Search and Work in Optimal Welfare Programs*

Nicola Pavoni
Università Bocconi, and IFS

Ofer Setty
Tel Aviv University

Giovanni L. Violante
New York University, CEPR, and NBER

First Draft: June 2010 – This Draft: June 2012 – INCOMPLETE

Abstract
Many existing welfare programs ("work-first" programs) require participants to work, often in non-profit or public agencies, in exchange for cash benefits. Others ("job search-first" programs) emphasize private job-search and provide assistance in finding and retaining a durable employment. We study the optimal design of welfare programs when the principal/government cannot observe the agent's search effort, but can actively facilitate the agent's job search at some cost, and can mandate the agent to work on a "simple task." Our main result is that when the generosity of the welfare program (i.e., its initial promised utility or available budget) is low, then the optimal program should be based on work activities. In contrast, when the generosity is high, the optimal program should be based on search –and search assistance– activities.

JEL Classification: D82, H21, J24, J64, J65.

Keywords: Moral Hazard; Recursive Contracts, Search, Welfare Program, Work.

*We thank seminar and conference participants at Aarhus University, 5th Csef-Igier Symposyum (Capri), 5th ENSAI Economics Day (Rennes), Philadelphia Fed, SED Meetings (Istanbul), Yale, and Warwick. We are grateful to Gayle Hamilton at MDRC for initial help with the NEWWS data.

1 Introduction

Government policies targeting the poor have the twofold objective of (i) offering income support and (ii) promoting economic self-sufficiency through employment. Achieving both objectives is challenging because the provision of assistance interferes with individual incentives to find and retain a suitable employment. In order to strike the right balance between assistance and incentives, governments use a wide range of policy instruments. These policies typically combine welfare benefits and earnings subsidies with mandatory activities such as job search, work, and training.

In the United States, the Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA) of 1996 deeply reformed the nation's system of cash welfare assistance for poor households –mostly single parents. The reform ended needy families legal entitlement to welfare assistance, and imposed work-related requirements for welfare recipients enforced by the use of sanctions (e.g., benefits suspension in case of noncompliance).[1] The reform also imposed cumulative lifetime limits (60 months) on the receipt of benefits. In the decade following the inception of the new system, both the caseload and total welfare expenditures were cut in half (Moffitt, 2008). The PRWORA legislation also removed much of the federal regulatory authority over the structure of the program, giving states full flexibility in choosing policy instruments and setting benefit levels. As a result, a huge variety of programs was implemented across U.S. states. Some programs are focused on assisting and monitoring individual job search, others on education and training, others yet on moving the individual as soon as possible into some form of employment. In this paper, we concentrate on jointly studying job search and work activities. For the time being, we leave training and adult education out of the analysis.[2]

Public programs centered around job search encompass elements of monitoring, skill enhancement, and help in seeking jobs. Here, we focus on the latter type of interventions where the public employment agency assists the job seeker by selecting suitable vacancies, providing contacts with potential employers, and making job referrals. We label this intervention

[1]The legislation uses the term "work-related requirement" with a broad meaning. In many cases, programs that enhance job-search skills or assist job-search, as well as education and training programs, satisfy such requirement.

[2]For a normative analysis of the use of training-based policies, see Pavoni and Violante (2005), Spinnnewijn (2010), Pavoni, Setty, Violante, and Wunsch (2012).

"Job-Search Assistance".[3] There is also a large variety of work-site activities across U.S. states. At one end of the spectrum the work requirement is simply intended as a "social obligation" for the recipient of a welfare check. At the opposite end, the work requirement is meant to function as a transition into self-sufficiency through private employment. For example, while the participant is mandated to work, the caseworker actively assists her search for a suitable employment in a similar job. Or, the caseworker directly matches the individual to an employer with the expectation that she might be retained by that same employer. To distinguish the first type of work ("work in exchange for benefits") from the second ("stepping stone to private employment"), we label them, respectively, "Mandatory Work" and "Transitional Work".

The central question of the paper is how search-based activities and work-based activities should be optimally combined in a welfare program, and how associated benefits and wage subsidies should be designed. Our point of departure is the classic setup –originated largely from the seminal article of Shavell and Weiss (1979)– where the optimal unemployment insurance contract is studied in the presence of a repeated moral hazard problem: the risk-neutral principal (planner/government) cannot observe the risk-averse unemployed agent's effort (hidden action). Following the most recent contributions in the literature (Atkeson and Lucas, 1995; Wang and Williamson, 1996; Hopenhayn and Nicolini, 1997; Pavoni, 2007; Shimer and Werning, 2008; Hopenhayn and Nicolini, 2009; Pavoni 2009), we exploit the recursive representation of the planner's problem where the expected discounted utility promised by the contract to the unemployed agent becomes a state variable.

We enrich this repeated moral hazard environment by letting workers' wages and their job finding probabilities depend on *human capital* (skills) and allow human capital to depreciate along the unemployment spell. Human capital is our second key state variable in the recursive representation. The introduction of human capital depreciation in the problem permits a better representation of labor market data along two important dimensions. First, since wages depend on human capital, in our economy workers experience wage losses during unemployment, consistently with the findings of a vast set of empirical studies (for a

[3] To enforce active job search, some programs require the welfare recipient to show evidence of her job-search efforts (applications, contacts, interviews) to the caseworker. The optimal use of monitoring of search activities is analyzed extensively in Pavoni and Violante (2007), and Setty (2010). Other programs contain an element of training, i.e., the development of job-search and interviewing skills. Wunsch (2010) studies the optimal design of this type of intervention.

survey, see Fallick, 1996). Second, since we let the job-finding probability depend on human capital, search effort becomes less effective as the unemployment spell progresses, inducing negative duration dependence in the unemployment hazard–a common feature of the data, as discussed by Machin and Manning (1999) in their survey.[4]

The key innovation that allows us to use this framework to analyze the optimal design of welfare programs is that we introduce additional "technologies" and associated worker "activities" (i.e., use of technologies) besides search.[5] To formally model work-based and job-search assistance policies we introduce two technologies. First, a *secondary production* technology that is less productive than the (primary) one used in private employment but that, as the latter, requires effort to yield output. This feature reflects that work-based activities employ the welfare recipients on basic tasks with very low value added. Second, a costly *assisted search* technology that allows the agent to sample a subset of her available job opportunities without search effort, upon payment of a cost (to an agency who searches on behalf of the unemployed). This technology, therefore, frees up time from search to either work or rest.

We define a "policy" as a principal's prescription of an activity for the agent with an associated conditional transfer. We interpret the use of the secondary production technology alone as Mandatory Work, and the joint use of this production technology and assisted search as Transitional Work. Moreover, since the assisted search technology can be always used on its own, the model also includes a Job Search Assistance policy. In addition to these three policy instruments, the framework yields naturally Unemployment Insurance, where the worker exerts search effort on her own, and Social Assistance, corresponding to income support with no effort requirements.

As in Pavoni and Violante (2007), we characterize the optimal welfare program. Optimality requires maximization of the agent's expected discounted utility subject to the government's budget constraint. A full characterization means studying: 1) in which region of the state space (the two dimensional space in promised utility and human capital) each policy dominates the others; 2) the optimal sequence of policies along the program

[4]In particular, several studies (e.g., Blank, 1989, for welfare recipients; Bover, Arellano, and Bentolila, 2002, for UI benefits recipients) continue finding a rapidly declining hazard even after explicitly controlling for unobserved heterogeneity. Skill depreciation is also a central ingredient in a popular explanation of the comparative unemployment experience of the U.S. and Europe (e.g., Ljungqvist and Sargent, 1998).

[5]In Pavoni and Violante (2007), we added a search-effort monitoring technology.

determined by the endogenous dynamics of promised utility and the exogenous human capital depreciation; 3) the optimal level and time-path of benefits and wage subsidies upon employment, associated to each policy.

For the model calibration, we exploit the National Evaluation of Welfare-to-Work Strategies (NEWWS). This is a large-scale longitudinal study, conducted by the U.S. Department of Health and Human Services, between 1991-1999. As part of the survey, 40,000 welfare recipients in seven distinct U.S. locations were randomly assigned to various treatment and control groups. These data allow us to set values for the most of the key parameters of our model.

The main lesson we learn from our exercise is that there are two types of welfare programs that emerge as optimal, depending on the initial level of generosity of the program, a parameter of the economic environment determined, for example, by politico-economic or government budget constraints outside our model. After an initial spell of Unemployment Insurance, common to all programs, a generous (or deep pocketed) principal would implement an optimal program based on *search* which follows the sequence Job-Search Assistance $\rightarrow$ Social Assistance. A less generous (or more budget constrained) principal would, instead, implement an optimal program based on *work* which follows the sequence Transitional Work $\rightarrow$ Mandatory Work. The reason is that, for low levels of promised utility, the effort compensation cost is smaller and it is convenient for the principal to require the agent to exert work effort and produce in exchange for welfare benefits. Another stark result we obtain is that, in order to be effective, Job Search Assistance must be combined with a large gap between consumption across states (i.e., unemployment benefits and subsidized wage) to compensate for the additional effort –relative to that in Job Search Assistance– the agent must exert in the event she finds employment.

In an extension of the baseline model, we introduce a technology that allows the principal to monitor the agent job search effort at a cost, along the lines of Pavoni and Violante (2007), and Setty (2012). We find that Job Search Monitoring emerges as optimal, mostly within generous search-based programs, between a spell of Unemployment Insurance and one of Job Search Assistance.

The rest of the paper is organized as follows. Section 2 describes in some detail the different policy instruments that we aim at modeling. Section 3 formalizes the economic environment faced by the agent. Section 4 introduces the principal and describes the set of feasible contracts the principal can offer the agents. Here, we provide a mapping between the activities recommended by the principal to the agent and the actual policy instruments detailed in Section 2. Section 5 parameterizes the model based on the NEWWS data. Section 6 characterizes the optimal welfare-to-work programs, i.e., where the different policies emerge as optimal in the (U, h) space, the optimal sequences of policies, and optimal consumption (i.e., unemployment benefits and wage taxes/subsidies). Section 7 extends the model by incorporating monitoring of job-search effort. Section 8 concludes.

2 The US welfare system

For poor households with labor income, the key pillar of the US welfare system is the *Earned Income Tax Credit*, an earning subsidy program introduced in 1975, and greatly expanded since then (Holtz and Scholtz, 2001). For those individuals without any earnings, but with some significant recent employment history, the main form of government assistance is *Unemployment Insurance*. Workers eligible for Unemployment Insurance receive benefits, linked to their previous earnings, for a given period (ordinarily, 6 months). Upon expiration of unemployment insurance benefits (or immediately, for those without significant employment history), a number of transfer programs are in place. Food Stamps, Housing subsidies, and Child subsidies are means-tested, but there is no requirement or obligation attached to them. They configure a form of pure income assistance policy of last resort, which we label *Social Assistance.*

The other major means-tested transfer program is the Temporary Assistance for Needy Families (TANF). Since the PRWORA legislation of 1996, welfare recipients who wish to qualify for TANF benefits are, instead, required to participate in work or work-related (e.g., job-search, vocational training, adult education) activities after two years of receiving cash assistance. Failure to participate can result in a reduction or termination of benefits to the family (Moffitt, 2003).

The legislation gives states with ample freedom on how to implement these various activities. As a result, even abstracting from training/education and just focusing on search assistance and work, as we do, leaves an enormous variety of policy interventions and summarizing them is an arduous task. At the same time, distilling their key features is necessary for building a formal model and this is the route we take here.

Search-based activities: There are several examples of search-based policy experiments implemented in recent US history.[6] Meyer (1995) surveys ten such experiments spanning from the late 1970s to the early 1990s, divided into two groups. In the first group, cash bonuses were given to UI recipients who found jobs quickly and kept them for a minimum period of time. In the second group, UI recipients were subject to extensive checks of their search activity, or were provided services including job-search workshops, additional information on job openings, or even direct job placements.[7]

In the first bonus experiment carried out in Illinois, all unemployed were given a weekly bonus of $500 if they found a job within 11 weeks (qualification period) and retained it for four months (reemployment period). Later designs were more sophisticated: bonuses were determined as a fraction of UI benefits, in turn proportional to previous earnings, and qualification and reemployment periods differed across individuals, depending on their previous employment history.[8]

Job-search experiments combined elements of monitoring, training, and assistance. States require all UI claimants to submit evidence of their job search efforts (e.g., details of employer contacts), but often actual enforcement is weak. In some of the experiments, enforcement was increased substantially. For example, in the Charleston Claimant Placement and Work Test Demonstration and in the Nevada Claimant Placement Program, UI claimants were actively monitored and required to report every week to employment services who would check on their eligibility.[9] Four experiments, Charleston, New Jersey, Washington, and Wisconsin, required that claimants groups attend a seminar on how to find a job. The intensity

[6] Bergemann and van den Berg (2006), and Thomsen (2009) survey job search assistance programs in European countries.

[7] The four bonus experiments are the Illinois UI Incentive Experiments, New Jersey UI Reemployment Demonstration, Pennsylvania Reemployment Bonus Demonstration, and Washington Reemployment Bonus Experiments. The six job search experiments are the Nevada Claimant Placement Program, Charleston Claimant Placement and Work Test Demonstration, New Jersey UI Reemployment Demonstration, Nevada Claimant Employment Program, Washington Alternative Work Search Experiment, and the Wisconsin Eligibility Review Pilot Project.

[8] The random assignment of UI claimants allows a credible evaluation of the treatment effects of these policies. Estimated effects are often imprecise and their range wide, but in general, larger bonuses and longer qualification periods led to significantly shorter unemployment spells (Meyer, 1995, Table 2).

[9] Ashenfelter, Ashmore, and Dechenes (2005) discuss randomized experiments in Connecticut, Massachusetts, Virginia and Tennessee conducted in the mid 1980s which incorporated only stricter enforcement and verification of job search, and did not contain elements of training or assistance.

of the seminar varied across locations. The Charleston workshop lasted approximately three hours and provided a forum for discussing basic search and interviewing strategies. The Washington workshop lasted two days and included training on skills assessment, interview and application techniques, and preparing resumes. Job-finding services provided also differed substantially. Some experiments offered very little extra services, while others offered substantial assistance to job search. In the Charleston experiment, claimants were placed in the state job-matching system and a job-development attempt or referral was made for each claimant. In New Jersey, a job resource center was set up in each office and listings of job openings and telephones were made available to the unemployed.

A more recent set of experiments, part of the National Evaluation of Welfare-to-Work Strategies (NEWWS) conducted between 1991-1999, mandated some welfare recipients to participate in "job clubs", i.e., job search activities including instructions for resume preparation, job search and interviewing, supervised "phone rooms" where participants could call prospective employers and search for job leads. Some sites employed job developers on staff who searched for job leads in the local community on behalf of the unemployed.

In what follows, we concentrate our attention on the *Job Search Assistance* component of these programs. In an extension, we also analyze *Job Search Monitoring* alongside assistance.[10]

Work-based activities: The most notable movement following the PROWRA legislation has been toward a "work-first" approach in which recipients and new applicants for benefits are moved as quickly as possible into work of any kind (Moffitt, 2003). The types of jobs performed by welfare recipients assigned to work activities always involve basic unskilled tasks such as food preparation and delivery, janitorial, maintenance and custodial tasks in low-income housing blocks or in schools, street and park cleaning, garbage collection, entry-level clerical tasks, housekeeping, caring for the children and the elderly, etc. (Brock et al., 1993). Employers are usually nonprofit organizations, public agencies clustering in social services, and sometimes private for-profit employers.

The intent of the programs changes substantially from location to location. According to Fagnoni (2000) –a comprehensive report to Congress on work-site activities in several U.S.

[10]Wunsch (2012) studies the optimal design of welfare programs which include job-search skill augmentation, and applies her analysis to Germany.

locations– there is a "continuum" of work-based policies ranging from those which can be represented as "work in exchange for benefits" to those which are heavily supplemented with job search assistance and/or training and therefore represent a "stepping stone to private employment."

In the former class of pure work-fare programs, the emphasis is on the idea of personal responsibility: work is a pre-condition to receive public assistance. For example, in the West Virginia Community Work Experience, and in New York City Work Experience programs, work was the only activity; there was no training, job-search assistance, or attempt to further job placement. Required work hours were calculated based on TANF plus Food Stamps benefits divided by the minimum wage (Fagnoni, 2000). We label this type of work-based activities *Mandatory Work*.

The latter class of programs is, instead, designed with the aim of guiding the participant towards long-term, private, unsubsidized employment.[11] This objective is pursued in different ways across states.[12] In some programs (e.g., Washington State Community Job Initiative, and Vermont Community Service Employment Program), clients receive individualized job search assistance from the staff of the program or of collaborating agencies. Job search activities include job readiness workshops, job clubs, soft skills training, and assistance to job search through the use of computerized job banks (Pavetti and Strong, 2001). In other programs, participants are initially carefully matched with an employer and, while there is no contractual obligation on the part of the employer to hire the participant, there is a mutual expectation of this outcome if the participant performs well. Examples of this design are the Philadelphia TWC program (Pavetti and Strong, 2001), the Massachusetts Supported Work program (Fagnoni, 2000), and the Forest City PREP program (Kirby et al., 2002). Moreover, some programs also provide financial incentives to promote employment retention. Philadelphia TWC program participants receive a bonus of $200 at the start of unsubsidized employment, $200 at 2 months, and $400 at 6 months into their spell (Kirby et al., 2002). We label this type of work-based activities which combine a work requirement

[11]For example, a common feature is that participants do not work in exchange for TANF benefits, but they receive a paycheck from their employer subsidized (often entirely) by TANF funds or other funding, pay FICA and payroll taxes. As a result, they qualify for EITC, unemployment insurance, and social security benefits.

[12]Kirby et al. (2002) report that as of May 2001, there were approximately 40 work-based programs of this type around the country.

with an active effort to assist job search and job placement *Transitional Work*.[13]

3 Economic environment

We now describe an economic environment where the policies described in Section arise as possible activities (i.e., choice of effort and technologies) of the individual.

Demographics and preferences: Individuals are infinitely lived. They have period utility over consumption c and effort a given by $u(c) - v(a)$. Preferences are time-separable and the future is discounted at rate $\beta \in (0,1)$. We impose that $c \geq 0$, and that $u(\cdot)$ is strictly increasing, strictly concave and smooth, and u^{-1} has a convex first derivative. This last technical assumption will prove useful in our characterization and is satisfied by a wide range of utility functions, including the CRRA class with risk-aversion parameter greater than one half, and the entire CARA class (see Newman, 1995). Effort a takes values in $\{0,1\}$, and the disutility of effort $v(a)$ is set to $e \cdot a$, with $e > 0$.

Employment status and disutility of effort: We denote the employment status of the agent by z. The agent can be either unemployed (z^u) or employed (z^w). Employment is an absorbing state.[14]

Human capital: At any point in time, agents are endowed with a stock of human capital (skills) $h \geq 0$. During unemployment, human capital depreciates geometrically and deterministically at rate $\delta \in [0,1]$ and follows the law of motion:

$$h' = (1-\delta)\, h \tag{1}$$

Note that, given an initial level of human capital h_0 at the start of the unemployment spell, unemployment duration d of a worker with human capital h can be recovered as $d = \ln(h/h_0) / \ln(1-\delta)$.

[13]Many transitional work programs also include skill development components (e.g., training related to the target job, workshops on job readiness and adhering to workplace norms). Since we have abstracted from the training component in job search-based programs, we abstract from it also in the context of work-based programs

[14]The optimal unemployment compensation contract with job separation and multiple unemployment spells is studied by Hopenhayn and Nicolini (2009). Their findings are relevant to our set up only in the sense that, while we assume an exogenous value for initial promised utility of the unemployed, with multiple spells this initial value would be endogenously determined by the employment history.

Production technologies: An agent who is working, i.e. employed on a production technology, needs to expend effort e to produce positive output. There are two types of production technologies in the economy which we call primary and secondary. An agent of type h employed on the primary production technology produces output $\omega(h)$. We let $\omega(\cdot)$ be a continuous and increasing function, with $\omega(h) \in [0, \omega_{\max}]$ and $\omega(0) = 0$. Note that, human capital depreciation induces wage depreciation –i.e., a deterioration of the agent's productivity in the primary sector– along the unemployment spell. A key feature of our model economy is that access to a work opportunity (i.e., a job) in the primary sector is frictional. Below we describe the friction in detail.

An agent working on the secondary production technology, upon applying effort e, produces an amount $\underline{\omega} \geq 0$ independent of h. Moreover, access to the secondary sector is frictionless, i.e., a secondary job is readily available. This dual sector structure is meant to represent a labor market where an agent who is willing to work can always find a job performing a simple task (e.g., janitor, fast-food cook, cashier, clerk at a supermarket, street sweeper, etc...) in the public sector or in a non-profit organization, whereas finding a job vacancy that matches someone's occupational and industry skills, and hence paying proportionally to h, takes time.

Private search technology: It is useful to distinguish two distinct stages in the search activity. In the first stage, the agent locates all her job opportunities, sends out applications and she may be re-contacted by employers. The number of job opportunities is denoted by the discrete variable $\eta(h) \geq 0$, where $\eta(\cdot)$ is increasing in h. Exerting search effort $(a = 1)$ means applying to all job opportunities and being re-contacted by each one with probability $\mu \in (0, 1)$. Without sending applications $(a = 0)$ the probability of being re-contacted is zero. Moreover, we assume that the matching stage yields at most one contact per period.[15] As a result, the per-period contact probability is given by

$$m(h, a) = 1 - (1 - \mu)^{a\eta(h)}. \tag{2}$$

If the agent is re-contacted, a meeting (e.g., a job interview or a trial period) between employer and agent takes place. In this second stage, the firm and the agent meet and draw

[15]This assumption is without loss of generality for two reasons. First, one can think of the period to be short (e.g., one day). Second, we can generalize the technology to allow for an arbitrary number N of contacts per period and, while the expression for π is more involved, the essence of the search process is unchanged.

an idiosyncratic outcome: with probability $\theta(r)$ the worker is retained by the firm, where r is a worker action. We let $r \in \{0, 1\}$ and $\theta(1) \equiv \theta > \theta(0) = 0$. The worker has control of the interview and can always, by choosing $r = 0$, make sure that it fails and that she does not receive a job offer.[16] We call this action r the "retention action". Putting both stages of the search technology together, the job finding probability is

$$\pi(h, a, r) = \theta(r) m\left(h, a\right), \tag{3}$$

where it is useful to note that if $a = 0$ or $r = 0$, then $\pi = 0$; if $\eta \to \infty$, and $r = 1$, then $\pi = \theta$. As a result, the job finding rate $\pi \in [0, \theta]$. It is important to note that, as the unemployment spell progresses and h declines, so does the hazard rate since the set of job opportunities shrinks. Finally, let y denote the outcome of the search activity during unemployment, with $y \in \{f, s\}$, where f denotes "failure" and s "success".

Assisted search technology: Upon payment of κ units of consumption, the unemployed can entirely devolve the search activity to an agency and save on the search effort cost. The agency sends out a fixed number of applications $\underline{\eta}$ to a subset of the job vacancies available to the unemployed. When h is low, and $\eta\left(h\right) \leq \underline{\eta}$, then the agency is able to apply to all the available job opportunities and the job finding probability of an individual using the assisted search technology is $\lambda\left(h, r\right) = \theta(r)\left[1 - (1 - \mu)^{\eta(h)}\right] = \pi\left(h, 1, r\right)$, as if she exerted high search effort privately. When, for h large enough, $\underline{\eta} < \eta\left(h\right)$, then assisted search is less effective than private search and the job finding rate under search assistance is $\lambda\left(r\right) = \theta(r)\left[1 - (1 - \mu)^{\underline{\eta}}\right]$ which is independent of h and lower than $\pi(h, 1, r)$.

Financial and insurance markets: We study the optimal contract when the worker has no access to storage, credit, or insurance markets.[17]

[16] For example, the worker can appear "sloppy" and "uninterested" about the job at the interview, or pretend she is not competent in the required tasks.

[17] The agent would like to purchase insurance against the event she remained jobless. In absence of insurance markets, she would choose to self-insure through borrowing and saving. In Pavoni and Violante (2005), we show that when agents have *anonymous access* to credit markets, but face a no-borrowing constraint, the optimal contract outlined here can be implemented with a simple additional instrument: an interest tax on savings large enough to induce the agent to borrow, if she could. Since she cannot, she would optimally choose to stay hand-to-mouth. The presence of *hidden storage* through a storage technology with a negative real return (e.g., minus the inflation rate) would put, implicitly, an upper bound on how large the saving tax could be.

4 Contractual relationship

We now introduce a risk-neutral planner/government (principal) who faces an intertemporal budget constraint and a real interest rate equal to $\beta^{-1} - 1$. At time $t = 0$, the planner offers the unemployed worker (agent) an insurance/credit contract that maximizes the expected discounted stream of net revenues (fiscal revenues minus expenditures) and guarantees the agent at least an expected discounted utility level U_0. The value of U_0 should be thought of as an exogenous parameter measuring the "generosity" of the welfare system (e.g., the outcome of voting or a political process).

Information structure: The use of the private and assisted search technologies and their outcome y is observable and contractible. Output during both primary and secondary work is fully observable and, since the technology is deterministic, work effort is contractible. However, search effort and the retention action are private information of the agent and under her control: these are the sources of moral hazard.

Contract: At every node, the contract specifies a consumption level for the agent, recommendations on the search or work effort level to exert, on the retention action, and on the use of available technologies: private search, assisted search, or work on the secondary technology. During the unemployment spell, the consumption level corresponds to the unemployment compensation; during (primary) employment, the difference between the consumption level and the wage implies a wage subsidy if positive anda tax if negative.

The period t components of the contract are contingent on all publicly observable histories up to t and the search-effort and retention-action recommendations must be incentive compatible. Moreover, at every t, we allow the planner to specify the contract contingent on the publicly observable realization $x_t \in [0, 1]$ of a uniform random variable X_t. This "randomization" may be used in the optimal contract to convexify the planner's problem and, thus, enhance utility (Phelan and Townsend, 1991; Phelan and Stacchetti, 2001). A contract is a welfare program.

Table 1: Mapping between effort level and technologies into policies

	Private Search	Assisted Search	Private Search & Assisted Search	Secondary Production	Assisted Search & Secondary production	None
High effort	UI	$\times$	$\times$	MW	TW	$\times$
No effort	$\times$	JA	$\times$	$\times$	$\times$	SA

4.1 Components of the contract as policy instruments of the welfare program

The combination of recommendations on the search/work effort level to expend, on the retention action, and on the use of technologies configures only five possible options. All other combinations can be easily excluded: 1) prescribing positive search effort with the use of the assisted search technology would be redundant; 2) prescribing the use of private search or secondary production and no effort is not optimal since the technologies require effort as an input to be productive. Similarly, we can exclude: 3) recommending the zero retention action and the use of search assistance, as this expenditure would be wasted; 4) simultaneously prescribing the zero retention action and use of private search, since the planner could always recommend zero effort and save the agent the disutility of high effort. In particular, the contract always features $r = 1$.

We label the residual five options "policies" of the welfare program, and we index them with i. We denote as "Unemployment Insurance" ($i = UI$) the joint recommendation of private search activity and positive effort. The combination of zero effort together with the use of the assisted search technology corresponds to "Job Search Assistance" ($i = JA$). The zero effort recommendation without the use of any technology denotes "Social Assistance" ($i = SA$). A positive effort recommendation paired with the use of the secondary production technology denotes "Mandatory Work" ($i = MW$). Finally, since the costly assisted search technology does not require any effort, it can be used in conjunction with the secondary production function. We call this combination of work and search assistance "Transitional Work" ($i = TW$). Table 1 summarizes these combinations.

4.2 Recursive formulation

Following Spear and Srivastava (1987) and Abreu, Pearce, and Stacchetti (1990), we formulate and solve this problem recursively. The recursive formulation requires two state variables: human capital h (or equivalently the unemployment duration d) and the continuation utility U promised by the contract.[18] The planner takes the initial conditions of this pair (U_0, h_0) as given.

Exploiting this recursive representation, consider an unemployed agent who enters the period with state (U, h). At the beginning of the period, the planner selects the optimal policy instrument $i(U, h)$ by solving

$$V(U,h) = \max_{i \in \{JA,MW,SA,TW,UI\}} V^i(U,h)$$

where the function V is the upper envelope of the values associated to the different policies which, in turn, we denote by V^i. In choosing a particular policy, implicitly, the planner also chooses an effort recommendation $a(U, h)$, the transfer $c(U, h)$ and the continuation utilities $U^y(U, h)$ conditional on the outcome y of (private or assisted) search, when recommended. We describe these additional choices in the next section.

As anticipated, the planner in general may decide to use randomizations through X. In this case, the value function for the planner solves

$$\begin{aligned} \mathbf{V}(U,h) &= \int_0^1 \max_{U(x)\in D} V(U(x),h)\,dx \\ s.t. &: \\ U &= \int_0^1 U(x)\,dx \end{aligned} \tag{4}$$

where the constraint says that the planner is committed to keep his promises: it must deliver to the agent continuation utility U in (ex-ante, with respect to the shock x) expected value terms.

4.3 Policies

We now describe in detail the planner problem during employment and for each of the five policy instruments available during the welfare program.

[18]Employment status $z \in \{z_u, z_w\}$ is a trivial state since it equals z_u along the duration of the contract and then, upon finding a primary job, it switches to z_w forever since employment is an absorbing state.

Primary employment (wage tax/subsidy): Consider an employed worker with state (U,h). Since employment is an absorbing state without informational asymmetries, the planner simply solves

$$\begin{aligned} W(U,h) &= \max_{c,U^s} \omega(h) - c + \beta W(U^s,h) \\ s.t. &: \\ U &= u(c) - e + \beta U^s \end{aligned} \tag{5}$$

where $e \geq 0$ is the work effort level on primary employment. The planner will provide full consumption smoothing for the agent, thus promised utility is constant over time, i.e., $U^s = U$. The promise-keeping constraint implies that in every period the optimal transfer c^e is constant and satisfies $c^e(U) = u^{-1}((1-\beta)U + e)$. Therefore, the magnitude

$$\tau(U,h) = \omega(h) - c^e(U) \tag{6}$$

is the implicit tax (or subsidy, if negative) the government imposes on employed workers. State-contingent taxes and subsidies are a key component of an optimal welfare plan.

By inspecting problem (5), it is easy to see that the value of employment has the following form:

$$W(U,h) = \frac{\omega(h)}{1-\beta} - \frac{u^{-1}((1-\beta)U + e)}{1-\beta} \tag{7}$$

and therefore W is a continuous function, increasing in h, and decreasing, concave and continuously differentiable in U.

Unemployment Insurance (UI): When the worker is enrolled in the unemployment insurance scheme, the problem of the planner is

$$\begin{aligned} V^{UI}(U,h) &= \max_{c,U^f,U^s} -c + \beta\left[\pi(h)W(U^s,h') + (1-\pi(h))\mathbf{V}(U^f,h')\right] \\ s.t. &: \\ U &= u(c) - e + \beta\left[\pi(h)U^s + (1-\pi(h))U^f\right], \end{aligned} \tag{8}$$

$$U \geq u(c) + \beta U^f, \tag{IC-S}$$

$$U^s \geq U^f \tag{IC-R}$$

where $e > 0$ is the effort level during search. Next period human capital h' is generated through the law of motion (1). The pair $\left(U^s, U^f\right)$ are the lifetime utilities promised by the planner contingent on the outcomes (s or f) of search. Recall that the outcome of search is verifiable. To simplify notation, we have shortened $\pi(h,1,1)$ as $\pi(h)$. The first constraint above describes the law of motion of the state variable U (promise-keeping constraint). The second constraint (IC-S) states that payments have to be incentive compatible to induce search. The third constraint (IC-R) states that payments have to be incentive compatible to induce the worker to the high retention action in case a contact is made, i.e., the value of employment for the job seeker must be weakly above the value of unemployment.

By combining the promise keeping constraint and the incentive compatibility constraint on search effort (IC-S), we can rewrite the latter as

$$U^s - U^f \geq \frac{e}{\beta\pi(h)}. \tag{IC-S}$$

Inspecting this new formulation of (IC-S), it is easy to see that the additional incentive compatibility constraint on the retention action (IC-R) will never bind during UI, since the promised utility spread necessary to induce high search effort is also large enough to induce the high retention action. Finally, the expressions for $\mathbf{V}$ and W are given by equations (4) and (5), respectively.

Job Search Assistance (JA): The problem of the planner that chooses to use the assisted search technology and recommend no effort is:

$$\begin{aligned} V^{JA}(U,h) &= \max_{c,U^f,U^s} -c-\kappa+\beta\left[\lambda(h)\,W(U^s,h')+(1-\lambda(h))\mathbf{V}(U^f,h')\right] \\ s.t. &: \qquad\qquad (9) \\ U &= u(c)+\beta\left[\lambda(h)\,U^s+(1-\lambda(h))\,U^f\right], \\ U^s &\geq U^f. \qquad\qquad \text{(IC-R)} \end{aligned}$$

To simplify notation, we have shortened $\lambda(h,1)$ as $\lambda(h)$. Notice the similarity between problem (JA) and problem (UI): the two are identical, except for the fact that there is no effort cost in the promise-keeping constraint and no incentive-compatibility constraint (IC-S), in exchange for the additional per period cost κ.[19] Another difference with (UI) is that, for high levels of h, $\lambda < \pi(h)$. Clearly, in JA the retention constraint (IC-R) is likely to be binding because, as opposed to JA, private employment requires effort.

[19] In this context, the assisted search cost κ can be interpreted as the salary of the agency employee ("caseworker") who inspects available vacancies to find a suitable match for the agent, plus the additional administrative expenditures associated to this task.

Social Assistance (SA): In social assistance, the agent is "released" by the planner for the current period, in the sense that the planner does not demand high effort or the use of technologies, but simply transfers some income to the worker. The problem of the planner is

$$\begin{aligned} V^{SA}(U,h) &= \max_{c,U^f} -c+\beta\mathbf{V}(U^f,h') \\ s.t. &: \\ U &= u(c)+\beta U^f. \end{aligned} \tag{10}$$

The expression for $\mathbf{V}$ is given by equation (4) and the constraint describes how the promised utility U can be delivered by a combination of current and future payments. It is natural to think of SA as a pure income-assistance program.

Mandatory Work (**MW**): When the planner assigns the worker to the secondary production technology, its problem becomes

$$\begin{aligned} V^{MW}(U,h) &= \max_{c,U^f} \; -c+\underline{\omega}+\beta\mathbf{V}(U^f,h') \\ s.t. &: \\ U &= u(c)-e+\beta U^f. \end{aligned} \tag{11}$$

The planner gives up search in the labor market and the worker produces an amount $\underline{\omega}$ by paying a utility cost in terms of work effort e. Recall that work effort can be observed because output is deterministic. Thus, there is no incentive compatibility constraint during mandatory work. Under this policy, the agent works in exchange for benefits and has no chance of transiting into private employment.

Transitional Work (TW): When the planner uses the assisted search technology and, in addition, assigns the agent to work on the secondary production technology, the planner's problem is

$$\begin{aligned} V^{TW}(U,h) &= \max_{c,U^f,U^s} \; -c-\kappa+\underline{\omega}+\beta\left[\lambda(h)W(U^s,h)+(1-\lambda(h))\mathbf{V}(U^f,h')\right] \\ s.t. &: \\ U &= u(c)-e+\beta\left[\lambda(h)U^s+(1-\lambda(h))U^f\right], \end{aligned} \tag{12}$$

$$U^s \geq U^f. \tag{(IC-R)}$$

The way to interpret this policy option, in light of our discussion of Section 2, is that while the agent is required to produce, the caseworker actively assists her search for a suitable employment.

It is convenient to state some basic properties of these value functions. By applying fairly standard results in dynamic programming, the convexified upper envelope $\mathbf{V}$ inherits the same continuity, monotonicity and concavity properties of u, but two caveats are worth mentioning. First, monotonicity in U is guaranteed whenever at (U, h) the consumption level c associated to the optimal program is positive (e.g., whenever $u(0) = -\infty$). Second, the concavity of $\mathbf{V}$ in U is warranted thanks to the randomization in (4). Finally, the properties of $\mathbf{V}$ are inherited by the value functions of each single policy V^i. In particular, all the problems defining policies $i \in \{JM, MW, SA, TW, UI\}$ are also concave, and each V^i is continuously differentiable in U. See Pavoni and Violante (2007) for details.

4.4 Economic forces in the choice of policies

To understand the economic forces at work in the choice of policies, it is useful to compare, for a given pair (U, h) the costs and returns of each policy relative to Social Assistance. SA is a useful benchmark because it has no returns for the planner and, since effort is zero in SA, its cost to the planner is simply that of delivering promised utility U by implementing full insurance, i.e., $c^{SA}(U) = u^{-1}((1-\beta)U)$.

Costs: All the policies that require effort to succeed (MW, TW, UI) entail an *effort compensation cost* for the planner. Since $u(c)$ is concave and disutility from effort is separable, as U increases, the marginal utility of consumption falls whereas the marginal disutility of effort is fixed. Therefore, the higher U, the higher the transfer the planner has to pay to the agent to deliver the promised utility in order to compensate her for the fixed effort cost. To sum up, the effort compensation cost, a form of wealth effect due to the fact that leisure is a normal good in our model, increases with U. This is a central force in our characterization.

Some of the policies include the incentive compatibility constraint related to private search (IC-S), and the one related to the retention action (IC-R), respectively:

$$U^s - U^f \geq \tfrac{e}{\beta\pi(h)} \qquad \text{(IC-S)}$$

$$U^s \geq U^f \qquad \text{(IC-R).}$$

Recall that (IC-S) is present in UI, and (IC-R) is present in JA, TW and UI. However, as explained, (IC-R) is never binding in UI because (IC-S) requires a strictly positive gap between state-contingent promised utilities already, and it is never binding in TW either because, as we will see below, once the optimal program has reached TW it will never recommend low effort again.

Satisfying the incentive compatibility constraints is costly since the agent has concave utility and dislikes consumption (and, hence, promised utility) to be spread out across states. A planner facing an incentive compatibility constraint has to pay the agent a larger transfer, on average, to deliver a given level of promised utility U. These incentive costs for both IC-S and IC-R are increasing in U, since u^{-1} has convex first derivative.[20] Moreover, the cost associated to IC-S is decreasing in h. As the unemployment spell progresses and the job-finding probability decreases, the employment outcome –that can only be achieved if the worker exerts the high job-search effort level– becomes less likely, and the planner needs to differentiate even more the future promised utilities across states to induce the agent to search.

The third, and final, cost component is the fixed cost of using the assisted search technology κ during JA and TW.

Returns: The return to the planner of using the secondary production technology (in MW and TW) is the production of output $\underline{\omega}$. The return to the planner of using the assisted search technology is that the planner saves on the effort compensation cost and on the costs associated to the incentive compatibility constraint IC-S, since job search can take place without unobservable effort.

The main return of using private or assisted search is that, with probability $\pi(h)$ (or $\bar{\eta}$), a match in the primary sector is created. Recall from (7) that the net returns to employment in the primary sector for the planner are increasing in human capital h. There is also an effort compensation cost which makes the return to primary employment decreasing in promised utility U. Therefore, the net returns are small for low h and high U.

[20]The inverse of marginal utility $1/u'$ is the marginal cost to the planner of promising an additional unit of utility U to the agent. By "incentive cost" we mean the extra cost in units of consumption of promising the agent a state-contingent utility lottery delivering U necessary to satisfy incentive compatibility, relative to the cost of promising U with certainty. If $1/u'$ is convex, this incentive cost is increasing in the level of U.

5 Parameterization

Our main source of data is the National Evaluation of Welfare-to-Work Strategies (NEWWS), a longitudinal study that was administered by the US Department of Health and Human Services from 1991 to 1999. Its objective was to estimate the effectiveness of welfare-to-work programs, and specifically "what works best, and for whom?".[21]

The study covered eleven mandatory Welfare-to-Work programs in seven distinct locations and included over 40,000 individuals over a five-year follow-up period.[22] It is based on random assignment to treatment groups (subject to program requirements) and to control groups (without any requirement). The vast majority of program members were single mothers. In particular, 94% are women, 95% are singles and all have children. The median number of children is two. 44% of the sample is black and 44% is white. The average age of participants is 30.5. 42% of the participants are high-school dropouts, 51% have a high-school degree or GED, and only 7% has some years of college education. The average years of education in the sample is 11.2.[23]

The study contains several data sources, three of which are used in our analysis. The "full impact" sample collects five years of administrative records on demographic characteristics, earnings, and benefits for both treatment and control group members from all seven sites. Additional data on outcomes for adults and children were collected by interviewing a random sub-sample of about 5,000 members around two years after their date of random assignment and, in four of the seven sites, around their five-year anniversary. This survey includes ample data on the participants including the assignment of each participant to activities over the period, employment history before assignment, and history of non cash benefits receipts. The third data source collects data on the costs of each activity drawn from state, county, and local fiscal records, supportive service payment records, administrative records, and case file participation records.

[21]Data files from the NEWWS evaluation are maintained by the National Center for Health Statistics (NCHS) and are publicly accessible. The evaluation was conducted by MDRC under contract to the federal government from 1989 through 2002.

[22]The seven locations are: Atlanta GA (2 programs), Grand Rapids MI (2 programs), Riverside CA (2 programs), Columbus OH (2 programs), Detroit MI, Portland OR, and Oklahoma City, OK. This last location offered programs which are not of interest for our study.

[23]For more details, see Table 2.3 "Selected Baseline Characteristics of Full Impact Sample Members," pages 43-46 in NEWWS (2001).

We now turn to the choice of parameters. The unit of time is set to one month. It is useful to divide the parameters of the model into three groups. First, the preference parameters $\{u(\cdot), \beta, e\}$. Second, the labor market parameters $\{\omega(h), \delta, \pi(h)\}$. Third, the parameters of the assisted search and secondary production technologies $\{\lambda, \kappa, \underline{\omega}\}$.

We pick a value for the monthly discount factor of 0.9967 in order to match an interest rate of 4% on an annual basis, and use a logarithmic specification for the period utility over consumption. We assume that the disutility of search effort equals the disutility of work effort on both the primary and secondary sectors and, based on the evidence surveyed in Pavoni and Violante (2007), we set $e = 0.67$. This value represents a cost of participation of 49% in consumption equivalent terms. Attanasio et al. (2008), Hausman (1980), Cogan (1981), and Eckstein and Wolpin (1993) computed participation costs of, respectively, 21%, 27%, 41% and 62% in consumption equivalent terms ($e = 0.24, e = 0.31, e = 0.50$, and $e = 0.97$) within female labor force participation models. We chose a value on the high end of the range of the existing estimates for women since our sample is composed of low-skilled single mothers who, arguably, have a high cost of working.

Without loss of generality, we use a linear monthly earnings function $\omega(h) = \omega h$. We normalize h so that one unit corresponds to monthly earnings of \$100. In the NEWWS data, initial monthly earnings upon entering the program are around \$1,000, and hence $h_0 = 10$. We choose an annual human capital depreciation rate δ of 15 percent (see Pavoni and Violante, 2007, for details).[24]

The unemployment hazard function $\pi(h)$ is estimated from the monthly Current Population Survey (CPS) files over the period May 1995-April 1996, in the middle of the NEWWS sample period.[25] By selecting a sample of single women, 18-45 years of age with at most a high-school degree we stay as close as possible the NEWWS sample. Overall, we have 5,612 observations. The average age of the sample is 30, and median weekly wage is 250 dollars, consistent with the NEWWS sample (see NEWWS, Table 2.3). Our estimation strategy

[24] As we explain in Pavoni and Violante (2007), the existing microeconomic estimates of wage depreciation span a wide range. At the high end, Keane and Wolpin (1997) estimate an average annual wage depreciation rate of 23%. At the other end, the estimates of Jacobson, LaLonde and Sullivan (1993, Table 3) imply an annual depreciation of 10%. In the middle of the spectrum, Neal's (1995, Table 3) estimates imply an annual decay rate of 17.5%: Addison and Portugal (1989) implicitly estimate a yearly skill depreciation rate of 16%.

[25] Within the window 1991-1999, the year from May 1995 to April 1996 witnessed a very stable unemployment rate, always between 5.5% and 5.7%. We choose these 12 months for our estimation in order to avoid issues of non-stationarity in the parameters.

follows closely the maximum likelihood estimator outlined by Flinn (1986) and assumes a Weibull distribution $\alpha\phi d^{\phi-1}$ where d is the duration of the unemployment spell. Our estimation yields parameter estimates of $\alpha = 0.36$, and $\phi = 0.83$. Since $\phi < 1$, the estimated hazard displays negative duration dependence.[26] Figure 1 plots the estimated hazard as a function of duration, and its mapping into levels of h.

To estimate λ, the hazard rate from JA and TW, we focus on the transition rates into private employment from "Job Clubs", the program in the NEWWS data that has features similar to job search assistance.[27] We obtain $\lambda = 0.23$ at the monthly frequency. To fix ideas, Figure 1 shows that our job search hazard reaches 0.23 for $h = 9.60$, or roughly 4 months into the unemployment spell for a worker who initially has human capital $h_0 = 10$. We note that Cebi and Woodbury (2011), who study the impact of the Washington Alternative Work Search Experiment estimate a *bi-weekly* exit rate from job-search assistance programs between 0.1 and 0.15 (see their Figure 1), supporting our estimate of λ.

The cost of operating the assisted search technology (κ) is estimated based on "per worker per month" cost of the activity called Job Clubs in the NEWWS. Consistently with our model, we only include "operating costs" such as expenditures for employment-related case management services, overhead, program orientation, and other activities. We we do not include benefits or child care expenses. The costs across locations, described in Table 2, average to $445 per worker per month.

Since Job Clubs are not a pure search assistance activity, but include some training services, one may be concerned that this cost is overestimated. Supporting evidence for this estimate comes from Kirby et al. (2002) who examine six "Transitional Job" programs. Among the six programs they study, only PREP Forrest City, AR, Community Job Tacoma, WA, and Community Job Aberdeen, WA did not offer any form of training and only offered job placement services. We use information on these three sites. PREP is the only program, among these three, for which there is a breakdown of service costs (Kirby et al., 2002, Table V.4). In our calculation we include four items: "pre-placement activities" since they

[26]We then map this function of duration, into a function of human capital through on a depreciation rate of 15% per year and an initial earnings level equal to $1,000 (i.e., $h_0 = 100$).

[27]Here is the description of Job Clubs programs in the NEWWS: *Programs ran assisted job search activities, including classroom instruction on techniques for resume preparation, job search, and interviewing, as well as a supervised "phone room" where participants could call prospective employers and search for job leads. Some sites employed job developers on staff, who searched for job leads in the community. See* NEWWS (2001, p. ES-9 and 15).

Table 2: Average $ cost per worker per month

NEWWS Program	"Job Club"	"Work Experience"
Atlanta LFA	416	167
Atlanta HCD	463	203
Grand Rapids LFA	259	241
Grand Rapids HCD	259	241
Riverside LFA	759	572
Riverside HCD	759	572
Columbus Integrated	220	106
Columbus Traditional	205	46
Detroit	752	557
Portland	359	400
Average	445	298

Source: National Evaluation of Welfare-to-Work Strategies, How Effective Are Different Welfare-to-Work Approaches?, Five-Year Adult and Child Impacts for Eleven Programs: Chapter 13: Costs and Benefits, Table 13.2, pp. 304-306.

include screening of the worker to induce a good match with the employer, "unsubsidized job development and placement", "retention services", and "general administration", which amount to $628 per participant per month. These cost are 73% of the total of the PREP program. Applying this same percentage to the total costs in the other two sites (Table V.5), we obtain $277 for Tacoma, and for $379 for Aberdeen. The average across these three sites is $428 which is only slightly below our estimate from NEWWS data.

The parameter $\underline{\omega}$ captures output on the secondary technology net of administrative costs. Estimates of output are provided by Kirby et al. (2002). Across their six sites, hourly wages vary between $5.15 and $8.5, and hours worked vary between 20 and 40 (Kirby et al., Table 1). Using a baseline of 30 hours per week, monthly output ranges between $618 and $1,020. On average, we obtain $819.[28] To estimate administrative cost, we cannot use data from TW programs, since they include the cost of assisted search. We therefore use NEWWS cost data for the activity labeled "Work Experience," the closest activity to our Mandatory Work program.[29] The average estimated cost per worker per month for this activity is $298. The value of $\underline{\omega}$ is computed as output minus operating cost, i.e., $819 − $298 = $521. Table

[28]See also their Table V.2 for similar calculations.

[29]NEWWS (2001) defines Community Work Experience as programs requiring recipients to "work off their grant" in community service jobs.

Table 3: Parameterization

Parameter	Symbol	Value	Source
Preferences			
Discount factor	β	0.9959	Pavoni and Violante (2007)
Disutility from effort	e	0.67	Pavoni and Violante (2007)
Labor market			
Initial monthly earnings	h_0	$\$1,000$	NEWWS
Job search hazard	$\pi(h)$	Weibull with: $\alpha = 0.36, \phi = 0.83$	Monthly CPS (1995-1996)
Monthly depreciation	δ	0.0135	Pavoni and Violante (2007)
Assisted search			
Job search hazard	λ	0.23	NEWWS, and Cebi and Woodbury (2011)
Administrative cost	κ	$455	NEWWS, and Kirby et al. (2002)
Secondary production			
Output	$\underline{\omega}$	$521	NEWWS, and Kirby et al. (2002)
Monitoring			
Administrative cost	κ^M	$5	

3 summarizes all parameter values.

6 Optimal welfare programs

We are now ready to characterize the optimal welfare program. We begin by studying in which regions of the state space (U, h) the various policies arise as optimal. Here, we heavily exploit the recursive formulation of the optimal contracting problem. By projecting the upper envelope $V(U, h)$ on the (U, h) state space, we obtain a graphical representation of which policy is optimally implemented at every (U, h) pair. The state space can be divided into different connected areas, each corresponding to a specific policy whose value dominates all the others. The state space can also be thought of as a phase diagram, where U moves endogenously and h exogenously, that dictates the optimal sequence of policies along the unemployment spell, for any given initial pair (U_0, h_0). Finally, we turn to the dynamics of unemployment benefits and wage/taxes upon re-employment.

6.1 Optimal policies in the (U, h) space

When the upper envelope $V(U,h) = \max_i V^i(U,h)$ is projected onto the (U,h) space, as done in Figure 2, we obtain immediately the regions in the state space where each policy emerges as optimal. We start by interpreting Figure 2 as we move "horizontally" in the (U,h) space, i.e., we let h change for a given level of utility entitlement U. Next, we study the optimal policies as we move "vertically" through the diagram, i.e., we change U for a given level of human capital h.[30]

Moving horizontally (along h): For high levels of U and high levels of h (top left region of Figure 2), the planner assigns the worker to UI because the job finding probability $\pi(h)$ and the wage $\omega(h)$ are both large. As human capital depreciates (still for this high level of promised utility) the job finding rate decreases and, in order to save on the incentive cost associated to constraint IC-S, the planner shifts from UI to JA. Finally, as human capital further depreciates, the return to assisted search decreases because output in primary employment, a function of h, falls. The planner finds it optimal to save on the search assistance cost and simply provides the agent with a constant transfer in SA. Social assistance tends therefore to emerge for low h and high U when the return to employment are too low and the effort compensation cost is too high (top right region of Figure 2).

Consider now moving horizontally across the state space for lower levels of U. For low enough levels of U, TW appears in the state space in place of JA. The effort compensation cost is low enough that, while the planner uses the assisted search technology, it simultaneously finds it optimal to require the agent to work as well. Similarly, moving to the right, MW appears instead of SA. The planner gives up the search technology because its return is too small, since $\pi(h)$ and $\omega(h)$ are too small, and requires the agent to work in the secondary sector in exchange for her benefits.

Moving vertically (along U): As U decreases, the effort compensation cost declines and the planner shifts from policies without effort (JA, SA) to policies requiring effort (UI, TW, MW). The shift from SA to JA in the upper part of the graph is explained

[30]Figure 2 and all the other figures which follow are based on the parameterization described in Section 5.

by two forces. First, as U falls, so does the cost of satisfying the IC-R constraint. Second, the effort compensation cost during primary employment (a possible outcome of JA only) falls as U is reduced.[31]

6.2 Two types of optimal welfare programs

The optimal sequence of policies is dictated by the evolution of the state vector (U, h). Conditional on unemployment, h declines monotonically. The evolution of U depends on the specific policy. U is declining during UI and JA because of the binding incentive constraints, but it remains constant during SA, MW and TW.

The main insight about optimal policy transitions is that there are two types of welfare programs that are most likely to emerge as optimal, depending on the initial level of generosity U_0. Figure 2 illustrates the policy sequence in these two programs. A generous (or deep-pocketed) principal would implement an optimal program based on *search* which follows the sequence $UI \rightarrow JA \rightarrow SA$. A less generous (or more budget constrained) principal would, instead, implement an optimal program based on *work* which follows the sequence $UI \rightarrow TW \rightarrow MW$.

For $h_0 = 10$, our initial condition for human capital, the relative duration of each policy depends on the initial level of promised utility. In what follows, we restrict attention to a high and a low level, $U_0^{high} = 500$ and $U_0^{low} = 400$, which induce a search-based program and a work-based program, respectively. In the search-based program, the planner uses UI until month 11, then it switches into JA until month 52, and then starts implementing SA, an absorbing state. In the work-based program, UI is used for the first 12 months, TW for the subsequent 41 months, and then the planner switches into MW. Overall, the switching times from UI to assisted search and from assisted search into the absorbing program are quite similar across the two welfare programs.

6.3 Optimal sequence of payments and taxes/subsidies

Figure 3 plots the optimal path of unemployment benefits and wage tax/subsidy in two examples of unemployment histories, where the participant never finds a job, under the

[31]The higher is h, the higher the level of promised utility U at which this switch takes place. The reason is that the return to primary employment, present in JA but not in SA, is increasing in h.

search-based program (top two panels) and the work-based program (bottom two panels).

Unemployment benefits fall during UI because of the binding IC-S constraint. Optimal replacement ratios for UI benefits are higher in search-based programs because of the higher initial promised utility. The top-left panel shows that satisfying the IC-R constraint during JA requires both declining benefits and a positive "static" wedge between promised consumption upon employment $c^e(U,h)$ and benefits $c^u(U,h)$ during unemployment. The reason is that the agent exerts no effort in JA whereas employment requires effort, and hence she will choose $r = 1$ only if the principal promises a level of consumption during employment high enough to compensate for the additional work effort. This static wedge grows quickly as JA approaches SA and it entails both a fast drop in unemployment benefits and a fast rise in wage subsidy upon reemployment.

Moving to the work-based program, the bottom-left panel shows that the static wedge is not present in TW since the agent is required to supply work effort also during TW. Recall that the incentive constraint on the retention action IC-R is not binding during TW, since the program always features high effort from that point onward. As a result, the principal can fully insure the agent starting from her switch from UI into TW, as demonstrated by the constant consumption path.

Finally, because of the higher average level of promised utility and the necessity of creating a positive static consumption wedge, wage subsidies are more generous and appear at earlier durations in search-based program, compared to work-based welfare programs. For example, 30 months into the program, TW is still associated with a small tax upon reemployment, whereas JA requires a subsidy around 25 percent.

7 Extension: monitoring of agent's search effort

As discussed in Section 2, there is a variety of job-search based programs. In some of these programs, the emphasis is on monitoring and enforcing the individual private search effort. Here,we introduce a monitoring technology, as in Pavoni and Violante (2007), i.e., upon payment of a cost $\kappa^m > 0$, the job-search effort of the agent can be perfectly observed and enforced by the planner.[32] Note that monitoring would never be accompanied by a no-effort

[32]Setty (2012) generalizes this analysis to the case where monitoring allows the principal to acquire a costly imperfect signal of the agent's effort that can be used in the contract.

recommendation, because the cost would be wasted. Since output during work is observable and deterministic, monitoring of work effort is redundant. Finally, monitoring would not be paired with the use of assisted search because the high search effort induced by monitoring already generates the largest possible number of contacts for the individual, and hence any additional resource spent on search is wasted. As a result, the only new policy that arises in our environment is one where where the planner prescribes high search effort and the use of monitoring, which we call *Job Search Monitoring*.

Job Search Monitoring (JM): The problem of the planner that chooses to monitor the search effort of the agent is:

$$\begin{aligned} V^{JM}(U,h) &= \max_{c,U^f,U^s} -c-\kappa^m+\beta\left[\pi(h)W(U^s,h^f)+(1-\pi(h))\mathbf{V}(U^f,h^f)\right] \\ s.t. &: \\ U &= u(c)-e+\beta\left[\pi(h)U^s+(1-\pi(h))\,U^f\right]. \end{aligned} \tag{13}$$

Notice the similarity between problem (JM) and problem (UI): the former is identical to (UI) except for the fact that there is no incentive-compatibility constraint in exchange for the additional per period cost κ^m. This cost should be interpreted as the additional costs for the caseworker to monitor and enforce the search activity of the unemployed agent.

7.1 Results

We first discuss the parameterization of the monitoring cost κ^m. Ashenfelter et al. (2004) report that, in the experiments they evaluate, the additional processing weekly costs per claim associated with the treatments varied from \$1 to \$15 (in 1984 nominal dollars). These additional costs were mainly due to the added staff-time required to go through the supplemental eligibility checks and to monitor search effort.

Corson and Nicholson (1985) and Meyer (1995) study the Charleston Experiment which had the objective of strengthening the monitoring of UI work test, offering job-search workshops to job seekers, and enhancing their placement through additional services. UI claimants were divided into three groups differing in the intensity of the treatment. Group 3 was only subject to additional eligibility checks. Corson and Nicholson (1985) estimate that the program cost per claimant in treatment in this group was roughly \$9. Meyer (1995) reports, for this same experiment, smaller weekly costs, around \$6, because he measures costs for the treatment group net of those for the control group which should be interpreted as the costs of administering UI and, as such, should be excluded from our calculation.

Setty (2012) uses data from the Minnesota Family Investment Program, where each caseworker was responsible for 100 clients and, among other tasks, was assigned to apply sanctions, assist with housing, and document client activities. He obtains a weekly cost of \$7.5 per each unemployed worker monitored. This value is an upper bound, since the caseworker is involved in other activities than monitoring as well.

In sum, there is a wide range of estimates for κ^m varying between \$5 and \$60 per worker per month. Given our parameterization of Section 5, JM never appears as optimal for monitoring costs beyond \$30. As a result, it is only interesting to analyze how the optimal welfare program would be modified by the presence of JM when monitoring costs are low $(\kappa^m = \$5)$. Figure 4 shows that job search monitoring emerges as optimal in the upper region of the state space (hence, within search-based welfare programs) between UI and JM. To understand the forces at work, move vertically in the state space from top to bottom in the region where JM is optimal. For high levels of U, the effort compensation cost is high, and JA is implemented. As we lower U and it becomes efficient to induce search effort, the planner switches to JM to avoid the high incentive costs (increasing in U) associated to the unobservable search effort. As U falls and incentive costs are reduced, UI becomes optimal. With respect to Figure 2, JM eats into the area where JA was previously optimal. The extent to which this happens depends largely on the value of the monitoring cost κ^M relative to the assisted search cost κ.

8 Conclusions

Since Shavell and Weiss (1979), the literature on the efficient provision of consumption insurance and search incentives to the unemployed in presence of private information has largely focused on the optimal path of benefits during the unemployment spell. Unemployment compensation during job search is a key pillar of the welfare state, but it is by no means the only instrument used by policy makers. Many welfare programs directed to the low-income unemployed actively assist them in locating suitable employment, or do not elicit search effort at all from them and, instead, require them to work in exchange for benefits.

In this paper, we have used the tools of recursive contract theory to study the optimal design of a welfare program that combines private search, assisted search, and work activities. The investigation is still in progress. In the next draft, we plan to address three additional issues.

First, we plan to compute the implicit expected promised utility of actual programs (from the observed sequence of policies, their duration, and their benefits and wage subsidies) and calculate the optimal program corresponding to the same level of U_0. This exercise allows to determine budget savings from switching to the optimal program and to identify the key differences between actual and optimal programs.

Second, we wish to understand whether US states, roughly, get their programs right. There is a wide variance in the generosity of welfare programs across states, and our framework suggests that the most (least) generous states should implement search-based (work-based) programs. State-level data about expenditures on different types of programs from the U.S. Department of Health and Human Services allows to address this question.

Finally, another issue which we plan to address in the next version of the paper is that of evaluating the effectiveness of policies. The standard empirical exercise in the evaluation literature is based on comparing labor market outcomes (e.g., employment and wages) of the treatment and control groups (see Heckman, LaLonde, and Smith, 1999, for a survey). Our approach to the optimal design of welfare programs suggests that this is a narrow view of effectiveness of labor market policies: a policy may not be effective in isolation, but it can become so if combined with others which follow after a spell of the first policy. For example, consider the optimal sequence $UI \rightarrow TW$. It is easy to show that in our set up, the existence of this work-based policy where the unemployed is required to supply work effort, even when she does not find a job in the private sector, reduces the cost of providing search incentives during Unemployment Insurance since it lowers the value of remaining jobless for the agent.

References

[1] Abreu D., D. Pearce and E. Stacchetti (1990). "Towards a Theory of Discounted Repeated Games with Imperfect Monitoring," *Econometrica*, 58(5), 1041-1064.

[2] Addison J., and P. Portugal (1989). "Job Displacement, Relative Wage Changes and Duration of Unemployment," *Journal of Labor Economics*, 7(3), 281-302.

[3] Ashenfelter, O., D. Ashmore, and O. Dechenes (2005). "Do Unemployment Insurance Recipients Actively Seek Work? Randomized Trials in Four U.S. States," *Journal of Econometrics*, 125, 53-76.

[4] Atkeson, A. and R. Lucas (1995). "Efficiency and Equality in a Simple Model of Efficiency Unemployment Insurance," *Journal of Economic Theory*, 66, 64–88.

[5] Attanasio, O., H. Low, and V. Sanchez-Marcos (2008). "Explaining Changes in Female Labor Supply in a Life-cycle Model," *American Economic Review*, 98(4),1517-1552.

[6] Bergemann, A. and G.J., Van den Berg (2008). "Active Labor Market Policy Effects for Women in Europ: A Survey," *Annales d'Economie et de Statistique*, 385-408.

[7] Blank, R. (1989). "Analyzing the Duration of Welfare Spells," *Journal of Public Economics*, 39(3), 245-73.

[8] Brock T., D. Butler, and D. Long (1993). "Unpaid Work Experience for Welfare Recipents: Findings and Lessons from MDRC Research," *Mimeo MDRC*.

[9] Bover O., M. Arellano, and S. Bentolila (2002). "Unemployment Duration, Benefits Duration and the Business Cycle," *Economic Journal*, 112, 223-265.

[10] Cebi, M. and S. A. Woodbury (2010). "Long-Term Effects of the Work Test and Job Search Assistance: Reexamining the Washington Alternative Work Search Experiment," Mimeo.

[11] Cogan, J. F. (1981). "Fixed Costs and Labor Supply," *Econometrica*, 49(4), 945-63.

[12] Corson, W., and W. Nicholson (1985). "Evaluation of the Charlseton Claimant Placement and Work Test Demonstration," Unemployment Insurance Occasional Papers 85-2, US Department of Labor.

[13] Eckstein Z., and K.I. Wolpin (1989). "Dynamic Labour Force Participation of Married Women and Endogenous Work Experience," *Review of Economic Studies*, 56(3), 375-390.

[14] Fagnoni C. (2010). "Work-Site Activities can Play an Important Role in TANF Programs," Report to Congressional Requesters, United States GAO.

[15] Fallick, B. C. (1996). "A Review of the Recent Empirical Literature on Displaced Workers," *Industrial and Labor Relations Review,* 50:1, 5-16.

[16] Flinn, C. (1986). "Econometric Analysis of CPS-Type Unemployment Data," *Journal of Human Resources*, 21(4), 457-484.

[17] Hausman, J. (1980). "The Effect of Wages, Taxes, and Fixed Costs On Womens' Labor Force Participation," *Journal of Public Economics*, 14, 161-194.

[18] Heckman J., R. LaLonde, and J. Smith (1999). "The Economics and Econometrics of Active Labor Market Programs," in Handbook of Labor Economics, Vol. 3, Ashenfelter, A. and D. Card, eds., Amsterdam: Elsevier Science.

[19] Hopenhayn H., and J. P. Nicolini (1997). "Optimal Unemployment Insurance," *Journal of Political Economy,* 105(2), 412-438.

[20] Hopenhayn H., and J. P. Nicolini (2009). "Optimal Unemployment Insurance and Employment History," *Review of Economic Studies*, 76(3), 1049-1070.

[21] Hotz V. J, and J. K. Scholtz (2001), "The Earned Income Tax Credit," NBER Working Paper 8078.

[22] Jacobson L. S., R. J. LaLonde, and D. G. Sullivan (1993). "Earning Losses of Displaced Workers," *American Economic Review*, 83(4), 695-709.

[23] Keane M. P., and K. I. Wolpin, (1997). "The Career Decisions of Young Men," *Journal of Political Economy,* 105(3), 473-522.

[24] Kirby G., H. Hill, L. Pavetti, J. Jacobson, M. Derr, and P. Winston (2002). *Transitional Jobs: Stepping Stone to Unsubsidized Employment*, Mathematica Policy Research Inc.

[25] Ljungqvist L., and T.J. Sargent (1998). "The European Unemployment Dilemma," *Journal of Political Economy*, 106(3), 514-550.

[26] Machin S., and A. Manning (1999). "The Causes and Consequences of Long-Term Unemployment in Europe," in O. Ashenfelter and D. Card (Eds) *Handbook of Labor Economics*, Vol. 3C, 3085-3139.

[27] Meyer, B. D. (1990). "Unemployment Insurance and Unemployment Spells," *Econometrica*, 58(4), 757-782.

[28] Meyer, B. D. (1995). "Lessons from the U.S. Unemployment Insurance Experiments," *Journal of Economic Literature,* 33(1), 91-131.

[29] Moffitt, R. A. (2003). "The Temporary Assistance to Needy Families Program," in *Means tested Transfers programs in the United States*, R. A. Moffitt (Ed.), Chicago: Chicago University Press.

[30] Moffitt, R. A. (2008). "Welfare Reform: The US Experience," paper prepared for the Economic Council of Sweden conference *From Welfare to Work,* Stockholm, May 7, 2007. Mimeo, Johns Hopkins University.

[31] National Evaluation of Welfare-to-Work Strategies (2001). "How Effective Are Different Welfare-to-Work Approaches? Five-Year Adult and Child Impacts for Eleven Programs," U.S. Department of Health and Human Services, and U.S. Department of Education.

[32] Neal D. (1995). "Industry-Specific Human Capital: Evidence from Displaced Workers," *Journal of Labor Economics*, 13(4), 653-677.

[33] Newman A. (1995). "Risk-Bearing, Entrepreneurship, and the Theory of Moral Hazard." Mimeo, Boston University.

[34] Pavetti L., and D. Strong (2001). " Work-Based Strategies for Hard-to-Employ TANF Recipients: A preliminary Assessment of Program Models and Dimensions," Mathematica Policy Research.

[35] Pavoni N. (2007). "On Optimal Unemployment Compensation," *Journal of Monetary Economics*, 54(6), 1612-1630.

[36] Pavoni N. (2009). "Optimal Unemployment Insurance, with Human Capital Depreciation and Duration Dependence," *International Economic Review,* 50(2), 323-362.

[37] Pavoni N., and G.L. Violante (2005). "Optimal Welfare-to-Work Programs," *Federal Reserve Bank of Minneapolis Discussion Paper 143.*

[38] Pavoni N., and G.L. Violante (2007). "Optimal Welfare-to-Work Programs," *Review of Economic Studies*, vol. 74(1), 283-318.

[39] Pavoni N., O. Setty, G.L. Violante, and C. Wunsch (2012). "Optimal Training Programs," mimeo, NYU.

[40] Phelan C., and E. Stacchetti (2001). "Sequential Equilibria in a Ramsey Tax Model," *Econometrica*, 69, 1491-1518.

[41] Phelan C., and R. M. Townsend (1991). "Computing Multi-Period, Information-Constrained Optima," *Review of Economic Studies*, 58, 853-881.

[42] Setty, O. (2012). "Optimal Unemployment Insurance with Monitoring," mimeo, NYU.

[43] Shavell S., and L. Weiss (1979). "The Optimal Payment of Unemployment Insurance Benefits over Time," *Journal of Political Economy,* 87, 1347-1362.

[44] Shimer R. and I. Werning (2008). "Liquidity and Insurance for the Unemployed," *American Economic Review*, 98(5), 1922-1942.

[45] Spear S. E., and S. Srivastava (1987). "On Repeated Moral Hazard with Discounting," *Review of Economic Studies,* 53, 599-617.

[46] Spinnewijn, J. (2010). "Training and Search During Unemployment." Mimeo, LSE.

[47] Thomsen, S. (2009). “Job Search Assistance Programs in Europe: Evaluation Methods and Recent Empirical Findings,” FEMM Working Paper, Univeristy of Magdeburg.

[48] Wang C., and S. Williamson (1996). “Unemployment Insurance with Moral Hazard in a Dynamic Economy,” *Carnegie-Rochester Conference Series on Public Policy*, 44, 1-41.

[49] Wunsch C. (2012). “Optimal Use of Labor Market Policies: The Role of Job Search Assistance,” *Review of Economics and Statistics*, Forthcoming.

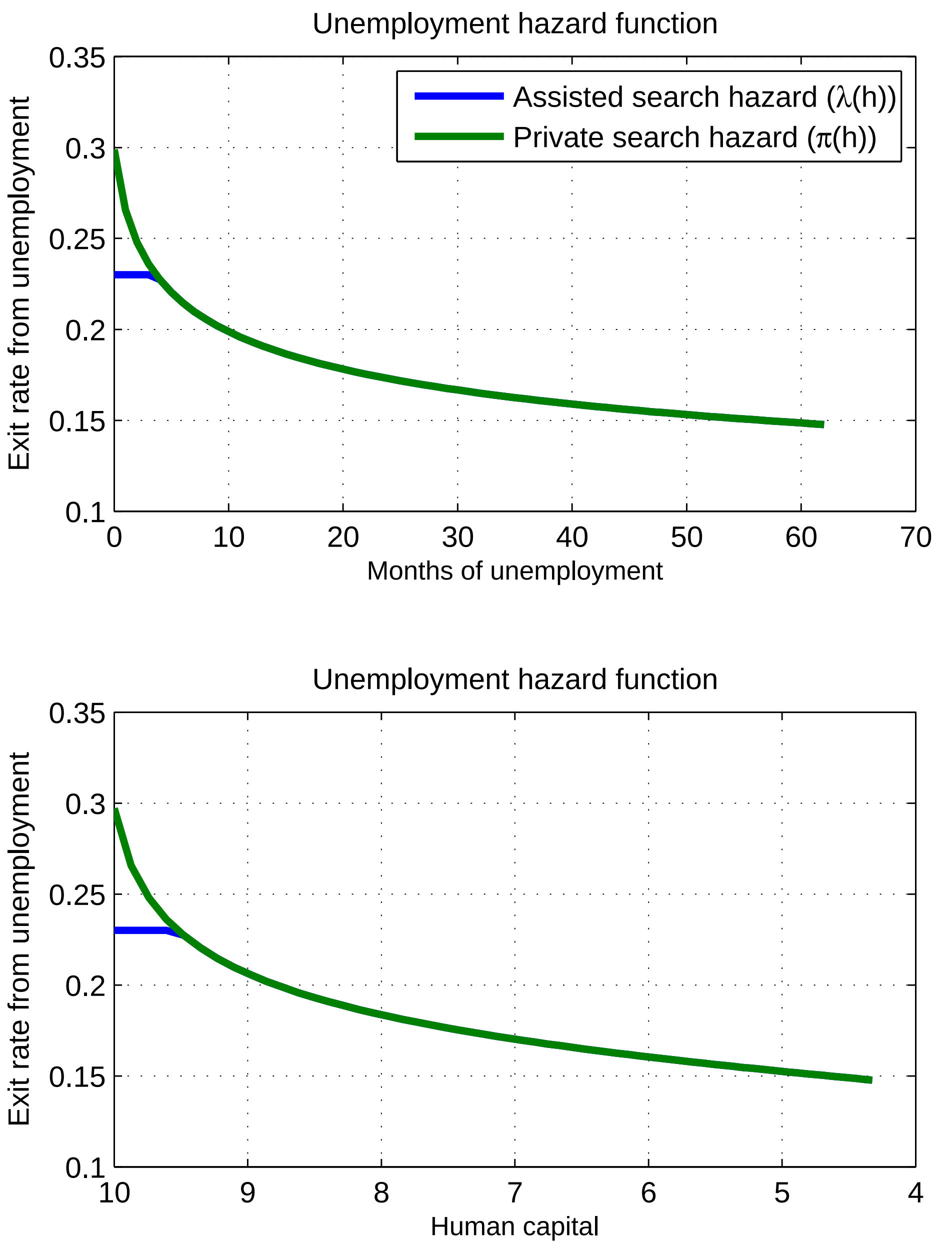

Figure 1: Exit rates from unemployment $\pi(h)$ and $\lambda(h)$. The $\pi(h)$ function is modelled as a Weibull hazard and is estimated on monthly CPS data May 1995-April 1996) for single women aged 18-45 with at most a high-school degree. The mapping from durations to human capital is based on an initial level of human capital of \$10 at duration zero, and a monthly depreciation rate of 0.0135. The constant portion of the $\lambda(h)$ function is estimated based on the exit rate into private employment from "Job Clubs" based on NEWWS data.

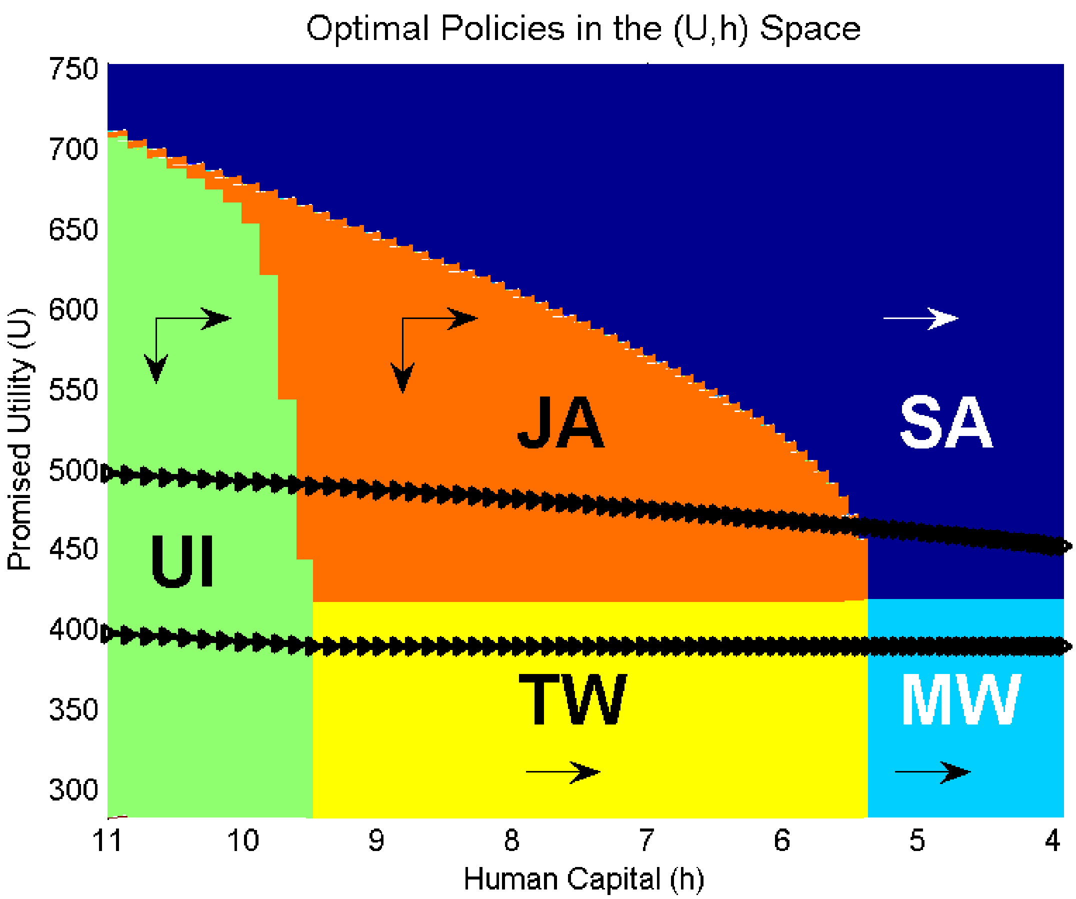

Figure 2: Policies of the optimal welfare program in the (U, h) space. The small arrows indicate the direction of the evolution of U and h under each policy. The two sample paths plotted in the figure correspond to a search-based program ($U_0 = 500$) and a work-based program ($U_0 = 400$).

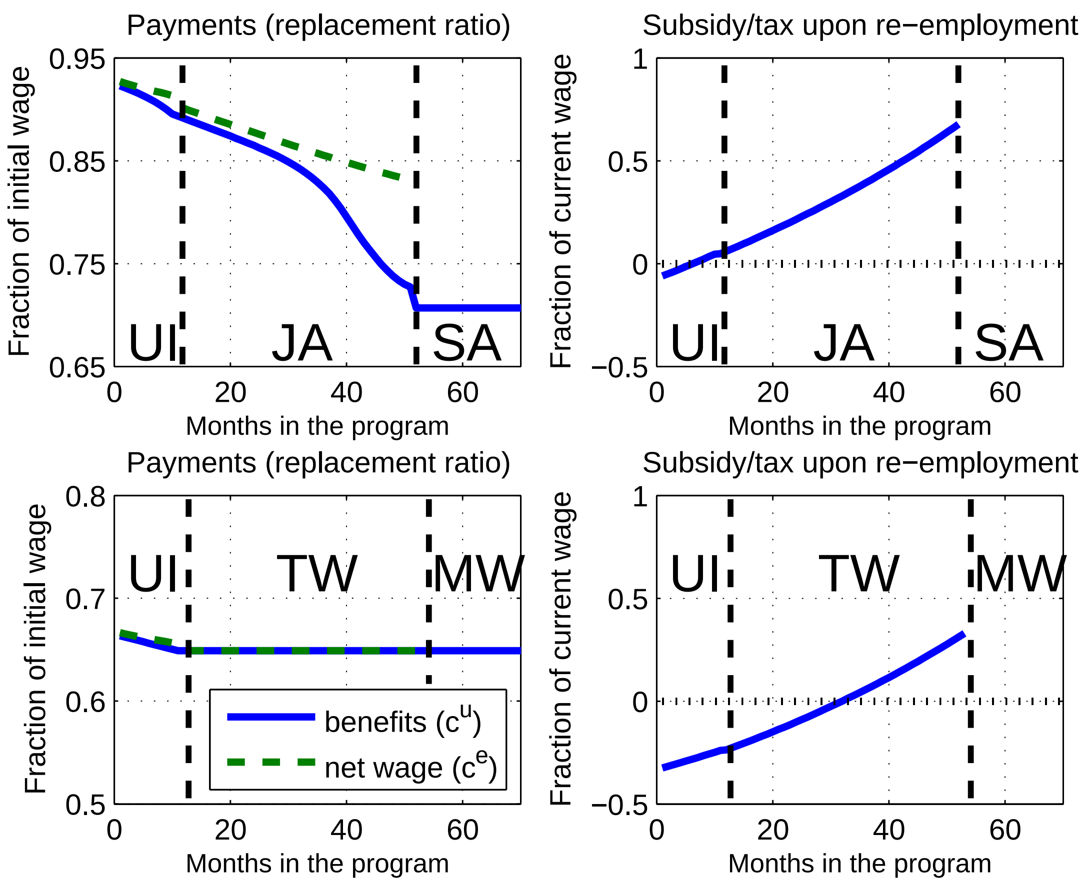

Figure 3: Payments of two optimal welfare programs. The top two panels plot benefits and re-employment tax/subsidy in the search-based program starting at ($U_0 = 500$). The bottom two panels correspond to the work-based program with ($U_0 = 400$).

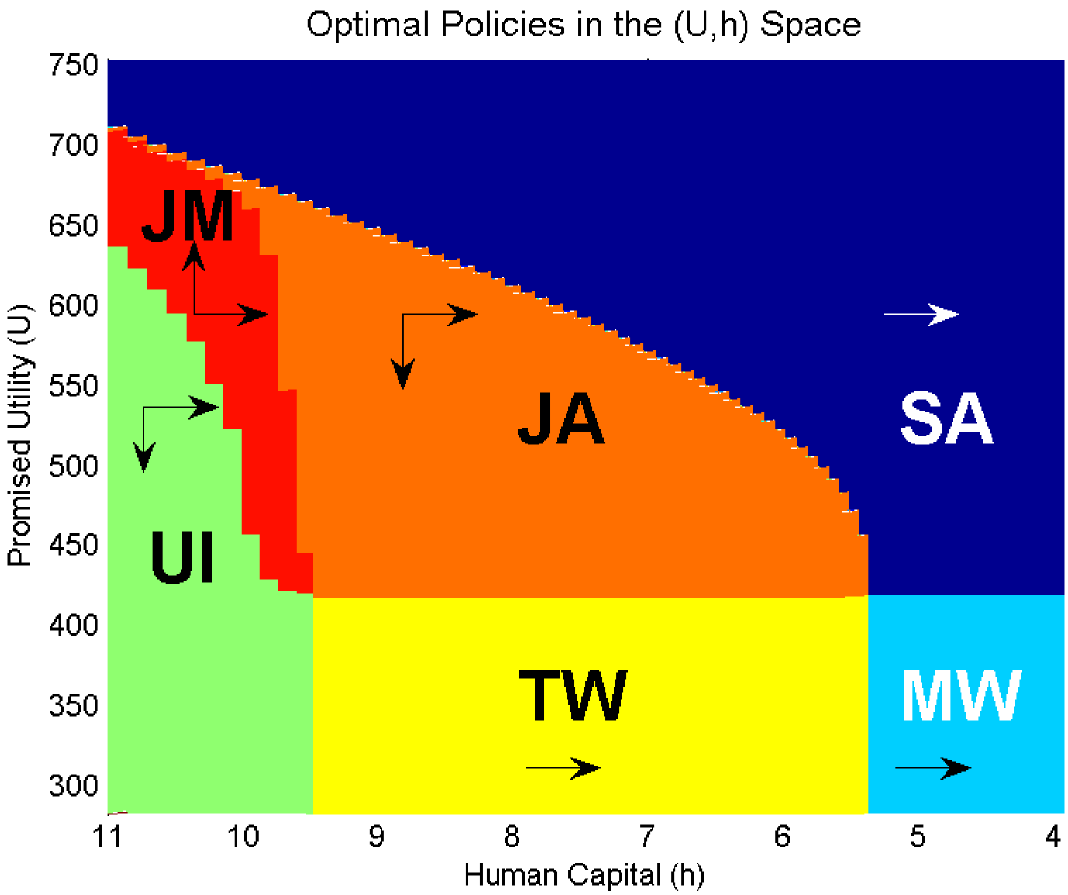

Figure 4: Policies of the optimal welfare program in the (U, h) space in the presence of Job Search Monitoring (JM) with cost κ^m =5 per worker per month. The small arrows indicate the direction of the evolution of U and h under each policy.