Minimum search effort requirement vs aggressive benefit cuts - from the view of the worker

MMMoLM report

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Abstract

This paper examines whether a minimum search effort requirement can achieve the same reduction in expected unemployment for low-productivity workers as an aggressive benefit cut, but at a lower utility cost to the individual. Using an extended McCall model with endogenous search effort, time dependency, and worker heterogeneity, I compare the two policies, calibrated to yield identical exit probabilities. The results show that a search requirement imposes a smaller utility loss and avoids penalizing high-productivity individuals. This highlights the potential of non-monetary active labor market policies to support fiscally sustainable systems with high benefit levels and strong insurance value.

Contents

1 Introduction

Striking the right balance between insurance and incentives is an important aspect of designing unemployment insurance (UI) policies. Offering financial support in the case of unemployment tends to make unemployment more attractive, and thus the incentive to actively search for a job during unemployment tends to decrease in the extend of the UI. This is studied in e.g. Van Doornik, Schoenherr, and Skrastins 2023 who show that access to UI eligibility increases layoffs, based on a reform of the UI system in Brazil. Lalive 2008 also studies a large extension of the possible benefit duration (PBD) in Austria using a regression discontinuity design. He finds this extension increases the length of unemployment durations by 0.9 for men and 0.32 per additional week of benefits.

In reality, individuals are heterogeneous and therefore differ in their motivation to actively search for a job when unemployed. Even with generous unemployment insurances, some people are still motivated to actively search for a job while others are less motivated. The aim of a UI-system is thus to provide a financial insurance while ensuring the least motivated still actively search for a job. This leaves policy makers with a trade off: how can an UI scheme be implemented while still maintaining a high incentive to find a job? A straight forward policy would be to financially worsen the UI-scheme by e.g. lowering the benefit it self or the PBD. These sort of policies often achieve the goal of increasing incentives, but implies a worse financial situation in the case of unemployment. This hurts risk-adverse individuals through two effects, namely the direct effect of lower consumption, but also the threat-effect that is effective for risk-adverse individuals. Another way to induce work incentives without financially worsening the UI, is through active labor market policies (ALMP), such as minimum search effort requirements, workfare, education, etc., which can me more or less productive dependent on the specific policy.

Such policies have become more and more popular in the last decades, and so has the research interest in them. With a pure-empirical, IV-approach, Arni and Schiprowski 2019 studies search requirements in Germany, and finds a decrease in unemployment duration of 2-4% when imposing a requirement of an extra job application per month. Likewise, Maibom, Rosholm, and Svarer 2017, also using a pure empirical approach, studies the effect on 3 different ALMP's: group meetings, individual meetings and an activation wall (threat of workfare). They find that only statistically significant results for the individual meetings, which have a 5% positive effect on employment. With a more theoretical approach, Fredriksson and Holmlund 2006 compares 3 different policies of a lower benefit duration, workfare requirements and monitoring-and-punishment in a search-and-matching model calibrated to fit US-data on wage replacement rate. They find the monitoring-and-punishment policy to be the most effective, and workfare to be inferior to the other two policies. Andersen and Svarer 2014 studies the effect of workfare requirements in a search-and-matching model similar to the one in Fredriksson and Holmlund 2006, calibrated on danish data. They find, that workfare requirements, even when unproductive increases the search effort and lead to an actual welfare improvement.

In this paper, a minimum search effort requirement (search effort floor) is studied. Specifically, a policy of imposing a minimum search effort requirement is implemented and evaluated against a policy of lowering the benefit aggressively. This is studied in a McCall model extended to include endogenous search effort, time dependency and heterogeneous workers in the form of a low (unproductive = high search costs) type and a high (productive = low search costs) type. The wage distribution has been calibrated on UK data. Further, the benefit scheme in the baseline situation, is set to mimic a very utilized version of the UK UI-system. The aim of this paper has been to make a theoretical analysis of the consequences for labor market outcomes arising from a search effort floor compared to a cut in benefits, and thus to examine if it is possible to ensure a level of search effort from the less motivated (low type) without imposing a harsh punishment to the already motivated (high type).

Based on a calibration ensuring the same possibility of having exited unemployment after two years for the low type, I find that the search effort floor reduces the utility in unemployment less that the aggressive benefit cut. Furthermore, the search effort floor has larger short run effects on probability of finding and accepting a job stemming from a combination of effects on search effort and reservation wages. However, the aggressive cut has larger long run effects.

2 Model

In the following section, the McCall model used to perform the analysis is developed theoretically and laid out in detail. The model largely follows the model and logic developed in section 2.2 of chapter 6 in Oswald 1988.

2.1 The McCall job search model

Time is discrete, the time horizon of the individual is infinite and the world consist initially of a single, unemployed worker. Each period, if unemployed, the worker has a probability of getting a job offer associated with a wage drawn from a known distribution. The probability of getting a job offer is dependent on the level of search effort, costly to the worker. When unemployed, the worker receives a monetary benefit from the public sector of a known size. This setup leaves the agent with a choice on both the intensive and extensive margin. That is, the agent chooses how much search effort to exert (intensive margin) and if a job offer arrives, whether to accept it or not (the extensive margin). If she chooses not to accept, she stays unemployed for another period, and waits to see if a job offer in a future period arrives with a high enough wage for the worker to find working valuable. If this is the case, then the worker opts out of unemployment. The worker is forward looking and discounts the expected value of the future. More discussion on the dynamics of the model follow below and in section 3.

The model starts with an unemployed worker in $t = 0$. In every period the worker chooses a level of search effort to exert, e_t in the range $e_t \in [0, 1]$. The level of effort determines the probability of receiving a job offer, p_t via the search production function $f(e_t)$ such that

$$p_t = f(e_t) \tag{1}$$

In every period, the agent can only receive a maximum of one single job offer.

Exerting effort is costly to the agent and is determined by the cost function $c(e_t)$. The cost function is assumed to have the following properties, $c'(e_t) > 0$ $c''(e_t) > 0$, $c(0) = 0$ (no fixed costs of searching) and (f^{-1} is convex.

If the worker accepts a job offer, it comes with a wage, w, which is drawn from a known wage

offer distribution, with CDF $F(w)$.
When not working, the worker receives a monetary benefit, b_t of known size from the public sector. Note that this benefit is time dependent to allow for changing benefits. The agent discounts the future at a constant rate determined by the discount factor β.
Flow utility from consumption is determined by the utility function $u(b_t) = u(w)$ when receiving the unemployment benefit and the labor market income respectively. Hence, the agent is indifferent between income from working and income from public benefits. [1]

$$u(b_t) = u(w) \quad for \quad b_t = w$$

When a job is accepted, the worker has that particular job forever after. The value of accepting the job in period $t+1$ that pays a wage, w is thus given as

$$U^E_{t+1}(w) = u(w) + \beta U^E_{t+2}(w)$$

Where superscript E denotes "Employment". The interpretation is clear; the value of employment today is given as the utility derived from the wage today, $u(w)$ plus the future, discounted value of employment, $\beta U^E_{t+2}(w)$. This equation is dynamic, with $U^E_{t+2}(w)$ containing $U^E_{t+3}(w)$ and so on. Since the environment is constant after accepting the job, $u^E_{t+1}(w) = u^E_{t+2}(w)$, and the job with the specific wage is held forever, we can simplify the value of employment to

$$U^E_{t+1}(w) = \frac{u(w)}{1-\beta} \tag{2}$$

On the other side, the value of unemployment is given as:

$$U^U_t = \max_{e_t}(u(b_t) - c(e_t) + \beta \left(f(e_t) \int \max \left(U^E_{t+1}(w), U^U_{t+1} \right) dF(w) + (1 - f(e_t)) U^U_{t+1} \right)$$

Where superscript U denotes unemployment. That is, the value of unemployment is the flow utility from UI benefits, $u(b_t)$ minus the costs of searching for a job, $c(e_t)$ plus the discounted expected value of a potential job offer. The first part of the large parenthesis is the value of a job offer that comes with probability, $f(e_t)$. Here the agent chooses whether to accept or not based on the expected future value of both options. The second part if

[1] The model could easily be extended to include different utilities from labor market income and public benefits, but as it irrelevant for the scope of this particular paper, it is not modeled for simplification.

simply the value of unemployment that arises if a job offer does not arrive, with probability $(1-f(e_t))$. The agent chooses his search effort to maximize this value of unemployment, U_t^U

Under the assumption that $p_t = f(e_t)$ is monotonic, we can rewrite the value function in terms of p_t as:

$$U_t^U = \max_{p_t}\left(u(b_t) - \tilde{c}(e_t) + \beta\left(p_t \int \max\left(U_{t+1}^E(w), U_{t+1}^U\right) dF_t(w) + (1-p_t)\, U_{t+1}^U\right)\right)$$

Where $\tilde{c}(p_t)$ is the composite of the search costs and the inverse of the search production function $\tilde{c}\,(p_t) = c\,(f^{-1}\,(p_t))$. This reformulation implies that the problem can be solved by choosing the probability of exiting unemployment p_t instead of the effort chosen (functional form is discussed in 3.2.2). As the value of employment is strictly increasing in the wage, w, there is a unique wage which will make the worker indifferent between staying unemployed for another period and take the job. This wage is labeled the "reservation wage" and is denoted w_{t+1}^* for wages starting in period $t+1$. Using the reservation wage and some algebraic manipulation, the value of unemployment can now be written as:

$$U_t^U = \max_{p_t,\, w_{t+1}^*} u\,(b_t) - \tilde{c}\,(p_t) + \beta\left(p_t \int_{w_{t+1}^*}^{\infty} U_{t+1}^E(w) - U_{t+1}^U dF(w) + U_{t+1}^U\right) \tag{3}$$

Where the part $U_{t+1}^E(w) - U_{t+1}^U$ is the net gain from taking the job, taking into account the foregone utility from unemployment. The integral has lower support in w_{t+1}^* as the net benefit-part only becomes relevant for jobs with wage offers above the reservation wage (those the agent accepts).

Any wage such that $U_{t+1}^E(w) \geq U_{t+1}^U$ is accepted, implying that the reservation wage must satisfy the condition $U_{t+1}^E(w_{t+1}^*) = U_{t+1}^U$, meaning that reservation wage is the exact wage that makes the agent indifferent between unemployment and employment. Using (2) we get:

$$u(w_{t+1}^*) = (1-\beta)U_{t+1}^U \tag{4}$$

Given the reservation wage, we can write the first order conditions that determine optimal search by taking the derivative wrt. p_t

$$\tilde{c}'\,(p_t^*) = \beta\left(\int_{w_{t+1}^*}^{\infty} U_{t+1}^E(w) - U_{t+1}^U dF(w)\right)$$

or by multiplying with the inverse of $\tilde{c}$:

$$p_t^* \prime = \tilde{c}'^{-1}\left(\beta\left(\int_{w_{t+1}^*}^{\infty} U_{t+1}^E(w) - U_{t+1}^U dF(w)\right)\right)$$

Using that $u(w) = (1-\beta)U_{t+1}^E$ and $u\left(w_{t+1}^*\right) = (1-\beta)U_{t+1}^U$ we can write the optimal probability of exiting unemployment as

$$p_t^* = \tilde{c}'^{-1}\left(\frac{\beta}{1-\beta}\left(\int_{w_{t+1}^*}^{\infty} u(w) - u\left(w_{t+1}^*\right) dF(w)\right)\right)$$

Given the optimal search effort, this will pin down the reservation wage in period t. By combining equation(3) and (4), we arrive at an expression for the reservation wage, w_t^* in period t as a function of the given, optimal search effort (=probability of exit) in t, p_t* and the reservation wage in the next period, w_t^*:

$$u\left(w_t^*\right) = (1-\beta)\left(u\left(b_t\right) - \tilde{c}\left(p_t^*\right) + \beta\left(p_t^* \int_{w_{t+1}^*}^{\infty} U_{t+1}^E(w) - U_{t+1}^U dF(w) + V_{t+1}^U\right)\right)$$

Finally, using (2) and (4), we can rewrite this to:

$$u\left(w_t^*\right) = (1-\beta)\left(u\left(b_t\right) - \tilde{c}\left(p_t^*\right)\right) + \beta u\left(w_{t+1}^*\right) + \beta\left(p_t \int_{w_{t+1}^*}^{\infty} u(w) - u\left(w_{t+1}^*\right) dF(w)\right)$$

2.2 Steady state

We have now developed the model over the period where policies can affect the different parameters of the model, and thus where the outcomes are time dependent. Suppose that at some point, T, the model reaches a steady state environment where all parameters remains constant for all future periods, $t \geq T$. In this specific analysis, this means, that the neither the benefit nor the search effort floor change afterwards this time, T (see section 3). When the environment becomes completely stationary, it must be the case, that the reservation wage stays constant: $w_T^* = w_{T+1}^* = w_{T+k} \quad \forall \quad k \geq 0$. Using the steady state, we can write the FOC's of the steady state as:

$$p_T^* = \tilde{c}'^{-1}\left(\frac{\beta}{1-\beta}\left(\int_{w_T^*}^{\infty} u(w) - v\left(w_T^*\right) dF(w)\right)\right) \tag{5}$$

and the reservation wage in steady state as:

$$u\left(w_T^*\right) = (1-\beta)\left(u\left(b_T\right) - \tilde{c}\left(p_T^*\right)\right) + \beta u\left(w_T^*\right) + \beta\left(p_T^* \int_{w_T^*}^{\infty} u(w) - u\left(w_T^*\right) dF(w)\right)$$

Which can be rearranged to

$$u\left(w_T^*\right) = u\left(b_T\right) - \tilde{c}\left(p_T^*\right) + \frac{\beta}{1-\beta}\left(p_T^* \int_{w_T^*}^{\infty} u(w) - u\left(w_T^*\right) dF(w)\right) \tag{6}$$

Equation (5) and (6) forms a system of 2 equations with the two unknowns, w_T^* and p_T^*. To completely solve the model for both the steady state and all periods from $0 \leq t < T$, one first solves the steady state values. With these in hand, one can use backward induction and recursively calculate all prior periods down to $t = 0$ with each period taking into account the next period.

2.3 Hazard and survival functions

It is possible to calculate the probability each period of the worker finding a job that she accepts. This depends on both the probability of receiving a job offer, $p_t(e)$ and the distribution of wages, $F(w^*)$. The probability of exiting unemployment at time t can thus be calculated as:

$$h_t = p_t\left(1 - F_t\left(w_{t+1}^*\right)\right)$$

Directly related to the hazard rate is the survival function, that calculates the cumulated probability of having 'survived' unemployment until a given point in time. With a positive hazard rate, the survival function is is decreasing in time, as it becomes increasingly unlikely that the worker has not been offered a job above the reservation wage in any of the prior periods. This can be calculated as:

$$S_t = \Pi_{k=1}^{t}\left(1 - h_k\right) \tag{7}$$

3 Implementation

In the following section, the implementation of the model developed in 2 Model will be laid out in detail, and a description of the different policies analyzed along the choices for functional forms, worker heterogeneity, parameter values and policies will be described. Furthermore, the analysis takes compares the policies for two different worker types that differ in their costs

3.1 Policies

As laid out in Introduction, this paper analyzes 3 different UI-schemes which differ in their way of sanctioning the unemployed. The aim is study how a minimum search effort requirement affects labor market outcomes, and how this compares to a more traditional, cut of the public UI benefits. To do this, 3 different policy schemes are set up to enable comparison. These are laid out below:

- Policy 1 - Baseline model
- Policy 2 - Search effort floor
- Policy 3 - Aggressive benefit cut

Policy 1 - The baseline model is characterized by a benefit of size b, which is then later reduced to $b_{cutoff} < b$, which is then the size of the benefit for the rest of eternity. Other than this benefit cut, no policies are implemented. This set-up act as the baseline for the model, to which the two policies of a minimum search requirement (search effort floor) and an aggressive benefit cut is compared against.

Policy 2 - Search effort floor is characterized by having a minimum search requirement of e_{min} implemented, such that the individual cannot exert effort below this level. This particular policy is meant to mimic various active labor market policies, that require benefit claimants to actively search for a job to stay eligible for the benefit. Such non-monetary requirements could be a minimum of job applications per month, mandatory meetings with caseworkers, etc. see e.g. Maibom, Rosholm, and Svarer 2017. Note, that the baseline model effect of the lowered benefit from b to b_{cutoff} in $t = 52$ is still active in this policy.

Policy 3 - Aggressive benefit cut is similar to the baseline model, but with a very aggressive benefit cut, where the benefit is cut to $b_{cutoff,aggresive}$ set at 10% of the average wage corresponding to an 80% decrease from the private insurance level, b. In this scheme, there is no effort floor, and the aggressive cut is thus the only policy.

3.2 Functional forms

As described in section 2 section, there are multiple choices to be made when aiming to perform actual analysis in a theoretical model like the McCall model. Specifically, one has to settle on a functional form for the benefit scheme, cost of search effort, probability of receiving a job offer as a function of exerted effort and the distribution of wage offers.

3.2.1 Cost of effort and worker heterogeneity

The cost of exerted effort follows the form:

$$c(e_t) = k\frac{e^{1+\kappa}}{1+\kappa}$$

where e_t is the exerted effort in period t

This functional form is convex and is determined by the two parameters k and κ. k acts simply as a scaling parameter whilst κ determines the convexity of the costs. Note that a higher κ implies a lower cost of search effort. The convex form of the cost function implies that a marginal increase in effort comes at a lower increase in costs when exerting low efforts compared to high efforts. This modeling is chose to reflect diminishing returns to scale from searching. In other words, the worker has small utility costs from writing the first job application, but when she has written many, it becomes increasingly more costly for her to write an extra one. This assumption does not seem unreasonable, if one thinks of the opportunity cost of forgone leisure, that more intense searching imply.

However, this line of thinking is not necessarily dominating potential, opposite effects. it could also be the case, that it becomes 'easier' to write job application number 10 compared to number 1, as the applicant have attained some particular skills in job searching, that makes her more efficient and hence lowers the marginal cost. In practice, either effect — or a combination of both — may be at work.

The source for worker heterogeneity is implemented in the cost functions as different sizes of the parameters. Specifically a productive "high type" and an unproductive "low type" is introduced. They differ in k and κ, where the "high type" has $k = 10$ and $kappa = 4$ while the "low type" has $k = 100$ $\kappa = 4$.

$$c(e_t)_{high} = k_{high}\frac{e^{1+\kappa_{high}}}{1+\kappa_{high}} = 10\frac{e^{1+4}}{1+4}$$

$$c(e_t)_{low} = k_{low}\frac{e^{1+\kappa_{low}}}{1+\kappa_{low}} = 100\frac{e^{1+4}}{1+4}$$

The specific values of k and κ are chosen arbitrarily to suit the analysis in a way, such that visible outcomes arise given the scaling of wages, benefits, search effort, etc. If one wanted to ensure external valid results from the analysis, these parameters should naturally be calibrated to fit moments of the real world.

Furthermore, the aim to model an "unproductive" and a "productive" type could also have been modeled in different ways than high and low costs of searching. E.g different returns to probability of getting job offers from exerting search effort is an opportunity, which could be resembling professional network. It could also have been modeled as different discounting rates, different wage offer distributions, etc. Lastly, both the assumption of only two worker types, in addition to the policy maker being able to perfectly observe their heterogeneity, is very unrealistic. However, as register data becomes better and more detailed, individual heterogeneity becomes easier to observe, and hence targeting specific groups with tailored policies become more realistic. The cost functions for the two worker types in this 'world' are illustrated below:

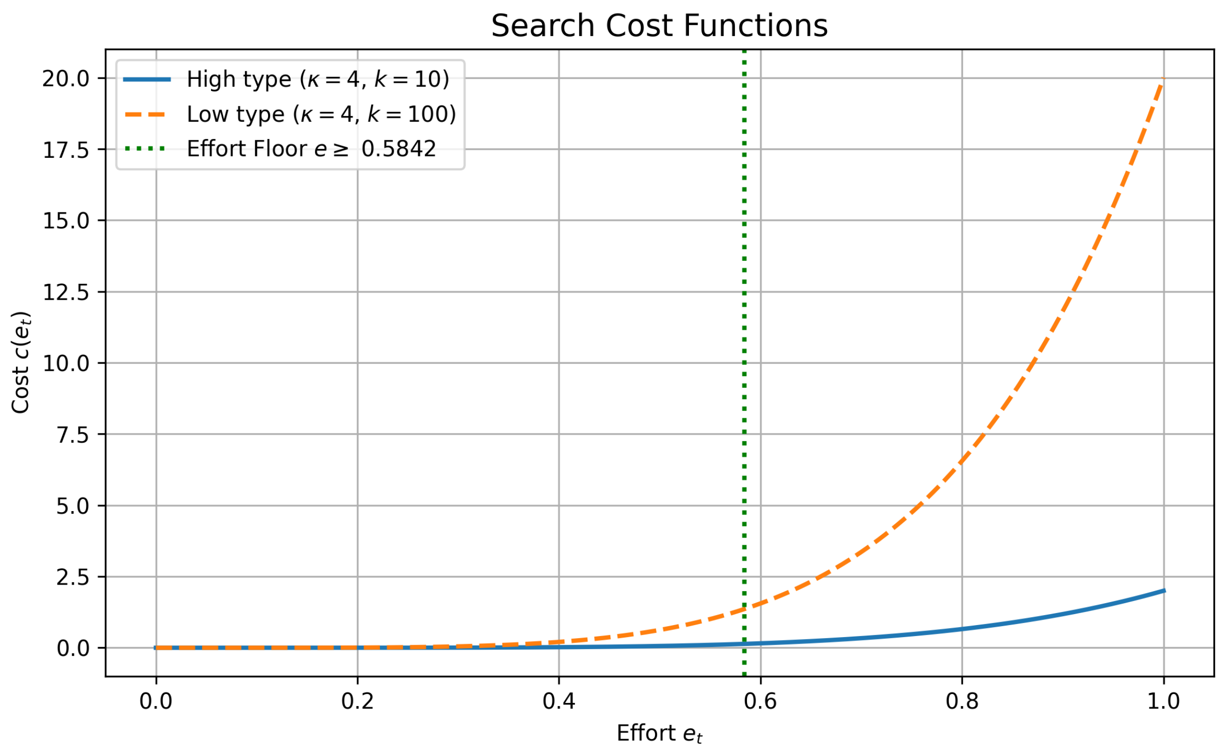

Figure 1: Search cost functions

3.2.2 Probability of job offer

Job offers arrive with a probability according to equation (1):

$$p_t = f(e_t) = e_t, \quad e_t \in [0, 1]$$

This functional form of the probability function sets the probability of finding a job equal to the search effort. Essentially, the functional form implies that the agent has the same marginal return from putting effort in job searching, no matter the level of effort. This ensures, that $p_t \in [0, 1]$ as effort takes values in the domain of $e_t \in [0, 1]$.
Similar to the discussion of the search effort costs, this functional form is probably a strong simplification of reality, as one could easily argue that there could be decreasing return to effort, if e.g. there are som low hanging fruits to collect when initializing job search. On the other hand, if job types are evenly distributed and there are *enough* jobs, then a flat probability in effort seems more reasonable. However, if one wants to model decreasing return to job search, then decreasing returns (probability) to job search is equivalent to implementing marginal increasing costs, as it has the same effect on the workers search

decision.

3.3 Distribution of wages

In this paper the wage offers are assumed to follow a log-normal distribution with PDF and CDF:

$$f(w) = \frac{1}{x\sigma\sqrt{2\pi}} \cdot e^{\left(-\frac{(\ln x-\mu)^2}{2\sigma^2}\right)} (PDF)$$

$$F(w) = \frac{1}{2}\left[1 + \operatorname{erf}\left(\frac{\ln x - \mu}{\sigma\sqrt{2}}\right)\right] = \Phi\left(\frac{\ln x - \mu}{\sigma}\right) (CDF)$$

The wages have been scaled to $w \in [0, 40]$ for simplicity. Furthermore, the distribution is fitted on actual income data from the "Understanding Society (USoc)" project, where researchers have been collecting longitudinal micro data from a large group of individuals in the UK - including data on income, unemployment spell durations, etc. First, the raw data from USoc is scaled such that the 99th percentile maps to $w = 40$, aligning the data with the range selected. A log normal PDF is then fitted to the data, which yields the following parameters:

$$\mu = 2.1107 \quad \text{and} \quad \sigma = 0.6784$$

This implies, that the expected wage of the model is given by:

$$\begin{aligned} E[w] &= e^{\mu} + \frac{1}{2}\sigma^2 \\ &= e^{2.1107} + \frac{1}{2}0.6784^2 \\ &= 8.6630 \end{aligned}$$

The log normal PDF has been fitted in such a way that it captures 99% of the wage mass. Consequently, 1% of the income observation mass falls outside the $[0, 40]$ interval. This log normal fit is then normalized such that the mass integrates to 1, as required for PDF's.

The fit is illustrated at figure 2 below:

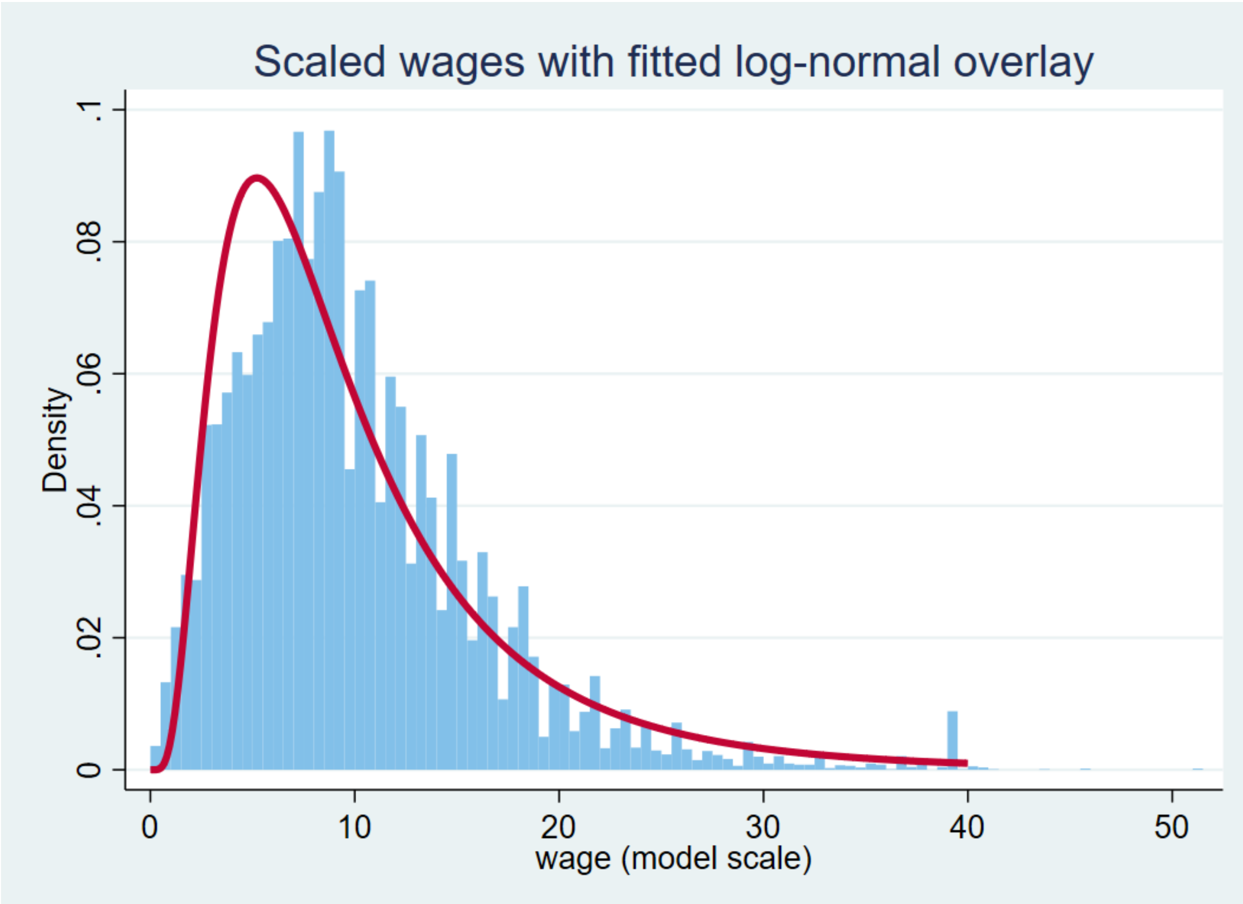

Figure 2: Log normal fit

The implications of this form are that jobs of lower wages are assumed to be more frequent than jobs of higher wages. Combined with the assumption that the workers are not able to search for specific job types, but only exert general search effort, this implies that in order to get offered a high-paying job, the worker must, in expectation, search more for a high-paying job than a low-paying job. This is regardless of his type, as the two worker types only differ in their costs of exerting effort.

3.4 Parameter values

In this section, I list the parameter values used in the project, and comment on the choices of those not already discussed above. Below is a complete table of the parameters:

Parameter	Value	Description
Wage distribution and utility		
$u(.)$	$log(.)$	Utility function is log
μ	2.1107	Median of $\log(w)$
σ	0.6784	Standard deviation of $\log(w)$
`wage grid`	$[0, 40]$	Minimum wage
Unemployment and discounting		
β	0.97	Yearly discount factor
b	$0.7 \cdot e^{\mu+\frac{1}{2}\sigma}$	Initial UI benefit
b_{cutoff}	$0.4 \cdot e^{\mu+\frac{1}{2}\sigma}$	Reduced benefit after cutoff
$b_{\text{cutoff, aggressive}}$	$0.1 \cdot e^{\mu+\frac{1}{2}\sigma}$	Aggressive benefit drop
Cost functions		
k_{high}	10	Level shifter in high-type cost function
k_{low}	100	Level shifter in low-type cost function
κ_{high}	4	Convexity of high-type cost
κ_{low}	4	Convexity of low-type cost
Time and policy parameters		
T	208	Model duration (e.g., weeks)
`UI_duration`	$T/2 = 104$	Duration of full UI benefits
$e_{\text{min}}^{\text{floor}}$	0.5842	Policy-imposed effort floor

Table 1: Overview of model parameters

3.4.1 Log-utility, $u(\cdot) = \log(\cdot)$

Workers have log utility of consumption. This is to acknowledge the fact that people in general tend to be risk averse, which the log utility form captures. In the setting of this model, it lowers the reservation wage, as they are less willing to take the risk of forgoing an offer in the hope of a better one in the future. An increasing and concave utility specification (e.g. log utility) is also used in Fredriksson and Holmlund 2001, Fredriksson and Holmlund 2006 and Andersen and Svarer 2014. Further, the log specification covers consumption in general, and thus the agent is indifferent between receiving monetary benefits from the public sector or receiving a wage. The analysis could have included different utilities derivations from different income types to account for disutility from working or on the other hand, some shame of being provided for by the public sector. Although such points may be valid, it has been left out for simplification.

3.4.2 Discount parameter, β

The choice of the yearly discount factor, $\beta = 0.97$ (i.e. a discount rate of 3%) is chosen in accordance with often chosen sizes in the literature. E.g. Maibom, Rosholm, and Svarer 2017 uses a discount rate of 3% while also testing 2% and 4% for robustness without their conclusions changing. Further, DellaVigna and Paserman 2005 assumes a discount rate of 5%. A 97% yearly discounting factor corresponds to a weekly discounting factor of:

$$\begin{aligned}\beta_{weekly} &= (1 - \beta_{yearly})^{\frac{1}{52}} \\ &= (1 - 0.97)^{\frac{1}{52}} \\ &= 0.999414..\end{aligned}$$

It should be noted, that using exponential discounting as is the case in this paper, is not necessarily the most realistic assumption of individual discounting behavior. Exponential discounting essentially makes future gains exponentially decreasing in present value terms. However, in the literature, a lot of evidence has been found of other forms of discounting such as hyperbolic discounting that captures so called present bias. Present bias is the phenomenon that individuals have more patience when it comes to long-run decisions compared to short run decisions. See e.g. DellaVigna and Paserman 2005 for a discussion and study on this particular debate.

3.4.3 UI benefit, b

The benefit levels are set in order to mimic a heavily simplified version of the UK UI-system. In the UK, it is possible to take out a private unemployment insurance, which usually covers a maximum of $50\% - 70\%$ of the pre-unemployment income. Usually, these insurances covers income for a year (Gocompare 2024). Thus, the initial benefit is set to 70% of the average income in the sample.

Furthermore, there exist a general coverage system, "Universal Credit" in the UK provided by the government. The size of the payout from Universal Credit is dependent on the household type. (Gov.UK 2024). In November 2023, the weighted average payout for singles with and without children from Universal Care amounted to 865,7£ (Department for Work and Pensions 2024). This corresponds to $\sim 40\%$ of the average wage in the USoc data, and thus, the benefit after 52 weeks where the individual is dependent on only Universal Care, is set to 40% of the mean income, implying a drop in income of 30%-points when going from the private insurance to Universal Care, corresponding to a marginal drop of $42,6\%$. The benefit paths is plotted below:

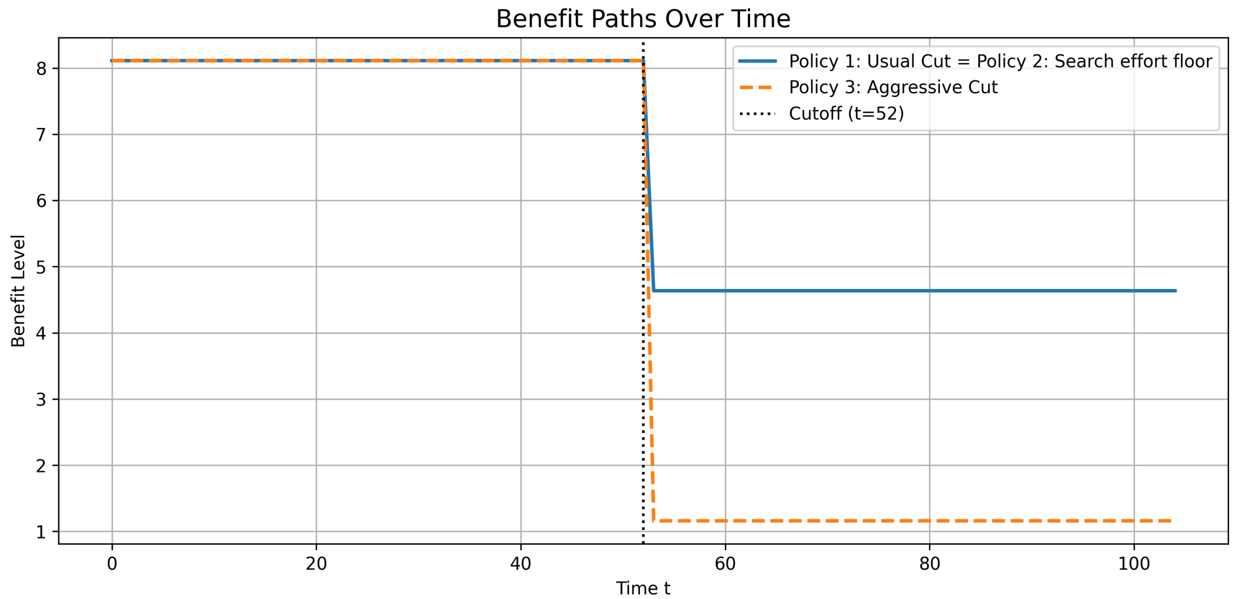

Figure 3: Benefit paths under different policies
[2]

It should be noted that this is a very rough simplification of the UK unemployment insurance system. First of all, there exist other, smaller, public benefits that can be claimed along side Universal Care (such as JSA), even though Universal Care has replaced many of these. Second, you can be eligible for Universal Care alongside working, where the benefit drops for 55p for every pound earned from working. This mechanic of claiming benefit and working at the same time is not modeled in this paper. The simplification of the system obviously limits the external validity of the analysis, but is neither the scope of this paper.

[2]Recall that the baseline cut is still effective in policy 2, which is why policy 1 and policy 2 follow the same benefit path.

3.4.4 Minimum Search Effort, $e_{\min}$

The minimum search effort requirement implemented in policy 2, is set to $e_{min} = 0.5842$. This particular level is a result of a calibration made of the requirement, such that the probability of the low type having exited unemployment after 2 years (in t=104) under policy 2 is equal to that of policy 3. In practice, as loss function of the form below form is minimized:

$$loss = (S_{t,policy2} - S_{t,policy3})^2$$

where S_t is the survival function calculated in accordance with equation (7). The idea stems from a policy evaluation perspective: if the policy maker wants to evaluate the search effort floor against the aggressive cut in the benefits, it makes sense to compare these based on them fulfilling the same goal. In this case, hitting some benchmark probability of continued unemployment after 2 years.

4 Results

In the following section, the results of the analysis will be presented. First, the outcomes from the baseline model will be presented, and afterwards, the outcomes of policy 2 and policy 3 will be studied in relation to each other, and the baseline of policy 1.

4.1 Policy 1: Baseline model

Figure 4 illustrates the various outcomes of the model under the baseline model described in section 3.1:

It is immediately seen, that the value of unemployment is higher for the high type than for the low type, reflecting, that the higher costs of searching has a cost to utility. Furthermore, we see that the value gradually declines towards the cutoff at t=52, where the benefit drops to b_{cutoff}. This gradual decline reflects the foresight of the worker, as she sees the benefit drop getting closer and closer the she stays unemployed.

Turning to the search effort, the low type exerts a much lower search effort than the high type, reflecting that the low type has higher costs of doing so, and thus the optimizing level of the low type is lower than for the high type. In addition, the search effort is increasing in $t = [1..52]$ as the agent approaches the cutoff. Again, this is a result of the agents foresight.

The reservation wage for the high type is higher than for the low type. This means that the high type is more 'picky' in his job choices than the low type, reflecting that the high type does not have as high costs of searching for another period than the low type. The reservation wage is decreasing as she approaches the cutoff, do to similar arguments as above.

The exit probability (hazard function), reflects the probability of the worker exiting unemployment at each period. An interesting dynamic arises here. Even though the high type is more picky than the low type, her increased search effort offsets the 'pickyness' and gives her a higher probability of exit each period compared to the low type. I.e. the higher probability of receiving job offers implies a higher probability of getting a job offer above his reservation wage which dominates the 'pickyness'. The lower exit probability each period results in a higher, accumulated probability of still being unemployed at each t. Hence, in expectation, the low type has longer unemployment spells than the high type.
Lastly, note that the slight curvature of the curves stem from log utility.

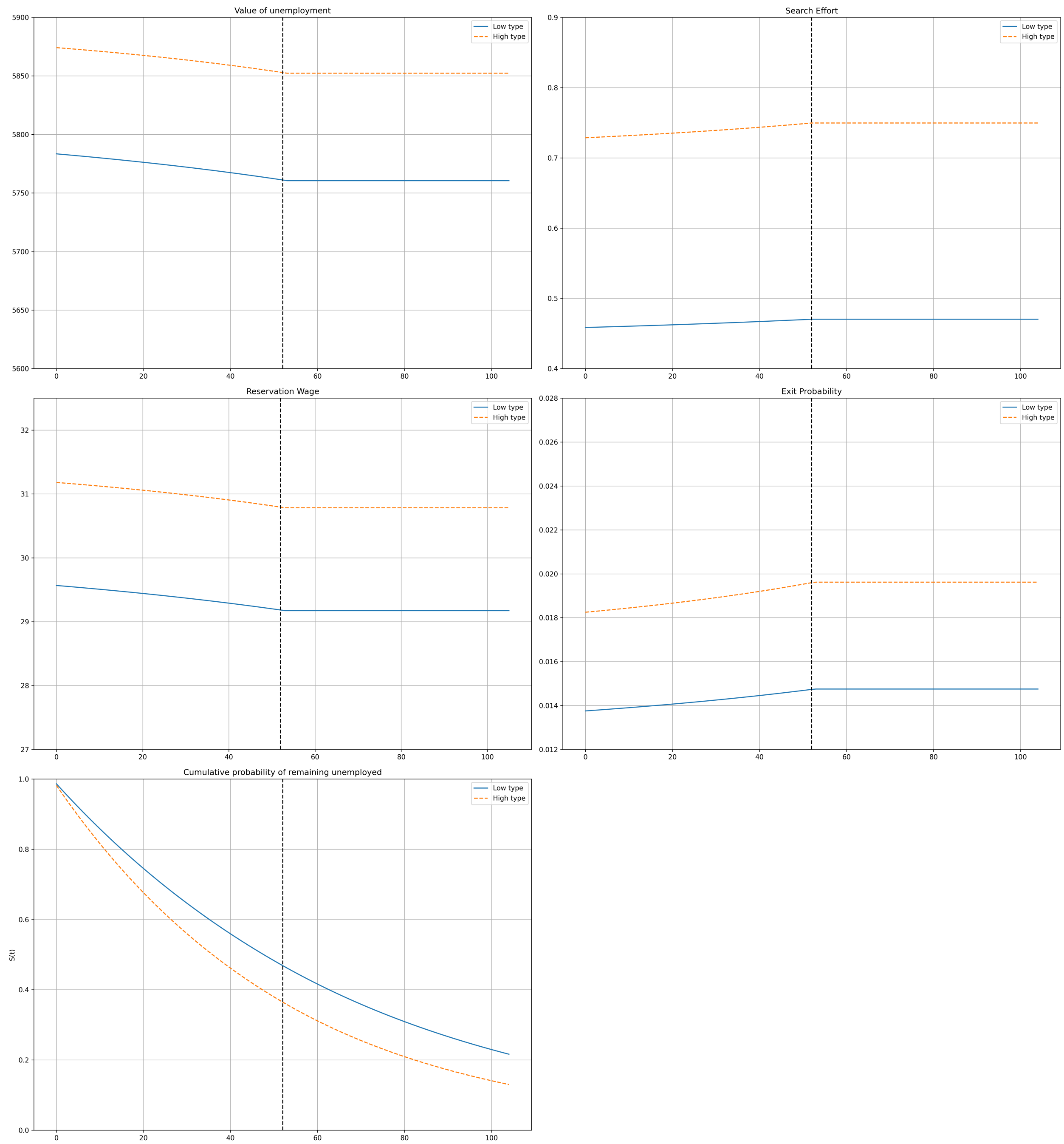

Figure 4: Outcomes of policy 1

4.2 Comparison of policies

In figure 5, outcomes of all three models are plotted side by side to allow for visual comparison of the different outcomes. Each column represents a policy and each row represent a specific outcome. Before analyzing the outcomes, recall that the search effort requirement, e_{min}, has been calibrated such that the probability of remaining unemployed in period T=104 (after 2 years) has been equalized for policy 2 and 3. Hence, policy 2 and 3 should be compared with the fact in mind, that the same political outcome has been reached. [3]

Row 1 illustrates the value of unemployment, these outcomes show, that the search requirement leads to a fall in utility for the low type, while the utility for both the high and low type falls in policy 3. This stems from the size of the search effort requirement, that lies below the high types optimal search effort, and hence only the low type is affected. Compared to policy 3, we see that both the high and the low type's utility has decreased, and has a more aggressive dive towards the cutoff. Note that the slight curvature on the curve along the transitioning path for these curves as well as for the other outcomes, stems from the log-utility specification and the exponential discounting. See 3.4.1 and 3.4.2 for a discussion.

Row 2 illustrates the search effort. For policy 2, the search effort is placed above the low types own optimal search effort, and hence, he is placed in a corner solution at the minimum requirement. Note that the high types optimal search effort is unaffected by the requirement. Comparing with policy 3, the aggressive benefit drop increases both type's optimal search effort compared to the baseline outcome of policy 1. The import insight here is, that the aggressive benefit cut affects both the high type and the low type's search effort while policy 2 only has an effect on the low type.

Row 3 illustrates the reservation wage. For policy 2, opposing forces are at play. First, we see that the low type's reservation wage decreases in policy 2. This is a consequence of her being forced to exert more effort, and thus take on higher total costs from searching than her optimal choice would have brought her. This lowers her pickyness. However, the increased search effort also increases the likelihood of receiving a job offer, and thus the probability of receiving a job offer above her reservation wage, which mitigates the fall in the reservation wage. Comparing with policy 3, we see that the reservation wage of both types have de-

[3] The probability of being unemployed after two years is $13,8\%$, which is a result of the arbitrarily chosen aggressive cut being 10% of the average wage.

creased as a result of the aggressive cut. Note that reservation wage of the low type in policy 3 falls to a point quite a bit below the reservation wage of the low type in policy 2.

Row 4 illustrates the probability of exiting unemployment at time t (hazard rate). For policy 2, it is seen, that the effort floor has increased the search effort of the low type so it now lies close to that of the high type. Further, we can see, that the high type has a steeper slope on the gradual increase towards the cutoff. This stems from the fact, that the low type now does not have an increasing optimal search effort path as he is forced in the corner solution of the minimal effort. The high type remains unaffected by the search effort floor, which drives the different steepness of the paths towards the cutoff. Comparing to policy 3, the aggressive cut now affects both types. For the low type, the initial probability has not increased as much as in policy 2, but the steady state is higher. I.e. the search effort requirement has larger immediate effects on exit probabilities, while the aggressive cut has larger long-run effects (after 2+ years).

Row 5 illustrates the cumulative probability of having exited unemployment (survival function) that result from the probability of exiting each period. Starting with policy 2, the survival function for the low and high type now follow almost the exact same path, which is a result of the hazard rate for the low type, in row 4, been increased to almost the same level as the high time. Comparing to the aggressive cut, the survival function for both types have increased and have become more steep, implying that both types find jobs more quickly compared to the baseline model.

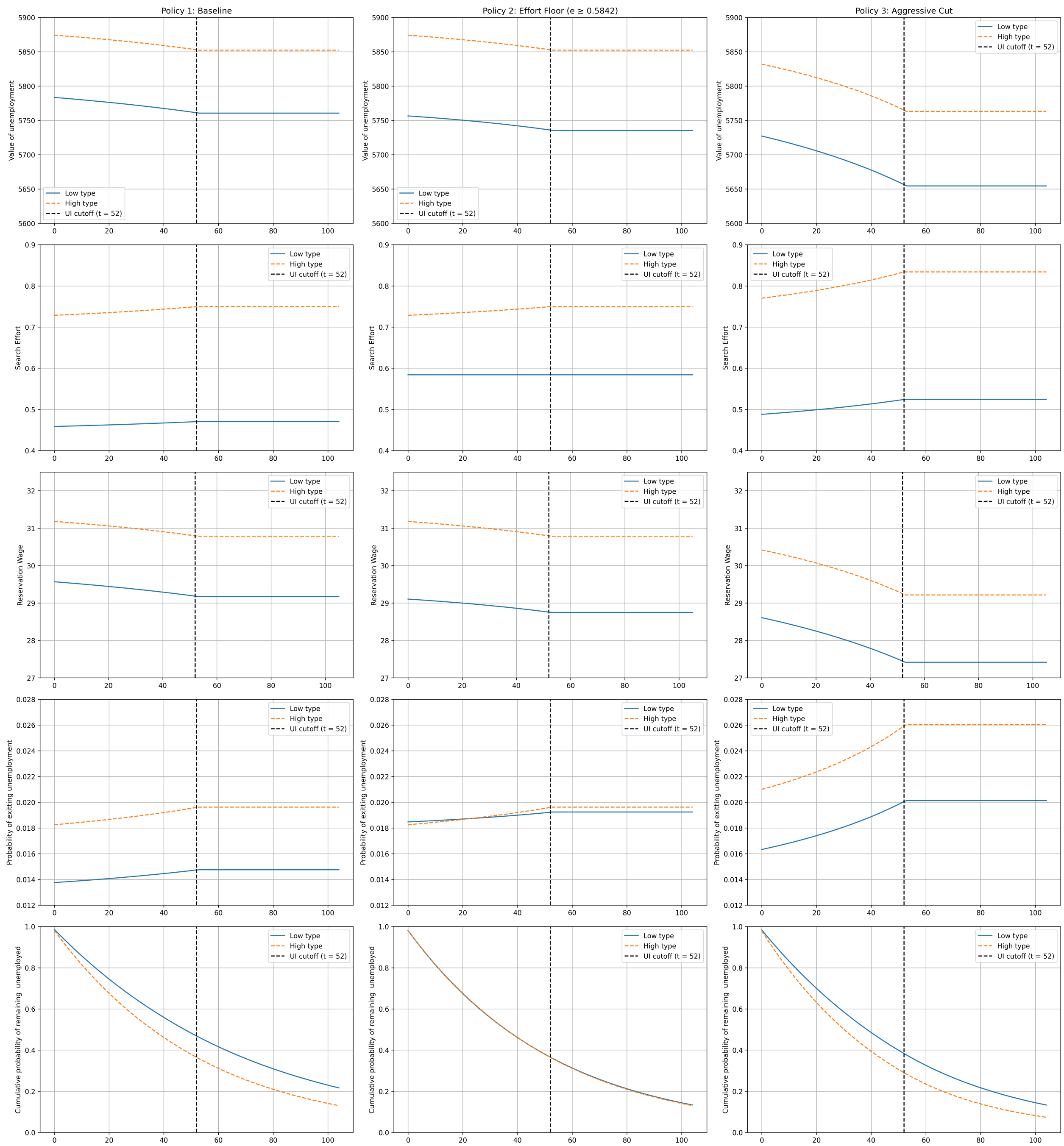

Figure 5: Outcomes of policy 1, 2 and 3

To summarize the key result of the two policies, these should be viewed in the light of both policies achieving the same cumulative probability of having exiting after 2 years. Policy 2 has more immediate effects on exit-probabilities while policy 3 has larger long run effects (after 2+ years). Lastly, policy 3 also makes the transition path from the initial state to steady state more aggressive, than in the baseline and in policy 1.

Another interesting point from the eyes of a benevolent policy maker, is, that the 'punishment' of policy 3 hits both the high and the low type whereas policy 2 hits the low type only. In addition to this, the drop in utility is larger in policy 3 compared to policy 1 for the low type. Hence, implementing policy 2 hurts the individuals less and achieve the same survival function value after 2 years for the low type. [4] With the reservation of a lacking social welfare analysis, the results indeed show, that it is possible to decrease the low types expected unemployment duration in a way that hurts her less than a benefit cut, with the positive side effect, that the high types utility is not hurt either.[5] The robustness of these results are discussed in 4.3.

The workers utility of unemployment (Bellman equation) is plotted in figure 6 to allow for visual comparison of the three policies:

[4] Note that this is not a conclusion on social welfare, as no financing of the policies is taken into account. It could very well be the case that the *social welfare* is maximized in policy 3

[5] It should of course be mentioned, that the aggressive cut hurts the high type as well, but also decreases her expected unemployment duration. That is, the implied punishment on the high type from the aggressive cut is not pure dead weight loss.

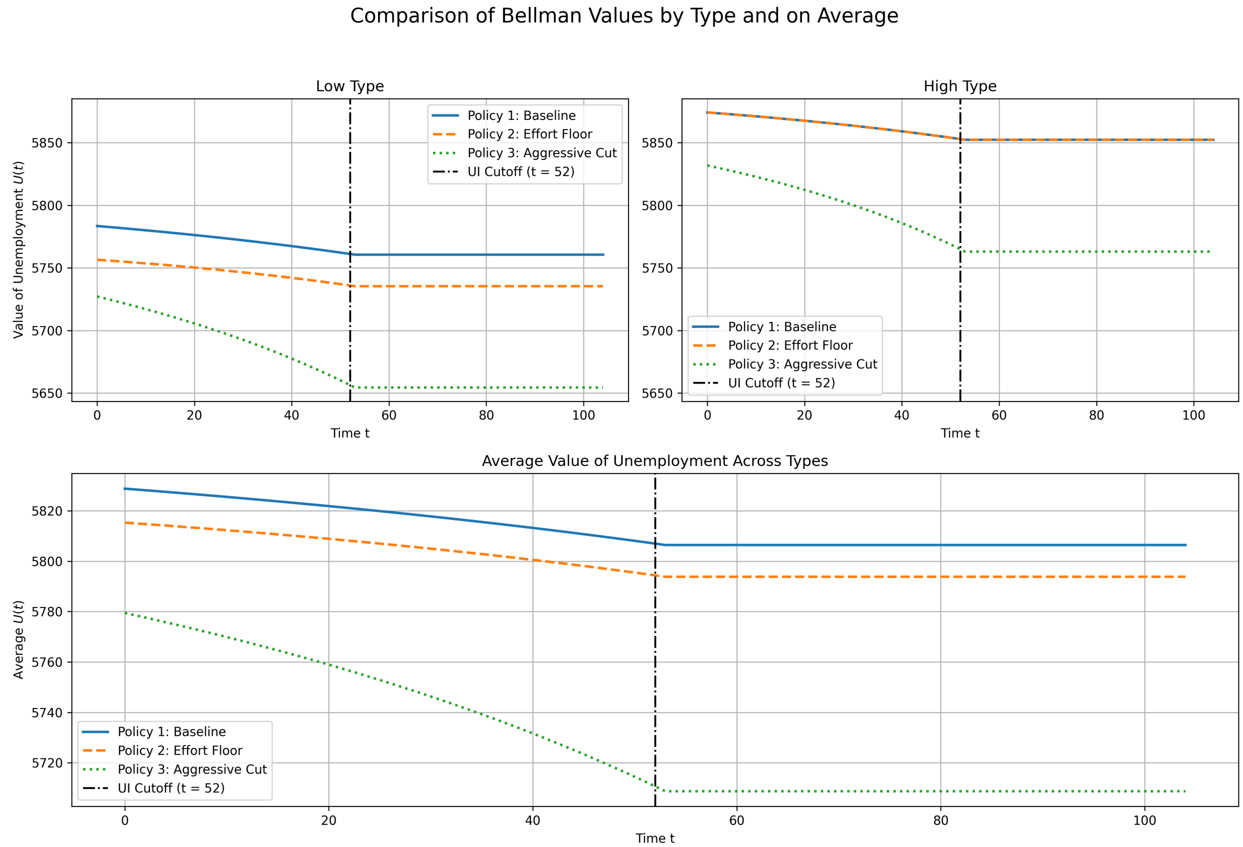

Figure 6: Welfare of the unemployed worker

4.3 Robustness

As many of the parameters have not been calibrated to real data, it is natural to question the robustness of the results derived in section 4. The results showed that the effort floor comes with less utility costs to the individual compared to the aggressive benefit cut. To test this, the model has been rerun in two different ways. First, a version where the cost parameter of the low type has been scaled with a factor $k_{low} = 500$ instead of the original $k_{low} = 100$. Second, a version with a higher, yearly discount rate of $\beta = 10\%$ instead of the original $\beta = 3\%$. When the models are run with the new parameters, the calibration of the minimum search requirement to satisfy the same survival function value after 2 years naturally changes.

The increased cost scale has unsurprisingly shifted the value of unemployment down in all three policies for the low type, shifted down the search effort in policy 2 and 3 for both types, and the reservation wage for high and low type in all 3 policies. However, the conclusions remain the same, namely that drop in utility for the low type under policy 2 is less than that of policy 3 when accounting for the calibration of e_{min} to ensure similar policy outcomes.[6]

As described in the results, the utility drop is larger in policy 3 for all periods t. Recall, that the worker has an immediate drop in utility at $t = 0$ from a lowered benefit in $t = 52$, as she is forward looking and discounts the future. Therefor, it is an interesting angle to investigate if making the worker less forward looking, can make him better of under policy 3 than policy 2 in the starting periods (low t). Changing the yearly discounting to $\beta = 10\%$ interestingly show, that the agent is better of initially, as she in these early periods cares less about what happens to his benefit in the *far future* of period $t = 52$. This mechanic is illustrated in figure 7. $\beta = 20\%$ have also been tested, with the unsurprising result, that for a longer, initial period, the agent is better of under policy 3 compared to policy 2.[7] The takeaway is, that the patience of the unemployed worker has an influence on the utility costs of the individual, even to the extent where they can change preference for the one over the other based on this.

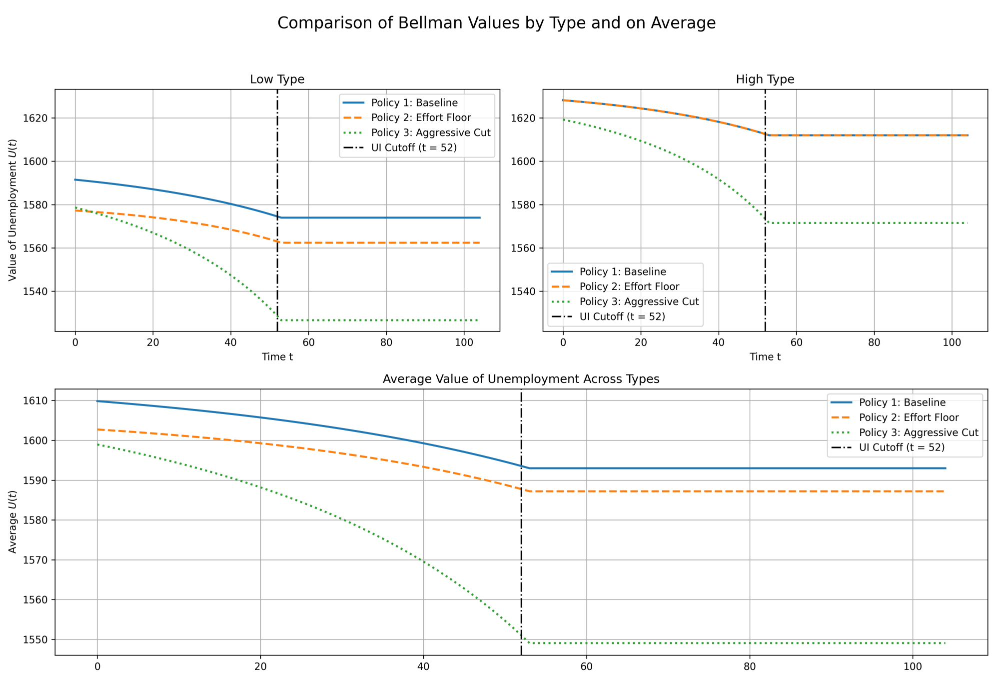

Figure 7: Welfare of the unemployed worker - robustness test for $\beta = 10\%$

[6]Plots can be found in appendix A1
[7]See appendix A2

5 Discussion

They analysis performed in this paper naturally have some limits that should be acknowledged. First the implemented McCall model Is highly stylized. It excludes important features such as, job destruction, on the job-search, ability to search for specific job types, representation of a financing side (public sector budget), etc. I

n the model, it is also assumed that when the agent accepts a job offer, this job is held indefinitely without the possibility to change job. Allowing for either job destruction or on-the-job search could have implications for the workers pickyness, as the choice of accepting a job offer is not permanent.

Also, allowing for the two types to search for jobs specifically above their reservation wage could have implications for the cost-effectiveness of the search and hence implications for the minimum search effort requirement.

The model neither account for general equilibrium effects, as it only focuses on behavior of a single individual. To capture many important and interesting aspects of a realistic job market settings it requires that the model accounts for things as labor market tightness, impact on wage offers from policies, etc.

In addition, while the model has loosely been structured to mimic a realistic setting of the UK UI-system, is has not been calibrated on any empirical moments beyond the wage distribution. That is, if one wanted to answer questions with more external validity, the model should ideally have been calibrated on real world empirical moments such as hazard rates or measures on costs functions. Doing so could have improved the robustness and credibility of the conclusions.

Lastly, a relevant critique of the comparison of this model, is that policy 3 is designed in a way such that it lowers both type's benefits, while policy 2 is designed with an effort level that only affects the low type. That is, if policy 3 had an aggressive cut in only the low types benefits, if would be a more 'fair' comparison on weighted utility. However, the aim is primarily to study the ability to target the low type, and type-discrimination in the benefit size can also lead to ethical and/or legal concerns. Even with these concerns, it should meanwhile be mentioned that many countries benefit discriminate on type in the form os providing different for students, elderly, etc.

Naturally, these caveats limits the realism of the model. However, despite its limitations, the framework remains useful in answering some specific questions like the one posed in this paper - namely the potential harm of different ALMP's from the perspective of the worker. The results should importantly be interpreted with these caveats in mind.

6 Conclusion

While the analysis have some natural weaknesses, which the results should be viewed in the light of, this paper has contributed with a set of interesting insights. It has been shown, that it is theoretical possible to implement a search effort requirement that achieve the same goal on expected unemployment as a cut in benefit levels, but at a lower costs to the utility of the individual. Actually, the search effort requirement has lower utility costs over the entire span of the individuals horizon, implying that the worker is strictly better of under such a policy compared to an aggressive cut in the benefits.

Importantly, it is shown that the search effort requirement is able to target the low type's search effort only, if the requirement is designed in the right way. Thus it is insured that the high type is not hurt from the policy which is a nice feature, if this is the goal of the policy maker. This asymmetry is central to understanding the different welfare implications of the two policies.

The robustness of the results have been shown to be dependent on the discounting / foresight of the worker. If the worker is sufficiently myopic, she can, in the short run, turn out to be better off under a policy 3 compared to the immediate search effort requirement. However, in the long run, when the cut is approached, the utility drops sharply to a point below the search effort requirement, which is the case for every larger value of the discounting rate.

With the mentioned limitations of the model, the natural suggestion for further research is to refine the models to account for some of the dynamics mentioned in section 5. Especially the social welfare consequences of policy 2 and policy 3 would be an interesting angle to explore, and a natural next step. Both to answer what policies are the most cost effective in terms of utility, but also it the policies have a net positive effect on social welfare at all, as this would require that the saved public spending on UI should outweigh the costs to the unemployed workers individual utility. With social welfare taken into account, this also strengthens the motivation for a calibration of the model to match real empirical moments, such that the outcomes of the model have more external validity.

A Appendix

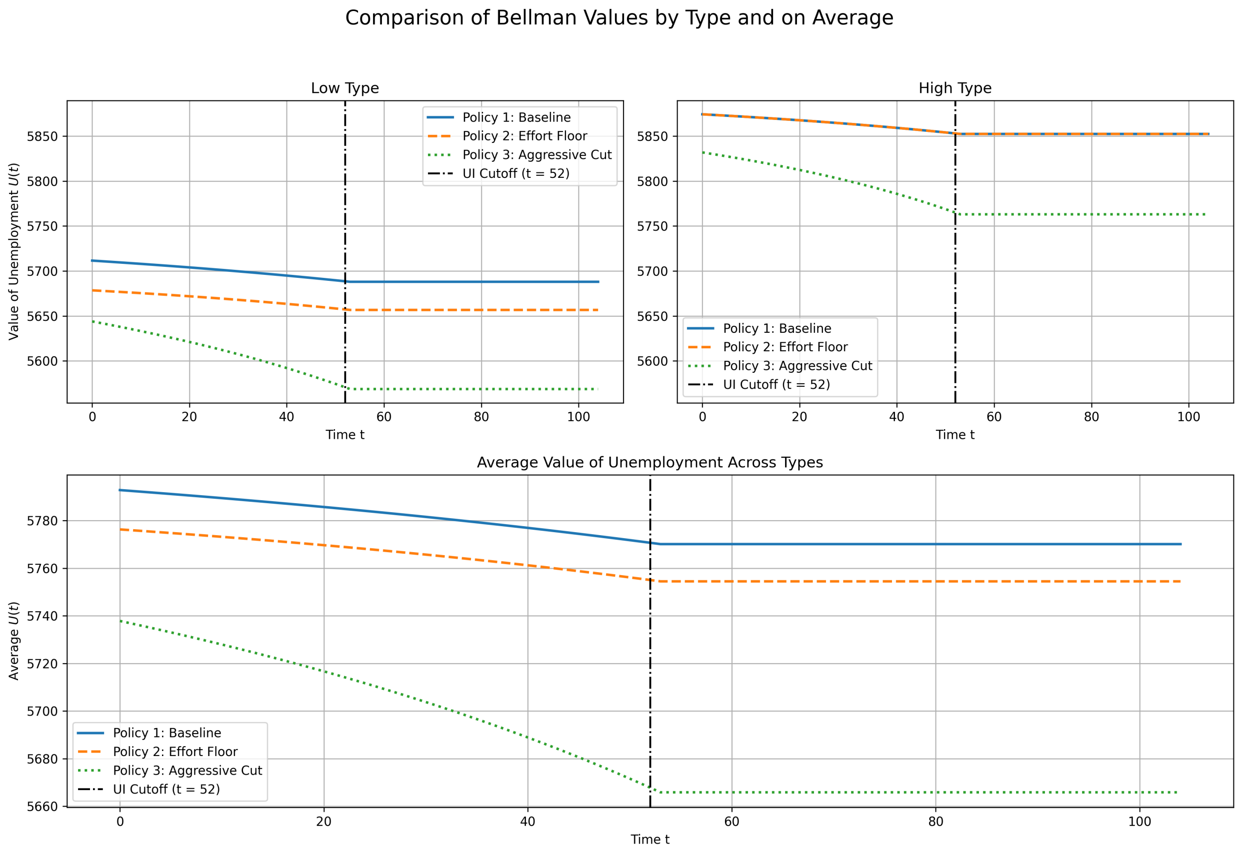

Figure A1: Welfare of the unemployed worker – robustness test for $k_{low} = 500$

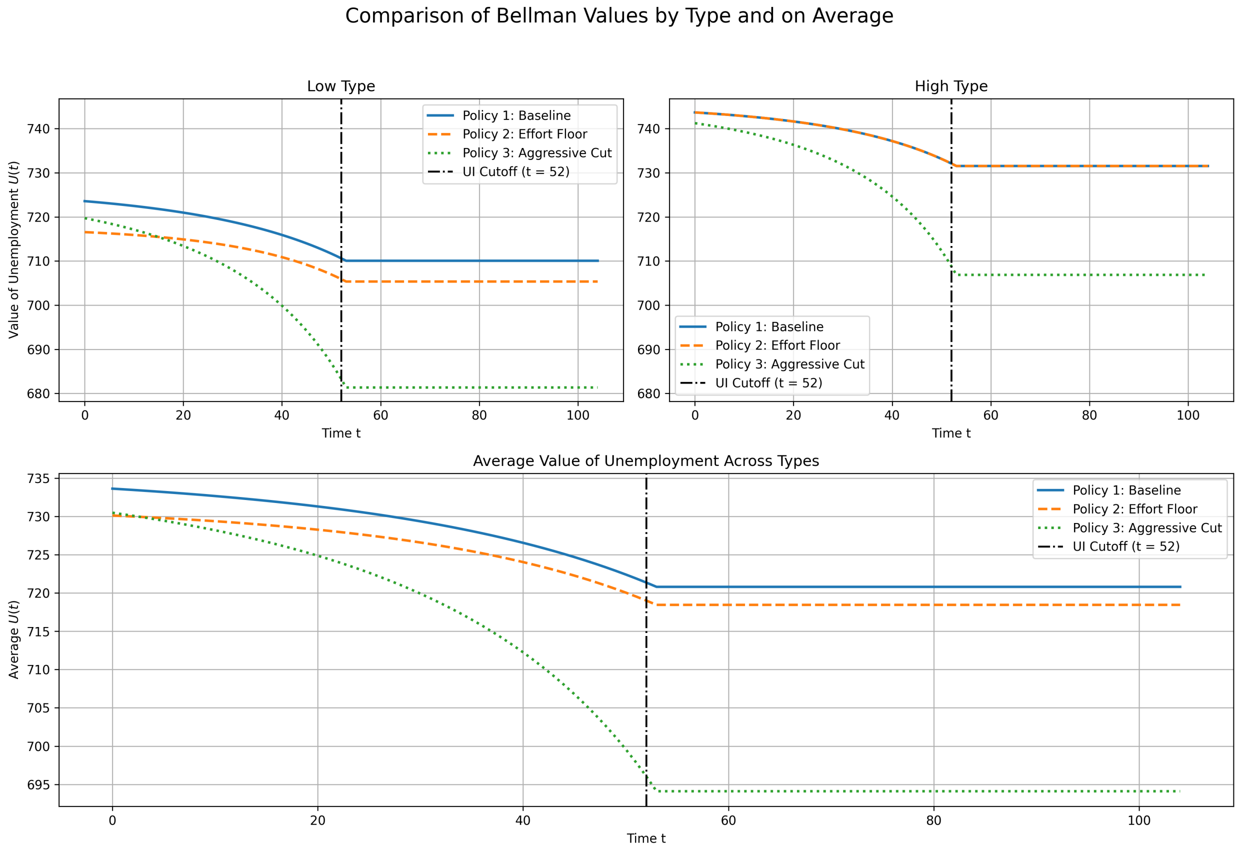

Figure A2: Welfare of the unemployed worker – robustness test for $\beta = 20\%$

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