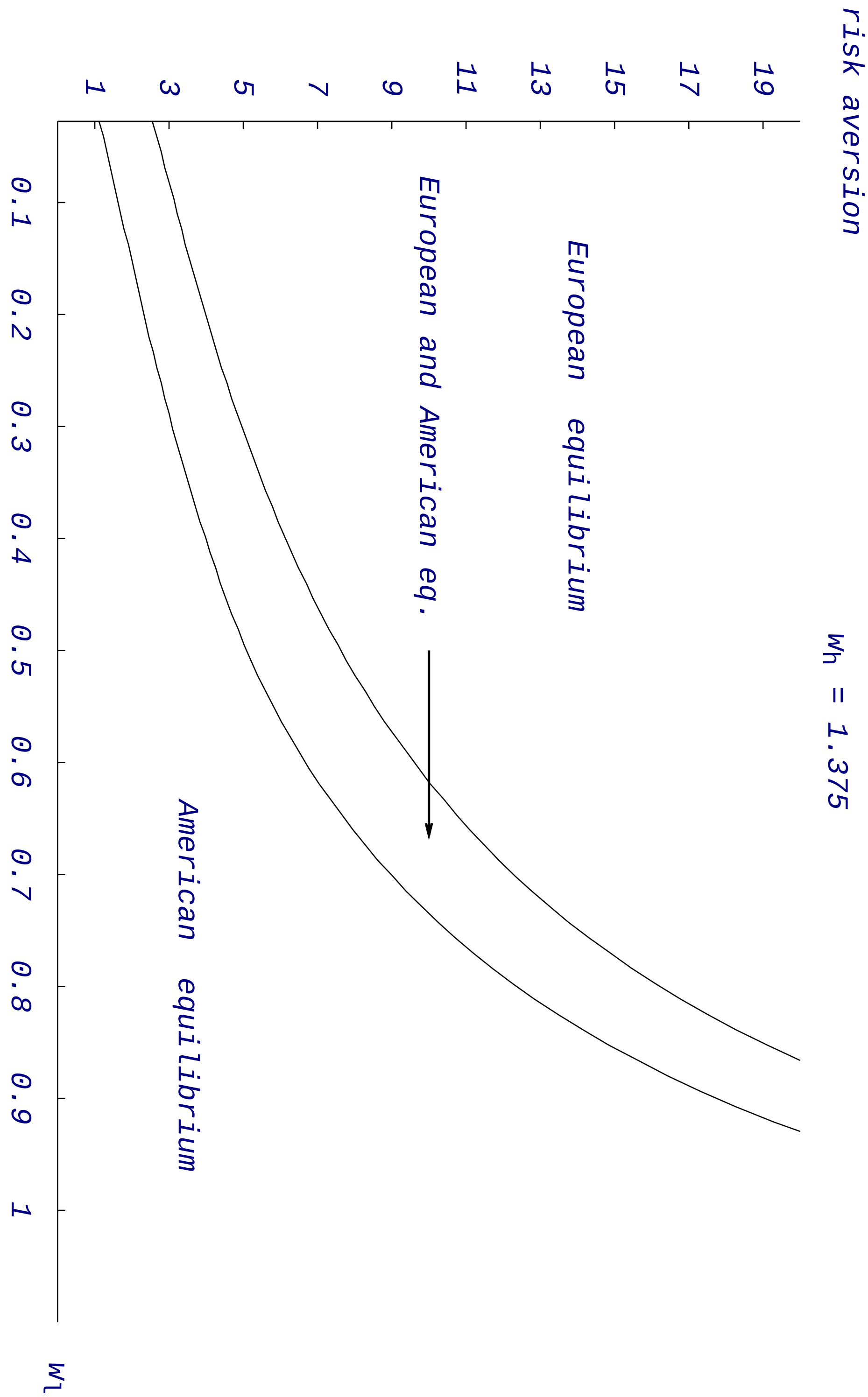
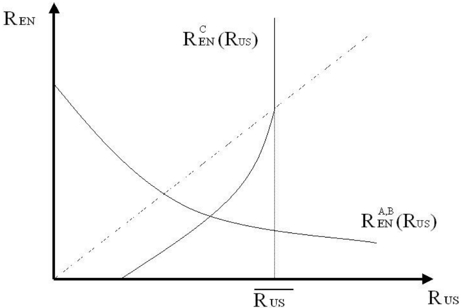
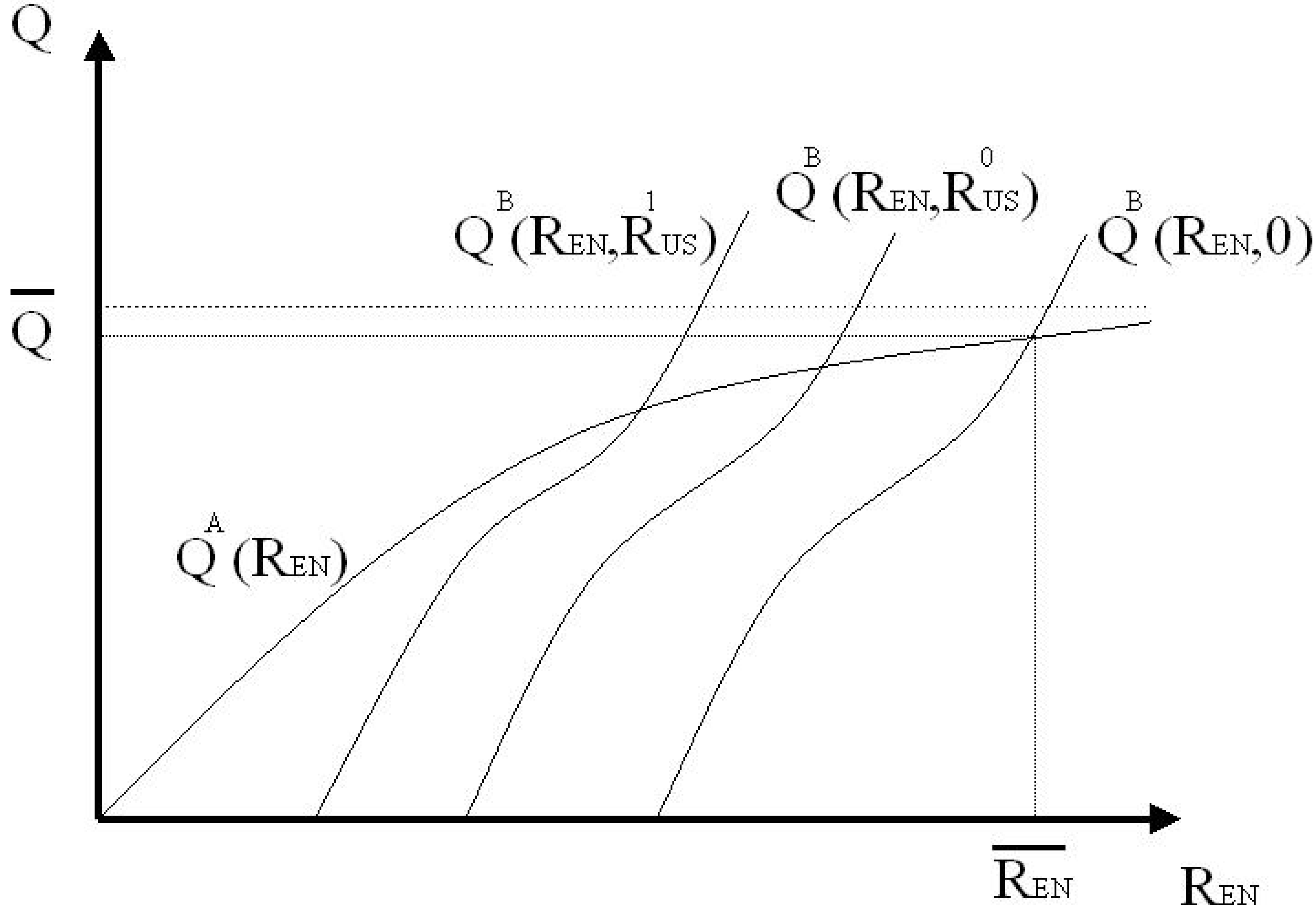


Figure 7: Region of parameter space where multiple SSPE are sustained in the extention of the model where specialization represents loss of general skills (section 6).


R EN
R C EN (R US)
R A,B EN (R US)
R US
R US


Q
Q̄
Q^B(R_EN,R_US^1)
Q^B(R_EN,R_US^0)
Q^B(R_EN,0)
Q^A(R_EN)
R̄_EN
R_EN