OPTIMAL UNEMPLOYMENT INSURANCE IN TURKEY IN THE PRESENCE OF MORAL HAZARD AND LIQUIDITY CONSTRAINTS

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Abstract

This study aims to analyze and improve the Unemployment Insurance Program adopted in Turkey. Such programs are praised highly in the world for providing relief to unemployed people. On the other hand, they are criticized for the adverse incentives they introduce to agents' reemployment efforts. I address this issue by employing an incomplete markets equilibrium model. Agents are making endogenous employment decisions depending on the generosity of the insurance payments. The model is calibrated so that it would mimic Turkish economy in 2004-2008. For a 10% lower bound level for moral hazard, the results indicate, welfare can be increased by 0.15% by adopting an optimal unemployment insurance program. Next, I extend the model to a case where eligibility to unemployment benefits are stochastic. This extension allows the model to account for the fact that these benefits are paid only for a limited time. For a 10% moral hazard rate, the welfare gains from adopting an optimal program are reduced to 0.01%. However, both welfare results are sensitive to degree of moral hazard. Welfare gains get as high as 9.17% for higher levels of moral hazard.

LİKİDİTE SINIRLAMALARI VE AHLAKİ TEHLİKENİN VARLIĞINDA TÜRKİYE İÇİN OPTİMAL İŞSİZLİK SİGORTASI

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Özet

Bu tez, Türkiye'de uygulanmakta olan İşsizlik Sigortası Programı'nı incelemeyi ve geliştirmeyi hedeflemektedir. Bu tür programlar dünyada da yaygın bir şekilde kullanılmakta ve işsizlere sağladığı olanaklardan dolayı çokça övülmektedirler. Öte yandan işsizlerin iş bulma davranışlarını olumsuz etkiledikleri gerekçesiyle de eleştirilerin hedefi olmaktadırlar. Bu sorun, eksik piyasalar modelinin 2004-2008 Türkiye'sine kalibre edilmesi ile incelenmiştir. Modelde iktisadi ajanlar işsizlik maaşının yüksekliğini de dikkate alarak işe girip girmeme kararını vermektedirler. Sonuçlar, alt sınır olarak belirlediğimiz %10 ahlaki tehlike seviyesinde, optimal bir işsizlik programı kullanmanın refahı %0.15 arttıracağını göstermektedir. Daha sonra bu model işsizlik maaşı almaya hak kazanmanın olasılıksal varsayılmasıyla genişletilmiştir. Bu eklenti işsizlik maaşlarının belirli bir süre için verildiği gerçeğini modele eklememize olanak sağlamaktadır. Bu yeni durumda %10 ahlaki tehlike için refah kazanımları %0.01'e kadar düşmüştür. Ancak iki modelde de sonuçlar ahlaki tehlikenin boyutuna son derece duyarlıdır. Daha yüksek ahlaki tehlike seviyeleri için refah kazanımları %9.17'yi bulmaktadır.

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1 Introduction

This paper attempts to analyze and improve the unemployment insurance program adopted in Turkey. Although it has been over a decade since the programs establishment, surprisingly there is little research done on the optimality of the unemployment insurance program. In fact, to the best of my knowledge, this is the first formal study on this subject. While the insurance system was subject to lots of criticisms for variety of reasons (i.e. low level of benefits, eligibility conditions, duration of benefits) the debates are generally fueled by the steadily increasing surplus in the programs funds. As there are more funds in the budget, the possible benefits of higher duration and benefits are cited without addressing their adverse effects on the incentives of beneficiaries. The arguments supporting such claims based on cross-country comparisons are also flawed as they exclude important factors such as different unemployment rate, average unemployment duration, and moral hazard rates. I hope this paper sheds some light to ongoing policy discussions.

Unemployment insurance programs are widely used in the world. They are adopted in most developed countries and 72 out of 198 countries practice them in total (ILO (2012). Yet such an extensive usage does not translate to an agreement in the consequences of employing such programs. The opinions on these programs are far from unified. They are highly praised for giving relief to unemployed people and help them retaining their life standard until they find a suitable job. This aspect of the unemployment insurance programs is considered as being one of the main pillars of the welfare state. On the other hand , they are also harshly criticized for providing adverse incentives to people not to work and live on the unemployment benefits. This situation is deemed as immoral exploitation of the workforce. Many of the programs are designed to address such discussions by lowering unemployment benefits and requiring tough eligibility conditions.

Such designs have been analyzed with two different approaches in the literature. One approach uses contract theory in a partial equilibrium environment to find an optimal contract for unemployment insurance. (Shavell and Weiss (1979), Hopenhayn and Nicolini (1997)). They generally focus on how should benefits evolve over time to provide appropriate incentives. The prevailing result from this perspective is that benefits should decline with longer unemployment spells. Such gradual diminution of the benefits punish those who try take advantage of the program by prolonging their unemployment. Other approach uses quantitative dynamic general equilibrium models to study the influence of unemployment insurance on macroeconomic variables, income distribution, and welfare. Hansen and Imrohoroglu (1992) points out that economy can attain first-best solution with an optimally designed program. This result derives from the fact that unemployment insurance program is contingent upon the job market revelations. This provides agents with richer tools to insure their future. However, they keenly warn policy makers that these programs might result in serious welfare losses for high degrees of moral hazard. Abdulkadiroglu, Kuruscu, and Sahin (2002) also utilize a similar model. They argue diminishing unemployment benefits prescribed by Shavell and Weiss (1979) and Hopenhayn and Nicolini (1997) has little importance when agents are able to save their earnings without the knowledge of the government.

The models in this study closely follow Hansen and Imrohoroglu (1992). The economy consists of ex-ante identical heterogenous agents. They differ in their asset holdings and employment history. Each period they face stochastic employment offers. As agents are not able to borrow when they need to do so, they cannot sufficiently insure themselves against such idiosyncratic shocks. Therefore an unemployment insurance program can help them accommodating such shocks and increase the welfare in the economy. However, it is also possible for such an insurance scheme to introduce adverse incentives to the economy. When agents receive an employment offer, they are faced with a trade-off between work and leisure. If there is enough insurance payment when the agent is unemployed, then agents have an extra incentive not to work. They may want to live on insurance payments while enjoying extra leisure hours. If the agents are successful in defrauding the system this way the unemployment rate could rise significantly, creating serious welfare costs.

In the hopes of quantifying the relative importances of these opposing effects, firstly, I calibrate the exact model of Hansen and Imrohoroglu (1992) so that it would mimic the Turkish economy in between 2004 and 2008. Then I searched for an optimal replacement ratio, which is the ratio of unemployment benefits to previous wage of beneficiary, while holding all other parameters the same. The results indicate that, for a lower bound of 10% moral hazard rate, there are significant welfare gains to be attained by adopting an optimal unemployment insurance program. Agents in the economy with the current replacement ratio (42%) should be 0.15% more productive so that they would have the same average utility as they would have with the optimal replacement ratio. Secondly, I extend the model of Hansen and Imrohoroglu (1992) by assuming stochastic unemployment benefits following Koehne and Kuhn (2013). This assumption allows the model to account for two aspects of the reality: (1) the fact that the unemployment benefits are paid only for a limited period of time and (2) the fact that eligibility is tied to employment history. The exact calibration strategy is employed again except this time with the addition of average duration of benefits. The results of this exercise suggest, for 10% degree of moral hazard, current replacement ratio is almost optimal. Welfare gain from replacing current program with an optimal one is as low as 0.01%. Above all, the original warnings of Hansen and Imrohoroglu (1992) are also relevant to the Turkish economy. Optimal replacement ratio is critically dependent on the degree moral hazard. Welfare gains from adopting an optimal replacement ratio get high as 7-9% as the moral hazard increases.

The paper proceed as follows. Next section summarizes the unemployment insurance program in Turkey. Section 3 and 4 introduce the models. Section 5 describes the calibration strategy. Section 6 provides the results and section 7 presents some concluding remarks.

2 Unemployment Insurance Program in Turkey

Turkey has adopted an unemployment insurance program in the June of 2000. People in the coverage of the program are obliged to pay premiums while they are working. The premiums consist of 1% cut from employers and 2% from employees and an additional 1% contribution from government on the net income of the respective employer. However, being unemployed is not in itself enough to become eligible to get benefits. The unemployed people must also satisfy the following conditions. They should have lost their job while they had the appropriate talent, health and desire to keep their jobs. Furthermore, they have to have 600 days of tenure in the last three years along with at least 120 day tenure before they were displaced from their jobs. Those with 600 days of tenure are insured for 180 days, those with 900 days of tenure are insured for 240 days and those who had 1080 days of tenure become eligible for 300 days.

How much insurance benefits will be paid is a function of the previous wage record the unemployed individual has. Payments are calculated as being 40% of the gross wage of the beneficiary in the last four months. However, there is an upper limit to such benefits. They cannot exceed 80% of the gross minimum wage. Moreover, beneficiary should behave as prescribed by the program to keep getting the benefits. Eligibility is lost if (1) the beneficiary rejects a suitable job offer provided from responsible institution İŞKUR, (2) the beneficiary is found to be working informally while collecting benefits, (3) the beneficiary is collecting old-age security pensions from any social institution while collecting unemployment insurance, and (4) the beneficiary does not attend to courses and workshops designed to improve their skills. In cases (1) and (2) eligibility is lost indefinitely while in other cases it possible to become eligible again.

Aybıyık, Görücü, and Koç (2012) lists the aspects of the unemployment insurance program has been criticized for in the literature. They report hard eligibility conditions and

Table 1: Unemployment Insurance Expenditure as a percentage of GDP

UI Expenditure/GDP	2004	2005	2006	2007	2008	2009	2010
Turkey	0,04	0,05	0,05	0,05	0,20	0,63	0,47
OECD Countries	0,58	0,53	0,47	0,4	0,42	0,66	0,55

Source: OECD and The Ministry of Development

Table 2: Financial Development of the Unemployment Insurance Program Funds

Financial Development of the Funds	2003	2004	2005	2006	2007	2008	2009	2010
Revenues	4108	4620	5033	6077	7390	9587	9713	8991
Expenditures	153	241	324	373	408	1940	5970	5147
Rev-Exp Difference	3956	4379	4708	5704	6982	7647	3743	3844
Total Funds	8938	13317	18025	23729	30711	38358	42101	45945

Source:The Ministry of Development
In Millions of TL

lower level of payments are cited as problems. This criticisms are partly justified by the low unemployment insurance expenditure to GDP ratio. On the other hand, the program has responded to the recent financial crisis with a huge increase. In 2009, Turkey spent almost same percentage of the GDP to unemployment insurance as the OECD average. They also point out the money stocking in the system and its misuses ((i.e. transferring funds to other projects, mainly The Southeastern Anatolia Project)) were primary concerns in policy discussions. In this study, I focus on the optimality of the replacement ratio, that is, how much should be the ratio of unemployment benefits to previous wage of the beneficiary. And, I will abstract away from other aspects of the unemployment insurance program.

3 The Model without Stochastic Unemployment Benefits

Firstly, I study the exact model of Hansen and Imrohoroglu (1992). This study provides valuable information on optimal replacement ratio as the model has been extensively used. Moreover, it helps to better understand the impact of eligibility conditions and (stochastically) finite unemployment benefits, which I will introduce later.

The economy is populated by a continuum of infinitely lived ex-ante identical individuals who maximize

$$E\sum_{t=0}^{\infty}\beta^t U(c_t, l_t), \tag{1}$$

where $0 < \beta < 1$ is a time discount factor, c_t is consumption in time t, and l_t is leisure in time t.Following Hansen and Imrohoroglu (1992) the utility function is assumed to have following form which displays constant relative risk aversion and an intratemporal elasticity of substitution between consumption and leisure equal to one: Such utility functions are standard in the literature.

$$U(c_t, l_t) = \frac{(c_t^{1-\sigma} l_t^{\sigma})^{1-\rho} - 1}{1 - \rho} \tag{2}$$

Each agent is endowed with one unit of time in each period for them to allocate between working and leisure. If an agent is employed she will receive a constant wage y. As the wage rate is constant and not competitively determined GDP is a linear function of the employed agents. Time spent in work is assumed to be indivisible. Therefore an agent can choose to work $0 < h < 1$ hours, or not at all.

Each period an individual faces a stochastic employment opportunity. These opportunities follow a two-state Markov Chain. Agent can either have an offer with wage y and hours h or she can have no offer at all. Let s denote the whether agent has an employment offer or not. If $s = e$ the agent is given the opportunity to work and if $s = u$ agent will be unemployed during that period. The transition function in both sectors are given by 2x2 matrix $\chi = [\chi_{ij}], i, j \in \{e, u\}$

Agents are prohibited from borrowing but can insure themselves against these employment shocks by saving with a non-interest-bearing asset. Let m_t denote the agents asset holding in time t, then the budget constraint at time t is given by:

$$c_t + m_{t+1} = y_t^d + m_t \tag{3}$$

where y_t^d is the disposable income in period t. Since borrowing is prohibited m_{t+1} must be nonnegative.

A possible problem with the unemployment insurance program is that agents may start rejecting job offers and be satisfied with the benefits while enjoying extra leisure time. This aspect is has been central to a lot of research since the pioneering work of Shavell and Weiss (1979). This sort of attempts are prohibited in all modern unemployment insurance schemes, yet the government cannot perfectly observe such agents. Therefore I assume those that receive an employment offer and reject it receive benefits with probability $\pi(\eta_t)$ where η_t is an indicator of the employment status of the agent in the previous period. $\eta_t = 1$ denotes that agent was employed in previous period whereas $\eta_t = 0$ denotes that individual was unemployed. These probabilities $\pi(0)$, $\pi(1)$ define the degree of moral hazard in the economy. An agent of type $(s, \eta, \eta') = (e, 0, 0)$ is referred as a *searcher* while $(s, \eta, \eta') = (e, 1, 0)$ is referred as a *quitter*, where η' is an agent's current employment decision. To sum up the whole unemployment insurance eligibility, let μ_t be an indicator that is equal to one if an agent receives benefits in time t and zero if an agent does not.

$$
\begin{aligned}
s &= u, && \Longrightarrow \mu_t = 1 \\
s &= e,\ \eta' = 1 && \Longrightarrow \mu_t = 0 \\
s &= e,\ \eta = 0,\ \eta' = 0 && \Longrightarrow \left\{ \begin{matrix} \mu_t = 1 \text{ with probability } \pi(0) \\ \mu_t = 0 \text{ with probability } (1 - \pi(0)) \end{matrix} \right\} \\
s &= e,\ \eta = 1,\ \eta' = 0 && \Longrightarrow \left\{ \begin{matrix} \mu_t = 1 \text{ with probability } \pi(1) \\ \mu_t = 0 \text{ with probability } (1 - \pi(1)) \end{matrix} \right\}
\end{aligned}
\tag{4}
$$

To finance the unemployment insurance program, government chooses an income tax, τ, so that total tax revenue equals total benefit payments. Therefore, government budget constraint is satisfied with equality. After the inclusion of income tax and unemployment insurance replacement ratio θ, the amount of disposable income received by a given agent is

$$
y_t^d = \left\{ \begin{matrix} (1-\tau)\theta y \text{ when } s = u \\ (1-\tau)\theta y \text{ when } s = e,\ \eta' = 0, \text{ and } \mu = 1 \\ 0 \quad \text{ when } s = e,\ \eta' = 0, \text{ and } \mu = 0 \\ (1-\tau)y \quad \text{when } s = e \text{ and } \eta' = 1 \end{matrix} \right\}
\tag{5}
$$

The timing of the events is as follows. First the agents observe their employment opportunities. Given employment opportunities, current asset holdings, and their previous employment status (m, s, η) agent chooses whether to work or try to cheat the insurance system by declaring themselves unemployed when there was an employment offer. After they make their choice, they find out whether they receive benefits or not. And given this they make their choices about consumption and savings subject to non-negativity constraints. The maximization problem by an agent in the beginning of a period is represented by the following dynamic problem.

$V(m,s,\eta) =$

$$\left\{\begin{array}{ll} \max_{m'}\left\{U(m+(1-\tau)\theta y-m',1)+\beta\sum\limits_{s'}\chi(u,s')V(m',s',0)\right\} \quad \text{if } s=u \\ \max\left\{\begin{array}{l} \max_{m'}\left\{U(m+(1-\tau)y-m',1-h)+\beta\sum\limits_{s'}\chi(e,s')V(m',s',1)\right\}, \\ \pi(\eta)[\max_{m'}\left\{U(m+(1-\tau)y-m',1-h)+\beta\sum\limits_{s'}\chi(e,s')V(m',s',0)\right\} \\ +(1-\pi(\eta))\max_{m'}\left\{U(m-m',1-h)+\beta\sum\limits_{s'}\chi(e,s')V(m',s',0)\right\}] \text{ if } s=e \end{array}\right. \end{array}\right\}$$

subject to $m' \geq 0$.

A stationary competitive equilibrium for this economy consists of a set of decision rules $c(m,s,\eta,\mu)$, $\eta'(m,s,\eta), m'(m,s,\eta,\mu)$ (for consumption, employment, and asset holdings respectively), a time invariant measure $\lambda(m,s,\eta,\mu)$, a government policy (θ,τ) such that:

1. Given the government policy (θ,τ), $c(m,s,\eta,\mu)$, $\eta'(m,s,\eta,\mu), m'(m,s,\eta,\mu)$ solves the agents problem in equation (6).

2. Goods market clears.

$$\sum_{m,s,\eta,\mu}\lambda(m,s,\eta,\mu)c(m,s,\eta,\mu) = \sum_{m,s,\eta,\mu}\lambda(m,s,\eta,\mu)\eta'(m,s,\eta,\mu)y;$$

3. Government budget constraint is satisfied.

$$\sum_m\{[\lambda(m,e,\eta,1)+\lambda(m,u,\eta,1)](1-\tau)\theta y-\lambda(m,e,\eta,0)\eta'(m,e,\eta,0)\tau y\}=0$$

4. λ is an invariant distribution given decision rules $\eta'(m,s,\eta,\mu), m'(m,s,\eta,\mu)$, employment transition probabilities $\chi_{ss'}$, and moral hazard probabilities $\pi(\eta)$.

Computation strategy is as follows. Given an unemployment insurance program (replacement ratio θ) I start with guess on the tax rate. Value function iteration is performed to solve equation (6). Then, using the probabilities over employment status, moral hazard, and the benefit eligibility, the invariant distribution is found by iteration, consistent with the decision rules by referring to the law of large numbers. Finally, the decision rules and the invariant distribution is used to evaluate the government budget constraint. If government budget is positive then the initial guess of tax is decreased; whereas, if government budget is negative the tax is increased. This procedure is applied until the equilibrium is reached. More details of the calculation and uniqueness of this equilibrium can be found in Imrohoroglu (1989) and in Hansen and Imrohoroglu (1992).

4 Calibration

As our model is based on Hansen and Imrohoroglu (1992) I calibrate functional parameters accordingly with their strategy. A period in this model economy is set to 6 weeks in real life. Before tax wages are normalized to 1 and h is set to .45 assuming substitutable time (98 hours a week) and the time spend on working and commuting (45 hours a week). The discount factor β and intratemporal elasticity of between consumption and leisure σ assigned $\beta = 0.995$, and $\sigma = 0.67$ as presented in Kydland and Prescott (1982). The risk aversion parameter ρ is set to 2.5 following Mehra and Prescott (1985).

Transition probabilities, $\chi_{ss'}$, are chosen to match the average employment rate and average unemployment duration in Turkey from 2004 to 2008. Data on these targets are available on the TURKSTAT website. Unemployment rate is found to be around 10.5 percent. The average unemployment duration is based on the TURKSTAT reports which gives information on the number of unemployed people in the beginning of the year period and how much time it took for them to be out of unemployment. However, the time durations are reported in intervals (1-2, 2-4, 6-8, 9-11, 12-24, 24-36, 36+ months). Therefore, there is need for a further assumption regarding the mean of these intervals for the sake of calculating mean unemployment duration. Tunali (2003) uses (1.5, 4, 7, 10, 14, 25, 52) respectively. Using the same weight structure, average unemployment duration is found to be around 45 weeks (7.5 periods in our model) over the years 2004-2008. Following equations are then utilized to find respectable probabilities:

$$
\begin{aligned}
(1-\chi_{22})^{-1} &= 7.5 \quad \text{(Average unemployment duration)} \\
0.895.\chi_{12} + 0.105.\chi_{22} &= 0.105 \quad \text{(10.5\% average unemployment rate)} \\
\chi_{12} &= 1-\chi_{11}, \quad \chi_{21} = 1-\chi_{22}
\end{aligned}
$$

where subscript 1 denotes $s = e$ and subscript 2 denotes $s = u$. These probabilities ensure that employment opportunity will be presented .895 percent of the time, which implies an upper bound on the employment rate as individuals are endogenously choosing whether to work or not.

$$\chi = \begin{bmatrix} .9844 & .0156 \\ .1333 & .8667 \end{bmatrix}$$

Benchmark replacement ratio is calculated from the OECD data. OECD reports net replacement ratio for six different family types (based on marital status, children, and income group) for the initial phase of unemployment. Following Koehne and Kuhn (2013) the number is calculated for single persons with no children and averaged over the three income pre-unemployment income levels and found to be 42% in 2011.

5 Optimal Unemployment Insurance without Stochastic Unemployment Benefits

In this section the results are presented. As the moral hazard in the economy is unknown, different values are experimented around to guide policy makers. I consider two cases: An economy where only searchers can defraud the program and an economy where there is no discrimination between searchers and quitters in their ability to defraud. The results indicate that the better understanding of the level of moral hazard is crucial for the unemployment insurance program to work in its best. To assess the welfare consequences of unemployment insurance program the following question is asked: How much more productive should an employed agent in the benchmark economy (42% replacement ratio) have to be (i.e., how much should the wage rate y increase) so that the same average utility with the optimal replacement ratio is attained.

If there is no moral hazard in the economy ($\pi(0) = \pi(1) = 0$) the optimal replacement ratio is found to be 67%. In this economy agents have no need to accumulate non-interest bearing assets to smooth their consumption. The extra welfare from adopting 67% replacement ratio is 0.65%. Table-3 shows the results for an economy where quitters cannot defraud the system. ($\pi(1) = 0$).

It is worth noting that 10% increase in the success rate of searchers in defrauding the system has no effect on steady state properties of the economy where there is no moral hazard. On the other hand, as moral hazard rate increases the average utility in the steady state starts declining. The current replacement ratio seems to be most compatible with 20% moral hazard for searchers. However, if government is highly unsuccessful, the replacement ratio gets as low as 11%. In such an economy there is huge welfare gain (6.29%) in reducing the optimal replacement ratio.

Table 3: Results for the Model without Stochastic Unemployment Benefits

$\pi(0)$	$\pi(1)$	Optimal θ	Tax	Assets	Employment Rate	Average Utility	Welfare Change
0	0	0.67	0.0729	0	0.895	-0.5516	0.65%
0.1	0	0.67	0.0729	0	0.895	-0.5516	0.65%
0.2	0	0.48	0.0605	0.622	0.821	-0.5582	0.18%
0.3	0	0.21	0.0271	2.631	0.857	-0.5630	0.41%
0.4	0	0.15	0.0196	3.700	0.863	-0.5645	2.21%
0.5	0	0.11	0.0142	4.590	0.871	-0.5655	6.29%

Moral Hazard for Searchers Only

Table 4: Results for the Model without Stochastic Unemployment Benefits

$\pi(0)$	$\pi(1)$	Optimal θ	Tax	Assets	Employment Rate	Average Utility	Welfare Change
0	0	0.67	0.0729	0	0.8945	-0.5516	0.65%
0.1	0.1	0.53	0.0664	0.242	0.830	-0.5567	0.15%
0.2	0.2	0.35	0.0482	0.806	0.823	-0.5616	0.51%
0.3	0.3	0.23	0.0329	2.142	0.833	-0.5642	1.37%
0.4	0.4	0.1	0.0127	4.791	0.875	-0.5657	4.78%
0.5	0.5	0.08	0.0103	5.313	0.877	-0.5664	9.17%

Moral Hazard for Everyone

Table-4 summarizes the results for the no discrimination case ($\pi(0) = \pi(1)$). As opposed to previous case, the economy also reacts to lower levels of moral hazard. The welfare change is minimized with 10% moral hazard rates. Yet 0.15% welfare gain can still be attained by fine tuning of the replacement ratio. However, there are huge welfare gains (9.17%) to be earned if economy is characterized with high moral hazard rates.

6 The Model with Stochastic Unemployment Benefits

In this section the model with stochastic unemployment benefits will be presented. The unemployment insurance in this economy is administered as follows. Eligibility to get unemployment benefits is history dependent. Only those who were employed can be considered to be in the insurance scheme. Therefore each period eligible agents consists of those who were employed and a fraction of those who were receiving unemployment benefits in the previous period. If an agent is eligible to get the benefits, she will receive θy, where θ is the replacement ratio. Unlike in Hansen and Imrohoroglu (1992) benefits is not assumed to be paid infinitely many periods. Following Koehne and Kuhn (2013) an agent who received unemployment benefits at time $t-1$ and continues to be unemployed at time t will receive benefits with probability p which reflects the average duration of unemployment benefits. Making the duration of unemployment benefits stochastic is not the same as agent has the information of her eligibility in each period with certainty as in reality, yet this way I incorporate the fact that benefits are paid for a limited time only and eligibility comes with employment while enjoying substantial gains in the computational complexity of the problem. The unemployment insurance program and the amount of disposable income received by a given agent changes in the following way:

$$\begin{aligned}
s &= u,\ \mu_{t-1}=1 &&\Longrightarrow \left\{\begin{array}{l}\mu_t = 1 \text{ with probability } \ p \\ \mu_t = 0 \text{ with probability } (1-p)\end{array}\right\} \\
s &= u,\ \mu_{t-1}=0 &&\Longrightarrow \mu_t = 0 \\
s &= u,\ \eta=1 &&\Longrightarrow \mu_t = 1 \\
s &= e,\ \eta'=1 &&\Longrightarrow \mu_t = 0 \\
s &= e,\ \eta=0,\ \eta=0 &&\Longrightarrow \left\{\begin{array}{l}\mu_t = 1 \text{ with probability } \pi(0) \\ \mu_t = 0 \text{ with probability } (1-\pi(0))\end{array}\right\} \\
s &= e,\ \eta=1,\ \eta=0 &&\Longrightarrow \left\{\begin{array}{l}\mu_t = 1 \text{ with probability } \pi(1) \\ \mu_t = 0 \text{ with probability } (1-\pi(1))\end{array}\right\}
\end{aligned} \tag{6}$$

sums the program whereas

$$y_t^d = \left\{\begin{array}{cl}
(1-\tau)\theta y & \text{when } s=u \text{ and } \mu=1 \\
0 & \text{when } s=u \text{ and } \mu=0 \\
(1-\tau)\theta y & \text{when } s=e,\ \eta'=0, \text{ and } \mu=1 \\
0 & \text{when } s=e,\ \eta'=0,\ \text{and } \mu=0 \\
(1-\tau)y & \text{when } s=e \text{ and } \eta'=1
\end{array}\right\}$$

shows the amount of disposable income received by a given agent.

In this version of the model, in the beginning of the period, not only an individual's employment opportunity is revealed, but also they observe whether they are eligible to receive unemployment benefits or not. Given these, current asset holdings, and previous employment status they decide whether to work, stay unemployed without benefits, or attempt to cheat the insurance program by trying to get benefits when they reject a job offer. The maximization problem of these model translates to:

$$V(m,s,\eta,\mu)=$$

$$\begin{cases}
\max_{m'}\left\{U(m+(1-\tau)\theta y-m',1)+\beta\sum\limits_{\mu'}\sum\limits_{s'}\chi(u,s')V(m',s',0,\mu')\right\} & \text{if } s=u,\mu=1\\
\max_{m'}\left\{U(m-m',1)+\beta\sum\limits_{s'}\chi(u,s')V(m',s',0,0)\right\} & \text{if } s=u,\mu=0\\
\max\left\{\begin{array}{l}\max_{m'}\left\{U(m+(1-\tau)y-m',1-h)+\beta\sum\limits_{s'}\chi(e,s')V(m',s',0,1)\right\},\\ \max_{m'}\left\{U(m-m',1)+\beta\sum\limits_{s'}\chi(u,s')V(m',s',0,0)\right\} \qquad \text{if } s=e,\mu=0\end{array}\right\} & \\
\max\left\{\begin{array}{l}\max_{m'}\left\{U(m+(1-\tau)y-m',1-h)+\beta\sum\limits_{s'}\chi(e,s')V(m',s',0,1)\right\}\\ \pi(\eta)[\max_{m'}\left\{U(m+(1-\tau)y-m',1-h)+\beta\sum\limits_{\mu'}\sum\limits_{s'}\chi(e,s')V(m',s',0,\mu')\right\},\\ +(1-\pi(\eta))\max_{m'}\left\{U(m-m',1-h)+\beta\sum\limits_{s'}\chi(e,s')V(m',s',0,0)\right\}] \ \text{if } s=e,\mu=1\end{array}\right\} &
\end{cases} \tag{7}$$

subject to $m'\geq 0$.

A stationary competitive equilibrium for this economy consists of a set of decision rules $c(m,s,\eta,\mu)$, $\eta'(m,s,\eta)$, $m'(m,s,\eta,\mu)$ (for consumption, employment, and asset holdings respectively), a time invariant measure $\lambda(m,s,\eta,\mu)$, a government policy (θ,τ,p) such that:

1. Given the government policy (θ,τ,p), $c(m,s,\eta,\mu)$, $\eta'(m,s,\eta,\mu)$, $m'(m,s,\eta,\mu)$ solves the agents problem in equation (8).

2. Goods market clears.

$$\sum_{m,s,\eta,\mu}\lambda(m,s,\eta,\mu)c(m,s,\eta,\mu)=\sum_{m,s,\eta,\mu}\lambda(m,s,\eta,\mu)\eta'(m,s,\eta,\mu)y;$$

3. Government budget constraint is satisfied.

$$\sum_{m}\{[\lambda(m,e,\eta,1)+\lambda(m,u,\eta,1)](1-\tau)\theta y-\lambda(m,e,\eta,0)\eta'(m,e,\eta,0)\tau y\}=0$$

4. λ is an invariant distribution given decision rules $\eta'(m,s,\eta,\mu)$, $m'(m,s,\eta,\mu)$, employment transition probabilities $\chi_{ss'}$, and moral hazard probabilities $\pi(\eta)$ and eligibility probability p.

The algorithm behind the computation of this model is exactly the same as in the Hansen and Imrohoroglu (1992) and its equilibrium properties directly translates to this model. Calibration strategy is also identical except the eligibility probability. Average unemployment benefits duration is calibrated to $p = 3/4$ so that on average an agent is eligible for benefits for 6 months (4 period in the model). The calculation strategy of the average unemployment benefits duration is identical[1] to calculation of average unemployment duration.

7 Optimal Unemployment Insurance with Stochastic Unemployment Benefits

In this section the results for the model with stochastic unemployment benefits are presented. When there is no moral hazard, the optimal replacement ratio is 95%. This ratio is a lot higher than both the current replacement ratio (42%) and the optimal for model without stochastic unemployment benefits (67%). This high replacement ratio is the result of the fact that beneficiaries are eligible to get insurance payments only for a finite periods of time. Beneficiaries get 4 periods of insurance on average whereas average unemployment duration is as high as 7.5 periods. Therefore, the benefits are not only insuring the agents for the period they are in, but also for the periods to come where the agents are not probably eligible to get these benefits. This is also reflected on the average asset holdings as agents use a lot more assets to smooth their consumption over periods possible without any disposable income.

Table-5 summarizes the optimal replacement ratio levels where only searchers can defraud the system ($\pi(1) = 0$). When compared to previous model economy, this model economy is highly successful in managing the moral hazard problem for searchers. An interesting result here is that the optimal replacement ratio does not change with higher moral hazard rates.[2] Therefore, it can be argued that, if government can perfectly monitor the decision making process of the quitters the question of the optimal replacement ratio becomes

[1]The probability of not getting offer when did not get an offer in the last period (χ_{22}), and the probability of eligibility for the unemployment will continue in the next period (P) is calculated accordingly with the following formula. Let p be any of these probabilities and D be the respective duration.

$$\begin{aligned} D &= 1.(1-p) + 2.p.(1-p) + 3.p^2(1-p) + 4.p^3(1-p)... \\ &= (1-p).(1+2p+3p^2+4p^3...) \\ &= (1-p).(1-p)^{-2} \\ &= (1-p)^{-1} \end{aligned}$$

[2]Little differences in the replacement ratios in this exercise are attributed to numeric precision. Such changes have no effect on the welfare analysis as they are negligible.

Table 5: Results for the Model with Stochastic Unemployment Benefits

$\pi(0)$	$\pi(1)$	Optimal θ	Tax	Assets	Employment Rate	Average Utility	Welfare Change
0	0	0.99	0.0424	7.3140	0.894	-0.5663	0.19%
0.1	0	1	0.0432	7.2646	0.891	-0.5665	0.16%
0.2	0	1	0.0438	7.2675	0.890	-0.5666	0.18%
0.3	0	1	0.0444	7.2608	0.889	-0.5666	0.18%
0.4	0	0.98	0.0443	7.2818	0.889	-0.5667	0.19%
0.5	0	1	0.0461	7.2673	0.888	-0.5667	0.19%

Moral Hazard for Searchers Only

Table 6: Results for the Model with Stochastic Unemployment Benefits

$\pi(0)$	$\pi(1)$	Optimal θ	Tax	Assets	Employment Rate	Average Utility	Welfare Change
0	0	0.99	0.0424	7,314	0.894	-0.5663	0.19%
0.1	0.1	0.56	0.0257	8,134	0.874	-0.5678	0.01%
0.2	0.2	0.1	0.0044	9,480	0.895	-0.5686	0.32%
0.3	0.3	0.05	0,0022	9,669	0.895	-0.5688	1.62%
0.4	0.4	0.04	0.0019	9,721	0.895	-0.5688	3.49%
0.5	0.5	0.03	0.0013	9,759	0.895	-0.5688	7.81%

Moral Hazard for Everyone

independent of the moral hazard.

Table-6 shows the results when quitters are also able to defraud the system. When $\pi(0) = \pi(1) = 0.1$ the welfare gains from adopting optimal replacement ratio is in its minimum for this study. If the Turkish economy is similar to this model economy, current replacement ratio is almost optimal. When compared to the model without stochastic benefits, here the replacement ratio reacts more to the moral hazard rates. This is due to higher asset holdings in steady states. Higher asset holdings decreases the marginal utility from consumption and gives incentive to agents not to work. To combat such incentives the optimal replacement ratios are falling sharply with moral hazard.

8 Discussion

When comparing across these two models, it is important to keep in mind that endogenous asset and employment decisions are playing crucial roles in the determination of the optimal replacement ratio. For example, the fact that benefits are paid for finite periods of time does not directly justify higher replacement ratios. In such situations agents also self insure themselves against possible unemployment spells without unemployment benefits. Therefore, it is no surprise to see that the steady states in the model with stochastic benefits is characterized with more average assets and higher employment rates.

It is also crucial to understand also an eligibility condition is introduced by employing stochastic benefits. This aspect is especially important for employment decisions. Unlike the model of Hansen and Imrohoroglu (1992) two opposing forces arise when replacement ratio is increased. Firstly, agents are more prone to reject job offers as the returns from defrauding is increased. This relates to both models. On the other hand, defrauding might result in losing the eligibility for higher replacement ratios in the subsequent spells of unemployment. This second effect is nonexistent in Hansen and Imrohoroglu (1992) as agent are always eligible whatever their history. (When agent is caught cheating today, she will be eligible for insurance if she does not get a job offer.) Moreover, the probability of being eligible for insurance after working is 1 whereas probability of being eligible after defrauding is 0.75. This further amplifies the second effect. Therefore, rejecting a job offer is more costly in the model with stochastic benefits. Quantitatively, this situation is best observed when defrauding is not accessible to quitters.

Finally, results show the importance of better understanding moral hazard for both of the models. Yet how much moral hazard prevails in the Turkish economy? Unfortunately, there is no clear-cut answer to this question. Pallage and Zimmermann (2005) report that, in their verbal communications with the administrators of unemployment insurance programs from eleven OECD countries, they were informed that administrators believe moral hazard rate is around 0.1 and 0.2.[3] (They do not discriminate between searchers and quitters.) How expected degree of moral hazard in these countries coincide with reality and how they compare to Turkey is an important policy question. The welfare comparisons here is also implies that the current replacement ratio mostly compatible with $\pi(0) = \pi(1) = .1$. However, if moral hazard is higher, there arises significant welfare costs in using the current replacement ratio. Therefore, monitoring cannot be taken as trivial issue in the design of the unemployment program. Being able to detect defrauders should be a primary obligation of the administrators of the unemployment insurance program.

[3] They study unemployment insurance programs of Belgium, Canada, Denmark, France, Germany, Ireland, Norway, Spain, Switzerland, United Kingdom, and United States.

9 Conclusion

In this paper, the optimality of unemployment insurance program in Turkey is analyzed. Growing surplus in the unemployment insurance funds caused a lot of controversy about the magnitude of replacement ratio. Here, the issue is studied by employing incomplete markets equilibrium models with liquidity constraints and moral hazard. Firstly, the same model of Hansen and Imrohoroglu (1992) is calibrated to mimic Turkish economy. Then the model is extended by making benefits stochastic to incorporate the fact that benefits are paid only for a limited period of time and to become eligible individuals has to work. The extension is influenced by Koehne and Kuhn (2013) as it introduces important perspectives of reality without avoiding the making model too complex for analysis.

The results indicate that a good understanding of the degree of moral hazard is very important in designing the unemployment insurance program. Moreover, how unemployment insurance program is modeled also have important effects on what should be the optimal rate of replacement ratio. Current replacement ratio (42%) is found to be compatible with 10% moral hazard rate. This number is also cited by Pallage and Zimmermann (2005) as a lower bound for the developed countries. For a lower bound of 10% moral hazard rate, agents in the model without stochastic benefits with current replacement ratio, should be 0.15% more productive so that they would have the same average utility as they would have with the optimal replacement ratio. I have found that welfare gains are even smaller if the fact that benefits are paid for a limited period of time is introduced to the model. In that case, welfare gain is reduced to 0.01%, that is, the current replacement ratio is almost optimal. However, it is important to keep in mind that both of these results are sensitive to the degree of the moral hazard. Welfare gains from adopting an optimal replacement ratio get high as 7-9% as the moral hazard increases.

Examining the role of unemployment insurance with deterministic unemployment benefit and eligibility durations is left for future work. Furthermore, in Turkey the unemployment benefits cannot exceed the minimum wage. Therefore, a model with heterogenous wage offers coupled with this aspect of the benefit payments can also be important in designing the unemployment insurance program. For now, I conclude by presenting solutions for different moral hazard rates for two different models and let the readers be the judge.

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