Optimal unemployment insurance with endogenous preferences

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January 31, 2019

Abstract: This paper mixes state-dependent utility theory with endogenous preferences to investigate the optimality of unemployment insurance. In our model, individuals assign weights to consumption units in two possible states: work or unemployment. The higher the weight assigned to consumption in the work state, the lower the one assigned to consumption in the unemployment state. These weights shape the magnitude of moral hazard effects while searching for jobs as well as the desire for unemployment insurance. The model can predict that the demand for social insurance remains low despite unemployment exposure is large. In a sufficient statistics approach à la Chetty, we find a new sufficient statistics formula which takes into account inherited values. We show that unemployment insurance is higher than the optimal level in a lot of countries, except for the UK, due to high preferences for work. In a second part of the paper we extend the model to explain the difference in take-up rates of unemployment insurance for different social backgrounds.

Keywords: State-Dependent Preferences; Job Search; Optimal Unemployment Insurance; Endogenous preferences, sufficient statistics, take-up rates

JEL classification: J17; J64; J68; J88; H21

1 Introduction

In this paper, we investigate the impact of endogenous preferences on the optimality of unemployment insurance. An analysis à la Chetty usually shows that unemployment insurance is mostly optimal in several countries, or could even be increased in some of them (the US for instance). We present in this paper a framework that aims to take into account the existence of social norms, namely work ethic, that shape the demand for unemployment insurance.

In this framework, individuals choose their preferences in that they decide what disutility they suffer in different states (here employment versus unemployment). We suppose that the disutility in one state decreases at the expense of the increase of the disutility in the other state. The existence of endogenous preferences has been studied a lot in previous decades. For instance, in Snower and Lechtaler (2013), individuals can choose between two identities: the elite identity corresponds to a personality with a high pro-work ethic with low disutility of work and high disutility from being unemployed. On the other hand, there is the underclass identity which is an anti-work ethic with high disutility of working and a low disutility from being unemployed. Though, in their paper, the disutility comes as an additive parameter in the utility function and they use the assumption that the disutility is 0 in the low-disutility state. In our framework, the disutility comes as a multiplicative parameter in the utility function so that it can never be 0.

Usually, the endogeneity of preferences comes through a cultural transmission process. The usual way to model it is the one of Bisin and Verdier, where parents are altruistic but with imperfect empathy. In this setting, parents evaluate the child's future utility with their own preferences. The consequence of this hypothesis is that parents always prefer their child to have the same trait as themselves. In our paper, when we suppose that individuals choose their own preferences, it is exactly as if parents where 100% altruistic with perfect empathy, i.e. they know the utility of their child. The consequence is that individuals end with the preferences for different states that maximize their own happiness.

The identity theory, or the inheritance of norms and the role of these norms on economic outcomes has been studied a lot in the past few decades. Lindbeck, Nyberg and Weibull (1997) investigate the factors determining the size of the welfare state and focus on the role of social norms. They conclude that different countries with the same unemployment rate might differ in terms of social benefits because of different social stigma associated with unemployment. Algan and Cahuc (2006, 2009, 2010) show in their different papers the role of social values on the unemployment policies that might be implemented. According to them, for instance, countries with higher civic values have higher unemployment benefits, lower job protection and higher participation rates.

Michau (2012) is the closest paper to ours. He investigates the relationship between the cultural transmission of civicness and the provision of unemployment insurance. This paper is a combination of Bisin-Verdier and Algan-Cahuc, where civicness denotes the likelihood of cheating on social benefits and is transmitted by parents through imperfect empathy. Though, his paper diverges from ours in several aspects. First of all, as stated before, we suppose that parents (or any person who transmits the work ethic) has perfect empathy: they maximize the expected utility of individuals themselves. Second of all,

the government chooses the unemployment policy through an utilitarian mechanism: there is no voting in our model. Third, as stated before, the low disutility that a high work-ethic individual gets from working comes at the cost of a high-disutility whenever unemployed. These disutilities are modeled by a multiplicative argument in the utility function while it is simply an additive term which differs for different types in his paper. Last but not least, in our paper individuals have a second choice to make: their exposition to unemployment. This aspect is particularly interesting since we investigate the role of work ethic on the optimality of unemployment insurance. Indeed, we think it is necessary to consider not only the role of preferences per se but also the role of preferences on the exposition to unemployment and their consequences on the demand for social insurance.

The main goal of UI is to smooth consumption across labor market states. The basic model is based on the expected utility theory conceived by Von Neumann and Morgenstern (1944). It supposes that preferences are exogenously given and do not vary across states. In this world, perfect insurance involves equal gains in employment and unemployment. However, it is well-known that individuals' preferences vary across states. Arrow (1973) provides clear examples in the case of health. Models with state-dependent preferences were developed by economists like Karni (2005) who defines state-dependent preferences as the case *"When the prevailing state of nature is itself of direct impact to the decision maker"*. Moreover, since Becker (1996) a voluminous literature has flurished to account for endogenous preferences. A key idea emphasized by these papers is that actual utility functions are themselves the result of an optimization process.

In this paper, we mix state-dependent utility with endogenous preferences to study their implications for unemployment and the social demand for unemployment insurance.

We consider a particular model of endogenous state-dependent preferences. This consists in an ex-ante reallocation of utility derived from consumption levels between possible states. We consider a job search model where unemployment benefits are financed by an income tax. Thus, individuals choose their preferences in each state but also their exposition to each state. The consideration of endogenous state-dependent preferences alters the magnitude of moral hazard effects. As Dionne (1982) already noticed, when the marginal utility in bad state is less or equal than the marginal utility in good state, moral hazard is less important with state-dependent utility functions.

We start with a description of such endogenous preferences in a general context with multiple states (Section 2). State-specific consumption receives a particular weight and the sum of weights is one. Individuals allocate their budget of weights across the different states so as to maximize their expected utility. We show they give more weight to more likely and more favorable states. This behavior increases utility differentials between states and lowers the need for insurance against the occurrence of bad states.

We then turn to UI and focus on a simple case where the risk of unemployment is exogenous (Section 3). Individuals allocate their weights between employment and unemployment, whereas a benevolent planner sets nonemployment income and the payroll tax rate under a balanced budget constraint. Owing to endogenous preferences, the model can predict that the demand for social insurance remains low despite unemployment exposure is large. The reason is individuals give a large weight to consumption derived from labor earnings and, therefore, a small weight to consumption once unemployed. For more exotic

parameterizations, the size of the social insurance scheme may decrease with unemployment exposure.

Then we allow for job search effort and endogenous exposure to unemployment (Section 4). The demand for social insurance increases as the economy deteriorates. This increase has two origins. On the one hand, the rise in unemployment risk naturally increases the need for insurance. On the other hand, people set a higher weight to consumption units in unemployment. Still, the demand for unemployment insurance is lower than full insurance, which is in line with Rey (2003). We also investigate the role of risk aversion in such a setting. Risk averse workers tend to set very close weights to consumption units in employment and unemployment. This increases the need for UI and reduces incentives to search. We then find that more risk averse workers are more likely to be unemployed.

We then turn to an analysis of the current unemployment insurance across countries and try to assess whether they are optimal or not, using the sufficient statistics formula à la Chetty (2008) in Section 5. We first suppose that the work ethic is the same for all countries and fixed exogenously. We are then able to use the actual Chetty formula to assess whether or not the current unemployment insurance are optimal in different OECD countries. The results depend on the value of relative risk aversion and relative prudence we assume as well as on the moral hazard effect that we have in mind. The more individuals are risk averse, the more unemployment insurance should decrease in order to improve social welfare. The same can be said for the moral hazard effect. Nevertheless, the gain or loss evaluated with Chetty formula when we exogenously fix the work ethic are very low. We then turn in the same kind of analysis but taking into account that individuals can actually shape their utility function in order to choose their optimal work ethic. We thus give a new formula for the optimal unemployment insurance in the case where individuals have endogenous preferences. Using an upper and lower bounds for the optimal work ethic, we find that in all the countries that we study except for the UK, unemployment insurance should decrease in order to increase social welfare, no matter the level of moral hazard effect, relative risk aversion and relative prudence. This is so because the work ethic is sufficiently high so that individuals do not give a huge attention to the unemployment state and income. Thus they have a low demand for social insurance.

Finally, we give insights for future research by assuming that inside a country, individuals might be heterogeneous (Section 6). If this is a case, we can explain, for instance, the difference of take-up rates of unemployment insurance for different groups which have different values. We then give an insight on the difference of take-up rates for different social groups. Indeed, we show that low-social backgrounds have a higher probability of taking their benefits up because they give a higher importance to unemployment income compared to high social backgrounds that have a higher unemployment stigma.

2 Endogenous preferences by income origin

We introduce our key assumption whereby individuals can choose the relative weights of consumption units according to income origin. We then provide stylized evidence from the European Values Survey in favor of this assumption.

2.1 Main idea

Suppose there are $N \geq 2$ possible states indexed by i. State i occurs with probability $p_i \in [0,1]$, $\sum_i p_i = 1$. Let also ω_i be income in state i. We call $\alpha_i \in [0,1]$, the weight of state-i specific consumption. We assume $\sum_i \alpha_i = 1$. This assumption can simply be seen as a constraint of investment. The weight α_i says to what extent individuals receive disutility from being in state i: the higher α_i the lower the disutility of state i. A lower disutility in one state comes to the expense of a higher disutility in other states because learning to enjoy a particular state takes time that one cannot take to learn enjoying other states. For instance, if one invests a lot in work ethic, he might not have enough time to invest in social interactions.

Let $v : R_+ \to R$ be the felicity function and W the expected utility. The felicity function is endowed with the usual properties, i.e., strictly increasing, strictly concave, with $v'(x) \to \infty$ when $x \to 0$ and $v'(x) \to 0$ when $x \to \infty$. We have

$$W = \max_{\{\alpha_i\}_{i=1}^N} \sum_i p_i v(\alpha_i \omega_i). \tag{1}$$

We implicitly make two assumptions. First, the actual felicity function is state-specific. State dependence occurs through the sequence of weights $\{\alpha_i\}$. Therefore effective consumption units depend on income origin. Second, individuals choose the sequence $\{\alpha_i\}$ so as to maximize their expected utility.

The Lagrangian is

$$L(\alpha_1, ..., \alpha_N, \lambda) = \sum_i p_i v(\alpha_i \omega_i) + \lambda \left(1 - \sum_i \alpha_i\right). \tag{2}$$

The first-order conditions of optimality state that, for all $i = 1, ..., N$,

$$p_i \omega_i v'(\alpha_i \omega_i) = \lambda. \tag{3}$$

By setting appropriate weights, individuals transfer consumption units between states. The optimal set of weights does not lead to equal marginal utility across states. Instead, the quantity that is constant is the marginal felicity multiplied by the probability of occurrence of the state, times state-specific income. Therefore individuals give more weight to consumption in states with higher occurrence and higher income.

Optimal weight setting can be seen as anti-insurantial. The purpose of insurance schemes is to redistribute income across states. With state-independent preferences, perfect insurance leads to equal income in each state. This consists in paying premia in good states and receiving compensation in bad ones. Instead, optimal weight setting leads to transfer consumption units from rare and bad states to frequent and good ones. As we will see in the next section, this tends to reduce the demand for insurance.

The preferences we describe are a particular case of state-dependent utility theory. State dependence occurs when the utility derived from wealth depends on the state of nature (Karni, 1983). Here, the utility in different states differs through consumption weights. More originally, individuals optimally choose the set of weights. The trade-off between the different weights makes the optimization problem a meaningful one. There is no free lunch: increasing effective consumption units in a particular state comes at the cost of decreasing them in another state.

In terms of narrative, choosing the set of weights is a shortcut for adopting a nexus of values giving heterogeneous importance to different income sources. We argue that individuals choose the values that are the most suited to their life prospects. Those who expect to become successful workers will strongly value income derived from working hard. Meanwhile they will develop a culture of disdain for transfer income. On the contrary, those who are likely to know long and recurrent episodes of unemployment will value solidarity and redistribution. Thus, individuals who expect to rapidly find jobs will choose a high weight for consumption in employment while those who expect to remain unemployed for a long time will assign a large weight to consuption in nonemployment.

Of course, "individuals" can be replaced by benevolent parents, teachers or friends. Actually anyone with sufficient knowledge of one's skills and sufficiently loving to promote welfare-maximizing values. Value transmission becomes part of cultural transmission, whether achieved through family arrangements, formal schooling or best-friend-forever type of discussions.

2.2 Stylized facts

We promote the thesis whereby the exposure to unemployment leads people to have more favorable views about nonemployment income and those who are nonemployed. We now provide indirect evidence from the European Values Survey (EVS). In this section we show the correlations that exist between the answers to the different questions we are interested in. These questions are related to the opinion of individuals about work, leisure but also on the benefits and the dependence on social aids. Let's first describe precisely the different questions. The first two concern the importance in one's life of work and leisure. People can answer on a scale from 1 to 4 where 1 means "Very important" and 4 "Not at all important". The third question is a proxy for risk aversion. It concerns the importance of job security. It is a dummy which takes value 1 if people do mention that job security is an important feature for a job. Then, individuals are asked whether it is or not humiliating to receive money without working for it. They can answer on a scale from 1 to 5 where 1 means "Strongly agree" and 5 "Strongly disagree". They answer with the same scale to the following assessment: "People who don't work turn lazy", "Work is a duty to society", "People should not have to work if they don't want to", "Work should come first even if it means less spare time". Finally, individuals give their opinion on the justifiability of claiming government benefits to which one is not entitled to. The answers are on a scale from 1 to 10 where 1 means "Never Justifiable" and 10 "Always justifiable". Table 1 represents the correlations between these questions for the all sample (all countries, 1999). If some questions seem no correlated at all, we also observe strong (positive or negative) correlations. For instance, those who declare more that leisure is important in life are less likely to declare that work should come first (coefficient of correlation: -0.115). In the same way, those who declare that work is important in life are more likely to also declare that it is humiliating to receive money without working for it, that people who don't work turn lazy, and that work should come first even if it means less spare time. Those who declare that it is humiliating to receive money without working for it are strongly likely to also declare that people who don't not work turn lazy, that work is a duty towards society and thus that work should come first even if it means less spare time.

Variables	Important in life: Leisure time	Important in life: Work	Important in a job: Job security	Humiliating to receive money without working for it	People who don't work turn lazy	Work is a duty towards society	People should not have to work if they don't want to	Work should come first even if it means less spare time	Justifiable: claiming government benefits which not entitled to
Important in life: Leisure time	1.000								
Important in life: Work	0.101	1.000							
Important in a job: Job security	-0.018	-0.054	1.000						
Humiliating to receive money without having to work for it	-0.046	0.118	-0.103	1.000					
People who don't work turn lazy	-0.043	0.123	-0.097	0.362	1.000				
Work is a duty towards society	-0.007	0.133	-0.074	0.306	0.383	1.000			
People should not have to work if they don't want to	0.027	-0.039	0.017	-0.091	-0.124	-0.228	1.000		
Work should come first even if it means less spare time	-0.115	0.158	-0.118	0.289	0.321	0.401	-0.108	1.000	
Justifiable: claiming government benefits not entitled to	0.003	0.007	-0.040	0.094	0.052	0.113	-0.099	0.067	1.000

The cross-correlation table gives insights on what we could consider as the empirical α of our model. Remember that in the model, α represents the weight put on the consumption units that come from employment income. Thus if we take the individual answers to some of the previous questions that concern the role of work in life and others which are more about the taste for leisure and non-employment income, we can determine an empirical α.

The first empirical α that we define is the simplest one:

$$\alpha = \frac{\textbf{Work importance}}{\textbf{Work importance}+\textbf{Leisure importance}}. \tag{4}$$

Figure 1 represents the distribution of α defined in Equation (4) over the all sample. We can see that it is particularly centered around 0.45 which can be explained by two different reasons. First of all it represents a mean in each country which does not take into account the variations within a country. Moreover, individuals are more likely to answer questions by choosing the middle of a scale instead of the extreme options. Thus, the empirical α here is simply a proxy of what we can expect in our model.

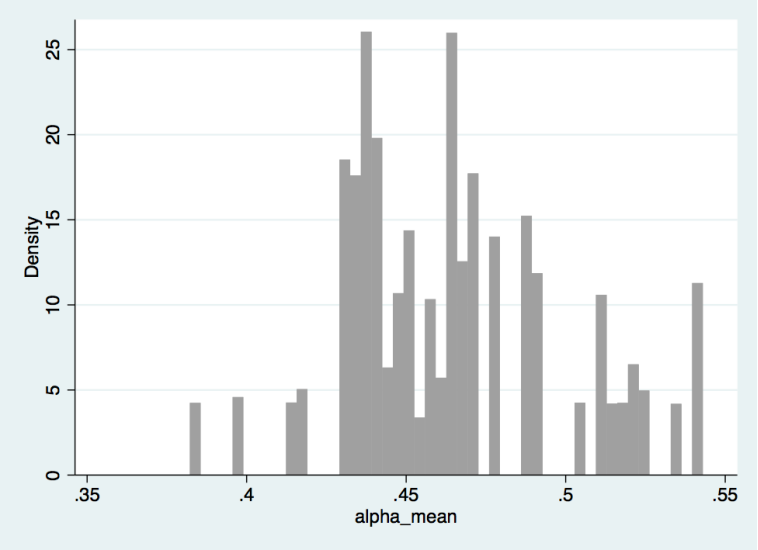

Figure 1: Distribution of empirical α in the sample

One of the main interests of the paper is to provide evidence on the relationship between the unemployment rate, the generosity of the unemployment insurance system and the endogenous value of α. Table 2 shows the cross-correlation between these three features. We show that a higher unemployment rate is strongly correlated with a lower α while a higher replacement rate from employment to unemployment is correlated with a higher α. This is in line with our model: a higher unemployment rate increases the probability of being unemployed and then decreases the probability of being in state 1 (employment). Moreover, a higher replacement rate increases the income in state 2 (unemployment). These two features lead individuals to choose a lower weight for state 1, i.e. α decreases.

Variables	Empirical α	Unemployment rate	Generosity index
Empirical α	1.000		
Unemployment rate	-0.347	1.000	
Generosity index	0.202	-0.416	1.000

Table 2: Cross-correlation table

One could argue that the definition of the empirical α is not very robust. We then use other definitions by using more questions in order to see what happens when we give different definitions to α. Thanks to the previous analysis of the EVS questions of interest, we know what some of them are strongly correlated. For instance, the importance of work is strongly positively correlated with thinking that it is humiliating to receive money without working for it as well as declaring that work should come first even if it means less spare time. Thus the second empirical α we can define is the following:

$$\tilde{\alpha} = \frac{\textbf{Work importance+Humil+Work 1st}}{\textbf{Work importance+Humil+Work 1st+Leisure importance}} \tag{5}$$

Figure 2 shows the repartition of $\tilde{\alpha}$ in the sample. We see that on average the empirical $\tilde{\alpha}$ that we find is higher than with α as defined in equation (4) because we take into account more features than just the importance of work and leisure times. Indeed here we also consider the opinion of individuals on being helped by society, on working without liking it and so on. We can easily argue that these features are strongly correlated with the utility that one derives from being in one state or the other.

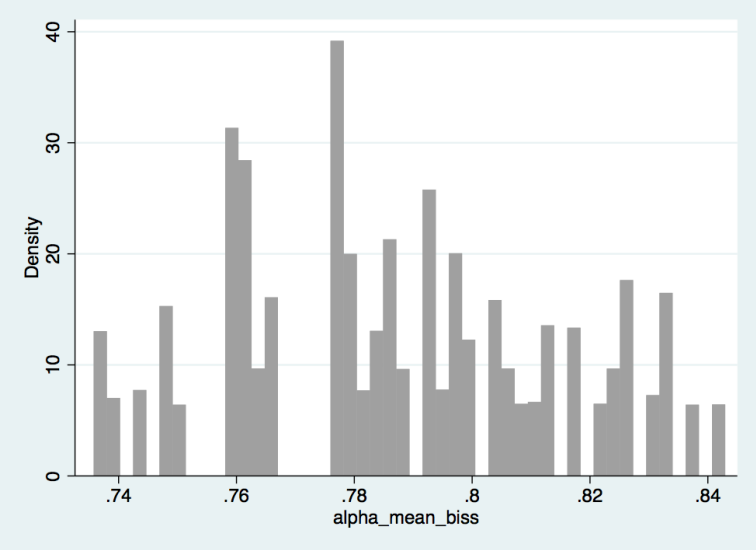

Figure 2: Distribution of empirical $\tilde{\alpha}$ in the sample

Table 3 shows the same correlations as before: a higher unemployment rate and a lower replacement rate are both correlated with a lower $\tilde{\alpha}$.

Variables	Empirical $\tilde{\alpha}$	Unemployment rate	Generosity index
Empirical $\tilde{\alpha}$	1.000		
Unemployment rate	-0.435	1.000	
Generosity index	0.390	-0.416	1.000

Table 3: Correlations between α and the labor market

Variable	Panel	Mean	Sd	Min	Max	Observations
Empirical α	Overall	0.46	0.13	0.2	0.8	N=70018
	Between		0.03	0.42	0.54	n=27
	Within		0.13	0.12	0.85	T=2593
Empirical $\tilde{\alpha}$	Overall	0.79	0.09	0.43	0.93	N=66543
	Between		0.03	0.75	0.84	n=27
	Within		0.09	0.39	0.96	T=2464
Unemployment rate (%)	Overall	9.25	4.53	2.24	27.47	N=64744
	Between		4.12	3.52	19.41	n=36
	Within		2.04	-4.26	24.82	T=1798
Generosity index (%)	Overall	13.81	10.72	0	50.22	N=65400
	Between		9.31	6.66e-06	40.38	n=35
	Within		2.78	-5.85	31.04	T=1868

Table 4: Descriptive statistics

To go further in the analysis, we propose a two-steps regression in order to disentangle the role played by individual characteristics and labor market state. Looking correlations gives an insight on what seems to happen in terms of relationship between the unemployment rate, the replacement rate and the preferences of individuals. Anyway, the correlations presented in Tables 2 and 3 come from the entire sample: waves 1999-2001 and 2008-2010 for all countries. We want to go further in the analysis by observing a form of causality. To do so, we use a two-step procedure. In a first step we regress the empirical α on a set of individual characteristics and Year-Country fixed-effects. In a second step, we use the estimated fixed-effects and regress them on the unemployment rate, an index for the generosity of the unemployment insurance and a year fixed-effect in order to capture the actual role played by the labor market state. We do that for the two empirical α and $\tilde{\alpha}$ computed in previous subsection.

Table 5 presents the results of the first step. If individual characteristics seem to play a small but significant role in the value of α, country-year fixed effects also have their importance.

VARIABLES	(1) Empirical α	(2) Empirical $\tilde{\alpha}$
Age	-0.000117***	-0.000846***
	(3.65e-05)	(2.43e-05)
Feeling of happiness	-0.00969***	-0.00863***
	(0.000883)	(0.000588)
Gender, Female	0.00464***	0.00449***
	(0.00114)	(0.000758)
Marital status	0.00430***	0.00196***
	(0.000281)	(0.000187)
Employment status	0.00456***	0.000416**
	(0.000291)	(0.000193)
Education level	0.00237***	0.00852***
	(0.000857)	(0.000569)
Monthly household income	0.00221***	0.00234***
	(0.000548)	(0.000363)
Country-Year Fixed Effects		
Austria (2008)	0.0340***	
	(0.00518)	
Belgium (1999)	-0.00179	0.00352
	(0.00501)	(0.00324)
Belgium (2009)	0.0211***	0.0127***
	(0.00508)	(0.00327)
Czech Republic (1999)	-0.0131***	-0.0249***
	(0.00486)	(0.00314)
Czech Republic (2008)	0.0387***	-0.00492
	(0.00508)	(0.00327)
Denmark (1999)	0.0598***	0.0165***
	(0.00579)	(0.00380)
Denmark (2008)	0.0640***	0.0314***
	(0.00537)	(0.00347)
Estonia (1999)	-0.0101*	-0.0275***
	(0.00584)	(0.00382)
Estonia (2008)	0.0138***	-0.00890***
	(0.00516)	(0.00332)
Finland (2009)	0.0894***	0.0317***
	(0.00554)	(0.00359)
France (1999)	-0.0137***	0.00301
	(0.00516)	(0.00334)
France (2008)	-0.0138***	-0.00289
	(0.00509)	(0.00327)

Germany (1999)	0.0160***	-0.00524
	(0.00496)	(0.00323)
Germany (2008)	0.0332***	-0.00881***
	(0.00484)	(0.00312)
Greece (1999)	0.0107*	-0.0146***
	(0.00571)	(0.00370)
Greece (2008)	0.0215***	-1.69e-05
	(0.00516)	(0.00333)
Hungary (2008)	0.0225***	-0.0138***
	(0.00521)	(0.00334)
Iceland (1999)	0.00333	0.00405
	(0.00569)	(0.00370)
Iceland (2009)	0.00293	0.0195***
	(0.00614)	(0.00398)
Ireland (1999)	0.0375***	0.0143***
	(0.00579)	(0.00378)
Ireland (2008)	0.0586***	0.0229***
	(0.00680)	(0.00447)
Italy (1999)	-0.0190***	-0.0367***
	(0.00497)	(0.00323)
Italy (2009)	-0.0228***	-0.0288***
	(0.00560)	(0.00364)
Latvia (1999)	-0.0604***	-0.0502***
	(0.00576)	(0.00376)
Latvia (2008)	-0.00908*	-0.0126***
	(0.00522)	(0.00337)
Lithuania (1999)	-0.0349***	-0.0583***
	(0.00623)	(0.00409)
Lithuania (2008)	0.0150***	-0.0238***
	(0.00533)	(0.00344)
Luxembourg (2008)	-0.0200***	-0.0253***
	(0.00524)	(0.00341)
Netherlands (1999)	0.0637***	0.0468***
	(0.00559)	(0.00361)
Netherlands (2008)	0.0711***	0.0456***
	(0.00515)	(0.00334)
Norway (2008)	0.0340***	0.0153***
	(0.00548)	(0.00354)
Poland (2008)	0.0139***	0.00392
	(0.00536)	(0.00348)
Portugal (1999)	-0.0232***	-0.0145***
	(0.00618)	(0.00404)
Portugal (2008)	0.00424	-0.0202***
	(0.00584)	(0.00382)
Slovakia (1999)	-0.0106**	-0.0333***
	(0.00527)	(0.00342)
Slovak Republic (2008)	-0.00454	-0.0217***
	(0.00536)	(0.00347)
Slovenia (1999)	-0.0127**	-0.0271***
	(0.00632)	(0.00409)
Slovenia (2008)	0.0117**	0.00351
	(0.00580)	(0.00376)

Spain (1999)	-0.0185***	-0.0124***
	(0.00586)	(0.00383)
Spain (2008)	0.0128**	0.0107***
	(0.00557)	(0.00361)
Sweden (1999)	0.0520***	0.0334***
	(0.00554)	(0.00361)
Sweden (2009)	0.0754***	0.0331***
	(0.00558)	(0.00368)
Switzerland (2008)	0.0213***	0.0204***
	(0.00554)	(0.00360)
Turkey (2001)	-0.0296***	-0.0489***
	(0.00534)	(0.00347)
Turkey (2009)	-0.00685	-0.0384***
	(0.00471)	(0.00306)
Great Britain (2009)	0.0794***	0.0337***
	(0.00551)	(0.00357)
Constant	0.437***	0.818***
	(0.00495)	(0.00331)
Observations	51,184	48,837
R-squared	0.077	0.146

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5: First step: OLS regression of empirical α and $\tilde{\alpha}$

For the second step, since the dependent variables (the country-year fixed effects) have been estimated in the first step, there might be measurement errors. To correct for the latter, we use Card and Krueger (1992) to weight the values of the dependent variable. The weight is simply the inverse of the first-step variance of the fixed-effects. Table 6 presents the results of the second step. We observe in both cases (α and $\tilde{\alpha}$) that an increase of the unemployment rate is associated with a decrease in preferences for work (negative sign). On the generosity index, the impact depends on the definition of α. For the simplest definition, an increase in the generosity of the unemployment insurance leads to a decrease in the taste for work. For the more complex $\tilde{\alpha}$, the effect seems to be positive: **when the generosity of the unemployment insurance is higher, individuals seem to give more importance to work**. Though, the impact is very small in this case: 5.71e-05.

VARIABLES	(1) Empirical α	(2) Empirical $\tilde{\alpha}$
u	-0.00365***	-0.00295***
	(7.18e-05)	(3.09e-05)
Generosity index	-0.00106***	5.71e-05***
	(1.77e-05)	(7.80e-06)
Year Fixed Effects		
2000	0.0379***	
	(0.000590)	
2008	-0.00317***	0.00216***
	(0.000521)	(0.000224)
2009	0.0482***	0.0155***
	(0.000658)	(0.000280)
Constant	0.0469***	0.0193***
	(0.000610)	(0.000277)
Observations	12,713	10,676
R-squared	0.482	0.697

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 6: 2nd step: Role of the labor market state

Note. The generosity index has been computed from the OECD value "Expenses for unemployment (% of GDP). We correct this value by multiplying by $(1-u)/u$ in order to obtain a proxy for the replacement rate.

With this section we conclude on the fact that there seems to be, empirically, a strong and negative relationship between the unemployment rate and the preferences of individuals for work unity of consumption. This relationship is also true (even if less clear) for the generosity of unemployment insurance: a higher generosity lowers the preference for work compared to work. The impact is less obvious when we take a more precise definition for this taste, $\tilde{\alpha}$. Anyway, what we call the empirical α is a simple proxy of the α we consider in our model. This can explain the relationship between α and the generosity of unemployment insurance that is in the data but not in our model.

We now insert these preferences into a model of optimal unemployment insurance.

3 Basic model

The model is static and involves a continuum of unemployed individuals who look for a job. These workers are homogeneous and their mass is normalized to one. There are two possible states, employment and unemployment. The probability of finding a job is $(1-u) \in [0,1]$. With complementary probability, u,

workers are unemployed. The employment wage is $w > 0$. There is a payroll tax rate $t \in [0,1]$, i.e., the net wage is $w(1-t)$. Unemployment income is $b > 0$.

The expected utility is

$$W = \max_{\alpha \in [0,1]} \{(1-u)v(\alpha w(1-t)) + uv((1-\alpha)b)\}, \tag{6}$$

where v is the felicity function and $\alpha \in [0,1]$ is the weight of employment consumption. Hereafter we name it the relative taste for labor earnings, or simply the taste for work.

The budget of the UI scheme is balanced, so that

$$ub = (1-u)tw. \tag{7}$$

Thus setting t is equivalent to setting b.

We suppose that individuals or – benevolent parents – choose α, whereas the policy-maker chooses t.

Let $\hat{\alpha} \equiv \hat{\alpha}(t)$ be the optimal choice of α. The first-order condition is necessary and sufficient. This gives

$$\frac{v'(\alpha w(1-t))}{v'((1-\alpha)b)} = \frac{u}{1-u}\frac{b}{w(1-t)} \Leftrightarrow \frac{v'(\alpha w(1-t))}{v'((1-\alpha)(1-u)tw/u)} = \frac{t}{1-t}. \tag{8}$$

The marginal utility ratio is equal to the unemployment to employment probability ratio multiplied by the replacement ratio. Once accounted for the budget constraint, the former ratio is equal to $t/(1-t)$. Therefore the optimal taste for work decreases with the payroll tax rate, i.e., $\hat{\alpha}'(t) < 0$. It takes the following values: $\hat{\alpha}(0) = 1$, $\alpha(1/2) = 1-u$ and $\hat{\alpha}(1) = 0$. Moreover, $\hat{\alpha}(u)$ is such that

$$\frac{v'(\alpha w(1-u))}{v'((1-\alpha)(1-u)w)} = \frac{u}{1-u}. \tag{9}$$

This implies that $\hat{\alpha}(u) > 1/2$ when $u < 1/2$.

Therefore the optimal taste for work is larger than $1/2$ when the payroll tax rate is equal to the probability of occurrence of insured risk. The intuition for this result is as follows. When $t = u$, income is the same in the two states. The expected utility is $(1-u)v(\alpha(1-u)w) + uv((1-\alpha)(1-u)w)$. Starting from $\alpha = 1/2$, a simple way to increase utility consists in transferring consumption units from the least likely state, unemployment, to the most likely one, employment.

The policy-maker sets t such that

$$\hat{t} \equiv \hat{t}(\alpha) \in \arg\max_t W. \tag{10}$$

The first-order condition is necessary and sufficient. This gives

$$\frac{v'(\alpha w(1-t))}{v'((1-\alpha)(1-u)tw/u)} = \frac{1-\alpha}{\alpha}. \tag{11}$$

The optimal tax rate decreases with α, i.e., $\hat{t}'(\alpha) < 0$. We also have $\hat{t}(0) = 1$, $\hat{t}(1/2) = u$ and $\hat{t}(1) = 0$. Thus the optimal tax rate is equal to the probability of unemployment when preferences are state-independent. This standard result implies perfect smoothing: income does not vary across labor market states.

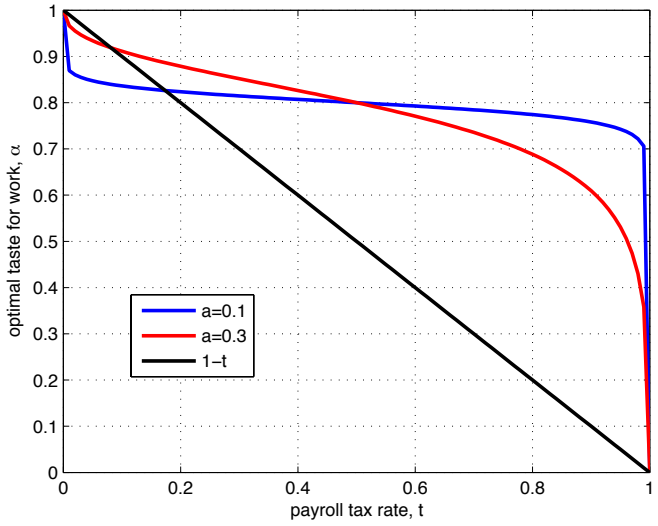

Figure 3: Optimal taste for work as a function of the payroll tax, t

In equilibrium, $\alpha^* = \hat{\alpha}(t^*) = 1 - t^* = 1 - \hat{t}(\alpha^*)$. The properties of functions $\hat{\alpha}$ and $\hat{t}$ imply that $\alpha^* \neq 1/2$ and $t^* \neq u$ unless $u = 1/2$. Therefore the consideration of endogenous preferences together with optimal UI lead to state-dependent preferences. It also follows that income varies across labor market states.

We illustrate our results with a parameterized example. The felicity function is isoelastic: $v(x) = x^a$, $a \in (0, 1)$. Then,

$$\hat{\alpha}(t) = \left[1 + \frac{u}{1-u}\left(\frac{t}{1-t}\right)^{a/(1-a)}\right]^{-1}, \tag{12}$$

$$\hat{t}(\alpha) = \left[1 + \frac{1-u}{u}\left(\frac{\alpha}{1-\alpha}\right)^{a/(1-a)}\right]^{-1}. \tag{13}$$

We set $u = 0.2$ (for visualization purpose) and consider two possible values for a, i.e., $a = 0.1$ and $a = 0.3$. Figure 1 depicts the equilibrium. The curve $\alpha = \hat{\alpha}(t)$ intersects the straight line $\alpha = 1 - t$ in $t = t^*$. In both cases, the resulting equilibrium is such that $t^* < 0.2$ and $\alpha^* > 0.8$. The equilibrium with the highest parameter a also displays the lowest taste for work and the largest tax rate. Therefore, risk aversion generates a larger demand for social insurance. Though this may sound obvious, one must realize that risk aversion does not play any role in the model with state-independent preferences. Here it affects the equilibrium t^* through the joint determination of α^*. Risk averse workers cannot afford losing too many efficient units of consumption when nonemployed. Therefore they choose a relatively small taste for work and ask for a relatively large formal insurance system. Note that risk aversion is ill-defined here because preferences are state-dependent. Appendix 1 clarifies this notion and shows that the correct measure of absolute risk aversion is negatively impacted by parameter a.

More generally, the equilibrium is such that

$$\alpha^* = \frac{1}{\left(\frac{u}{1-u}\right)^{(1-a)/(1-2a)} + 1}, \tag{14}$$

$$t^* = \frac{\left(\frac{u}{1-u}\right)^{(1-a)/(1-2a)}}{\left(\frac{u}{1-u}\right)^{(1-a)/(1-2a)} + 1}. \tag{15}$$

Thus the taste for work, α^*, decreases with u when $a < 1/2$ and increases with it when $a > 1/2$. Meanwhile the tax rate, t^*, increases with u when $a < 1/2$. The case where $a < 1/2$ is here more realistic because nonemployment income is lower than the net wage. Indeed, when $u < 1/2$, we have $\alpha^* > 1/2 > t^*$, which implies that $w(1-t^*) > b^* = (1-u)t^*w/u$. When $a > 1/2$, the opposite properties hold. Therefore, when $u < 1/2$, we have $\alpha^* < 1/2 < t^*$.

Endogenous preferences have important implications. First, they can explain why the demand for social insurance is small, despite the exposure to unemployment is large. In the likely case where $a < 1/2$ and $u < 1/2$, individuals value more labor earnings than nonemployment income. Therefore their demand for formal insurance is low and this implies low taxation and resulting nonemployment income.

Second, the demand for insurance can over-respond to unemployment risk. This phenomenon arises in the likely case where $a < 1/2$. As the likelihood of unemployment increases, individuals put more weight on consumption in this state. Therefore a rise in unemployment can be followed by a strong increase in employment taxation and nonemployment income.

Third, the model can also predict that an increase in unemployment risk is not necessarily followed by an expansion of the social insurance system. This arises in the more exotic case where $a > 1/2$. Then, following an increase in unemployment exposure, people alter their preferences to transfer effective consumption units from unemployment to employment.

We now turn to a situation with endogenous unemployment risk.

4 Job search effort

We now suppose that workers choose their exposure to unemployment, u, at some cost $c(u)$. The cost function is such that $c(1) = c'(1) = 0$ and $c'(0)$ sufficiently large. Moreover, $c'(u) < 0$, $c''(u) > 0$ for all $u \in [0, 1)$.

At given t, the optimal search effort and the optimal taste for work result from

$$W = \max_{\alpha,u}\{-c(u) + (1-u)v(\alpha w(1-t)) + uv((1-\alpha)b)\}. \tag{16}$$

Individuals do not take into account the impact of unemployment exposure on the payroll tax rate.

The first-order conditions give

$$\begin{aligned} -c'(u) &= v(\alpha w(1-t)) - v((1-\alpha)b), && (17)\\ \frac{v'(\alpha w(1-t))}{v'((1-\alpha)(1-u)tw/u)} &= \frac{ub}{(1-u)w(1-t)}. && (18) \end{aligned}$$

The planner sets t while accounting for individual responses to the tax rate and the balanced-budget constraint of the UI scheme. We have

$$\hat{t} \in \arg\max_t \{-c(u) + (1-u)v(\alpha w(1-t)) + uv((1-\alpha)b)\}, \quad (19)$$

subject to (17), (18) and $b = b(u,t) = (1-u)tw/u$.

Inserting the budget constraint into equations (17) and (18), we obtain

$$\begin{aligned} -c'(u) &= v(\alpha w(1-t)) - v((1-\alpha)(1-u)tw/u), && (20)\\ \frac{v'(\alpha w(1-t))}{v'((1-\alpha)(1-u)tw/u)} &= \frac{t}{1-t}. && (21) \end{aligned}$$

These equations can be jointly solved in $u \equiv \hat{u}(t)$ and $\alpha \equiv \hat{\alpha}(t)$. The planner's optimization problem becomes

$$\hat{t} \in \arg\max_t \{-c(\hat{u}(t)) + (1-\hat{u}(t))v(\hat{\alpha}(t)w(1-t)) + \hat{u}(t)v((1-\hat{\alpha}(t))b(\hat{u}(t),t))\}, \quad (22)$$

The first-order condition gives

$$\begin{aligned} & (-c'(\hat{u}(t)) - v(\hat{\alpha}(t)w(1-t)) + v((1-\hat{\alpha}(t))b(\hat{u}(t),t))) \times \hat{u}'(t)\\ & +((1-\hat{u}(t))w(1-t)v'(\hat{\alpha}(t)w(1-t)) - \hat{u}(t)b(\hat{u}(t),t)v'((1-\hat{\alpha}(t))b(\hat{u}(t),t))) \times \hat{\alpha}'(t)\\ & -\hat{\alpha}(t)w(1-\hat{u}(t))v'(\hat{\alpha}(t)w(1-t))\\ & +(1-\hat{\alpha}(t))\hat{u}(t)v'((1-\hat{\alpha}(t))b(\hat{u}(t),t)) \times (b_u(\hat{u}(t),t)\hat{u}'(t) + b_t(\hat{u}(t),t))\\ = \; & 0. \end{aligned}$$

By the envelope theorem, the first two lines vanish. Therefore we have

$$\frac{v'(\hat{\alpha}(t)w(1-t))}{v'((1-\hat{\alpha}(t))b(\hat{u}(t),t))} = \frac{1-\hat{\alpha}(t)}{\hat{\alpha}(t)} \frac{\hat{u}(t)}{1-\hat{u}(t)} \frac{b_u(\hat{u}(t),t)\hat{u}'(t) + b_t(\hat{u}(t),t)}{w}, \quad (23)$$

where $b = (1-u)tw/u$, $b_u = -tw/u^2$ and $b_t = (1-u)w/u$.

This condition is very similar to the previous section. However, there is a fiscal externality that the planner has to account for. This externality is captured by the term $b_u(\hat{u}(t),t)\hat{u}'(t)$ in the numerator of the right-hand side of equation (23). Individuals do not take into account the impact of their choice of unemployment risk on the payroll tax rate. The planner has to monitor this effect while setting the tax rate, which tends to decrease b when the tax rate increases, thereby reducing u through optimal search.

We obtain

$$\frac{v'(\hat{\alpha}(t)w(1-t))}{v'((1-\hat{\alpha}(t))b(\hat{u}(t),t))} = \frac{1-\hat{\alpha}(t)}{\hat{\alpha}(t)} \left\{1 - \frac{t\hat{u}'(t)/\hat{u}(t)}{1-\hat{u}(t)}\right\}. \quad (24)$$

The elasticity of unemployment risk vis-à-vis the tax rate, $-t\hat{u}'(t)/\hat{u}(t) < 0$, quantifies the fiscal externality that contributes to lowering the optimal tax rate. This externality is not new. What is new is its interaction with the taste for work.

In equilibrium, $\alpha^* = \hat{\alpha}(t^*)$. Combining equations (18) and (24), we obtain

$$1 - \alpha^* = \frac{t^*}{1 - \frac{t^*\hat{u}'(t^*)/\hat{u}(t^*)}{1-\hat{u}(t^*)}(1-t^*)} > t^*. \tag{25}$$

The fiscal externality forbids the planner to equalize the weight of consumption derived from nonemployment income to the payroll tax rate. The spread between these two variables depends on the elasticity of unemployment risk with respect to the tax rate.

We illustrate this section with a parameterized example. The felicity function v is $v(x) = x^a$, $a \in (0,1)$, whereas the cost of effort function is $c(u) = c_0(1-u)^\beta$, $\beta > 1$. Equations (20) and (21) imply that:

$$\alpha = \left[1 + \frac{u}{1-u}\left(\frac{t}{1-t}\right)^{a/(1-a)}\right]^{-1}, \tag{26}$$

$$\beta c_0(1-u)^{\beta-1} = (\alpha w(1-t))^a - ((1-\alpha)(1-u)tw/u)^a. \tag{27}$$

Replacing (26) into (27) gives:

$$\psi(u) = \beta c_0(1-u)^{\beta-1} - \left[1 + \frac{u}{1-u}\left(\frac{t}{1-t}\right)^{a/(1-a)}\right]^{-a}(w(1-t))^a + \left(1 - \left[1 + \frac{u}{1-u}\left(\frac{t}{1-t}\right)^{a/(1-a)}\right]^{-1}\right)^a ((1-u)tw/u)^a = 0. \tag{28}$$

The solution of this equation in u is the implicit function $\hat{u}$. We then deduce the function $\hat{\alpha}$ from equation (26).

How does the equilibrium respond to changes in the environment? Parameter c_0 is here particularly interesting. It is a fundamental parameter of the search cost function. As such, it embeds all the microeconomic characteristics affecting the odds of finding a job. However, its inverse $1/c_0$ can also be seen as an index of the state of the economy. When c_0 increases, the two following statements are equivalent: the marginal search cost rises and the marginal productivity of effort goes down.

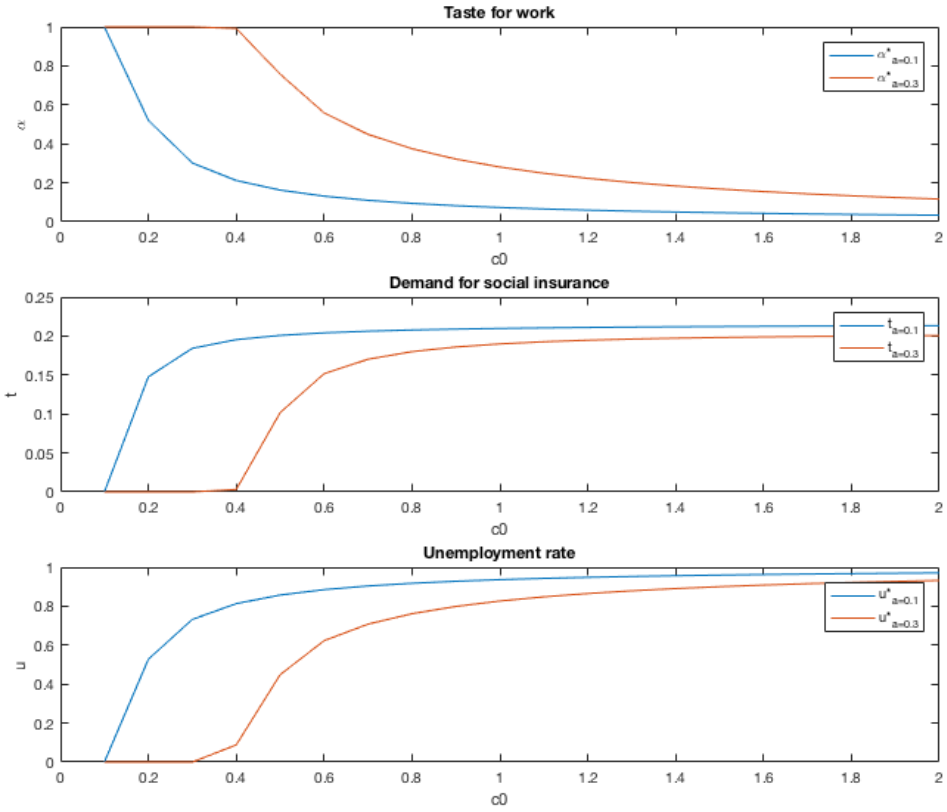

Figure 4: Evolution of the optimal choices when the economic situation changes

Figure 4 plots α^*, t^* and u^* as functions of c_0 for two different levels of risk aversion, i.e., $a = 0.1$ and $a = 0.3$. On each sub-plot, the blue line is associated to more risk averse individuals. Figure 4 reveals that the optimal taste for work, α^*, decreases with parameter c_0, whereas the tax rate, t^*, and unemployment risk, u^*, increase with it. When c_0 increases, individuals become more likely to remain unemployed. As a consequence, they assign a higher weight to consumption in nonemployment. Both effects combine so that the demand for UI strongly responds to c_0.

Figure 4 highlights the role played by risk aversion. As stated in Section 2, risk averse workers do not want to lose too many units of consumption when unemployed. Therefore, they choose a relatively small taste for work and ask for large UI. On the sub-plot describing the optimal taste for work, the blue curve is indeed below the red curve. The consequence is a higher demand for social insurance: on the sub-plot describing the optimal tax rate, the blue curve is located above the red one. Lastly, more risk averse workers expose themselves to a higher risk of unemployment. Indeed, on the third sub-plot, the unemployment rate is higher for more risk averse individuals. One might think that more risk averse workers would try to avoid unemployment as much as they can. However, the opposite situation seems to hold. The reason is that more risk averse workers allocate more weight to consumption in nonemployment, thereby reducing the utility differential between employment and nonemployment. The return to search

is lower, which explains why the search effort decreases with risk aversion.

We conclude this section by a technical discussion. On Figure 4, the red curve sticks to the x-axis for low values of c_0. This is so because there is no interior solution to equation (28) when c_0 is small. Indeed, $\psi(0) = (1-t)^{a^2/(1-a)}\beta c_0 + w^a(t^{a^2/(1-a)+a} - (1-t)^{a^2/(1-a)+a})$ and $\psi(1) = w^a(t^{a/(1-a)} - (1-t)^{a/(1-a)})$. For $t < 0.5$, $\psi(1) < 0$. Moreover, $\psi'(u) < 0$ if and only if $\beta > 1 + a$. Therefore an interior solution exists if and only if $\beta > 1 + a$ and $\psi(0) > 0$. In turn, the latter condition implies that c_0 must be sufficiently large. Otherwise, the search effort is such that $u^* = 0$ and there is no demand for UI.

If Equation (25) gives the formula for the theoretical optimal unemployment insurance, the parameterization of the model might lead us to conclusions different from what occurs in reality. This is what Chetty (2006) pointed out and to which he gave a solution with the sufficient statistics approach. We use it in the next subsection in order to assess the optimality of unemployment insurance in different countries with our model.

5 Optimality of unemployment insurance: a sufficient statistics approach

In this section, we question the optimality of unemployment insurance with a particular approach: the sufficient statistics. In a first part we derive a formula for the optimal unemployment insurance as a function of some statistics, following Chetty (2008). We then suppose that the weight for the employment income is exogenous and fixed to 0.5, and derive the welfare gain of increasing unemployment benefits. In a second part we give some insights on the role played by endogenous preferences on the optimal UI compared with previous work. We give lower and upper bounds for the value of work and compare the results of the welfare gains in the two extreme cases to the Chetty analysis with exogenous α.

Sufficient statistics methodology has been developed in recent years by Chetty. In 2009, he presented this approach as *a bridge between structural and reduced-form* analyses. The main interest of this methodology is to find a formula for the effects of a policy on welfare that depend only on easily estimable elasticities and/or statistics. For instance, in 2008, Chetty presents a model in which the formula for the optimal unemployment benefit level is a function of the liquidity effect and the moral hazard effect.

5.1 General formula

From previous section, we know that the social planner's problem is to maximize $W = -c(\hat{u}(t)) + (1 - \hat{u}(t))v(\hat{\alpha}(t)w(1-t)) + \hat{u}(t)v((1-\hat{\alpha}(t))b)$ where $\hat{u}(.)$ and $\hat{\alpha}(.)$ are the optimal choices of workers knowing t. They verify simultaneously (17) and (21). We also know by the budget constraint that $t = bu/(w(1-u))$, so that

$$\frac{\partial t}{\partial b} = \frac{u}{w(1-u)} + \frac{b}{w(1-u)^2}\frac{\partial u}{\partial b}. \tag{29}$$

To simplify the computations, let's give some notations. We denote $v_e = v(\alpha w(1-t))$, $v_e^{'} = v^{'}(\alpha w(1-t))$, $v_u = v((1-\alpha)b)$, and $v_u^{'} = v^{'}((1-\alpha)b)$. We can now derive the impact on welfare of an infinitesimal increase of b:

$$\frac{\partial W}{\partial b} = u[(1-\alpha)v_u^{'} - \alpha v_e^{'}(1+\frac{\epsilon_{u,b}}{1-u})], \tag{30}$$

where $\epsilon_{u,b}$ is the elasticity of unemployment with respect to benefits: $\epsilon_{u,b} = \frac{b}{u}\frac{\partial u}{\partial b}$. Following Chetty (2008), to obtain a money metric value of the welfare gain of increasing b by €1, we divide (30) by the welfare gain of increasing the wage by €1:

$$\frac{\partial W/\partial b}{\partial W/\partial w} = \frac{u}{(1-u)(1-t)}\left[\frac{(1-\alpha)v_u^{'} - \alpha v_e^{'}}{\alpha v_e^{'}} - \frac{\epsilon_{u,b}}{1-u}\right]. \tag{31}$$

5.2 Analysis à la Chetty, with exogenous work value

Following Chetty (2008), we want to evaluate the right-hand side of (31). If the current unemployment insurance is optimal, then the right-hand side of (31) should be null. Otherwise, if it's positive then there is room for increasing unemployment benefits while if it's negative, government should decrease UI.

We suppose that the work value, α, is fixed for everyone and set to 0.5. Equation (31) then simplifies and allows to use the Taylor approximation used in Chetty (2006). We thus find that the welfare gain of increasing unemployment benefits can be derived from:

$$\frac{\partial W/\partial b}{\partial W/\partial w} = \frac{u}{1-u}\left[\gamma(1-r) + 0.5\rho\gamma(1-r)^2 - \epsilon_{D,b}\right], \tag{32}$$

where γ is the Relative Risk Aversion, ρ is the Relative Prudence, $r = b/(w(1-t))$ is the net replacement rate from employment to unemployment and $\epsilon_{D,b}$ is the elasticity of unemployment duration with respect to unemployment benefits.

To evaluate the optimality of UI we thus need to use the following sufficient statistics: the unemployment rate, the tax rate on wages aimed to finance unemployment insurance, the net replacement rate from employment to unemployment, the elasticity of the duration of unemployment with respect to benefits, the relative risk aversion and the relative prudence. If the three former are easily known, to evaluate the three latter we have different solutions. For the elasticity of unemployment duration with respect to unemployment benefits, the best solution would be a natural experiment where some individuals see their benefits increase while others don't, and then to see the impact on their unemployment duration. Since such an experiment is not available, we can either compare individuals who have different unemployment benefits while they are on the same labor market, by controlling for individual characteristics or use the estimates of previous papers like Landais et al (2010). For relative risk aversion and relative prudence, we refer to Etner et al. (2007, 2009) which give respectively 1 and 2 as benchmark values.

Table 7 gives the welfare consequence of an increase in unemployment benefits for different countries and different estimates of $\epsilon_{D,b}$, γ and ρ.

	RRA= 1 and RP= 2			RRA> 1 and RP= 2		
	$\epsilon_{D,b} = 0.3$	$\epsilon_{D,b} = 0.5$	$\epsilon_{D,b} = 0.7$	$\epsilon_{D,b} = 0.3$	$\epsilon_{D,b} = 0.5$	$\epsilon_{D,b} = 0.7$
France	0.02	-0.01	-0.04	0.04	0.02	-0.01
Germany	0.01	0.004	-0.01	0.03	0.02	0.01
Netherlands	0.01	-0.01	-0.02	0.02	0.004	-0.01
UK	0.06	0.05	0.04	0.1	0.09	0.08
Belgium	-0.02	-0.04	-0.06	-0.01	-0.03	-0.05
Finland	0.02	-0.01	-0.03	0.04	0.02	-0.01
Ireland	0.05	0.03	0.01	0.09	0.07	0.05
Denmark	-0.01	-0.02	-0.03	0	-0.01	-0.03
United-States	0.01	0.001	-0.01	0.03	0.02	0.01

Table 7: Welfare gain of increasing unemployment benefits for different OECD countries in 2016 for an exogenous $\alpha = 0.5$

Note. Here the tax rate is proxied by OECD data on taxes for social security (% of GDP).

We find that the effect of an increase in unemployment benefits depends on the country as well as on the relative risk aversion and the moral hazard effect. Indeed, a higher relative risk aversion is always combined with a higher need for social insurance. Moreover, the higher the moral hazard effect, the lower the positive effect of an increase in social benefits. This is due to the fact that a higher moral hazard leads to a higher cost for society. Finally, using Figure 5, we easily see that the increase of unemployment benefits has a positive impact on social welfare when the replacement rate in this country is very low (for instance the UK). When the replacement rate is already high, for instance Belgium, it is always the case that the unemployment benefits should be decreased to increase social welfare when the work value is fixed to 0.5. Note that a value of work equal to 0.5 is quite low compared to what we find in our model. Indeed, equation (25) shows that the optimal α should be higher than $1-t$ where t is never higher than 0.2. In the next subsection, we turn to the analysis of the welfare gain of increasing unemployment benefits when α is actually endogenous. We develop an alternative method for the computation of this value since the Taylor approximation does not apply anymore in the presence of α.

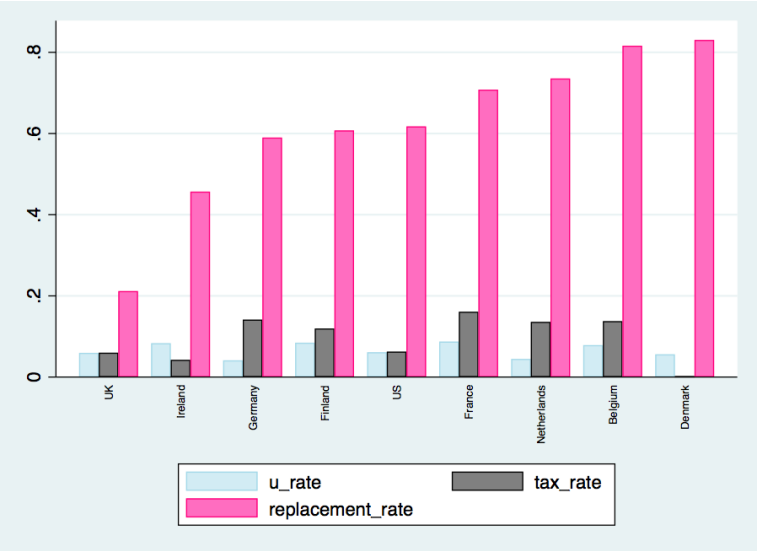

Figure 5: Unemployment rate, Replacement rate and Tax rate for different OECD countries in 2016

5.3 New analysis, when the work value is endogenous

Suppose now that α is not exogenous but is optimally chosen by individuals, i.e. that (21) is true. To give an analysis of the optimality of unemployment insurance in such a case, we need to know the actual α, which is not an easy task. Indeed, we've compared α to a work ethic along this paper, and it is well-known that cultural values are not easily estimated. Thus, instead of using an empirical α, what we do is to determine a lower and an upper bounds for α^* from the general model, and to provide the analysis of unemployment insurance optimality in the cases where α is at his lower and upper bounds. This reasoning is more in line with Chetty whose objective is to stay as most as possible in a general setting instead of parameterizing it.

From Equation (21), we know that the optimal value for work depends on the tax rate. Thus, choosing two bounds for the tax rate we find two bounds for α^*. Indeed, it is obvious that the tax rate is between 0 and 0.5. Actually, if we look at Figure 5, we see that the tax rate belongs to $(0, 0.2)$ but for simplicity purposes we choose $t = 0.5$ as un upper bound for the tax rate. We can then determine the bounds of the optimal work value.

When the tax rate tends to 0, Equation (21) allows to say that the optimal work value tends to 1. Conversely, when the tax rate tends to 0.5, we can find that $\alpha^* = b/(b + w * 0.5)$. Thus, this evaluation leads to conclude that $\alpha^* \in (\frac{b}{b+0.5b}, 1)$. We can then derive the value of the welfare gain of increasing unemployment benefits in these two extreme cases.

When α goes to 1, we have:

$$\lim_{\substack{\alpha \to 1 \\ t \to 0}} \frac{\partial W/\partial b}{\partial W/\partial w} = \frac{u}{1-u}[-1-\epsilon_{D,b}] < 0 \tag{33}$$

Thus, when α tends to its higher bound, it is always the case that an increase in unemployment benefits would decrease social welfare. This occurs because when α is high, individuals earn more utility from being employed than being unemployed. Thus an increase of the unemployment income gives less than an increase of the employment income that comes through a decrease of the tax rate which finances unemployment benefits. At the end, individuals want a lower unemployment insurance because they don't give any importance to the unemployment state. Let's now determine what occurs when α is at its lower bound.

First, let's derive a new expression for the welfare gain of a marginal increase in unemployment benefits. If Chetty (2006) uses a Taylon approximation of the difference in marginal utilities to determine the social welfare gain of increasing UI, we use instead an exact result that comes from the optimal choice of the taste for work. Indeed, from (21), we derive that $v_u^{'} = v_e^{'}(1-t)/t$. We include it into (31) to find that:

$$\frac{\partial W/\partial b}{\partial W/\partial w} = \frac{u}{(1-u)(1-t)}\left[\frac{1-\alpha}{\alpha}\frac{1-t}{t} - 1 - \epsilon_{D,b}\right]. \tag{34}$$

Assume now that the tax rate is 0.5, which leads $\alpha^* = b/(b+0.5w)$, and replace these values into (34). We find that:

$$\lim_{\substack{\alpha \to b/(b+0.5w) \\ t \to 0.5}} \frac{\partial W/\partial b}{\partial W/\partial w} = \frac{u}{0.5(1-u)}\left[\frac{0.5w}{b} - 1 - \epsilon_{D,b}\right]. \tag{35}$$

The advantage here is that we only need to estimate the moral hazard effect ($\epsilon_{D,b}$) to determine the welfare gain of increasing unemployment benefits: relative risk aversion and relative prudence are only reflected by the optimal choice of taste for work. We need to be careful though on the interpretation of the moral hazard effect since now it comes from two effects: the direct effect of unemployment benefits on the duration of unemployment and the effect of unemployment benefits on the work ethic which affects also the duration of unemployment. Finally, what we have in the data is the replacement rate $r = b/(w(1-t))$. To compute w/b we thus need to correct r by multiplying it by the actual $(1-t)$ in the data and take the inverse of the result. Table 8 presents the values of the welfare effect of increasing unemployment benefits when α is at its lower bound. Here should remind here that the optimal work ethic is a strictly decreasing function of the tax rate. Thus, if the welfare effect of increasing unemployment benefits is negative when α is at its lower bound, it is the case for all higher values of α.

	$\epsilon_{D,b} = 0.3$	$\epsilon_{D,b} = 0.5$	$\epsilon_{D,b} = 0.7$
France	-0.09	-0.14	-0.18
Germany	-0.03	-0.04	-0.06
Netherlands	-0.06	-0.09	-0.11
UK	0.15	0.13	0.11
Belgium	-0.11	-0.14	-0.18
Finland	-0.08	-0.12	-0.16
Ireland	-0.03	-0.07	-0.11
Denmark	-0.09	-0.12	-0.15
United-States	-0.05	-0.07	-0.09

Table 8: Welfare gain of increasing unemployment benefits for different OECD countries in 2016 for a tax rate fixed to 0.5

We find that except for the UK which has a very low replacement rate, it is always the case with an endogenous work value, even at its lower bound, that an increase in unemployment benefits would decrease social welfare. This result is explained by what we called earlier the anti-insurantial role of the weights α_i. Indeed, as soon as α is high enough, individuals do not give enough importance to the non-employment income for it to be demanded. Thus, except if it is very low and the unemployment rate is not, as it is the case in the UK, no country needs to have such unemployment insurance. Nevertheless, since we compared the UK and Belgium earlier, we should try to go further in the analysis to understand how endogenous preferences can explain that countries with the same unemployment rate ends with such different unemployment insurance.

In the next subsection we give an insight on how the model of endogenous preferences presented here might lead to the existence of multiple equilibria.

6 Endogenous preferences: an alternative explanation to low take-up rates?

We talk about a low take-up rate when an important part of individuals who are eligible to a social aid do not get this financial earnings. The non take-up phenomenon concerns all social benefits, from housing to family and unemployment aids. We show in this section that our model enables to give a reason why individuals from different social backgrounds do not have the same take-up rate of unemployment benefits.

6.1 Low take-up rates: previous evidence

Most of the time, when the government tends to evaluate the optimality of a policy, they take into account the possibility of fraud: some people might claim and get benefits to which they are not entitled. Though, till very recently they failed taking into account the opposite problem: people who should get financial help do not take them. It is important to understand the reason of this behavior in order to adapt the policy.

There are different definitions for the non take-up. The literature differentiates first between the primary non take-up where eligible individuals do not ask for the help they are entitled to, and the secondary non take-up where eligible individuals ask for the financial help but do not receive it. We can also distinguish the complete non take-up where individuals do not receive any part of the benefits from the partial non take-up where they receive only a part of the benefits to which they are eligible. Timing is also an important key of the non take-up. Thus, we can find people who face permanent non take-up (i.e. they never get any financial help) but we can also define the temporary non take-up when people do not ask for the benefits as soon as they become eligible but take some time before asking for it. Finally there is also what we call the frictional non take-up which comes from the time needed for the administrative procedure.

The main interest with this problem is to disentangle the different causes of the non take-up. Indeed, we can easily that there are different responsibilities. For instance, the frictional non take-up is partly due to the administration failures to answer quickly to a demand, while individuals who do not ask for any benefits are more responsible of their own situation. Though, the economic literature (Hernanz, Malherbet and Pellizzari 2004, Currie 2006) determine three main causes for the non take-up. The first determinant they give is the cost/benefit analysis done by the eligible individuals. Indeed, they assume that there are costs associated with the application to financial support (time, complex administrative procedure...) while the benefits are sometimes to low, or for a too court duration compared to the costs.This would explain why some people would prefer not to take their benefits up. The second category of reasons the literature points out is the lack of information with respect to eligibility: some individuals might not ask for their benefits because they do not know that they are eligible to them. Finally, the last explanation might be social and psychological costs such as stigma associated with enrollment.

Hernanz, Malherbet and Pellizzari (2004) wrote a survey on the different analyses run to evaluate empirically the non take-up rates (i.e. the ratio of the eligible who do not claim benefits over the total eligible population). Estimates span a range between 20% and 40% for unemployment benefits non take-up rates. According to McCall (1995) and Storer et al. (1995), unemployment insurance is taken up by workers who expect a long period of unemployment. These workers are also those who have lower incomes and thus lower benefits rights. Thus, workers who could have high benefits are more likely to ask less for unemployment benefits. This is in line with a result of Katz and Meyer (1990) and Braun, Engeldhardt, Griffy and Rupert (2016) according to which UI non-collectors tend to have much shorter unemployment durations. Our model makes all these choices endogenous: individuals with higher α put a higher effort in their job search so that they have shorter risk of unemployment. In the same time, they give less importance to consumption in unemployment state and are thus less likely to ask for unemployment

income. This is what we formally show in the next subsection.

6.2 The take-up of unemployment benefits with endogenous preferences: amendment of the previous model

In this section we take the previous model with endogenous preferences and exposure to unemployment. We add to the model two features. First, we suppose that individuals are heterogeneous in their cost of searching. For instance one can think of the difference in job-finding cost for individuals from different social backgrounds who don't have the same social network. Second, we add a new variable of choice: the effort made to take the unemployment benefits up once unemployed. We call this effort γ. We suppose that a low take-up corresponds to giving up a part of unemployment benefits. Thus the higher is γ, the higher is the take-up, and with effort γ, the individual gets γb. Following Blasco and Fontaine (2010) we suppose that this effort is costly, and we denote by $\kappa(\gamma)$ this cost with $\kappa'(\gamma) > 0$ and $\kappa''(\gamma) > 0$. This cost can refer to the information cost, the administrative cost as well as the psychological cost of asking for benefits. The individual then chooses α, u and γ, depending on his research cost $c(u)$ such that:

$$\alpha^*, u^* \text{and } \gamma^* \in \arg\max_{\alpha,u,\gamma}[(1-u)v(\alpha w(1-t)) + u[v((1-\alpha)\gamma b) - \kappa(\gamma)] - c(u)]. \tag{36}$$

When unemployed, the individual gets γb where γ is the probability of taking benefits up. The individual pays the cost of taking benefits up only if unemployed. The first order conditions give:

$$\frac{v'(\alpha w(1-t)))}{v'((1-\alpha)\gamma b)} = \frac{u\gamma b}{(1-u)w(1-t)}, \tag{37}$$

$$c'(u) = v((1-\alpha)\gamma b) - \kappa(\gamma) - v(\alpha w(1-t)), \tag{38}$$

and

$$\kappa'(\gamma) = (1-\alpha)bv'((1-\alpha)\gamma b). \tag{39}$$

The objective of this section is to explain the take-up rate in our model. The first interest is to show what is the impact of endogenous preferences on the take up effort. Then we will also show the impact of unemployment benefits. Using (39), we derive the response of the effort of taking up γ to an increase in the preferences for work α:

$$\frac{\partial\gamma}{\partial\alpha} = \frac{-v'((1-\alpha)\gamma b)b(1-R)}{\kappa''(\gamma) - ((1-\alpha)b)^2 v''((1-\alpha)\gamma b)}, \tag{40}$$

where R is the relative risk aversion. Since $\kappa''(\gamma) > 0$, $v'(x) > 0$ and $v''(x) < 0$, we easily see that $\partial\gamma/\partial\alpha < 0$, i.e. people with higher preferences for work are more likely to ask for unemployment benefits in case of unemployment.

Using (38), we find that $\partial\gamma/\partial c_0 \to +\infty$. Thus, the higher the cost for searching a job, the higher the probability of taking nonemployment income up. This come through two effects: the first one is that if it is costly to look for a job, it is more likely to be unemployed. As a consequence, it is more likely that the individual needs social benefits for leaving. Moreover, we can easily show that $\partial\alpha/\partial c_0 < 0$. Thus, according to (40), we understand why the heterogeneity of the search cost has an additive impact on the take-up rate through the endogeneity of α.

With the same reasoning, we also find that $\partial\gamma/\partial b > 0$, i.e. when the unemployment benefits increase, individuals have more incentives to take them up and make a higher effort γ. So our model is able to predict the empirical results: higher unemployment benefits increase the take-up rate. Moreover, apart from the different costs associated with taking up, we show that there exists another reason why individuals would not take their rights: if they have a high taste for their consumption that come from the revenue of work compared to their taste for consumption when they are unemployed, they sort of dislike unemployment benefits so that they have no incentives to ask for them. Note that even if the cost of asking was null, a higher α would still lead to a lower take-up because of the preference for the revenue of work.

The conclusion of this subsection is that it might be optimal for some workers not to take their rights in terms of unemployment benefits. As a consequence, while some non take-up is due to inefficiency in the administrative procedure or in the lack of information, the non take-up rate due to endogenous preferences should not worry policy-makers. This gives some insights for future research. One could investigate the part of the non take-up rate which is explained by preferences, in order to see whether or not the non take-up is a problem of inefficiency, which should be corrected, or simply a consequence of rational behavior, in which case nothing should be done about it.

7 Appendix

7.1 Descriptive statistics 1

Variable	Panel	Mean	Sd	Min	Max	Observations
Age	Overall	46.56	17.64	15	108	N=70977
	Between		2.84	38.87	51.50	n=27
	Within		17.40	12.06	107.07	T=2628
Feeling of happiness	Overall	1.92	0.69	1 (Very happy)	4	N=69344
	Between		0.24	1.54	2.25	n=27
	Within		0.65	0.67	4.38	T=2568
Gender	Overall	1.54	0.50	1 (Male)	2 (Female)	N=71286
	Between		0.03	1.49	1.60	n=27
	Within		0.50	0.94	2.06	T=2640
Marital status	Overall	2.85	2.20	1 (Married)	6 (Single/Never married)	N=70766
	Between		0.21	2.34	3.30	n=27
	Within		2.19	0.55	6.52	T=2620
Employment status	Overall	3.09	3.11	1 (Full time)	8 (Other)	N=70887
	Between		0.35	2.50	4.31	n=27
	Within		2.08	-0.22	8.59	T=2625
Education level	Overall	1.85	0.74	1 (Low)	3 (High)	N=70654
	Between		0.18	1.42	2.153	n=27
	Within		0.72	0.72	3.43	T=2616
Monthly household income	Overall	1.62	1.32	0.05	14.73	N=53423
(x1000)	Between		0.70	0.58	3.02	n=27
	Within		1.15	-1.25	15.31	T=1978

Table 9: Descriptive statistics for the explicative variables in the first step

7.2 Descriptive statistics 2

Variable	Panel	Mean	Sd	Min	Max	Observations
Tax rate (OECD)	Overall	0.11	0.04	0.00059	0.16	N=65041
	Between		0.04	0.003	0.16	n=26
	Within		0.005	0.1	0.13	T=2501
Tax rate (Budget constraint)	Overall	0.01	0.008	0	0.035	N=65040
	Between		0.007	4.04e-06	0.03	n=26
	Within		0.003	-0.003	0.02	T=2501

Table 10: Descriptive statistics for the tax rate

7.3 Risk aversion with state-dependent utility function

When using the CES felicity function, we somewhat improperly refer to parameter a as measuring (the opposite of) risk aversion. In this Appendix, we show that a is indeed negatively correlated with the standard measure of risk aversion when preferences are state-dependent.

We base our discussion on Karni (1983). According to this paper, the absolute risk aversion (ARA) is defined by

$$\text{ARA} = \left[-(1-p)\frac{U''(w_1^*)}{U'(w_1^*)} + (-p)\frac{V''(w_2^*)}{V'(w_2^*)}\right]\frac{1}{2}\frac{p}{1-p}(w_1 - w_1^*), \tag{41}$$

where we use Karni's notations: p is the probability of being in state 1, $U(.)$ the utility function in state 1 and $V(.)$ the utility function in state 2. The levels w_1^* and w_2^* define the reference sets:

$$\text{RS}(U) = \{(w_1^*, w_2^*), U'(w_1^*) = U'(w_2^*)\}. \tag{42}$$

In our paper, $U(x) = \alpha x^a$, $V(x) = (1-\alpha)x^a$, and $p = 1-u$ is the probability of being employed. We have RS(U) =RS(V) : $w_1^* = w_2^*$. Therefore the absolute risk aversion is

$$\text{ARA} = \frac{1}{2}\frac{1-a}{w_2^*}\frac{1-u}{u}(w_1 - w_1^*) \tag{43}$$

with $\partial\text{ARA}/\partial a < 0$, i.e., when parameter a increases, individuals are less risk averse. This property justifies our consideration of a as a proxy for risk aversion.