Macroeconomic Dynamics (2024), **28**, pp. 1673–1681
doi:10.1017/S1365100523000603

CAMBRIDGE UNIVERSITY PRESS

ARTICLE

Optimal unemployment insurance with behavioral agents

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Abstract

This paper studies how behavioral biases affect the optimal unemployment insurance. I revisit the optimal UI of Landais et al. (2018) and show how the optimal UI formula is modified and leads to novel economic insights. The optimal UI replacement rate is the conventional Baily-Chetty replacement rate, which solves the trade-off between liquidity and job-search incentives, plus a market tightness correction term which shows how welfare is affected by UI through tightness, and plus a behavioral bias correction term, which shows how welfare is affected by UI through job search effort.

Keywords: Biased beliefs; business cycle; optimal insurance; reference dependence

1. Introduction

The main challenge of designing an optimal unemployment insurance is that there exists a problem of moral hazard. The unemployment insurance needs to take the trade-off between the provision of the liquidity and consumption smoothing and the incentives for the unemployed to put a significant effort on searching jobs into account [Baily (1978); Chetty (2006)]. Behavioral economics plays an important role on policy making as it introduces different biases related to the job search behavior and job matching process. Behavioral economics suggests that the agents will form a biased expectation and be loss adverse when evaluating the job offers [Kahneman and Tversky (1979)].

These behavior biases of agents should be considered when designing an optimal unemployment insurance because they affect the efficiency of providing an unemployment insurance. Chetty et al. (2009) have analyzed the conditions of biased beliefs where the sufficient statistic formulas for insurance need to be modified. This paper relies on the recent development of behavioral economics and analyzes the optimal policy with biased agents, which fits well in the behavioral public economics literature. Spinnewijn (2015) showed that agents are overconfident and overestimated how fast they will get a job and analyze the optimal insurance considering such optimistic agents. DellaVigna and Paserman (2005) have analyzed how time-inconsistent preferences lead to a procrastination in job search effort. Paserman (2008) has estimated the magnitude of hyperbolic discounting and showed implications on policy design. DellaVigna et al. (2017) have showed how the agents set a reservation wage based on previous income (reference point) will affect the job search behavior. These empirical results related to the job search effort and job matching process provide implications on designing an optimal unemployment insurance.

This paper builds on Landais et al.'s (2018) extension of Baily (1978) and Chetty (2006) by considering an economy of behavioral agents and derive a behavioral version of the optimal UI. The theoretical approach of this paper is broadly applicable for optimal policy. For example, it could be applied to monetary policy, debt policy, and government purchases, where the optimal policy will then consist of an additional bias correction term.

This paper fills two gaps in the literature. First, even in the absence of market externalities, there was no known general formula for optimal UI in the presence of behavioral agents. Second, there has been no general account of how insurance-incentive trade-off in the presence of moral hazard, labor market responses, and biases jointly shape optimal UI replacement rates. Although this is not the first article to study optimal UI in the presence of biases, it is the first to embed internalities in the optimal UI framework where it accounts for the firms' labor-demand behavior.

Previous papers studying optimal UI with behavioral agents abstract from market correction motives and therefore they omit the effects of market tightness on biases. In addition to the absence of market correction motives, previous papers [such as Spinnewijn (2015)] focus on specific biases. To incorporate internalities and show the implications of the previous findings, this paper follows the sufficient statistics approach to behavioral public finance [Mullainathan et al. (2012); Farhi and Gabaix (2020); Chetty (2015)], which can capture many specific behavioral biases and generates an empirically implementable formula for sufficient statistics for the optimal UI.

The paper is organized as follows. Section 2 develops a behavioral model. Section 3 characterizes the optimal UI formula. Section 4 analyzes bias and optimal UI in three specific matching models. Section 5 provides implications. Section 6 concludes the paper.

2. The model

This setting of labor market and firms is closely following Landais et al.'s (2018). The number of employed workers is l, and the number of unemployed workers is $1 - l$. The number of job opening is v. The job search effort of the unemployed workers is e. The matching function $l = m(e, v)$ represents the number of matches created between firms and workers. The labor market tightness $\theta = v/e$ is the ratio of job openings to job search effort. The job-finding rate per unit of job search effort is $f(\theta) = m(e, v)/e = m(1, \theta)$. The job-finding rate $e \cdot f(\theta)$ is a product of job search effort and the job-finding rate per unit of job search effort. The vacancy-filling rate is $q(\theta) = m(e, v)/v = m(1/\theta, 1) = f(\theta)/\theta$. The elasticity of job finding rate per unit of job search effort with respect to the tightness is $1 - \eta$, and the elasticity of the vacancy-filling rate with respect to tightness is $-\eta$.

The representative firm employs l workers paid a real wage w to produce a consumption good. There are two types of workers in the firm, the number of workers who are producing is n, the number or recruiters is $l - n$ who do not involve in producing the good. The firm's production function is $y(n)$. The number of producers is $n = l \cdot (1 - \rho/q(\theta))$, and the number of recruiters is $l - n = l \cdot \rho/q(\theta)$. The recruiter–producer ratio is $\tau(\theta) = (l - n)/n = \rho/(q(\theta) - \rho)$. The relationship between the number of producing workers and total number of employees can be expressed as $l = (1 + \tau(\theta)) \cdot n$.

The elasticity of recruiter–producer ratio $\tau(\theta)$ with respect to tightness θ is $\eta \cdot (1 + \tau(\theta))$. The market is assumed to be a perfectly competitive market. The firm chooses l to maximize profits $y(l/(1 + \tau(\theta))) - w \cdot l$. The labor demand $l^d(\theta, w)$ gives the optimal number of employees.

$$y'\left(\frac{l^d(\theta, w)}{1 + \tau(\theta)}\right) = (1 + \tau(\theta)) \cdot w$$

The left-hand side of the equation represents the marginal product of an additional producer, while the right-hand side of the equation shows the marginal cost. The first-order condition shows that the marginal product equals the marginal cost $(1 + \tau(\theta)) \cdot w$. Intuitively, the marginal cost of hiring an extra worker increases in both tightness and wage and thus firms decrease the number of hiring.

2.1. Agent's problem

At the beginning, workers are unemployed and search for a job with effort e. The disutility from job search is $\psi(e)$. The disutility function is differentiable, increasing, and convex. The probability of getting a job is $e \cdot f(\theta)$, and the probability of staying unemployed is $1 - e \cdot f(\theta)$.

The consumption when unemployed is c^e and c^u when unemployed, assuming that there is no insurance against unemployment by themselves. The consumption utility is $u(c)$. The utility function is differentiable, increasing, and concave. The utility gain from work is $\Delta U \equiv u(c^e) - u(c^u)$, which shows that there is a positive gain from work as long as the wage is higher that than the unemployment benefits.

I define a sufficient statistic for any difference between perceived expected utility V and true expected utility U, where the agent chooses e to maximize her *perceived* expected utility V taking θ, c^e, c^u as given,

$$V(e) = e\widetilde{f(\theta)}v\left(c^e\right) + \left(1 - e\widetilde{f(\theta)}\right) v\left(c^u\right) - \psi(e)$$

Where the agent perceives the job-finding rate per unit of job search effort as $\widetilde{f(\theta)}$ instead of $f(\theta)$ and $\Delta V \equiv v(c^e) - v(c^u)$.

First-order condition satisfies

$$\widetilde{f(\theta)}\Delta V - \psi'(e) = 0$$

Which gives us the optimal job search effort.

This equation says that a utility-maximizing job seeker searches to the point where the marginal cost of search, $\psi'(e)$, equals the marginal benefit of search, which is the rate at which search leads to a job, $f(\theta)$, times the utility gain from work, ΔU. Since $\psi'(e)$ is increasing in e, $e(f(\theta), \Delta U)$ is increasing in $f(\theta)$ and ΔU. Intuitively, job seekers search more when the job-finding rate is higher and when UI is less generous because in these conditions the marginal benefit of search is higher. The labor supply $l^s(\theta, \Delta U)$ gives the number of workers who find a job when they search optimally. It is defined by

$$l^s(\theta, \Delta U) = e\big(f(\theta), \Delta U\big) \cdot f(\theta).$$

Since $e(f(\theta), \Delta U) \cdot f(\theta)$ is increasing in $f(\theta)$ and ΔU, and $f(\theta)$ is increasing in θ, $l^s(\theta, \Delta U)$ is increasing in θ and ΔU. Intuitively, more workers find a job when tightness is higher because a higher tightness encourages job search and increases the job-finding rate per unit of effort; more workers find a job when UI is less generous because a lower UI encourages job search.

An equilibrium parameterized by a utility gain from work ΔU is a collection of variables $\{e, l, n, c^e, c^u, w, \theta\}$ such that $\{e, l, n, c^e, c^u\}$ is the feasible allocation parameterized by θ and ΔU; the wage is given by the wage mechanism: $w = w(\theta, \Delta U)$; and the labor market tightness equalizes labor supply and labor demand:

$$l^d(\theta(\Delta U), w(\theta, \Delta U)) = l^s(\theta(\Delta U), \Delta U)$$

2.2. Bias across studies

A key feature of this framework is to derive optimal UI formula that is flexible enough to incorporate a variety of possible job-seeker biases while allowing empirically implementable, including but not limited to:

1. Biased beliefs: job seekers overestimate the likelihood of getting a job and have incorrect beliefs on the returns to job search [Spinnewijn (2015)]. As a result, they put too little effort on job search because they perceived a lower marginal utility of searching for job relative to the normative marginal utility and thus they perceive the wrong job finding rate per search effort $f(\theta)$ by overestimating the probability of getting a job. Hence, $\gamma > 0$.

2. Reference-dependent preferences: job seekers set a reservation wage based on previous income, and the reference point is a function of past consumption [DellaVigna et al. (2017)] and thus they may wrongly perceive the gain from getting a job ΔU. Hence, $\gamma > 0$.
3. Present bias: inconsistent preferences lead to a procrastination in job search, and hyperbolic discounting suggests that impatience is negatively correlated to job search effort [DellaVigna and Paserman (2005)] or they do not fully account for the benefits of working when making labor supply decision. Hence, $\gamma > 0$.

Social planner maximizes U and substitutes the first-order condition of agents. I define internalities (marginal bias) γ to be the difference between marginal benefit of job search and marginal utility at e:

$$\gamma = \widetilde{f(\theta)}\Delta V - f(\theta)\,\Delta U$$

The equation says that when $\gamma < 0$, it gives a lower marginal utility from job search and thus the search effort is "too low" relative to their normative preferences. When $\gamma > 0$, it gives a higher marginal utility from job search and thus the search effort is "too high". And when $\gamma = 0$, search effort maximizes utility as the standard model.

2.3. The social welfare function

Social planner maximizes $SW(\theta, \Delta U)$ subject to *actual behavior* and budget constraint:

$$\max SW(\theta, \Delta U) = e\big(f(\theta)\,, \Delta U\big) f(\theta)\,\Delta U + U\big(c^u(\theta, \Delta U)\big) - \psi\big(e\big(f(\theta)\,, \Delta U\big)\big)$$

Subject to government budget constraint:

$$y\left(\frac{l^s(\theta, \Delta U)}{1+\tau(\theta)}\right) = l^s(\theta, \Delta U)\; U^{-1}\big(U\big(c^u(\theta, \Delta U)\big) + \Delta U\big) + \big(1 - l^s(\theta, \Delta U)\big)\, c^u(\theta, \Delta U)$$

The function SW gives the social welfare in a feasible allocation parameterized by θ and ΔU. The consumption level $c^u(\theta, \Delta U)$ ensures that the government's budget constraint is satisfied. The term $U^{-1}(U(c^u(\theta, \Delta U)) + \Delta U)$ gives the consumption of employed workers when unemployed workers consume $c^u(\theta, \Delta U)$, and the utility gain from work is ΔU. The function SW plays a central role in the analysis because it allows us to compute the social welfare in an equilibrium parameterized by ΔU: in that equilibrium, the social welfare is $SW(\theta(\Delta U), \Delta U)$, where $\theta(\Delta U)$ is the equilibrium level of tightness.

3. The optimal UI formula

The social planner chooses UI to maximize social welfare based on agents' true expected utility, subject to the budget constraint. The social planner chooses ΔU to maximize $SW(\theta(\Delta U), \Delta U)$. This section characterizes the behavioral version of optimal UI and generates the optimal UI replacement rate. The formula is expressed in terms of a variety of sufficient statistics.

$$0 = \frac{\partial SW}{\partial \Delta U} + \left(\frac{\partial SW}{\partial \theta} + \underbrace{\frac{\partial SW}{\partial e}\frac{\partial e}{\partial \theta}}_{\textit{No Longer Zero}}\right)\frac{\partial \theta}{\partial \Delta U} + \underbrace{\frac{\partial SW}{\partial e}\frac{\partial e}{\partial \Delta U}}_{\textit{No Longer Zero}}$$

$$\underbrace{0 = \frac{\partial SW}{\partial \Delta U}}_{\text{Baily}-\textit{Chetty formula}} + \underbrace{\frac{\partial SW}{\partial \theta}\frac{\partial \theta}{\partial \Delta U}}_{\textit{Market Correction term}} + \underbrace{\frac{\partial SW}{\partial e}\left(\frac{\partial e}{\partial \Delta U} + \frac{\partial e}{\partial \theta}\frac{\partial \theta}{\partial \Delta U}\right)}_{\textit{Bias Correction term}} \tag{1}$$

The first term at the right-hand side is the standard Baily-Chetty term, which shows the direct effect of UI on welfare. The second term is the market correction term, which shows how welfare is affected by UI through tightness. The third term is the bias correction term, which shows how welfare is affected by UI through job search effort. In contrast to the standard model with unbiased agents, at which a change in ΔU will affect the behavior and these behavioral responses have only second-order impact on the expected utility by the envelope theorem. In other words, the last term in equation (1) would not be zero anymore because the agents do not maximize the true expected utility but instead they maximize their perceived expected utility.

$$\frac{\partial SW}{\partial e} = f(\theta)\,\Delta U - \psi(e) = f(\theta)\,\Delta U - \widetilde{f(\theta)}\Delta V = \widetilde{f(\theta)}\Delta V - \gamma - \widetilde{f(\theta)}\Delta V = -\gamma \tag{2}$$

With unbiased agents, $\gamma = f(\theta)\Delta U - f(\theta)\Delta U = 0$ and thus $\partial SW/\partial e = 0$. When agents are biased ($\gamma \neq 0$), search effort does not maximize utility as the standard model and thus agents misperceive the marginal return to job search effort and exert "wrong" effort given the true return. A change in the effort in response to the change in ΔU or θ creates a first-order change in welfare.

To derive the optimal UI formula, three elasticities are required. The microelasticity of unemployment with respect to UI

$$\varepsilon^m = \frac{\Delta U}{1-l}\frac{\partial e}{\partial \Delta U} f(\theta)$$

measures how job-search effort responds to UI.

The microelasticity measures the percentage change in unemployment when the utility gain from work changes by 1%, taking the change in job seekers' search effort into account and holding tightness unchanged. Hence, the microelasticity measures a how a change in UI affects the unemployment through job search effort in terms of partial equilibrium. There is a negative relationship between job search effort and UI. In other words, the job search effort decreases in UI and thus $\varepsilon^m < 0$.

$$\frac{\partial e}{\partial \Delta U} = \frac{1-l}{\Delta U}\frac{1}{f(\theta)}\varepsilon^m \tag{3}$$

The discouraged-worker elasticity

$$\varepsilon^f = \frac{f(\theta)}{e}\frac{\partial e}{f'(\theta)\,\partial\theta}$$

measures how job-search effort responds to labor market conditions.

The discouraged-worker elasticity measures the percentage change in job search effort when the job-finding rate per unit of effort changes by 1%, holding UI unchanged. There is a positive relationship between job search effort and job-finding rate. In other words, job search effort increases in job-finding rate per effort and thus $\varepsilon^f > 0$.

$$\frac{\partial e}{\partial \theta} = \frac{ef'(\theta)}{f(\theta)}\varepsilon^f = \frac{\left(\frac{1}{\theta}\right)\cdot(1-\eta)\cdot l}{f(\theta)}\varepsilon^f \left(\because 1-\eta = \frac{\theta f'(\theta)}{f(\theta)}\right) \tag{4}$$

The macroelasticity of unemployment with respect to UI

$$\varepsilon^M = \frac{\Delta U}{1-l}\frac{\partial l}{\partial \Delta U}$$

measures how the unemployment rate responds to UI.

The macroelasticity measures the percentage change in unemployment when the utility gain from work changes by 1%, given that both the change in agents' search effort and the tightness in equilibrium are considered. In contrast to the microelasticity, it shows how a change in UI affects the tightness and thus the macroelasticity measures how a change in UI affects the unemployment in term of general equilibrium. On the other hand, it measures how a change in UI affects the wage.

$$\frac{\partial \theta}{\partial \Delta U} = -\frac{1-l}{l}\frac{1}{1-\eta}\frac{\varepsilon^m}{1+\varepsilon^f}\left(1-\frac{\varepsilon^M}{\varepsilon^m}\right)\frac{\theta}{\Delta U} \tag{5}$$

We obtain the bias term satisfying

$$\frac{\partial SW}{\partial e}\left(\frac{\partial e}{\partial \Delta U}+\frac{\partial e}{\partial \theta}\frac{\partial \theta}{\partial \Delta U}\right) = \gamma(\theta, \Delta U)\left[\frac{\left(\frac{1}{\theta}\right)\cdot(1-\eta)\cdot l}{f(\theta)}\varepsilon^f\cdot(-1)\cdot\frac{1-l}{l}\cdot\frac{1}{1-\eta}\cdot\frac{\varepsilon^m}{1+\varepsilon^f}\right.$$
$$\left.\cdot\left(1-\frac{\varepsilon^M}{\varepsilon^m}\right)\cdot\frac{\theta}{\Delta U}+\frac{1-l}{\Delta U}\cdot\frac{1}{f(\theta)}\cdot\varepsilon^m\right]$$

Where internalities satisfy $\gamma(\theta, \Delta U) = f(\theta)\Delta U - \psi'(e)$

$$\frac{\partial SW}{\partial \theta} = \frac{l}{\theta}\cdot(1-\eta)\cdot\phi\cdot w\cdot\left[\frac{\Delta U}{\phi\cdot w}+R\cdot\left(1+\varepsilon^f\right)-\frac{\eta}{1-\eta}\cdot\tau(\theta)\right] \tag{6}$$

$$\frac{\partial SW}{\partial \Delta U} = (1-l)\cdot\frac{\phi\cdot w}{\Delta U}\cdot\varepsilon^m\cdot\left[R-\frac{l}{\varepsilon^m}\cdot\frac{\Delta U}{w}\cdot\left(\frac{1}{U'(c^e)}-\frac{1}{U'(c^u)}\right)\right] \tag{7}$$

where ϕ is the harmonic mean of workers' marginal consumption utilities:

$$\frac{1}{\phi} = \frac{l}{U'(c^e)}+\frac{1-l}{U'(c^u)}$$

By plugging in equations (2)–(7) into the first-order condition (1) and divide the resulting equation by $(1-\eta)\cdot\phi\cdot w\cdot\varepsilon^m/\Delta U$, we obtain the optimal UI replacement rate formula satisfying

$$R = \underbrace{\frac{l}{\varepsilon^m}\frac{\Delta U}{w}\left(\frac{1}{U'(c^e)}-\frac{1}{U'(c^u)}\right)}_{Baily-Chetty\ term}+\underbrace{\left(1-\frac{\varepsilon^M}{\varepsilon^m}\right)\frac{1}{1+\varepsilon^f}\left(\frac{\Delta U}{w\phi}+\left(1+\varepsilon^f\right)R-\frac{\eta}{1-\eta}\tau(\theta)\right)}_{Market\ correction\ term}$$
$$+\underbrace{\gamma\left[\frac{1}{f(\theta)}\frac{1}{\phi w}-\frac{\varepsilon^f}{1+\varepsilon^f}\frac{1}{f(\theta)}\left(1-\frac{\varepsilon^M}{\varepsilon^m}\right)\right]}_{Bias\ Correction\ term} \tag{8}$$

The first term at the right-hand side is the standard Baily-Chetty term, which shows the direct effect of UI on welfare. The second term is the market correction term, which shows how welfare is affected by UI through tightness. The market correction term is the product of the effect of UI on tightness, measured by the elasticity wedge, and the effect of tightness on welfare, measured by the efficiency term. Hence, the market correction term is positive when an increase in UI pushes tightness toward its efficient level. The third term is the bias correction term, which shows how welfare is affected by UI through job search effort. In contrast to the standard model with unbiased agents, at which a change in ΔU will affect the behavior and these behavioral responses have only second-order impact on the expected utility. In other words, the last term in equation (1) would not be zero anymore because the agents fail to maximize the true expected utility. The formula is similar to numerous optimal tax formulas obtained in the presence of both externalities and internalities [Allcott et al. (2019); Allcott et al. (2014)]: They have an additive structure with a standard term plus externalities term and internalities term. As in many optimal tax formulas, the right-hand side of equation (8) is endogenous to UI. Even though the formula characterizes optimal UI only implicitly, it is useful because it transparently shows the economic forces at play and because it gives the conditions under which the optimal UI replacement rate is above or below the Baily-Chetty replacement rate.

In the special case with no market externalities and no internalities, equation (8) gives the Baily-Chetty formula. When there is market externalities and no internalities, we recover the optimal UI condition in Landais et al. (2018).

Landais et al. (2018) show a special case where UI has no adverse effect on unemployment ($\varepsilon^M = 0$), and complete insurance is never optimal. Hence, the optimal replacement rate is below one. However, when bias term is nonzero, equation (3) shows an interesting special case. Set $\varepsilon^M = 0$ and $R = 1$ (which implies $\Delta U = 0$) in formula (3). It gives $1 = 1 - \eta \cdot \tau(\theta)/\left[\left(1+\varepsilon^f\right)\cdot(1-\eta)\right] + \gamma\left[1/(\phi w f(\theta)) - \varepsilon^f/\left(f(\theta)\left(1+\varepsilon^f\right)\right)\right]$, which may hold if the second term and third term at the right-hand side are equal. Hence, $R = 1$ could be optimal.

4. Bias and optimal UI in three specific matching models

The optimal UI formula shows that the optimal UI replacement depends on the effect of UI on tightness, which means the sign of the elasticity of wedge plays an important role on determining the optimal UI because it appears in both market correction term and bias correction term. There are three matching models that create different signs of the elasticity wedge and thus it affects the optimal UI replacement rate.

4.1. The standard model of Pissarides (2000)

Landais et al. (2018) show that if the wage is determined by bargaining, an increase in UI lowers ΔU, which leads to a rise in wages. In other words, an increase in UI raises job seeker's bargaining power over wages and thus lead to a downward shift of labor-demand curve. As a result, the elasticity wedge is negative. Recall that the bias term satisfies $\gamma\left[1/(f(\theta)\phi w) - \left(1 - \varepsilon^M/\varepsilon^m\right)\cdot\varepsilon^f/\left(\left(1+\varepsilon^f\right)f(\theta)\right)\right]$, where $1 - \varepsilon^M/\varepsilon^m$ is the elasticity wedge. Since the elasticity wedge is negative, the bias term is larger compared to the cases where the elasticity wedge is smaller than or equal to zero. In addition to how biased job-seekers' search effort is affected by ΔU and θ (captured by the bias γ), the bias is larger because of the negative sign of elasticity wedge. Intuitively, when wage is determined by bargaining, biased job seekers tend to set an inefficiently high wage based on past income (reference-point), regardless of the labor market condition [Feldstein and Poterba (1984); Hogan (2004)]. Hence, $\gamma\left(1 - \varepsilon^M/\varepsilon^m\right)$ represents part of the biases which are related to the job matching process. The intuition is supported by empirical evidence of behavioral economics in which reference dependence is one of the behavioral factors related to job searching behavior.

Alternatively, $\gamma\left(\varepsilon^f/\left(1+\varepsilon^f\right)\right)$ represents part of the biases, which are related to the job searching behavior of job seekers such as overconfidence. Intuitively, when ε^f is zero, tightness has no effects on job search effort, which become the overconfidence term in Spinnewijn (2015), where he considers overconfidence only. However, since ε^f is positive, $\gamma\left(\varepsilon^f/\left(1+\varepsilon^f\right)\right)$ is smaller than the case where market tightness effect on job search effort is eliminated. In other words, Spinnewijn (2015) overestimates the bias on job search effort without taking market tightness and other related biases into account.

4.2. The fixed-wage model of Hall (2005)

In contrast to the standard model of Pissarides (2000), UI has no effects on the fixed wage and thus UI does not affect the labor-demand curve. Hence, the elasticity wedge is zero and thus the bias term becomes $\gamma(1/(f(\theta)\phi w)$. It is interesting to contrast this result with the bias term in the standard model, for which $\gamma\left[1/(f(\theta)\phi w) - \left(1 - \varepsilon^M/\varepsilon^m\right)\cdot\varepsilon^f/\left(\left(1+\varepsilon^f\right)f(\theta)\right)\right]$.

The intuition is as follows. When wage is fixed, biases related to wage bargaining or job matching process are no longer relevant as the bias term is independent to the discouraged-worker elasticity ε^f and the elasticity wedge $\left(1-\varepsilon^M/\varepsilon^m\right)$. In other words, $\gamma\left(1-\varepsilon^M/\varepsilon^m\right)$ is zero which means the bias term is lower compared to the standard matching model. It suggests that the optimal UI is higher than the that of the standard matching model.

4.3. The job-rationing model of Michaillat (2012)

Landais et al. (2018) show that UI does not affect fixed wage, and the elasticity wedge is positive. Since the elasticity wedge is positive, the bias term is smaller than that of the standard model. In this model, the real wage is inefficiently high which exceeds the equilibrium level in the job rationing model. Intuitively, it could be explained by the reference-dependent bias where the reference-point (High real wage) is higher than the benefits level during unemployment, which decrease the bias level. In addition, $\gamma\left(1-\varepsilon^M/\varepsilon^m\right)$ represents part of the biases, which are related to the job matching process and it lowers the bias term. Hence, the misperception on the higher real wage corrects part of the bias that is generated by job matching process. It would be interesting to investigate whether if a higher reference point, compared to past income, affects the job search behavioral and/or job matching process. Optimal UI is therefore higher than that of the standard model of Pissarides (2000).

5. Implications

In the United States, when unemployment is high, the unemployment insurance is more generous compared to the case where the unemployment is low. This policy raises a huge debate, and the results of this paper provide implications on whether this policy is desirable in terms of welfare optimization.

The optimal UI formula in this paper shows that the estimates of variables play an important role in determining the optimal UI replacement rate and most importantly the sign of the bias correction term, efficiency term, and elasticity wedge are the key factors to generate the optimal UI replacement rate. There is a growing empirical research on these relevant estimates. When the economy experiences slumps, tightness is inefficiently low, and the tightness is inefficiently high when it experiences booms. In addition, there is a positive relationship between UI and tightness. In other words, an increase in UI will lead to an increase in tightness. When the elasticity wedge is positive, an increase in UI will lead to an increase in tightness, which means that the elasticity wedge $\left(1-\varepsilon^M/\varepsilon^m\right)$ is positive. Empirical evidence as mentioned before has shown that the marginal bias is positive. However, it is important to estimate this term $\left[\gamma\left[1/(f(\theta)\phi w)-\left(1-\varepsilon^M/\varepsilon^m\right)\cdot\varepsilon^f/\left(\left(1+\varepsilon^f\right)f(\theta)\right)\right]\right]$, at which the sign is the key factor to determine the optimal policy during the business cycle. There is a large amount of empirical studies on estimating the value of ε^f, but it suggests that the effects of labor market condition (job-finding rate) on job search effort are small. Thus, it is reasonable to set ε^f equals zero. This suggests that the bias correction term is positive.

When the economy is in slumps, the market correction term is positive and the bias correction is positive and thus the optimal UI replacement rate is higher than the Baily-Chetty replacement rate.

6. Conclusion

This paper generalizes the main results of the traditional theory of optimal UI to allow for a large class of behavioral biases. The analysis revisits the classical results and encompasses the traditional arguments of Baily-Chetty and Landais et al. (2018). The optimal UI replacement rate is the conventional Baily-Chetty replacement rate, which solves the trade-off between liquidity and job-search incentives, plus a market correction term, and plus a bias correction term. The formula shows that biases play an important role on determining the optimal replacement rate, and the framework is applicable to other public finance problem.

References

Allcott, H., B. Lockwood and D. Taubinsky (2019) Regressive sin taxes, with an application to the optimal soda tax. *Quarterly Journal of Economics* 134(3), 1557–1626.

Allcott, H., S. Mullainathan and D. Taubinsky (2014) Energy Policy with Externalities and Internalities. *Journal of Public Economics* 112, 72–88.

Baily, M. N. (1978) Some aspects of optimal unemployment insurance. *Journal of Public Economics* 10(3), 379–402.

Chetty, R. (2006) A general formula for the optimal level of social insurance. *Journal of Public Economics* 90(10-11), 1879–1901.

Chetty, R. (2015) Behavioral economics and public policy: A pragmatic perspective. *American Economic Review* 105(5), 1–33.

Chetty, R., A. Looney and K. Kroft (2009) Salience and taxation: Theory and evidence. *American Economic Review* 99(4), 1145–1177.

DellaVigna, S., A. Lindner, B.ÁZS Reizer and F. Johannes (2017) Schmieder, reference-dependent job search: Evidence from Hungary. *The Quarterly Journal of Economics* 132(4), 1969–2018.

DellaVigna, S. and M. D. Paserman (2005) Job search and impatience. *Journal of Labor Economics* 23(3), 527–588.

Farhi, E. and X. Gabaix (2020) Optimal taxation with behavioral agents. *American Economic Review* 110(1), 298–336.

Feldstein, M. and J. Poterba (1984) Unemployment insurance and reservation wages. *Journal of Public Economics* 23(1-2), 141–167.

Hall, R. E. (2005) Employment fluctuations with equilibrium wage stickiness. *American Economic Review* 95(1), 50–65.

Hogan, V. (2004) Wage aspirations and unemployment persistence. *Journal of Monetary Economics* 51(8), 1623–1643.

Kahneman, D. and A. Tversky (1979) Prospect theory: An analysis of decision under risk. *Econometrica* 47(2), 263–291.

Landais, C., P. Michaillat and E. Saez (2018) A macroeconomic approach to optimal unemployment insurance: Theory. *American Economic Journal: Economic Policy* 10(2), 152–181.

Michaillat, P. (2012) Do matching frictions explain unemployment? Not in bad times. *American Economic Review* 102(4), 1721–1750.

Mullainathan, S., J. Schwartzstein and W. J. Congdon (2012) A reduced-form approach to behavioral public finance. *Annual Review of Economics* 4(1), 511–540.

Paserman, M. D. (2008) Job search and hyperbolic discounting: Structural estimation and policy evaluation. *The Economic Journal* 118(531), 1418–1452.

Pissarides, C. A. (2000) *Equilibrium Unemployment Theory*, 2nd ed. Cambridge: MIT Press.

Spinnewijn, J. (2015) Unemployed but optimistic: Optimal insurance design with biased beliefs. *Journal of the European Economic Association* 13(1), 130–167.

Cite this article: Yeung HC (2024). “Optimal unemployment insurance with behavioral agents.” *Macroeconomic Dynamics* **28**, 1673–1681. https://doi.org/10.1017/S1365100523000603