

GALATASARAY UNIVERSITY
INSTITUTE OF SOCIAL SCIENCES
ECONOMICS DEPARTMENT

**THE IMPACT OF UNEMPLOYMENT INSURANCE ON
THE BEHAVIOR OF HETEROGENEOUS WORKERS**

MASTER'S THESIS

Doğın GÜLÜMSER

Thesis Supervisor: Assoc. Prof. Mustafa ULUS

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PREFACE

First, I would like to express my deep sense of gratitude to my supervisor Assoc. Prof. Dr. Mustafa ULUS for his never-ending support and excellent guidance. It was a great honor to work with him and there is no way to thank him enough. I would also like to thank the entire economics department.

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TABLE OF CONTENT

Contents

1	INTRODUCTION	1
2	LITERATURE REVIEW	5
3	UNEMPLOYMENT INSURANCE IN TURKEY	11
4	BASIC JOB SEARCH MODEL	14
4.1	Optimal Search Strategy	17
4.1.1	Flow Equations	17
4.1.2	Comparative Statics	19
4.1.3	A Numerical Example	21
5	TWO-SIDED SEARCH MODEL	34
5.1	Matching Process	35
5.2	The Behaviour of the Workers and Firms	37
5.2.1	Workers	37
5.2.2	Firms	38
5.2.3	Labor Demand	39
5.3	Wage Bargaining	40
5.4	Free Entry Condition	42
5.5	Comparative Statics	44
5.6	Computational Exercise	48
6	CONCLUSION	55
7	APPENDIX	61
7.1	Unemployment Rate	61
7.2	Unemployment Durations for Different Values of α	61
7.3	Decomposition	62
7.4	Comparative Statics of Unemployment Composition Equation	63
7.5	Comparative Statics of Free Entry Equation	63

ABBREVIATIONS

MS	Matching Skill
PBD	Potential Benefit Duration
RR	Replacement Rate
TEA	Turkish Employment Agency
UB	Unemployment Benefits
UI	Unemployment Insurance
WC	Wage Curve



LIST OF SYMBOLS

α	Matching Skill Parameter
β	The Bargaining Power of Workers in Wage Negotiation
γ	The Composition of High-Skilled Workers in the Total Population
λ	The Arrival Rate of Job Offers
ϕ	Disutility of Effort
σ	The Composition of High-Skilled Workers in the Unemployment Pool
θ	Labor Market Tightness
$\theta m(\theta)$	The Probability of Finding a Job
$m(\theta)$	The Probability of Filling a Vacant Job
Π^v	The Value of a Vacant Job
Π^e	The Value of a Filled Job
b	Unemployment Benefit Level
D	Unemployment Duration
e	The Effort Level
h	The Cost of Posting a Vacant Job
$H(.)$	Wage Distribution
l	Employment Rate
L	The Number of Employed Workers
N	Total Population
r	The Discount Rate
S	Total Surplus
x	Reservation Wage
$\bar{x}$	The Highest Wage
u	Unemployment Rate
U	The Number of Unemployed Workers
V^u	The Value of Unemployment
V^e	The Value of Employment
w	Wages
y	The Productivity of a Worker

List of Figures

1	Reservation Wage and Effort Level	23
2	Unemployment Rate and (γ)	27
3	The Composition of Unemployment and (γ)	28
4	Unemployment Duration and (γ)	31
5	The Composition of Unemployment and Labor Market Tightness	44



List of Tables

1	Beneficiaries of Unemployment Insurance	12
2	Reservation Wages and Effort Levels for Different Levels of α and b	24
3	The Unemployment Rate for Different Levels of α and b	26
4	Unemployment Duration for Different Levels of α and b	30
5	The Individual Effects of Effort Level and Reservation Wage on the Unemployment Duration and Unemployment Rate	32
6	Calibration Parameters and Equilibrium Values	49
7	Changes in Unemployment Benefits for $\gamma = 0.4$	50
8	Changes in Unemployment Benefits for $\gamma = 0.6$	51
9	Changes in MS of a Type-H Worker When $\gamma = 0.4$	52
10	Changes in MS of a Type-H Worker When $\gamma = 0.6$	52
11	Changes in MS of a Type-L Worker When $\gamma = 0.4$	53
12	Changes in MS of a Type-L Worker When $\gamma = 0.6$	53
13	Changes in γ	53

RÉSUMÉ

L'assurance-chômage est une institution sociale et un outil politique important qui a un impact sur les variables fondamentales du marché du travail. Le plan du régime d'assurance est crucial pour déterminer les indicateurs clés du marché du travail, tels que le taux de chômage, la durée du chômage, la participation à la population active, etc. Grâce à l'assurance-chômage, les travailleurs peuvent être indemnisés dans une certaine mesure suite à la perte de salaire involontaire. La couverture contre le chômage entraîne une augmentation du bien-être de la société en empêchant de fortes fluctuations des niveaux de consommation des individus pendant une période déterminée. D'autre part, l'assurance-chômage a des effets dissuasifs sur le niveau d'effort de recherche des chômeurs. Par conséquent, l'assurance chômage a un effet positif sur la compensation des pertes de revenus salariaux et un impact négatif sur la diminution de l'incitation à la recherche d'emploi et sur l'allongement du temps passé au chômage. Tatsiramos et Van Ours (2014) indiquent que l'objectif principal d'une conception optimale de l'assurance-chômage doit viser l'équilibre parfait entre ces deux effets.

Le niveau des prestations et la durée potentielle des prestations sont deux variables essentielles qui constituent la structure de l'assurance-chômage. Un travailleur qui perd son emploi n'a droit à des allocations de chômage que s'il remplit certaines conditions. Les conditions requises pour avoir droit aux allocations de chômage, ainsi que le montant et la durée des allocations affectent le comportement de recherche d'emploi des chômeurs. De nombreuses études montrent que ces variables affectent des macro-variables telles que le taux de chômage et la durée moyenne du chômage. Ces changements ont attendu des résultats sur le comportement de recherche d'emploi des chômeurs. Par exemple, une augmentation des prestations de chômage augmente le salaire de réservation des chômeurs et une augmentation de la période potentielle de prestations augmente la durée du chômage. Par conséquent, le changement dans la conception de l'assurance-chômage affecte le comportement de recherche d'emploi dans la direction attendue. Même si la direction de l'effet est la même pour tous les travailleurs, l'ampleur diffère selon les qualifications des travailleurs. Par exemple, un travailleur mieux qualifié peut réagir moins à une modification du montant des prestations de chômage qu'un travailleur moins qualifié.

Pendant la période de chômage, le comportement de sortie du chômage ne doit pas nécessairement être le même pour tous les types de chômeurs. Parce que les travailleurs ont des caractéristiques différentes dans de nombreuses dimensions. Cette hétérogénéité entre les travailleurs peut consister en des différences de caractéristiques telles que l'âge, le sexe, l'éducation et l'ancienneté. Cependant, ces caractéristiques peuvent être observées par les employeurs. Contrairement à ces caractéristiques observables, les travailleurs ont également des caractéristiques non observables. Par exemple, certains travailleurs obtiennent de meilleurs résultats dans les entretiens que d'autres en raison de leur compétence à communiquer en face à face. Par conséquent, les travailleurs présentant les mêmes caractéristiques observables peu-

vent différer les uns des autres en termes de compétences de communication en face à face et de réussite des entretiens. Ce type de capacité a été utilisé dans cette étude comme compétence ou capacité de recherche d'emploi. Ce type de compétence spécifique n'est pas une caractéristique que les employeurs peuvent observer jusqu'à l'entretien. En plus des caractéristiques observables mentionnées ci-dessus, une autre caractéristique qui ne peut être déterminée avant l'appariement est la productivité des travailleurs. Dans ce travail, la productivité de différents types de travailleurs a été acceptée comme étant la même. Par conséquent, la seule chose qui différencie les travailleurs est les compétences de recherche d'emploi mentionnées ci-dessus.

Grâce à des études empiriques, il a été observé que le comportement des chômeurs est assez différent les uns des autres. Dans de nombreuses études, l'hétérogénéité non observée a été mentionnée comme la raison de cette différence. Dormont et al. (2001) ont montré que les travailleurs qualifiés quittent le chômage plus rapidement. Cependant, cette constatation observée n'a pas été présentée auparavant dans un cadre théorique. Dans cette étude, les effets des travailleurs ayant différents niveaux de qualification sur le marché du travail sont examinés dans le cadre du modèle théorique. L'étude vise à présenter un cadre théorique selon lequel les différences observées empiriquement dans les structures de chômage peuvent émerger en raison des différentes capacités des travailleurs. En outre, nous évaluons les effets des différences de compétences d'appariement des travailleurs sur les résultats sur le marché du travail sous différents angles. Afin d'analyser ces impacts, nous construisons d'abord un modèle de recherche d'emploi de base, dans lequel les chômeurs reçoivent des offres salariales dans un intervalle spécifié et choisissent le niveau des efforts de recherche. L'évolution des prestations de chômage dans ce modèle statique donne des résultats attendus sur les indicateurs fondamentaux du marché du travail. L'augmentation des prestations entraîne une augmentation des salaires de réserve de tous les types de travailleurs et une diminution des efforts de recherche d'emploi. Ces deux effets conduisent à une augmentation du taux de chômage et de la durée du chômage. À la lumière de nos constatations, les différences de compétences en recherche d'emploi ont une influence différente sur la durée du chômage des travailleurs et les taux de chômage. Comme mentionné précédemment, la différence se produit en ampleur et non en direction. Une assurance chômage plus généreuse oblige les deux types de travailleurs à augmenter le salaire de réservation et à diminuer leur niveau d'effort. Tout d'abord, le taux de chômage des travailleurs hautement qualifiés est inférieur au taux de chômage des travailleurs peu qualifiés.

En plus, le ratio des travailleurs crée des différences significatives dans les macro-variables telles que le taux de chômage et la durée moyenne du chômage. Par exemple, dans une population comptant de nombreux travailleurs moins qualifiés, le taux de chômage et la durée moyenne du chômage deviennent plus sensibles aux modifications de l'assurance-chômage. Par ailleurs, on constate que les travailleurs moins qualifiés restent plus au chômage que les travailleurs qualifiés après l'augmentation des allocations de chômage. En supposant que le changement dans les allocations de chômage a été réalisé dans le sens inverse, s'il existe plus

de travailleurs avec de faibles compétences dans une économie, la diminution des allocations réduira davantage le taux de chômage et la durée du chômage. Bien que le modèle de recherche d'emploi de base soit utile pour expliquer certains aspects des modèles de sortie du chômage des travailleurs hétérogènes, il ne prend en compte que l'offre de l'économie et est donc insuffisant pour expliquer le comportement de la demande de l'économie.

D'un autre côté, l'inclusion de la demande de l'économie dans le modèle permet d'interpréter les changements du marché du travail sous un angle différent. Dans cette deuxième partie, un modèle standard de recherche et d'appariement est construit en incorporant les comportements des entreprises dans le modèle. Contrairement au modèle standard de recherche et d'appariement, l'inclusion des différentes compétences d'appariement des travailleurs dans le modèle affecte la possibilité pour les travailleurs de quitter l'entretien avec succès et donc la probabilité de trouver un emploi. Ainsi, il nous permet d'examiner les résultats de la composition des travailleurs dans la population et l'hétérogénéité des travailleurs sur l'offre et la demande de travail à travers différents mécanismes. Dans ce modèle, les entreprises sont en position déterminante du nombre d'emplois à créer alors que créer d'emplois a un coût particulier. Les postes vacants continuent de peser sur les entreprises jusqu'à ce qu'un travailleur la remplisse. Dans ces conditions, les entreprises souhaitent pourvoir leurs postes dans les meilleurs délais. La décision de création d'emplois dépend des compétences correspondantes des travailleurs ainsi que de la répartition des travailleurs dans la population. Si une rencontre ferme avec un travailleur bien qualifié dans l'entretien, le coût prévu d'un poste vacant diminuera. Par conséquent, les entreprises préfèrent un bassin de population ou de chômage avec des travailleurs hautement qualifiés. D'un autre côté, les travailleurs hautement qualifiés ont un pouvoir de négociation plus élevé dans la négociation des salaires. Bien que ce type de travailleur ait un pouvoir de négociation plus élevé et, par conséquent, un niveau de salaire plus élevé, les employeurs préfèrent une composition de la population qui comprend des travailleurs qualifiés. Par conséquent, à mesure que la population de travailleurs hautement qualifiés augmente, les entreprises sont plus disposées à créer de nouveaux emplois.

En outre, une modification de l'assurance-chômage montre son effet à travers un mécanisme différent dans le modèle de recherche et d'appariement. L'augmentation potentielle des allocations de chômage augmente la valeur de l'option extérieure des travailleurs. Cette hausse renforce la pression à la hausse sur les salaires. La pression à la hausse sur les salaires entraîne une diminution de la volonté des entreprises de créer de nouveaux emplois. La baisse du nombre d'emplois créés, en maintenant le nombre de chômeurs fixes, entraînera une augmentation du taux de chômage d'équilibre. L'existence de deux types différents d'employés sur le marché modifie la composition des travailleurs dans le bassin de chômage. Par exemple, après l'augmentation de l'allocation de chômage, le nombre de travailleurs hautement qualifiés dans le pool de chômage augmentera. L'effet inverse sur l'assurance se traduira par une augmentation du taux de ces travailleurs dans le pool de chômage.

Par conséquent, les conséquences du changement de l'assurance-chômage dans les deux modèles vont dans le sens attendu. Cependant, suite à un changement dans la conception de l'assurance-chômage, les deux modèles offrent des prévisions différentes sur l'évolution de la composition de chômage. Une modification du montant des prestations de chômage dans le modèle de recherche d'emploi n'a affecté que les comportements de recherche d'emploi des travailleurs, les salaires de réservation et les niveaux d'effort. Ce modèle était structuré en supposant que la répartition des salaires et la demande de travail n'étaient pas affectées par ce changement. Il a été observé que les travailleurs peu qualifiés correspondent à cette augmentation en augmentant les frais de réservation et en réduisant davantage les efforts de recherche d'emploi. Par conséquent, après l'augmentation des prestations conformément aux estimations du modèle, le nombre de travailleurs peu qualifiés augmente dans la composition du pool de chômage. Dans le plan de recherche et d'appariement, on observe que la demande de main-d'œuvre des entreprises joue un rôle décisif dans la composition du bassin de chômage. Dans ce modèle, l'augmentation des allocations de chômage montre son effet à travers les salaires. Après l'augmentation des salaires, les entreprises réduisent le nombre d'emplois vacants en raison de la baisse du retour attendu de la création d'emplois. Cette réduction affecte davantage les travailleurs hautement qualifiés que leurs homologues. Bien que les entreprises préfèrent rencontrer des travailleurs ayant des compétences d'appariement élevées, le résultat est observé car l'influence est plus forte pour les travailleurs de ce type. Pour cette raison, la proportion de ces travailleurs dans le bassin de chômage augmentera.

ABSTRACT

Unemployment insurance (UI) is a social institution and an important policy tool that has strong impact on the labor market's fundamental variables. The design of unemployment insurance is crucial in determining the labor market's key indicators, such as unemployment rate, unemployment duration, labor force participation etc. Thanks to unemployment insurance, workers can be compensated to some extent following the involuntary wage loss. Coverage against unemployment yields an increase in welfare of the society by preventing sharp fluctuations in individuals' consumption levels for a specified period. On the other hand, unemployment insurance shows disincentive effects on the level of search effort of job-seeking workers. Therefore, unemployment insurance has a positive effect on compensating the loss from wage income and a negative impact on decreasing the incentive for job search and extending the time spent in unemployment. Tatsiramos and Van Ours (2014) state that the main purpose of optimal unemployment insurance design must aim for the perfect balance between these two effects.

The benefit level and the potential benefit duration are two essential variables that build up the unemployment insurance structure. A worker who loses her job is entitled to unemployment benefits only if she meets certain conditions. The conditions required to qualify for unemployment benefits, together with the amount and the duration of the benefits affect the workers' job search behavior. Many studies show that these variables affect macro variables such as unemployment rate and average duration of unemployment. These changes have expected results on the job search behavior of unemployed workers. For instance, a rise in unemployment benefits increases the reservation wage of workers and a rise in the potential benefit period increases the unemployment duration. Therefore, the change in unemployment insurance design affects the job search behavior in the expected direction. Even if the direction of the effect is the same for all workers, the magnitude differs with worker qualifications. For example, a better qualified worker may react less to a change in the amount of unemployment benefits than less qualified worker.

Throughout the unemployment spell, the exit behavior from unemployment does not have to be the same for every type of worker. Because workers have different features in many dimensions. This heterogeneity among workers can consist of differences in characteristics such as age, gender, education and tenure. However, these features can be observed by employers. Unlike these observable characteristics, workers also have unobservable characteristics. For example, some workers perform better in interviews than others due to their ability to face-to-face communication skills. Therefore, workers with same observable features may differ from each other in terms of the face-to-face communication skills and leaving successfully from interviews. This type of ability was used in this study as a matching skill or job finding ability. This specific skill type is not a feature that can be observed by employers until the interview. In addition to the observable characteristics mentioned above, another feature that cannot be

determined before the matching takes place is the productivity of the workers. In this study, the productivity of different types of workers was accepted as the same. Therefore, the only thing that differentiates workers is the above mentioned job finding skills.

Thanks to empirical studies, it has been observed that the unemployment behavior of unemployed workers is quite different from each other. In many studies, unobserved heterogeneity has been referred to as the reason for this difference. Dormont et al. (2001) showed that high skilled workers leave unemployment faster. However, this observed finding has not been previously presented within a theoretical framework. In this study, the effects of workers with different skill levels on the labor market are examined within the theoretical model framework. The study aims to present a theoretical framework that the empirically observed differences in the unemployment structures can emerge as a result of workers' different abilities. Besides, we evaluate the effects of differences in workers' matching skills on the labor market outcomes from different perspectives. In order to analyze these impacts, we first construct a basic job search model, where unemployed workers receive wage offers from a specified range and choose the level of job search efforts. Changes in the unemployment benefits in this static model give expected results on the labor market's fundamental indicators. The increase in the benefits leads to a rise in reservation wages of all types of workers and a decrease in job search efforts. These two effects lead to an increase in the unemployment rate and the duration of unemployment. In light of our findings, differences in job finding skills have different influence on workers' unemployment duration and unemployment rates. As mentioned earlier, the difference occurs in magnitude, not in direction. More generous unemployment insurance causes both types of workers to increase the reservation wages and decrease their effort levels. First of all, the unemployment rate of workers with high matching skill is lower than the unemployment rate of workers with low ability.

In addition to the above, the ratio of the workers creates significant differences in macro variables such as the unemployment rate and average unemployment duration. For instance, in a population with many low-skilled workers, both the unemployment rate and the average duration of unemployment becomes more sensitive to changes in the unemployment insurance. Besides, it is observed that low-skilled workers stay in unemployment more than high-skilled workers after the increase in unemployment benefits. Assuming the change in the unemployment benefit was realized in the opposite direction, if there exist more workers with low matching skills in an economy, the decrease in the benefits will decrease the unemployment rate and the duration of unemployment more. Although the basic job search model is handy in explaining certain aspects of exit patterns from unemployment of heterogeneous workers, it considers only the supply side of the economy and thus is insufficient to explain the behavior of the demand side of the economy.

On the other hand, the inclusion of the demand side of the economy into the model makes it possible to interpret the changes in the labor market from a different perspective. In

this second part, a standard search-and-matching model is constructed by incorporating firm behaviors into the model. Unlike the standard search-and-matching model, the inclusion of the workers' different matching skills in the model affects the possibility of the workers leaving the job interview successfully and thus probability of finding a job. Thus, it allows us to examine the outcomes of the composition of workers in the population and the heterogeneity of workers on both labor supply and labor demand through different mechanisms. In this model, companies are in the determining position of the number of jobs to be created while job creation has a particular cost. The unfilled vacancy continues to make a burden on firms until a worker fills it. Under these conditions, companies want to fill their positions as soon as possible. Job creation decision depends on the matching skills of the workers as well as the distribution of the workers in the population. If a firm encounter with a high skilled worker in the interview, the expected cost of a vacancy will decrease. Therefore, firms prefer a population or unemployment pool with highly skilled workers. On the other hand, high matching skill workers have a higher bargaining power in wage negotiation. Although this type of worker has higher bargaining power and consequently, a higher wage level, employers prefer a population composition that includes high skilled workers. Therefore, as the highly skilled worker population increases, firms are more willing to create new jobs.

Besides, a change in unemployment insurance shows its effect through a different mechanism in the search-and-matching model. Potential increase in unemployment benefits raises the value of workers' outside option. This raise strengthens upward pressure on wages. Upward pressure on wages leads to a reduction in firms' willingness to create new jobs. The decline in the number of jobs created holding the number of unemployed fixed, will lead to an increase in the equilibrium unemployment rate. The existence of two different types of employees in the market changes the composition of workers in the unemployment pool. For example, after the increase in unemployment benefits, the number of workers with high matching skills in the unemployment pool will increase. The opposite effect on insurance, will result in an increase in the rate of these workers in the unemployment pool.

As a result, the consequences of unemployment insurance in both models are in the expected direction. However, following a change in the unemployment insurance design, the two models offer different predictions on the change in the composition of the unemployment pool. A change in the amount of unemployment benefits in the basic job search model affected only workers' job search behaviors, reservation wages, and effort levels. This model structured on the assumption that wage distribution and labor demand were not affected by this change. It has been observed that workers with low matching skills respond to this increase by increasing reservation fees and reducing job search efforts more. Therefore, after the benefits increase in line with the estimates of the model, low-skilled workers' number increases in the unemployment pool composition. In the search-and-matching design, it is observed that the firms' labor demand plays a decisive role in the composition of the unemployment pool. In this model, the increase in unemployment benefits shows its effect through wages. After the wage level in-

crease, firms reduce the number of vacant jobs due to the decrease in the expected return of job creation. That reduction affects high skilled workers more than their counterparts. Although firms prefer to meet workers with high matching skills, the result is observed as the influence is stronger for workers of this type. For this reason, the proportion of such workers in the unemployment pool will increase.



ÖZET

İşsizlik sigortası, işgücü piyasası üzerinde doğrudan etkisi olan kurumsal bir yapı ve önemli bir politika aracıdır. İşsizlik sigortasının tasarımı, işsizlik oranları, işsizlik süreleri ve işgücüne katılım gibi işgücü piyasasının temel göstergeleri üzerinde önemli etkilere sahiptir. İşsizlik sigortası sayesinde işçiler, kendi istekleri dışında maruz kaldıkları ücret kaybını belirli bir ölçüde telafi edebilmektedir. Sigorta, bireylerin tüketim seviyelerindeki dalgalanmaları belirli bir süreliğine önleyici pozisyonuyla da toplumda refah artışı sağlamaktadır. Öte yandan, işsizlik sigortası işçilerin iş arama isteklerini olumsuz yönde etkileyen caydırıcı bir faktördür. Dolayısıyla, işsizlik sigortası ücret kaybını telafi etmesi yönüyle olumlu, iş arama isteğini azaltması ve işsizlikte kalınan süreyi uzatması itibarıyla da olumsuz bir etki yaratmaktadır. Tatsiramos ve Van Ours (2014) çalışmalarında optimal işsizlik sigortası tasarımının temel amacının bu iki etkiyi dengeleyen bir yapıya sahip olması gerektiğini belirtmektedir.

İşsizlik ödeneği miktarı ve süresi, işsizlik sigortası yapısını oluşturan iki temel değişkendir. İşini kaybeden bir çalışan, ancak belirli şartları sağladığında işsizlik ödeneği almaya hak kazanır. İşsizlik ödeneğine hak kazanmak için gereken şartlar ve hak kazandıktan sonra elde edeceği ödeneğin miktarı ve süresi, işini kaybetmiş bireylerin iş arama davranışlarını etkilemektedir. Yapılan birçok çalışma sonucu işsizlik sigortası tasarımında yapılan değişikliklerin, işsizlik oranı, bir işsizin ortalama işsizlikte kalma süresi gibi makro-işgücü değişkenleri etkilediği gözlemlenmiştir. Bu değişimler, işsizlerin iş arama davranışları üzerinde çoğunlukla beklenen sonuçlar doğurmaktadır. Örneğin, işsizlik ödeneğinde meydana gelen bir artış, işçilerin çalışmaya hazır oldukları en düşük ücret seviyesini arttırmaktadır. İşsizlik ödeneği süresinde meydana gelen bir artış bir işsizin işsizlikte geçirdiği süreyi arttırmaktadır. Dolayısıyla, işsizlik sigortası parametrelerinin değişiminin, işsizlerin iş arama davranışlarını beklenen doğrultuda etkilediği gözlemlenmiştir. Ancak, bu etkinin boyutu, yönü aynı olsa bile, farklı nitelikteki işçiler için farklılaşabilir. Örneğin, iş bulma ihtimali yüksek bir işçi, iş bulma ihtimali düşük bir işçiden, işsizlik ödeneği miktarında meydana gelen bir daha az ya da daha fazla tepki verebilir.

İşsizlik süresi boyunca, işsizlikten çıkış davranışlarının her işçi için aynı olmadığı gözlemlenmiştir. Çünkü işçiler birçok boyutta birbirlerinden farklı özellik taşırlar. İşçiler arasındaki bu heterojenlik (heterogeneity), yaş, cinsiyet, eğitim ve kıdem gibi farklılıklardan oluşabilir. Ancak bu özellikler işverenler tarafından da gözlemlenebilmektedir. Bu gözlemlenebilir karakteristiklerden farklı olarak, işçilerin gözlemlenemeyen farklılıkları da mevcuttur. Örnek olarak, kimi çalışanlar yüz yüze iletişim kabiliyetleri sebebiyle mülakatlarda diğer çalışanlardan daha başarılı bir performans sergilemektedirler. Dolayısıyla, yaş, eğitim, kıdem gibi gözlemlenebilen özellikleri birbiriyle aynı olan işçiler, yüz yüze iletişim kurma ve bunun sonucu mülakatlardan başarıyla ayrılma ihtimalleri açısından birbirlerinden farklılık gösterebilirler. Bu tarzda bir kabiliyet bu çalışmada eşleme becerisi (matching skill) veya iş bulma becerisi (job finding ability) olarak tanımlanmıştır. Bu spesifik beceri tipi, mülakata kadar

işverenler tarafından gözlemlenebilen bir özellik değildir. Yukarıda belirtilen gözlemlenebilen karakteristiklere ek olarak, eşleme gerçekleşmeden önce tayin edilemeyen başka bir özellik de işçilerin verimlilikleridir. Bu çalışmada farklı tipteki işçilerin verimlilikleri de aynı kabul edilmiştir. Dolayısıyla, işçilerin tek farklılaştıkları nokta, yukarıda belirtilen iş bulma becerileridir.

Ampirik çalışmalar sayesinde, işsizlerin işsizlikten çıkış davranışlarının birbirinden oldukça farklı olduğu gözlemlenmiştir. Birçok çalışmada işçiler arasında gözlemlenemeyen heterojenlik (unobserved heterogeneity) bu farklılığın sebebi olarak gösterilmiştir. Dormont vd. (2001) çalışmalarında yüksek beceriye sahip işçilerin işsizlikten daha hızlı ve daha kolay bir biçimde çıktıklarını göstermişlerdir. Ancak gözlemlenen bu bulgu, daha önce teorik bir altyapıyla birlikte sunulmamıştır. Bu çalışmada, farklı beceri seviyelerine sahip işçilerin işgücü piyasasında yarattığı etkiler teorik bir model çerçevesinde incelenmektedir. Çalışmanın amacı, işsizlikten çıkış yapılarında ampirik olarak gözlemlenen farklılıkların, işçilerin farklı kabiliyetlere sahip olmasının bir sonucu olarak karşımıza çıkabileceğini teorik bir çerçevede sunmaktır. Çalışmada ayrıca, işçilerin eşleşme becerilerindeki farklılıkların işgücü piyasası üzerindeki etkilerini farklı yönlerden değerlendirme amaçlanmaktadır. Bu farklılıkların işgücü piyasası üzerindeki etkilerini analiz etmek için, öncelikle işsizlerin belirli bir aralıktan ücret teklifleri aldıkları ve iş arama eforlarını seçtikleri temel iş arama modeli (basic job search model) kurulmuştur. Oluşturulan bu statik modelde işsizlik ödeneği parametresinde meydana gelen değişiklikler, işgücü piyasasının temel göstergeleri üzerinde beklenen sonuçları vermektedir. Ödenek miktarının artışı, her tipteki işçinin rezervasyon ücretinde artışa, iş arama eforlarında ise azalışa yol açmaktadır. Bu iki etki işsizlik oranının ve işsizlik süresinin artışına yol açmaktadır. Kurulan teorik modelin öngörülleri sayesinde iş bulma becerilerindeki farklılıkların işçilerin işsizlik süresi ve işsizlik oranları üzerinde farklı etkileri olduğu gösterilmektedir. Daha önce de belirtildiği gibi bu farklılık yön anlamında değil, büyüklük anlamında bir farklılıktır. İşsizlik sigortasının daha “cömert” hale gelmesi her iki tipte işçinin de rezervasyon ücretinin artmasına, efor seviyelerinin ise düşmesine yol açmaktadır. Örnek olarak, iş bulma kabiliyeti yüksek işçilerin ekonomide denge işsizlik oranı, kabiliyeti düşük işçilerin denge işsizlik oranından daha düşük çıkmaktadır. Bunun temel sebebi, iş bulma kabiliyeti yüksek olan işçilerin herhangi bir dönemde işsizlikten daha hızlı bir şekilde ayrılabiliyor olmalarıdır. Bu temel farklılık, hem bu işçilerin denge işsizlik oranlarının daha düşük olmasına hem de işsizlikte daha az zaman geçirmelerine sebep olmaktadır.

Bunlara ek olarak, yalnızca iş bulma becerileri üzerinden birbirlerinden ayrılan bu işçilerin nüfus içindeki dağılımları, işsizlik oranı ve ortalama işsizlik süresi gibi makro değişkenler üzerinde belirgin farklılıklar yaratmaktadır. Örneğin, çok sayıda iş bulma becerisi düşük işçinin bulunduğu bir nüfusta, işsizlik sigortası düzenlemesinde meydana gelen değişikliklere, hem işsizlik oranının hem de ortalama işsizlik süresinin daha hassas hale geldiği görülmektedir. Ayrıca, düşük iş bulma yeteneğine sahip işçilerin işsizlik yardımlarındaki artıştan sonra işsizlikte geçirdikleri sürenin diğer işçilere göre daha çok arttığı görülmekte-

dir. İşsizlik ödeneğinde meydana gelen değişikliğin tersi yönünde gerçekleştiği varsayılırsa, bir ekonomide düşük eşleşme becerisi olan işçiler çoğunluktaysa, ödenekte meydana gelen düşüş işsizlik oranını ve işsizlikte kalma süresini daha çok düşürecektir. Temel iş arama modeli, heterojen işçilerin işsizlikten çıkış davranışının belirli yönlerini açıklamada oldukça faydalı olsa da, işgücü piyasasını yalnızca arz yönlü ele almakta olup, işgücü talep eden kısmı açıklamakta yetersiz kalmaktadır.

Bununla birlikte, ekonominin işgücü talep eden tarafının modele katılması, işgücü piyasasındaki değişimlerin farklı bir perspektiften yorumlanmasını mümkün kılmaktadır. Çalışmanın ikinci bölümünde, firma davranışları da modelin içine katılarak standart bir arama-eşleme modeli oluşturulmaktadır. Standart arama-eşleme modeline ek olarak işçilerin farklı eşleme becerilerini modelin içine katılması, işçilerin iş görüşmesinden başarıyla ayrılma ihtimalini, dolayısıyla da iş bulma ihtimallerini doğrudan etkilemektedir. Böylece, işçilerin nüfus içindeki kompozisyonunun ve işçi heterojenliğinin hem işgücü arzı hem de işgücü talebi üzerindeki etkilerini farklı mekanizmalar yoluyla incelememiz bu model sayesinde mümkün olmaktadır. Bu modelde firmalar yaratılacak iş sayısını belirleyici konumda bulunmaktadır ve iş yaratmanın belirli bir maliyeti vardır. Yaratılan iş, bir işçi tarafından doldurulana kadar firmalara maliyet yaratmaya devam etmektedir. Bu koşullar altında firmalar, açtıkları pozisyonu mümkün olabilecek en kısa sürede doldurmak isterler. İş yaratma kararları, işçilerin eşleşme becerilerine ve aynı zamanda işçilerin nüfus içindeki dağılımına bağlıdır. Bir firma mülakatlarda eşleme becerisi yüksek işçilerle karşılaşır, işin açık kalmasından oluşacak olan ortalama beklenen maliyet azalacaktır. Dolayısıyla firmalar yüksek vasıflı işçilerin bulunduğu bir işgücü veya işsizlik havuzunu tercih ederler. Öte yandan, yüksek eşleşme becerisine sahip bireylerin ücret pazarlığındaki gücü daha yüksektir. Bu tipteki işçilerin ücret pazarlığındaki güçleri ve pazarlık sonucunda ücret seviyeleri daha yüksek olmasına rağmen, işverenlerin yüksek vasıflı işçiler içeren bir nüfus kompozisyonunu tercih ettiklerini göstermektedir. Bu nedenle, yüksek vasıflı işçi nüfusu arttıkça, firmalar yeni iş yaratmak için daha istekli hale gelmektedir.

Ek olarak, işsizlik sigortasında meydana gelen bir değişiklik, arama-eşleme modelinde farklı bir mekanizma üzerinden etkisini göstermektedir. İşsizlik ödeneğinde meydana gelecek potansiyel bir artış, çalışanların, çalışma dışındaki seçeneklerinin (*outside option*) değerini artırır. Bu artış çalışanların ücret pazarlığında ellerini güçlendirir ve ücretlerde yukarı yönlü bir baskı yaratır. Ücretlerdeki yukarı yönlü baskı firmaların yeni iş yaratma taleplerinde düşüşe yol açar. İşsiz sayısı veri iken yaratılan iş sayısında meydana gelen azalma, denge işsizlik oranının artışına yol açacaktır. Piyasada iki farklı tipte çalışanın varlığı düşünülecek olursa, bu etki sonrası farklı tipteki işçilerin işsizlik havuzundaki oranları değişiklik gösterecektir. Örneğin, işsizlik ödeneğinde meydana gelen artış sonrası işsizlik havuzunda bulunan yüksek eşleşme becerisine sahip işçi oranı artış gösterecektir. Nasıl ki yaratılan iş sayısındaki artış yüksek iş bulma kabiliyetindeki işsizlerin işsizlik havuzundan çıkışını doğrudan çarpan etkisiyle diğer işçilere nazaran daha çok arttıracaksa, tersi etki de yine bu işçilerin işsizlik havuzundaki oranlarının artışıyla sonuçlanacaktır.

Sonuç olarak, işsizlik sigortasının her iki modelde de yarattığı sonuçlar beklenen doğrultudadır. Bununla birlikte, işsizlik sigortası dizaynında meydana gelen bir değişiklik sonrası iki model, işsizlik havuzu kompozisyonunda oluşacak değişim üzerine farklı öngörüler sunmaktadır. Temel iş arama modelinde işsizlik ödeneğinin miktarındaki bir değişiklik, rezervasyon ücretleri ve efor seviyelerini etkileyerek yalnızca işçilerin iş arama davranışları üzerinden işsizlikle ilgili temel göstergeleri etkilemekteydi. Bu model, ücret dağılımının ve işgücü talebinin bu değişiklikten etkilenmediği varsayımıyla çalışmaktaydı. Bununla birlikte, işsizlik ödeneğinde meydana gelen bir artışın, düşük eşleme becerisine sahip işçilerin iş arama davranışlarını daha çok etkilediği ortaya çıkmıştır. Düşük iş bulma becerisine sahip işçilerin bu artışa rezervasyon ücretlerini daha çok arttırarak ve iş arama eforlarını daha fazla azaltarak tepki verdikleri gözlemlenmiştir. Dolayısıyla, modelin tahminleri doğrultusunda ödenek artışı sonrası, işsizlik havuzu kompozisyonunda daha fazla düşük kabiliyetli işçi kalmaktadır. Arama-eşleme modelinde ise firmaların işgücü talebinin, işsizlik havuzunun kompozisyonunda belirleyici bir rol oynadığı gözlemlenmektedir. Bu modelde işsizlik ödeneğinde meydana gelen artış, etkisini ücretler üzerinde göstermektedir. Artan ücret seviyesi sonrası firmalar açık iş sayısını, iş yaratmanın beklenen getirisindeki azalış sebebiyle azaltırlar. Bu azalış, yüksek iş bulma becerisine sahip işçileri daha fazla etkilemektedir. Firmalar eşleme becerisi yüksek işçilerle karşılaşmayı tercih etseler de, ortaya çıkan etkinin bu tipteki işçileri daha çok etkilediği gözlemlenmektedir. Bu sebeple, işsizlik havuzunun içindeki bu tipteki işçilerin oranı artış gösterecektir.

1 INTRODUCTION

Mismatch and prolonged unemployment durations are conspicuous symptoms of a malfunctioning labor market. Unemployment insurance (UI) plays an essential role in tackling such unemployment related problems. As it has been widely documented both theoretically and empirically, UI alleviates the unfavorable results of a sudden drop in wage income, leading to a welfare increase through smoothing consumption. On the other hand, UI shows strong disincentive effects as it leads workers to extend their unemployment span. For instance, workers spend more time in unemployment due to benefit compensation, and the average time spent in unemployment increases. Since a job seeking worker's behavior is subject to change in line with policy instruments, it is crucial to identify the scope of benefits to enhance efficiency.

This research lies in the area of exit patterns from unemployment of heterogeneous workers where we try to explain these different trajectories theoretically. There are many explanations on how the outflow from unemployment differs across heterogeneous workers. To name a few, workers may vary with their age, educational and tenure levels. All these characteristics naturally affect the transition patterns from unemployment to employment. Nevertheless, these qualifications are visible and observable by employers.

Throughout the unemployment spell, the exit behavior from unemployment need not be the same for every worker due to heterogeneity. Besides observable features, workers may differ due to their unobserved characteristics. For instance, while some are very successful at interviews, thanks to their vis a vis communication capabilities, some may not perform well. Thus, workers who have similar observable characteristics would have distinct exit behavior due to the mentioned communication capabilities. Another reason for this kind of heterogeneity can also arise from the quality of higher education institutions, even though we do not restrict workers' population to consist of highly educated individuals. Using large datasets, we can classify workers by their educational level, or years of schooling. Plus, even if we control for other observable characteristics, we can miss the heterogeneity among graduates of higher education institutions. Graduates of high-quality tertiary education institutions can be more likely to be successful at interviews. The reason can be either signaling, or individual capacity, or both. We will denote this kind of ability as matching skill or job finding ability. It is worth emphasizing that all workers have the same productivity level. So the only way we differentiate

workers is their matching skills. This specific ability is not observable to employers before the interview. Besides the observable characteristics, the unobservable characteristics such as matching skill will have particular impacts on equilibrium.

This thesis aims to evaluate the aspects of the workers' matching skill differentials on labor market outcomes. In order to analyze the differences in job finding abilities of the workers, we first develop a basic job search model in a steady environment where unemployed workers collect wage offers and decide how hard to search. Our findings show that these differences in job finding abilities have particular impacts on the unemployment duration and unemployment rates of heterogeneous workers. Additionally, we show that heterogeneous workers react differently to shocks related to UI design. The amount of benefits is positively correlated with the reservation wages irrespective of the type of workers, and negatively correlated with the search effort. These two impacts lead to a rise in the unemployment rate and the duration of unemployment for both types. Nevertheless, the influence of UI on the behavior of low matching skill workers is stronger. Following a benefit increase, low matching skill workers lower their search effort and increase their reservation wages more than high skilled workers.

Our findings on the basic search model's predictions on reservation wages show that a more generous UI system has a greater influence on low-skilled workers. The negative part is that their average duration in unemployment lengthens more compared to high skilled workers. On the other hand, their wage level increases on average due to a rise in reservation wage. In the literature, there exist two positive effects of UI on post-unemployment outcomes. First, the increase in reservation wage corresponds to an increase in re-employment wages. Second, more time devoted to search increases the quality of the match. Following our findings, we can assert that more generous unemployment benefits increase re-employment wages and the match quality more for low-skilled workers, decreasing wage inequality between workers.

Since we consider a labor market composed of high and low matching skill workers, their distribution in the population carries important implications. We explicitly define their ratio in the population and in the unemployment pool as the composition of unemployment. Concerning the workers' composition in the population, we reach distinct results on macro variables such as the unemployment rate and average duration of unemployment. For instance, we find that both the unemployment rate and the average duration of unemployment becomes

more sensitive to changes in benefits in a population with lots of low matching ability workers. Also, we show that low matching ability workers are more eager to stay as unemployed after the increase in unemployment benefits. So, the composition of unemployment and population together with different matching skills, play important role in determining the equilibrium unemployment and duration. Although the partial model is quite useful to explain certain aspects of exit behavior from unemployment of heterogeneous workers, it lacks to explain the responses on the demand side.

However, the demand side of the economy also provides crucial insights within such an environment. So in the second part, we develop a basic search-and-matching model. We incorporate both the matching skill and the composition of unemployment as an extension to a two-sided search design. In this way, we are allowed to examine the impacts of workers' composition and worker heterogeneity on labor supply and labor demand through different mechanisms. This unemployment composition parameter opens up another mechanism in examining the impact of UI. The results differ for different values of unemployment composition.

The firms are in a decisive position in determining the number of vacant positions in such a framework. Job creation is not costless, and the created job continues to make a burden to firms until a worker fills it. Under these conditions, firms want to fill vacant positions as soon as possible. Thus, job creation decision depends on the workers' matching skills and the workers' composition in the population. High skilled workers' higher probability of forming a match increases their outside option. It returns them higher bargaining power in wage negotiation-and eventually, higher wages. Yet, our findings show that firms prefer a population or unemployment pool with high-skilled workers. If a firm faces high-skilled workers in the interviews, the average cost of opening a job will decrease. Therefore, employers prefer a composition that involves high-skilled workers, despite the higher wages of these workers. Therefore, as these workers' population increases, firms become more willing to create new jobs.

Besides, a change in UI shows its impact through a different mechanism in the search-and-matching model due to different implications of the composition of unemployment. Upward pressure on wages leads to a drop in firms' demand to create new jobs. Considering the co-existence of two different types of employees in the market, the ratio of workers in the unemployment pool will change after this impact. For example, after the increase in benefits,

the number of high-skilled workers in the unemployment pool will increase compared to its level before benefits increase. Overall, the composition of unemployment takes place as a crucial variable in both models. While in the one-sided search design more generous UI system changes the composition of the unemployment pool in favor of high-skilled workers, it benefits low-skilled workers in the two-sided search model. UI benefits play a role in decreasing wage inequality among heterogeneous workers. We also find that job finding ability of low-skilled workers shows positive externality on high-skilled workers' wages and unemployment level.

The remainder of the thesis is as follows: Chapter 2 reviews the existing literature on workers' transition patterns from unemployment to employment and job search behavior, focusing on the studies related to UI compensation. Chapter 3 presents the features of the UI system in Turkey, showing some key figures on applicants and beneficiaries from compensation. Chapter 4 describes the main assumptions of the partial model, the agents' behavior, the equilibrium characteristics, and discusses the main findings. Chapter 5 offers a search-and-matching model and its equilibrium in an environment with heterogeneous workers. Finally, chapter 6 concludes.

2 LITERATURE REVIEW

UI is one of the most crucial parts of social security programs. Coverage against unemployment risks allows unemployed workers to mitigate the fluctuations in their income to smooth consumption and provides workers the necessary compensation while seeking a new job. On the other hand, it is widely documented that benefits cause unemployment spells to prolong.

In the neoclassical labor supply theory the main assumption is the perfect information in the labor market. So, workers do not have to look for jobs since they already know wages each job pays. They only choose the number of hours to devote to work for a given wage level. Their decision boils down to a trade-off between leisure and consumption. There is no notion such as unemployment since when a worker decides to work, she can instantly start working. Thus, this theory does not capture the influence of UI design on workers' job search behavior in an environment with imperfect information. The early studies of search models made it possible to evaluate the impacts of UI on workers' job search behavior and exit patterns from unemployment. The required analytical framework originated from influential articles of McCall (1970), Mortensen (1970), and Gronau (1971). These basic search models predict that more generous unemployment benefits increase workers' reservation wages and decrease their search effort. However, these papers do not provide any institutional features embedded in such as fixed duration of benefit payments and eligibility conditions.

Mortensen (1977) is the first that offers a theoretical model examining job search behavior and reservation wage movements within the institutional framework in a dynamic environment. His article embodies some institutional features in a way that unemployed workers receive a constant amount of benefits throughout the specified unemployment spell and only become eligible for benefits if they have a previous employment story. After the benefit period ended, the worker receives no extra insurance payment. There are crucial conclusions to draw from his paper. Primarily, the reservation wage of a worker decreases, and search effort increases as she approaches to benefit exhaustion date and; therefore, the exit rate of eligible workers from unemployment increases towards the end of the unemployment spell. Second, the increase in unemployment benefits makes it more attractive for job seekers to accept a job offer and qualify for future benefits. As a result, for individuals who are not currently receiv-

ing benefits, the hazard rate increases, a notion known as the "entitlement effect." On the other hand, the reservation wage of a worker who has just lost her job increases after a rise in benefit level, but an insured worker who is close to the expiration date reduces her reservation wage. Hence, unemployment to employment transition rate diminishes for newly unemployed workers but rises for individuals who have come to the period of benefits. Additionally, the model predicts that the hazard rate increases towards the end of benefit duration, but stays constant after benefit exhaustion. Overall, the disincentive effect of the potential benefit level increase can be captured in the model, as unemployed workers lessen their search effort, and generous unemployment benefits programs raise the value of unemployment.

Following the above-mentioned theoretical papers, early empirical works found strong evidence of the disincentive effect of unemployment benefits generosity. There exist many empirical research showing reactions of job search behavior of workers and their prolonged unemployment duration. Moffitt (1985) and Meyer (1990) uses Continuous Wage and Benefit History (CWBH) data and analyzes the effects of benefits on the duration of unemployment in the US. Moffitt shows that a %10 increment in unemployment benefits extends the duration of unemployment by half a week. Meyer finds that a %10 rise in unemployment benefits reduces hazard rate by 8.8 percent. Ham and Rea (1987) show that the exit rate from unemployment has a u-shaped formation in Canada. The exit rate first declines than rises at the end of benefits. Parallel conclusions found in Carling et al. (1996) showing the same exit pattern from unemployment in Sweden. However, the common finding observable in most of the cases that the hazard rate drops sharply after benefits expire.

Besides these one-sided search models and its applications, there are also two-sided search models incorporating similar institutional features and examining search behaviour and employment transition patterns¹. Thanks to search-and-matching models, we become eligible to model the firms' behavior. Since it takes time to find a suitable job for workers, it takes time to fill a vacant job for employers. In the standard two-sided search models, wages are the outcome of a bargaining process. In such models, UI raises the outside option of workers and thus put upward pressure on negotiated wages. Higher wages cause firms to post less vacancies and the final effect is prolonged unemployment duration.

¹See Petrongolo and Pissarides (2001) and Rogerson et al. (2005) for detailed surveys on search-theoretic models.

These early empirical studies used generally cross-sectional data at individual level. Since some changes in UI design provides a quasi-experimental identification for examining workers' job search behavior, recent studies started to use different methods such as difference-in-differences or regression discontinuity designs. Lalive et al. (2006) use difference-in-differences method to examine the UI design change that took place in Austria in 1989. The replacement rates and potential benefit duration has increased after this policy change. While some workers benefited from both rises in RR and PBD, some workers affected only from an increase in RR or PBD and some stayed unaffected. They find that both RR and PBD increase extends the average unemployment duration. They predict that the unemployment rate of workers following a %15 increase in RR increased by %5, which means that the unemployment duration elasticity with respect to RR is 0.3. The authors' another finding is that 9 weeks extension to 30 weeks of PBD extends the unemployment duration by 0.4 week and 22 week extension to 30 weeks prolongs the duration by 2.3 weeks. Carling et al. (2001) also employ a difference-in-differences methodology to examine the impact of reduction in replacement rates in Sweden. They estimate a %10 increase in the hazard rate after the benefit cut in Sweden. The authors also calculate the elasticity of the hazard rate with respect to benefits is 1.6. Tatsiramos and Van Ours (2014) provide a detailed survey on UI design examining theoretical and empirical studies. They evaluate both partial equilibrium models and search-and-matching models together with the optimal insurance design. As authors state, the main aim of UI is to maintain the balance between adverse effects to work incentives and smoothing consumption. On the other hand, Atkinson and Micklewright (1991) point out the demand side of the transitions. They show that the demand side of the economy plays a role in determining the transitions between different states of employment rather than supply-side explanations.

In the presence of complete credit markets, individuals are able to smooth consumption perfectly. This assumption implies that the only effect of generous benefits operates through the moral hazard effect, eliminating the possibility of liquidity constrained agents. The more recent debate on the existing literature focuses on the liquidity constraint of individuals on the reason of beneficiaries extending their search period, moral hazard, and liquidity effects. Chetty (2008) examines whether the reduction in labor supply via extending unemployment duration is solely the moral hazard effect. He identifies the effect of severance payments using the data provided at the firm level, presuming the severance payment operates through liquidity constraint

mechanism. Chetty decomposes the moral hazard and liquidity constraint effects and concludes that a decline in search effort is partially caused by moral hazard effect (%40) but mainly because of the inability to smooth consumption (%60), indicating almost half of the workers who have just laid off have zero liquidity. Card et al. (2007) evaluated the search behavior of people who were laid off just earlier than and after the 36-month cutoff for severance pay eligibility. They find that severance pay has a large impact on the duration of unemployment via showing evidence that cash-on-hand support through severance payments to individuals has more significant impacts on extending the search period than benefit extension. Their findings show that the liquidity effect dominates the moral hazard effect.

There are several papers that examine the impact of UI design on exit rates to employment in Turkey. Filiz (2017) uses Turkish Employment Agency (İŞKUR) data over the period 2002-2012 and implements a regression discontinuity design in order to examine the impact of the generosity of UI on the labor market transitions. She finds that a one week PBD increase causes the average duration in unemployment to prolong 0.07 weeks. Filiz also finds that the decrease in the probability of finding a job after is larger in Turkey compared to other developed countries. In a more recent study, Tunalı and Ulus (2020) investigate different exit rates to employment for workers who has different PBD levels, employing difference-in-differences and regression discontinuity designs using microdata from İŞKUR over the period 2010-2016. They examine the exit behavior from unemployment for different level of PBD groups². Contrary to expectations of standard models, they do not find a linear relationship between the length of PBD and duration in unemployment. While it is expected that workers those who have shortest PBD stay unemployed less than others, they find that unemployed workers with a PBD of 240 days leave the unemployment pool faster than others. Thus, it suggests that heterogeneity among workers might be a possible explanation of different exit patterns from unemployment as an alternative to pure UI disincentive effects.

One of the latest contributions has been made by Dellavigna et al. (2017) in which they construct a search-model with reference-dependent preferences asserting that exit rates can be attributed to habit formation. They investigate the effects of exit rate from unemployment after switching to a two-tier unemployment insurance system using the administrative data on

²There exist three PBD groups in Turkey with 180 days, 240 days, and 300 days

social security contributions in Hungary. Workers were benefiting from a flat replacement rate throughout the spell before the change. In this new two-step system, workers' gain is higher for the first weeks but then drops to a lower level than before during the spell. Unemployment to employment transition rate increases towards the end of the first tier decreases after and initially increases at the end of the spell. Thus this pattern indicates a bimodal shape of hazard rate. Additionally, this spike can be linked to some other factors. First, workers tend to increase their search effort due to a prospective benefit loss. Second, workers may find a job before the time we observe them leaving unemployment. As Boone and Van Ours (2012) show, a possible iteration made between employer and worker on the starting day of the work is possible. They present a theoretical model that shows that the job's nature is important for the decision of delay. The firms are more likely to accept a delay if the job is permanent. Also, this gives unemployment workers an incentive to wait until their benefits expire. Besides these papers, the sudden drop of exit rate is explained by unobserved heterogeneity. For instance, Dormont et al. (2001) uses French data and show that the magnitude of the spike from unemployment is affected by the workers' characteristics. They use classification of qualification as workers' reference wages. They indicate that high qualified workers' hazard rate is higher at the end of benefits. The major explanation on the issue is that high qualification workers can find jobs more easily. Different from other two papers, this last paper explain empirically end-of-benefit spikes and the fall afterwards and why it might be caused by unobserved heterogeneity.

All these research confirm that unemployed workers' hazard rate displays a horizontal pattern from the beginning of unemployment spells until the last weeks of the benefit period, unless benefit payments do not show a declining profile. Towards the end of the unemployment spell, there is a spike in the exit rate from unemployment, meaning that so many unemployed workers leave the pool just before the benefit exhaustion. Then, there is a sharp decrease in job finding rates after benefits expire.

Although empirical studies demonstrate that the hazard rate differentiates between different types of workers, there is no theoretical study that tries to explain the impact of unobserved heterogeneity. Our research question emerged from the need to provide a theoretical model trying to explain the fall after benefits exhaustion. Even though we build our model in a static environment and modify the standard model only by attaching different matching skills to

heterogeneous workers, we discover that they react differently to changes in UI design. Therefore, we believe that the theoretical analysis of the unobserved heterogeneity on examining different trajectories on leaving unemployment deserves careful analysis.



3 UNEMPLOYMENT INSURANCE IN TURKEY

In most countries unemployment benefits (UB) are covered by social insurance system and almost always subject to conditions of prior employment³. Workers' eligibility and the generosity of these benefits depend on the design of the UI system. The essential determinants of UB schemes are replacement rate (RR) and the potential benefit duration (PBD) while their levels vary with respect to several indicators like age, number of children, marital status etc.

First law on unemployment regulatory framework was enacted in 1999 and implemented in 2000. The first benefit payments realized in March 2002. From 2002 to 2005 UI system in Turkey is financed through contributions of employers (%3), employees (%2) and the government (%2) calculated as the percentage of gross wage. Since 2005, the contribution percentages have changed to (%2) for employers (%1) for government and (%2) for employees. The responsible institution for UI system in Turkey is Turkish Employment Agency, İŞKUR. According to İŞKUR, in order to qualify for unemployment insurance workers must have become involuntarily unemployed, paid premiums in the last 120 days of employment and have at least 600 days of paid contributions in the three years before unemployment. Workers are obliged to apply to the nearest İŞKUR unit in person or electronically within 30 days of the termination of the service contract.

The PBD in Turkey is determined by the following scheme: Benefits are paid for 180 days to people who have been insured and paid premiums for 600 days; 240 for 900 days and 300 for 1080 days over a period of three years, provided that the other conditions in the law are carried. Any worker who has worked and paid premiums less than 600 days in the last three years prior to the layoff is automatically considered as ineligible to benefits. In order benefits to be paid, insured unemployed persons must be ready to start working in accordance with the law.

While insurance regimes change considerably across countries, the most common qualification period to be entitled for benefits is six months of coverage within the year before employment ceased⁴. The qualification period varies between 4 to 12 months in 1 to 3 years in

³In some countries like Belgium, first-time job seekers and certain categories of students are also entitled to benefits.

⁴See Tatsiramos and Van Ours (2014) for a detailed survey.

most of the countries. However, the minimum qualification period in Turkey corresponds to 20 months (a month=30 days) which is one of the most strict regimes in the world. The PBD and RR are generally longer and higher in developed countries.

There is a common feature in many of the unemployment compensation schemes that tend to promote older workers providing more generous RR and PBD. However, in Turkey RR and PBD are fixed regardless of any determinant age, marital status or number of children. Furthermore, comparing with most of the developed countries Turkey has one of the lowest RR in compensating unemployed workers. While RR varies from %40 to %90 in most countries, the daily unemployment benefit in Turkey is %40 of the average gross earnings of the worker by taking into consideration in the last four months of insured workers' earnings⁵. Apart from stipend, entitled workers get health insurance and İŞKUR supports those workers through easing the job search process and providing vocational training.

Table 1: Beneficiaries of Unemployment Insurance

Year	Number of Unemployed Workers (a)	UI Applications (b)	UI Granted (c)	Benefit (c/b)	(b/a)	(c/a)
2003	2.493.000	143.155	118.437	83%	6%	5%
2004	2.385.000	169.409	127.528	75%	7%	5%
2005	2.388.000	198.323	144.435	73%	8%	6%
2006	2.328.000	172.795	152.257	88%	7%	7%
2007	2.376.000	246.113	221.801	90%	10%	9%
2008	2.611.000	381.669	331.953	87%	15%	13%
2009	3.471.000	546.112	464.906	85%	16%	13%
2010	3.046.000	426.995	326.082	76%	14%	11%
2011	2.615.000	441.238	321.062	73%	17%	12%
2012	2.518.000	609.245	365.719	60%	24%	15%
2013	2.747.000	732.409	422.334	58%	27%	15%
2014	2.853.000	900.910	501.636	56%	32%	18%
2015	3.057.000	1.086.293	589.888	54%	36%	19%
2016	3.330.000	1.520.282	799.847	53%	46%	24%
2017	3.454.000	1.326.967	695.967	52%	38%	20%
2018	3.537.000	1.635.111	841.847	51%	46%	24%
2019	4.469.000	1.955.041	1.013.056	52%	44%	23%

Source: Turkish Employment Agency and own calculations

Table 1 presents the number of applications and beneficiaries of UI program and their share in the total unemployed workers. In the second column of the table we see the number

⁵Before 2008 this level was equal to %50 of the average daily net earnings of the worker.

of unemployed workers in years. In the third and forth columns there are UI applications and beneficiaries in numbers. Beneficiary to applicant ratio stands in the fifth column. We see that this ratio was rather high with %90 in 2007 and since then we see a gradual decrease to %52 until 2019. The ratio was relatively high until 2010. It may be explained by the low application rate compared to number of unemployed workers since this rate was only %6 in 2003 and has become %44 in 2019. It means that now almost half of the unemployed workers apply for UI benefits. Among those applicants, almost half of them are granted benefits. Again, the possibility of a UI application to be considered successful was quite high (between %73 and %90) until 2011. In the last decade this rate has decreased gradually from %51 to %56. In the seventh column we see the ratio of benefit recipients to total number of unemployed workers. This ratio shows a steady rise from %5 to %23 between 2003 and 2019 with two exceptions 2010 and 2017.

Overall, since 2003 the number of workers granted UI benefits increased more than 8 times, UI applications augmented more than 13 times and the number of unemployed workers almost doubled.

4 BASIC JOB SEARCH MODEL

Basic job search theory (also called partial model) represents the behavior of an unemployed worker looking for employment. In this one-sided model, the optimal strategy for a worker is to choose her reservation wage, x , which is the minimum level of pay that she is willing to work. Since searching for a job is a costly and time-consuming process, workers would not want to take a job offer that is below this reservation wage. The reservation wage depends on various parameters like the discount rate and job destruction rate, but most importantly, on the arrival rate of job offers, benefit level, and in some models, search effort. Thus, the partial model becomes convenient for the evaluation of unemployment related policy changes.

In this section, we assume that there are two types of workers endowed with either high or low job finding skills (type-H and type-L). All workers have the same level of productivity. The number of type-H workers in our economy represented with γ and type-L workers with $(1 - \gamma)$ of the total population. We introduce the unemployment pool composition (σ) that indicates the proportion of type-H workers in the unemployment pool, while $(1 - \sigma)$ indicates the proportion of type-L workers where $\sigma = \frac{U_H}{U_H + U_L}$ and $(1 - \sigma) = \frac{U_L}{U_H + U_L}$. While U_H and U_L represent the number of unemployed workers, $L_H + L_L$ represent the number of employed workers. Since the population is normalized to 1, we can state that $N_H + N_L = 1$ and $N_i = L_i + U_i$ and $U_H + U_L + L_H + L_L = 1$. So for ease of understanding $N_H = \gamma$ and $N_L = (1 - \gamma)$.

For simplicity, employees do not look for another job and the jobs are independently destroyed at the rate q . In the model the arrival rate of job offers becomes $\lambda_i = e\alpha_i$, where e and α_i indicate search effort and state of the labor market respectively. As in Cahuc et al. (2014), the parameter α_i can be a function of the number of vacant jobs, job searchers, age, sex or educational level. So, we take this parameter as a skill level of workers, H for high L for low skilled workers where $\alpha_H > \alpha_L$. Both parameters are assumed to be strictly positive the relation $\lambda_H > \lambda_L$ holds.

Unemployed workers do not know the wages that correspond to each job. They only know the cumulative wage distribution $H(w)$. The workers randomly draw from the wage distribution until they receive a job offer that is higher than their reservation wage $w \geq x$. Once

they receive a job offer whose value higher than their reservation wage, they accept this job offer, and their instantaneous income becomes $w dt$ over a short interval of time dt . Over the same time interval, she loses her job with a possibility q that amounts to $q dt$, and by our assumption, she instantly becomes eligible to unemployment benefits b . The arrival rate of a job offer is denoted by λ that depends on various labor market conditions and personal characteristics. In this model, there is no prior work history restriction, and once a worker loses her job, she is entitled to benefits.

$$V_i^u = \frac{1}{1 + r dt} [w_i dt + (1 - q dt)V_i^e + q dt V_i^u] \quad (1)$$

The discounted expected utility of an employed worker $i = H, L$ is denoted as in (1) where r stands for the discount rate, V_i^u for the expected utility of being unemployed and V_i^e for being employed⁶. The worker earns the wage w_i until the job is destroyed. A worker loses her job with probability q and gets $q V_i^u$, with probability $(1 - q)$ she continues to enjoy the utility of being employed V_i^e .

Rearranging above expression and eliminating dt we get:

$$r V_i^e = w_i + q(V_i^u - V_i^e) \quad (2)$$

If we subtract V_i^u from both sides to get:

$$V_i^e - V_i^u = \frac{w_i - r V_i^u}{r + q} \quad (3)$$

The relation (3) is very instructive in understanding the relationship between the expected wage, the reservation wage, and the discounted expected utility of being unemployed. For any wage offer satisfying the relation $w < r V_i^u$, worker's gain of being employed is inferior to being unemployed $V_i^e < V_i^u$. In this case, she would not be willing to work because being unemployed is more valuable. She might believe that the next job offer could be more valuable, so it is worth waiting. Or, the difference between benefit level and offered wage is so small that she does not want to be exposed to the dis-utility of work. Thus, any value x that is equal to $r V_i^u$ defines the worker's reservation wage, and below this threshold, workers would prefer to be unemployed and keep searching for a job.

⁶This equation together with others in this section are exactly as in Cahuc et al. (2014), ch. 5.

To specify the discounted expected utility of a job seeker, we write:

$$rV_i^u = b + \lambda_i \int_{x_i}^{+\infty} [V_i^e(w) - V_i^u] dH(w) \quad (4)$$

While unemployed, workers attain unemployment benefit b that are positively correlated with the value of unemployment. An unemployed worker gets a job offer with a probability of λ_i and only accepts it if it is higher than her reservation wage x_i . When the job offer arrives, the worker's gain amounts to $V_i^e(w) - V_i^u$, which is an increasing function of w .

Replacing rV_i^u with x_i and using the equation (4) we arrive at following relation:

$$x_i = b + \frac{\lambda_i}{r + q} \int_{x_i}^{+\infty} (w - x) dH(w) \quad (5)$$

Equation (5) shows that the reservation wage is the sum of unemployment benefits and the discounted expected utility of the job that has a value above this reservation wage. It should be noted that x is unique at this expression since the value of right-hand side decreases as left-hand side increases with x_i .

Job search theory is a useful instrument to evaluate two important indicators: job finding rate (hazard rate) and average duration of unemployment. With probability λ_i an unemployed worker receives a job offer and with probability $[1 - H(x_i)]$ this offer is above the worker's reservation wage. So the probability of finding a job equals to $\lambda_i[1 - H(x_i)]$ at any time. We can conclude that the average duration of unemployment (D_i) equals:

$$D_i = \frac{1}{\lambda_i[1 - H(x_i)]} \quad (6)$$

The equation (6) is easy to interpret. Let's assume that a worker's probability to be employed is one in five over a period of time. Then, this worker is expected to remain unemployed for five period of time on average. The unemployment duration is negatively correlated with the arrival rate of jobs and positively correlated with reservation wage.

4.1 Optimal Search Strategy

In the partial model, job search intensity becomes a variable that workers have preference on. As in Mortensen (1977), a worker increases her probability of finding a job with search effort. However, the discomfort arising from search effort also goes up with search intensity. Hence, the workers are confronted with an optimization problem trying to choose optimal search effort that yields maximum utility.

Increasing search effort yields a higher expected utility to workers because the probability of finding a job increases with effort. However, there also exists cost of search effort. If there would be no cost to search, every worker would seek for a job at their maximum capacity. Since this is not the case, the optimal effort will be at the point where the marginal benefit from search equals its marginal cost. Generally, disutility of search is shown implicitly $\phi(e)$ as the cost arising from search effort e . The function is assumed to be convex and twice differentiable formally described as $\phi'(e) > 0$ and $\phi''(e) > 0$. We make use of the search effort cost as in Cahuc et al. (2014). However, we will introduce the search effort explicitly. We make use of the relation (5) and obtain the following:

$$x_i = b - \phi(e) + \frac{\alpha_i e}{r + q} \int_{x_i}^{+\infty} (w - x) dH(w) \quad (7)$$

Differentiating (7) with respect to e in order to obtain the optimal effort, one reaches the following equation:

$$\phi'(e) = \alpha_i \int_{x_i}^{+\infty} \frac{w - x}{r + q} dH(w) \quad (8)$$

Further, replacing the right-hand side of (8) in (7), we reach at (9).

$$x_i = b + e_i \phi'(e) - \phi(e) \quad (9)$$

These fundamental relations are exactly as in Cahuc et al. (2014).

4.1.1 Flow Equations

In this section, we describe the equilibrium values of unemployment rate of both type of workers. We let u_i and l_i denote the unemployed rate and employed rate respectively for

$i = H, L$. At each instant, $N_H u_H \alpha_H e (1 - H(x))$ H-type workers enter to employment while $q l_H$ workers lose their job where $l_H = N_H (1 - u_H)$. For L-type workers $q l_L$ workers lose their job and $N_L u_L \alpha_L e (1 - H(x))$ find a job. Thus, the law of motion of unemployment equations are written as:

$$\begin{aligned} \dot{u}_H &= q l_H - \alpha_H e_H (1 - H(x_H)) u_H \\ \dot{u}_L &= q l_L - \alpha_L e_L (1 - H(x_L)) u_L \end{aligned} \quad (10)$$

In a steady state, applying $\dot{u}_H = 0$ and $\dot{u}_L = 0$, the unemployment rates of workers are given by Equation (10):

$$u_H = \frac{q}{q + \alpha_H e_H (1 - H(x_H))} \quad u_L = \frac{q}{q + \alpha_L e_L (1 - H(x_L))} \quad (11)$$

Unemployment rate is a decreasing function of α_i and e but increasing function of q and reservation wage x . It is also worth to note that the size of the population of any type γ or $(1 - \gamma)$ does not affect the unemployment rate.

Further, since the total population is normalized to 1 with $U_H + U_L + L_H + L_L = 1$, we can easily define the total unemployment rate by

$$u = u_H \gamma + u_L (1 - \gamma) \quad (12)$$

Equation (12) represents the unemployment rate in the economy. It depends on each type of workers' unemployment rate and their percentage in the total population. Their distribution in the population play an important role in determining unemployment rate in equilibrium. At extreme cases when $\gamma = 1$ and $\gamma = 0$ the equilibrium unemployment rate will be different. In the latter, there will be more friction in the labor market. However, facing more frictions would lower workers' reservation wage and this would imply a lower unemployment rate for type-L workers.

Now, we need to express the number of unemployed workers so as to reach σ . Since σ stands for the proportion of H-type workers in the unemployment pool, we need an exact number of unemployed which determines the ratio of workers. If we multiply the proportion of i type workers with their unemployment rates, namely, $U_L = u_L (1 - \gamma)$ and $U_H = u_H \gamma$, we get

the number of unemployed workers. This relation is shown as the following:

$$\sigma = \frac{U_H}{U_L + U_H} = \frac{\frac{q}{q + \alpha_H e_H (1 - H(x_H))}^\gamma}{\frac{q}{q + \alpha_L e_L (1 - H(x_L))} (1 - \gamma) + \frac{q}{q + \alpha_H e_H (1 - H(x_H))}^\gamma} \quad (13)$$

$$\sigma = \frac{\gamma(q + \alpha_L e_L [1 - H(x_L)])}{(1 - \gamma)[q + \alpha_H e_H [1 - H(x_H)]] + \gamma[q + \alpha_L e_L [1 - H(x_L)]]} \quad (14)$$

Although γ or σ do not alter the unemployment rate of a specific group, they change the unemployment rate since the number of unemployed workers is a function of both variables. The stock of H-type workers (γ) is positively correlated with the composition of unemployment (σ) i.e., $\partial\sigma/\partial\gamma > 0$. One may expect a direct increase in the number of H-type unemployed workers if their stock in the population rises.

4.1.2 Comparative Statics

Using equations (8) and (9), we are able to obtain the comparative statics of the model.

The search effort e depends on $r, q, \alpha_i, \bar{x}$ and b . We evaluate the impacts on effort level using implicit differentiation rule as follows:

$$\frac{\partial e}{\partial b} < 0, \quad \frac{\partial e}{\partial \alpha_i} > 0 \quad \frac{\partial e}{\partial \bar{x}} > 0 \quad \frac{\partial e}{\partial r} < 0 \quad \text{and} \quad \frac{\partial e}{\partial q} < 0$$

First, a rise in the benefit level initially raises the utility of an unemployed worker. By providing less amount of effort, she garners the same marginal gain from a given effort. Now, the the gain from searching a job is greater than before for the same amount of effort. So the job seeker reduces her search effort.

Second, taking the derivative of equation (18) we see a positive relationship between α_i and search effort. As we have stated in the previous section, the marginal benefit from increasing search effort is greater for high skilled workers so high skilled workers increase their effort more than low skilled workers.

Third, the upper bound of wage distribution has also a positive impact on effort level. It is mostly due to the possibility of obtaining a job offer with higher wage. Since a worker's effort is contingent upon the expected utility from obtaining a job offer, the maximum level of

wage is an increasing function of search effort.

Finally, a rise in r implies that a worker places less value on future and searches less intensely because the value expected benefit from future decreases. If the job loss rate q increases, the value between being employed and searching for a job shrinks and thus every worker searches less. Another explanation to job loss rate is that since every job lasts shorter than before workers become less demanding so they are more unlikely to search.

Equation (9) determines the value of reservation wage solely as a function independent variables. Again, applying the implicit differentiation formula we obtain the following results:

$$\frac{\partial x}{\partial b} > 0, \quad \frac{\partial x}{\partial \alpha_i} > 0, \quad \frac{\partial x}{\partial \bar{x}} > 0 \quad \frac{\partial x}{\partial r} < 0 \quad \text{and} \quad \frac{\partial x}{\partial q} < 0$$

It is pretty straightforward to see from equation (9) that the reservation wage is positively correlated with the amount of unemployment benefits. Since b increases the value of unemployment $rV_u = x$, a worker becomes more demanding in terms of wages.

As it has been stated in previous section, α_i increase corresponds to a higher reservation wage. It is natural to expect that a high skilled worker's reservation wage is greater than low skilled worker. From equation (8), a high skilled is expected to search more due to the difference between α_H and α_L . It comes mainly from the expected benefit approach since the left-hand side of the equation represents the marginal cost of effort while right-hand side denotes the marginal benefit to search. High skilled worker searches harder for a given level of wage since she gets more benefit from a unit increase in effort.

The maximum level of wage distribution has a positive impact on reservation wage as expected. If an individual faces a wider range and higher range of wage, he/she normally increases his/her reservation wage.

Finally, the discount rate r increase implies that the worker cares less about the future and prefers to be employed as soon as possible, so it lowers the value of x . In case of q , when jobs are destroyed more frequently workers become less demanding.

Our primary aim was to investigate which skill type would be affected more from a change in the unemployment benefit. It is clearly stated that the effort level and the reservation

wage of both sides are affected in the same direction. Yet, the magnitude is expected to be unequal. In order to reach the final conclusion, we present explicit definitions for the variables of the model.

4.1.3 A Numerical Example

The comparative static results of the model are beneficial to understand the direction of the effects. Using these results, we reach the main conclusions, such as a high-skilled worker's reservation wage and effort level stands higher than those of low-skilled workers. However, we cannot discern which type of worker would be more affected in size by the changes in UI. Thus, in this section we assign a functional form to the effort function to obtain numerical results. Furthermore, we assume the wage is uniformly distributed, which makes our calculations easier. First, in compliance with the search effort function's properties, we assign effort function an explicit form of $2e^2$, satisfying the function's general property. Second, we assume that the wage is uniformly distributed with an upper bound $\bar{x}$ and the same for all types of workers. The instantaneous utility of a job seeker equals to $(b - 2e^2)$. A worker's discounted expected utility when unemployed, equation (7), becomes:

$$x_i = b - 2e^2 + \frac{\alpha_i e_i}{r + q} \int_{x_i}^{\bar{x}} (w - x) dH(w) \quad (15)$$

where x_i denotes different reservation wage levels that varies with α_i . As it is obvious from the above equation, one might expect the reservation wage to increase as benefits are more generous. Skill indicator α_i affects the minimum wage that workers are willing to take. For an H type, this value will be superior to L , holding other factors constant. Differentiating the expression with respect to e yields,

$$e_i^* = \frac{\alpha_i}{8(r + q)} (\bar{x} - x_i) \quad (16)$$

The convexity of the effort function ensures that the effort is at its maximum level. Equation (16) shows that it is optimal to equate the marginal cost from search to its marginal return. For a given level of reservation wage, the one whose marginal benefit from an additional effort is greater, increases search effort more. In this case, a high skilled worker would increase search effort more than a low skilled worker, since there is no such complementary structure in the

utility function as in Mortensen (1977). Given that effort functions are the same, the one whose marginal benefit is greater is a high skilled worker.

It is worth to remind that equations (15) and (16) are analogous versions of (7) and (8). Replacing the equation (15) in the equation (16), one obtains the following:

$$x_i = b + 2e_i^2 \quad (17)$$

which corresponds to (9). The equation (16) represents a negative relationship between reservation wage and effort while in (17) they move in the same direction. The equations (16) and (17) thus construct a system of equations that determine the unique values of e and x .

By replacing the value of e from (16) in (17) and the value of x from (17) in (16). By doing so, we first arrive at the following effort equation that is a single variable function:

$$e[8(r + q) + 2\alpha_i e] = \alpha_i(\bar{x} - b) \quad (18)$$

Replacing x from (17) in (16) we obtain the following relation:

$$x[32(r + q)^2 + 2\alpha_i^2(2\bar{x} - x)] = 32b(r + q)^2 + \alpha_i^2\bar{x}^2 \quad (19)$$

It is not so easy to see different impacts on reservation wages and effort levels for different levels of α . So, for illustrative purposes, we draw the Figure 1 using equations (16) and (17). First, we set b equal to 20 and then 30, $\bar{x}$ to 100, $r = 0.07$ and $q = 0.03$. Additionally, we equalize α_H to 0.8 and take α_L equal to a multiple of α_H , $\alpha_L = \alpha_H/2^n$, where $n = 1, 2, 3, 4$. By doing so, we see the effect of skill level changes on effort levels, reservation wages, unemployment rates and unemployment durations.

Replacing in related values gives us two equations with two unknowns x and e . Employing equation (16) for given values of α_H and α_L we reach the following equations:

$$(a) \quad x = 100 - e \text{ with } \alpha_H=0.8 \text{ for type-H workers,}$$

$$(b_1) \quad x = 100 - 2e \text{ with } \alpha_L=0.4$$

$$(b_2) \quad x = 100 - 4e \text{ with } \alpha_L=0.2$$

$$(b_3) \quad x = 100 - 8e \text{ with } \alpha_L=0.1$$

(b₄) $x = 100 - 16e$ with $\alpha_L=0.05$ for L-type workers respectively. In order to see the impact of benefit parameter on reservation wage and effort levels, we first set $b = 20$ and then increase the value to 30. From (17) we obtain following equations:

(c) $x = 20 + 2e^2$ before the change in benefit level,

(d) $x = 30 + 2e^2$ after the change in benefit level.

Figure 1: Reservation Wage and Effort Level

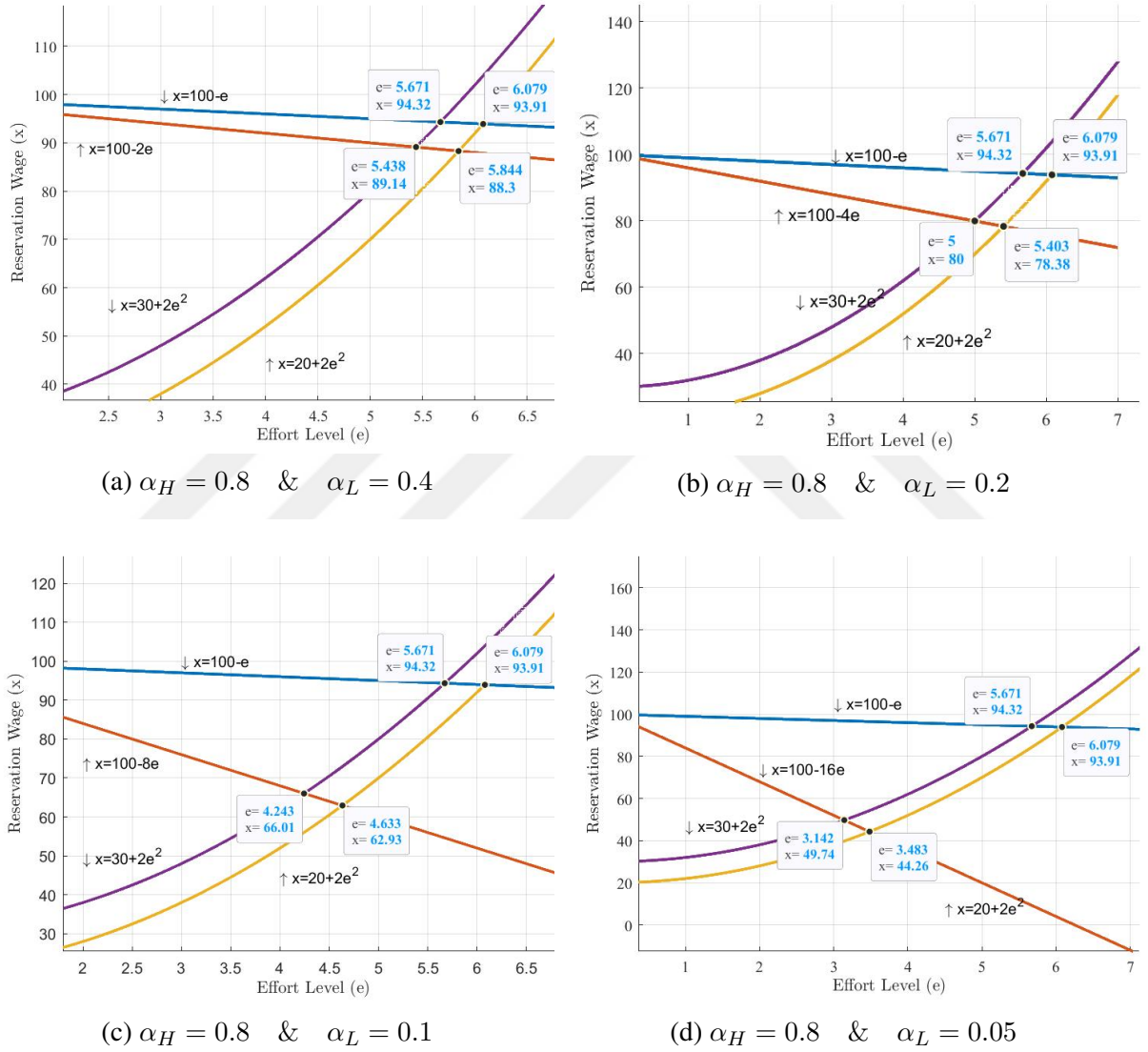


Figure 1 depicts the results. While sub-plot (a) describes the case when $\alpha_L=0.4$, b, (c) and (d) are created for values of $\alpha_L=0.2$, 0.1 and 0.05. Notice that the level of α_H is fixed at 0.8 enabling us to see the responses in effort and reservation wages compared to some fixed ability level. Figure 1 shows the intersection points of equations a - d for given values of b , α_H , α_L , $\bar{x}$ and $(r + q)$. In (a) blue line $x = 100 - e$ represents the H-type worker and red

lines $100 - 2e$, the same applies to other sub-plots for different values of α_L , keeping the other three equations unchanged. The yellow and purple curves depict before and after the change in benefit parameter b , respectively. First, consider the yellow curve, which depicts the case before benefit change where $x = 20 + 2e^2$. It is clear that H-type workers have higher reservation wage and effort level for a given unemployment benefit. The outcomes are as shown in the previous section. Generalizing the statement, for a given level of benefits and other exogenous variables, the workers endowed with higher skills are searching more intensely and have higher reservation wages. Table 2 gives relevant figures for each α_i before and after benefits increase. For $b = 20$, H-type workers' effort level and reservation wage equal $(6.07, 93.91)$, and they are both higher than the values of L-type $(5.84, 88.3)$. This study was aiming to investigate the impacts of unemployment benefits on the heterogeneous types of workers. To that end, we compare first the absolute value and the percentage changes in both types of workers' reservation wage and effort level following a shock to b .

	Benefit Level (b) = 20		Benefit Level (b) = 30		The Percentage Change	
	Effort (e)	Res. Wage (x)	Effort (e)	Res. Wage (x)	Effort (e)	Res. Wage (x)
$\alpha_H=0.8$	6.07	93.92	5.67	94.32	-6.6%	+0.4 %
$\alpha_L=0.4$	5.84	88.31	5.43	89.12	-7%	+0.9 %
$\alpha_L=0.2$	5.40	78.38	5	80	-7.4%	+ 2 %
$\alpha_L=0.1$	4.63	62.93	4.24	66	-8.4%	+ 4 %
$\alpha_L=0.05$	3.48	44.26	3.14	49.7	-9.7%	+ 10.9 %

Table 2: Reservation Wages and Effort Levels for Different Levels of α and b

It is apparent from Figure 1 and Table 2 that as the skill rate diminishes, reservation wage becomes more sensitive to changes in unemployment benefits. The impact on the search effort is precisely the opposite. The line depicting the negative relationship between the search effort and the reservation wage becomes steeper for smaller values of α . This shows us that low skilled agents are expected to react via searching less intensely while anticipating more wage increase than other workers. In the first three sub-plots, the change in search effort is approximately 0.4 points. When we look at the fourth sub-plot, the impact on the search effort, evaluating the difference in absolute value, seems to diminish due to the slope of the line.

Search effort declines for each skill level after the unemployment benefits increase

as expected. We now focus on the percentage changes. Type-H workers' effort diminishes from 6.07 to 5.67, which corresponds to %6.6 decrease ($\alpha_H = 0.8$), while type-L workers' effort level diminishes from 5.84 to 5.43 ($\alpha_L = 0.4$), which is equal to %7 change. If we focus on the response of the reservation wage, we observe a rise irrespective of skill level. The increase in the reservation wages for the case $\alpha_H = 0.8$ & $\alpha_L = 0.4$ is from 93.91 to 94.32 which equals %0.4, while for α_L 89.14 - 88.3 which is %0.9 increase. Thus, in the first case, type-L workers' reaction to changes in benefit parameter is more significant than type-H workers. Using the same method and calculating percentage changes of cases $\alpha_i = 0.2, 0.1$ and 0.05 , the percentage reduction in effort becomes %7.4, %8.4 and %9.7, increase in reservation wage becomes %2, %4, %11 respectively. It is worth to note that calculating the responses through percentage changes may be problematic since the initial points are not the same at different ability levels. However, absolute value changes might not always be significant as in effort changes at (a), (b), and (c), so considering percentage changes instead of total value changes seems correct. We conclude that the lower the skill level, the higher the reaction in the search effort and reservation wage. The magnitude comes in the second plan since we are primarily interested in the direction of changes. We know that it is not realistic to expect two workers with the same productivity level to be willing to work half of the wage.

Formally, we can state the above explanation as follows⁷

$$\left. \frac{\partial e}{\partial b} \right|_{\alpha_i=H} < \left. \frac{\partial e}{\partial b} \right|_{\alpha_i=L} \quad \text{and} \quad \left. \frac{\partial x}{\partial b} \right|_{\alpha_i=H} < \left. \frac{\partial x}{\partial b} \right|_{\alpha_i=L} \quad (20)$$

A low skilled worker is more sensitive to changes in unemployment benefits since her search effort and reservation wage response are more dominant than high skilled workers.

At this point, we can find the unemployment rates and expected unemployment durations for different skill types distinctly. The outcomes resulting from a benefit increase in the unemployment rate, unemployment duration, and the composition of unemployment for different levels of γ and α_i are also documented in the following sections. To determine the population unemployment rate and unemployment composition, we will have to assign a number to γ since the distribution of types in the populations influences the total unemployment

⁷The argument in equation (20) is only valid for percentage changes.

rate.

Unemployment Rate

Using (14) and (15), we manage to determine u_H , u_L and u together with the assigned values of α_i and γ ⁸. The unemployment rate for different levels of b and α are presented in Table 3.⁹ The unemployment rates presented in each row are calculated when the whole population consists of only one type. The first row of the table describes the situation when the entire population is formed of workers with $\alpha_i=0.8$.

	Benefit Level (b) = 20	Benefit Level (b) = 30	The Percentage Change
	Unemployment Rate (u_i)		in Unemployment Rate
$\alpha_H=0.8$ ($\gamma = 1$)	9.2 %	10.4 %	+ 1.2
$\alpha_L=0.4$ ($\gamma = 1$)	9.8 %	11.2 %	+ 1.4
$\alpha_L=0.2$ ($\gamma = 1$)	11.3 %	13 %	+ 1.7
$\alpha_L=0.1$ ($\gamma = 1$)	14.8 %	17.2 %	+ 2.4
$\alpha_L=0.05$ ($\gamma = 1$)	23.6 %	27.5 %	+ 3.9

Table 3: The Unemployment Rate for Different Levels of α and b

The unemployment rate decreases with an increment in skill rate and increases with unemployment benefits as expected. These different unemployment rates define the total unemployment rate implicitly when $\gamma = 0$ and $\gamma = 1$ —for instance, considering only $\alpha_H = 0.8$ and $\alpha_L = 0.4$ types in the economy. When there exist only $\alpha_H = 0.8$ and $\alpha_L = 0.4$ workers in the economy, the unemployment rate varies between %9.2 and %9.8 depending on their proportion in the total population. Nevertheless, when the gap between skill levels increases, the unemployment rate fluctuates in a wider range. For instance, assuming the co-existence of $\alpha_H = 0.4$ and $\alpha_L = 0.05$ when $b = 20$, the unemployment rate in this case varies between %9.8 and %23.6. For lower levels of α , the variation in unemployment rate is amplified since higher response of reservation wage and effort levels bring a higher increase in the unemployment rate.

Moreover, the reactions in the search effort and the reservation wages are reflected in the unemployment rates as expected. The unemployment rate is more sensitive to UI policy changes in an economy with type-L workers. Increasing benefits from 20 to 30 results in a %3.9 increase in the unemployment rate if the whole labor force endowed with skill level $\alpha_i = 0.05$;

⁸Calculations are provided in the Appendix 7.1.

⁹Unemployment rates are calculated for $\gamma=1$. The equilibrium unemployment rates for different compositions of α_H and α_L are presented in Figure 2.

however, if $\alpha_i = 0.8$ the increase in benefits raises the unemployment rate by %1.2 point.

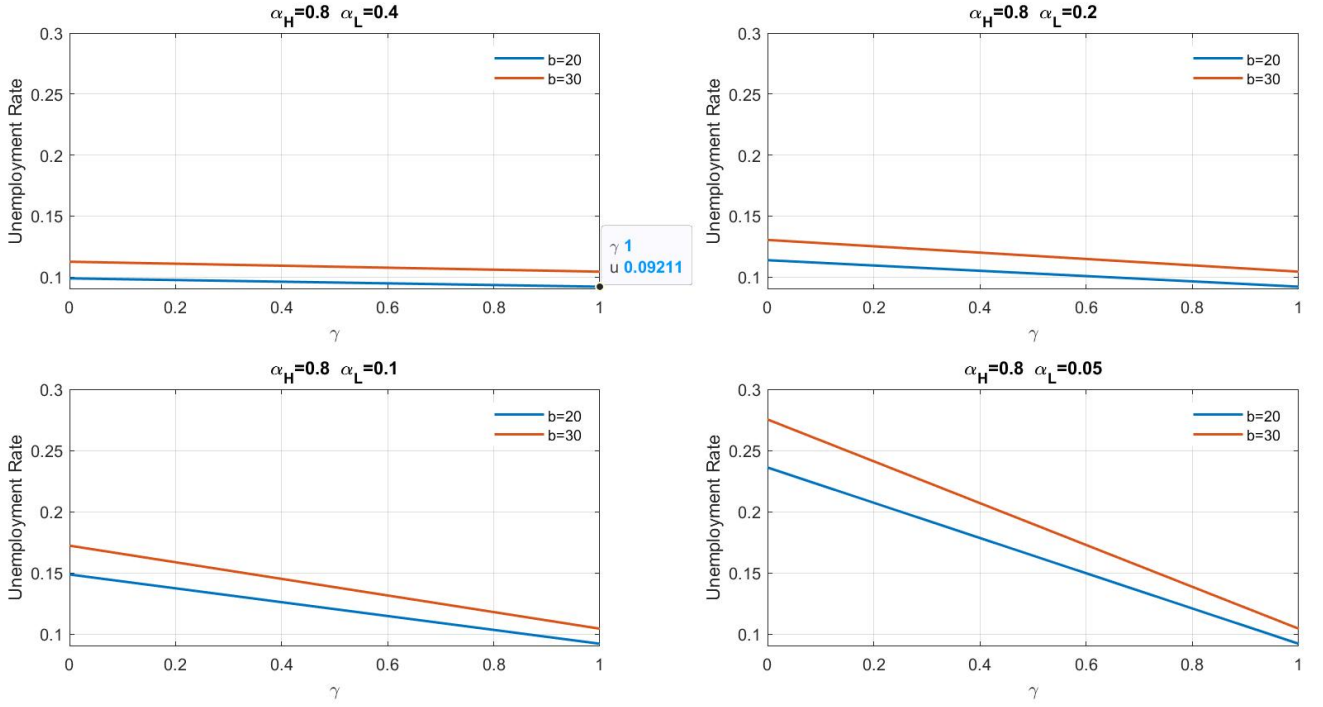


Figure 2: Unemployment Rate and (γ)

Figure 2 depicts the results shown in Table 3 for different values of γ . The composition of unemployment varies between 0 and 1 depending on the value of γ . For $\gamma = 1$ and $\gamma = 0$ the composition of unemployment becomes $\sigma = 1$ and $\sigma = 0$ respectively. The unemployment rate on the y-axis and γ is on the x-axis, both axes are drawn to scale. While the blue line shows the reaction of the unemployment rate for different values of γ before the change in unemployment benefit, the red line describes the unemployment level after the change. A rise in γ lowers the unemployment rate since higher γ means that a higher proportion of type-H workers exist in the unemployment pool. Also, job searching worker's distribution influences the job-finding rate of unemployed workers. As γ rises -so does σ , the unemployment rate raises.

It is clear that the macro variables are affected by the composition of the labor force and unemployment. If the population of type-H workers is high in the labor force, the unemployment rate is expected to be lower. Furthermore, the difference between skill levels is a crucial determinant of the unemployment rate. If the skill interval is wide, the variation in the unemployment rate becomes wider. Thus, policy changes related to unemployment insurance systems can be more effective in such an environment.

The Composition of Unemployment

σ is solely the function of U_H and U_L . We have shown in the section above that the unemployment rate of low skilled workers increases more than high skilled workers after a rise in benefits. This, of course, will be visible in the composition. As shown in the above numerical exercise, low skilled workers are eager to lower their search effort and increase their reservation wages more than high skilled workers as it can be seen through higher unemployment rates. Through this new level of the unemployment rate, multiplying with γ , the composition of unemployment will be populated with more low skilled workers.

Figure 3 represents the old and new levels of the unemployment composition for $0.5 < \gamma < 0.7$. Although it is not noticeable, when the values of α_i 's are close to each other, we do not observe significant changes in the composition. The composition shifts in favor of low-skilled workers as skill levels take values farther from each other. However, even though the difference between skill levels is quite high as in sub-plot (d), the composition does not seem to change much.

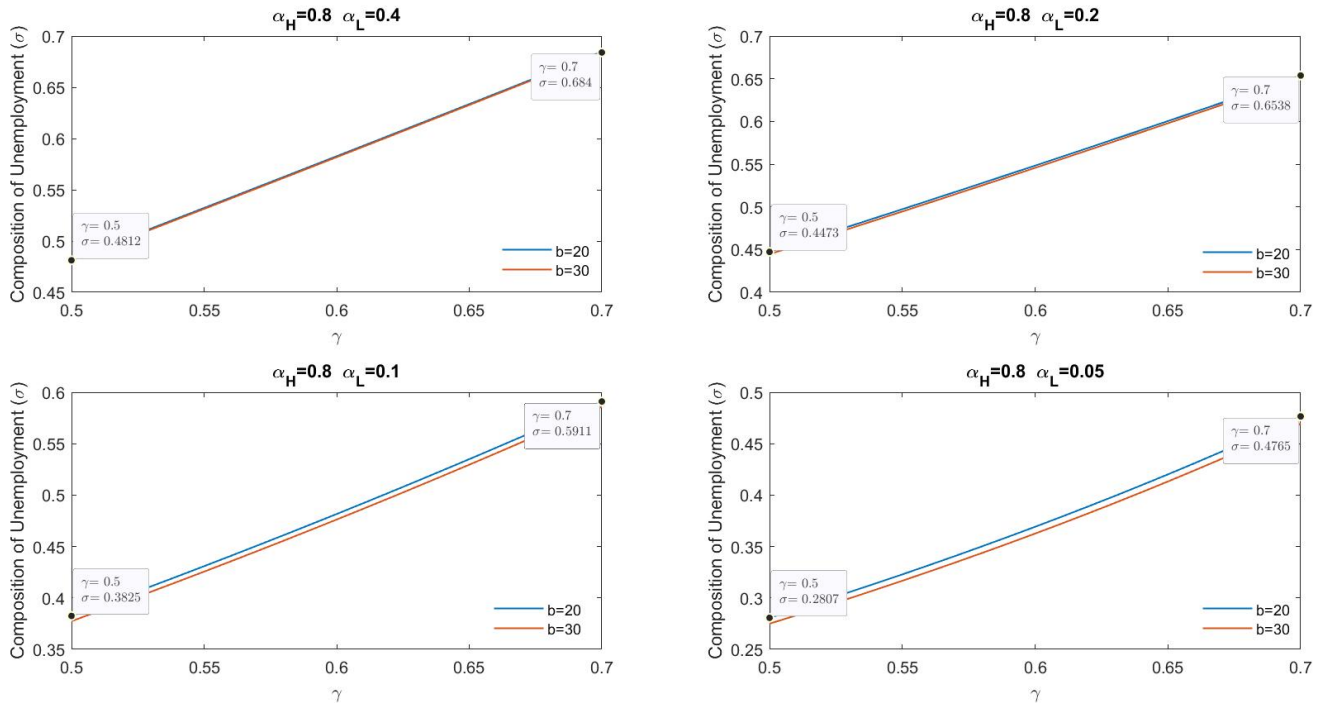


Figure 3: The Composition of Unemployment and (γ)

Since the sub-plots are not drawn to scale, the y-axis has different values. The ratio of high skilled workers in the unemployment pool diminishes as the divergence increases between

the values of $\alpha_H = 0.8$ and α_L , for a given γ . If we look at the point where the skill levels are evenly distributed ($\gamma = 0.5$) in the sub-plot (a), the ratio of high skilled workers in the unemployment is close to their population ratio (%48). However, in the sub-plot (d), even the distribution is equal in the population, high skilled workers comprise %28 of the unemployment pool.

Although this figure shows us the expected comparative statics effects, the composition's overall change does not seem substantial. Even for the extreme case in this graph, while α_H is 16 times higher than α_L , the composition change does not exceed %1. In this case, this low level of change in the unemployment ratio does not seem realistic, considering notable skill differences between workers.

Our primary aim is to present a qualitative solution rather than fully calibrate the model with real-life parameters. Several sophistications might help us to get a more realistic quantitative solution. As noted earlier, we are not trying to find exact changes; we only try to specify the directions. For example, we might have taken a normally distributed wage structure. The effort function could take another form that fits in the real-time data. Also, the linear relation between α_i and e might ease the impact of the changes in effort level. If we were to take the frequency of job offer ($\alpha_i e$) in a non-linear form, we would obtain different results.

Unemployment Duration

We evaluate the impact of unemployment benefit change on the average duration of unemployment for different types of workers. We can deduce the expected period of unemployment for both types of workers replacing $\lambda = \alpha_i e$ in (6):

$$D_H = \frac{1}{\alpha_H e_H [1 - H(x_H)]} \bigg|_{e_H, x_H}, \quad D_L = \frac{1}{\alpha_L e_L [1 - H(x_L)]} \bigg|_{e_L, x_L} \quad (21)$$

In (21), D_H and D_L denote the average duration of unemployment for high skilled and low skilled workers, respectively. First, we replace the values of α_i , e_i and $[1 - H(x_i)]$. For the case where unemployment benefit level equals $b = 20$, the corresponding values of (e_i, x_i) are (6.07 , 93.91) and (5.84 , 88.31). It is worth to remember that we have taken $\bar{x} = 100$. Replacing the relevant values for $b = 20$ we get:

	Benefit Level (b) = 20	Benefit Level (b) = 30	The Percentage Change
	Unemployment Duration (D_i)		in Unemployment Duration
$\alpha_H=0.8$ ($\gamma = 1$)	3.38	3.88	+ 14.8 %
$\alpha_L=0.4$ ($\gamma = 1$)	3.65	4.23	+ 15.9 %
$\alpha_L=0.2$ ($\gamma = 1$)	4.28	5	+ 16.8 %
$\alpha_L=0.1$ ($\gamma = 1$)	5.82	6.93	+ 19 %
$\alpha_L=0.05$ ($\gamma = 1$)	10.3	12.6	+ 22 %

Table 4: Unemployment Duration for Different Levels of α and b

The results shown in Table 4 claim that a type-L worker's unemployment duration lengthens more than of type-H worker. Again, the unemployment durations presented in each row are calculated when the whole population consists of only one type. The first row of the table describes the situation when the entire population is formed of workers with $\alpha_i=0.8$. In any unit of time, for a given unemployment benefit level, $b = 20$, a type-H worker is expected to remain unemployed for 3.38 period on average. This duration is approximately 3.65 period for type-L workers with $\alpha_L = 0.4$. Hence, we find that type-H workers' expected unemployment duration is lower than that of type-L workers on average.

The results after the change in benefit parameter are in line with the theory's predictions. A rise in the benefit parameter prolongs the duration of unemployment for each type of worker. As shown in Table 4, type-H workers' ($\alpha_H = 0.8$) expected unemployment duration extends to 3.88 period (%14.8 increase) while type-L workers' ($\alpha_L = 0.4$) expected duration in unemployment becomes 4.23 periods (%15.9 increase). Figure 4 shows the results for different values of α_i . Looking at lower values of α_i , one can see that the expected unemployment duration prolongs¹⁰. The percentage change in duration increases for lower skill levels (for $\alpha_i = 0.2$ the change is %16.8, for $\alpha_i = 0.1$ %19 and for $\alpha_i = 0.05$ %22).

Figure 4 carries two significant implications. First, if the difference between skill levels becomes more disperse, the expected unemployment duration floats on the broader range. For the case $\alpha_H = 0.8$ & $\alpha_L = 0.05$, the expected unemployment duration floats between 10 to 4 periods depending on γ . Second, when the skill dispersion is high, the duration becomes more sensitive to changes in unemployment benefits. It mainly due to magnitude of reaction in search effort and reservation wage. Higher γ indicates a higher proportion of type-H workers

¹⁰See appendix 7.2 for calculations at different values of α_i .

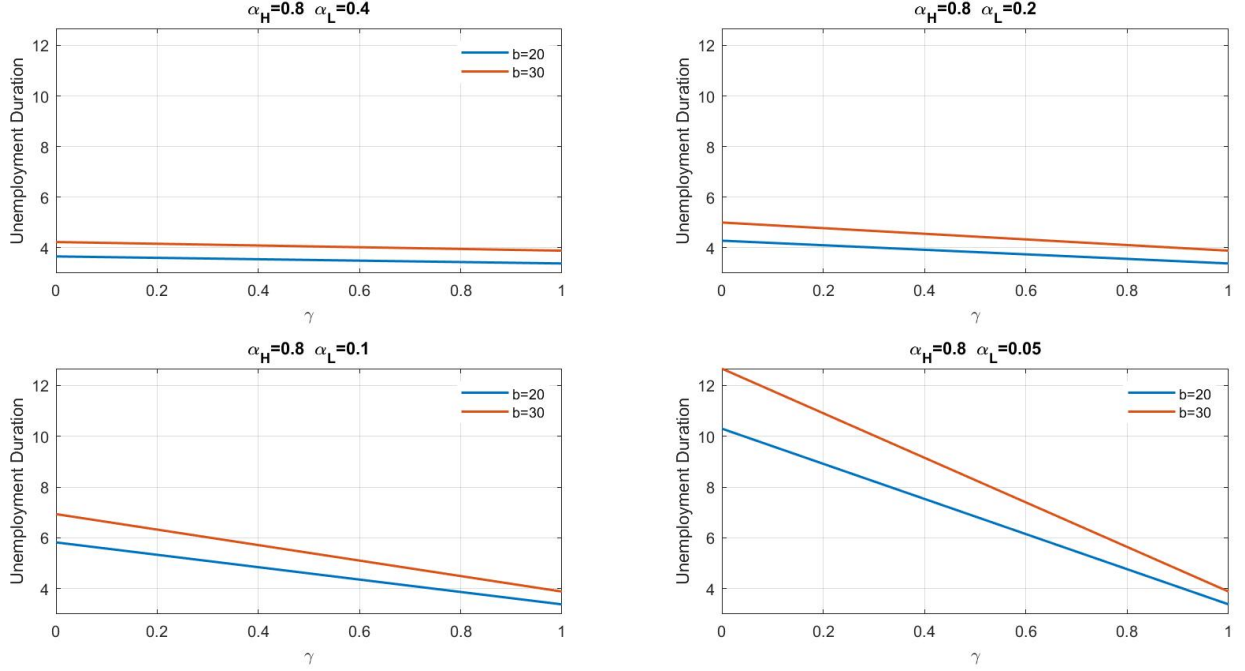


Figure 4: Unemployment Duration and (γ)

in the unemployment pool since it directly influences σ through (14). Job searching worker's proportion in the unemployment pool influences the job-finding rate of unemployed workers.

Moreover, as σ rises, the expected duration of unemployment decreases. The response of the reservation wage and effort level to unemployment benefit change magnifies as the skill level diminishes. The higher reaction hence reflects on the expected duration of unemployment.

A Simple Decomposition Exercise

In this section, we provide a numerical decomposition exercise in order to understand the impact of changes in the search effort and reservation wage on the duration of unemployment and the unemployment rate. By doing so, we can calculate the individual effects of two variables on the extension of duration and equilibrium rate of unemployment. We see the effects by first holding one variable at its previous level, while the other is after the benefits increase. However, we do not find any significant variation at any skill level. Though, for any level of α_i , the impact coming from reservation wage slightly outweighs the search effort impact with %51.3-52.7 of the total increase in the unemployment duration. The two mechanisms seem to contribute equivalently to lengthening the duration of unemployment. Overall, we are not able to assert any dominative effect on prolonging the unemployment period.

We adopt the same strategy in order to see the impacts of the changes in the effort level and reservation wages on the unemployment rate separately. The results are presented in Table 5. After decomposing the two effects we do not see a dominance of any variable. The impact of solely search effort on the unemployment rate changes between %45 and %50.6, while the complementary part belongs the change in reservation wage.

	Unemployment Duration		Unemployment Rate	
	Effort	Reservation Wage	Effort	Reservation Wage
$\alpha_H=0.8$	48%	52%	49.1%	50.9%
$\alpha_L=0.4$	47.3%	52.7%	45%	55%
$\alpha_L=0.2$	47.3%	52.7%	47.7%	52.3%
$\alpha_L=0.1$	48.7%	51.3%	48.8%	51.2%
$\alpha_L=0.05$	47.3%	52.7%	50.6%	49.4%

Table 5: The Individual Effects of Effort Level and Reservation Wage on the Unemployment Duration and Unemployment Rate

When we decompose the impacts, we do not see a systematic pattern in the increase of duration of the unemployment rate and the unemployment rate. The influence of the reservation wage on the duration of unemployment outweighs at every level of α .

In this part, we constructed a basic job search model with heterogeneous workers. The wage distribution is exogenous and uniformly distributed with an upper bound $\bar{x}$. For ease of illustration, the search effort function is taken as ke^2 with $k = 2$ in compliance with the theory's assumptions. We have checked for different values of k but results do not change significantly.

We are aware that a uniform wage distribution assumption is not realistic. As we have seen from the numerical exercise, this kind of hypothesis implies that wages become free to float in a wide range for workers with similar characteristics, besides their ability to form a match. Since we do not take observed heterogeneities into account, workers have the same level of productivity, education, or tenure. So the skill heterogeneity comes only from different success levels at interviews. In this environment, the frequency of job offers is five times higher for low skilled workers even though they have the same productivity level ($\alpha_H = 0.8$, $\alpha_L = 0.05$). Plus, especially in economies like Turkey, where the wage distribution is so dense in a small interval around the minimum wage, our results would not be valid. Assume two low-educated workers with same tenure levels. We cannot expect a worker to accept the wage offer that is half of the other worker. Furthermore, this situation reminds us the Diamond's Critique as there

is no reason for firms to offer such variant wages to the workers who have the same level of productivity.

Since the analysis made in this section was partial, we have not considered the firm side. Thus, neither the wage distribution nor the probability of being laid off reacts to any shift in parameters. For instance, the difference in unemployment composition (σ) following a change in benefit parameter or population composition (γ) does not affect the firm side. Or, the change in unemployment composition arises only due to workers' behavior. The results are generated through the variations in reservation wages and effort levels at distinct magnitudes. However, firms may respond to changes in the composition level of unemployment and population. In the following section, we incorporate the firm side and construct a search-and-matching model.

5 TWO-SIDED SEARCH MODEL

This section analyzes the impacts of the coexistence of two types of workers and their composition in the unemployment pool on tightness and equilibrium values of the labor market using a standard search-and-matching model. We construct a model in continuous-time consisting of a constant population normalized to 1. As in the previous section, there are H and L types of workers whose abilities (matching skills) are still only known to them. Unlike the setting in Gonzalez and Shi (2010), workers don't pass through a process to learn about their skill levels. And differently from Malherbet et al. (2020), there is no switch in skill levels through learning. Workers do not know which interview will produce a match. The number of high matching skill (MS) workers in our economy represents γ of the total population and low MS workers $(1 - \gamma)$ of the total population. Individuals have an infinite lifespan, and they are risk-neutral. There is no on-the-job search, and jobs are exogenously and identically destroyed at rate q . The labor force consists of employees and unemployed workers and described as following where subscript $i = H, L$:

$$N_i = L_i + U_i \quad (5.1)$$

and

$$N_L = 1 - N_H \quad \text{where} \quad N_H = \gamma \quad \text{and} \quad N_L = (1 - \gamma) \quad (5.2)$$

Since the total population is normalized to 1, $N_H + N_L = 1$, The relation $U_H + U_L + L_H + L_L = 1$ holds.

Not all job interviews produce a successful match. The workers' different matching probabilities are considered as the form of friction. There are two types of workers in the labor market, and they differ in their distinct possibilities of forming a match from a meeting. Worker heterogeneity may occur due to many different parameters like different skill levels, educational backgrounds, or schooling years. Besides, workers may be subject to different wage structures, different labor protection laws, and various employment durations due to firm or sector heterogeneity. However, in this section, we do not take firm or sector heterogeneities into account. Although the labor market is not segmented, and both types of workers are confronted with the same labor market tightness, workers differ in their probability of forming a productive match.

Or, they have different search efficiencies. However, this difference in search efficiency does not arise from their observable characteristics. It is affected by their unobservable characteristics, MS. The successful outcome rate from a job meeting, the MS parameter, for a high skilled worker is denoted by α_H while for a low skilled worker α_L , where $0 < \alpha_L < \alpha_H < 1$.

Each unemployed worker has the same level of productivity, and there are no observable differences between workers. For example, the probability of meeting with an employer is the same for both types because the labor market tightness is identical. We introduce another key parameter here that is the composition of unemployment (σ) indicating the proportion of H type workers in the unemployed pool, while $(1 - \sigma)$ shows the percentage of type-L workers where $\sigma = \frac{U_H}{U_H + U_L}$ and $(1 - \sigma) = \frac{U_L}{U_H + U_L}$.

5.1 Matching Process

The labor market is characterized by the simultaneous existence of job-seeking workers and firms with vacant positions. The two-sided search process is represented by an aggregate matching function $M=M(U, V)$, which links the flow of new hires M to vacancy rates V and job seekers U . Only unemployed workers search for a job, so there is no on-the-job search. The function M has traditional characteristics: it increases with its two input arguments, null if one of the arguments is equal to zero, and has constant returns to scale. This last property makes it possible to define the probability of filling a vacant job by $M(U, V)/V = M(1/\theta, 1) = m(\theta)$ where labor market tightness is given by $\theta = \frac{V}{U}$. Analogously, probability of a worker to find a job is $M(U, V)/U = M(1, \theta) = \theta m(\theta)$. It is also the exit rate from unemployment (hazard rate) for an unemployed worker. As the labor market tightness (θ) goes up; workers get into jobs easier than before. But, it is harder to fill a vacant position for firms since $m'(\theta) < 0$ and $[\theta m(\theta)]' > 0$. As the labor market gets tighter, the probability of filling a vacant job falls and the probability of a worker to find a job rises.

In our model, there is no transition between skill levels, and only workers know their types. If a worker is a high or low MS type, stays as is. In the steady-state, flows into unemployment, $(N_i)(1 - u_i)q$, and out of unemployment, $(N_i)u_i\alpha_i\theta m(\theta)$, must be equal where $i = H, L$.

$u_i = U_i/N_i$ states the unemployment rate in the steady-state.

$$u_H = \frac{q}{q + \alpha_H \theta m(\theta)} \quad (5.3)$$

$$u_L = \frac{q}{q + \alpha_L \theta m(\theta)} \quad (5.4)$$

Equations (5.3) and (5.4) give us the Beveridge Curve, and they describe a strictly decreasing and convex relationship between the unemployment rate and the labor market tightness θ . Steady-state unemployment rate rises with job destruction rate q , and declines with tightness and MS parameter α . Assume there is an improvement in MS parameter α_i over a period in the economy. We would expect to see that an interview is now more likely to become a match. Thus, the steady-state unemployment rate would decrease with increasing matching efficiency. It is worth noting that the equilibrium unemployment rate is lower for H-type workers because of the higher ability at the interviews.

At this point, we need another equation that links σ to θ . To create this linkage, we need to define the number of unemployed workers to reach σ . Since σ stands for the proportion of high MS workers in the unemployment pool, we need the exact number of unemployed workers. If we multiply the percentage of i type workers with their unemployment rates, namely, $U_L = u_L(1 - \gamma)$ and $U_H = u_H\gamma$, we get the number of unemployed workers. Thus, we will be able to see the relation between σ to θ . We denote the relationship in the following equation:

$$\sigma = \frac{U_H}{U_H + U_L} = \frac{\frac{q}{q + \alpha_H \theta m(\theta)} \gamma}{\frac{q}{q + \alpha_L \theta m(\theta)} (1 - \gamma) + \frac{q}{q + \alpha_H \theta m(\theta)} \gamma} \quad (5.5)$$

If we simplify the equation (5.5) we reach:

$$\sigma = \frac{\gamma(q + \alpha_L \theta m(\theta))}{q(1 - \gamma)(q + \alpha_H \theta m(\theta)) + \gamma q(q + \alpha_L \theta m(\theta))} \quad (5.6)$$

We see from above equation that σ is a function of the following variables:

$$\sigma = \sigma(\theta, \gamma, \alpha_L, \alpha_H, q) \quad (5.7)$$

We are particularly interested in the impact of θ on σ . Other results are shown in comparative

statics section. We simplify notation for ease of understanding and calculate the effect of θ on σ as:

$$\frac{\partial \sigma}{\partial \theta} = \frac{[m(\theta) + \theta m'(\theta)][\gamma q(1 - \gamma)(\alpha_L - \alpha_H)]}{[q(1 - \gamma)(q + \alpha_H \theta m(\theta)) + \gamma q(q + \alpha_L \theta m(\theta))]^2} < 0 \quad (5.8)$$

The denominator of above equation is clearly positive. Since the probability of finding job is an increasing function of labor market tightness, the first term in brackets of nominator is clearly positive. In the second brackets, the parameter γ varies between 0 and 1 and q also is greater than zero. Hence this leaves us $(\alpha_L - \alpha_H)$ which is negative by our assumption.

The logic behind the relationship (5.8) as follows: Assume there is an increment in labor market tightness that leads to an increase in the probability of finding a job. Since the labor market is not segmented, this effect applies to both type of workers at the same proportion. Thus, we expect unemployment rate for both type of workers to decline, u_H and u_L . But, the decline will be stronger for high MS type than low MS type due to multiplication effect. From multiplication effect, we see the number of high MS worker decreases with respect to low MS worker and it brings high MS worker to find a job more quickly. Since $\alpha_H > \alpha_L$, the equilibrium unemployment rate for high MS types would go down more than for a low MS type for a given level of change. The reason for that is a high MS worker leaves unemployment faster than low MS worker. It is natural for one to see that after an increase in θ , σ falls. Because high MS workers leave unemployment pool faster than low MS workers, the proportion of high MS workers in unemployment pool decreases.

5.2 The Behaviour of the Workers and Firms

5.2.1 Workers

The goal of workers is to maximize their intertemporal utility. Assuming all individuals discount the future at the same rate $r > 0$ and denoting V^e and V^u as the intertemporal utilities of employed and unemployed workers respectively, the discounted expected utilities of the two states are determined by the following Bellman equations:

$$rV_i^e = w_i + q(V_i^u - V_i^e) \quad , \quad i = H, L \quad (5.9)$$

$$rV_i^u = b + \alpha_i \theta m(\theta)(V_i^e - V_i^u) \quad , \quad i = H, L \quad (5.10)$$

The intertemporal utility of employed workers is as given in (5.9). Employed workers derive their utility from their wages and the possible losses associated with the destruction of the job that arrives identically at the rate q that brings them a loss of $V_i^u - V_i^e$. The value of employment also depends on the type of employed worker since their wages are affected by their outside options. Since the outside option of a type-H unemployed worker is greater, the wage level for type-H workers will be greater than of type-L workers.

The utility of an unemployed worker represented in equation (5.10). It consists of two parts showing the gains and losses related to the changes in employment status. The first part is the utility from currently receiving unemployment benefits or any allowances minus various costs. So it amounts to the total net gain of unemployment. The second part is the expected gain from finding a job, $V_i^e - V_i^u$, if she finds a job at the rate $\alpha_i \theta m(\theta)$. Notice that the probability of forming a match is different for two types of workers, while the probability of facing an employer is the same. Due to the difference that occurred out of MS parameter, unemployed workers' outside option differs. The outside option of high MS worker rV_H^u is thus greater than of low MS worker rV_L^u .

5.2.2 Firms

At every moment, firms post new vacancies at cost h , while some vacancies are filled with probability $m(\theta)$. Using Bellman equations, we determine the expected utility of a vacant and filled job. The discounted expected profit from a vacant job and filled job are determined by the following equations (5.11) and (5.12):

$$r\Pi^v = -h + m(\theta)[\sigma\alpha_H(\Pi_H^e - \Pi^v) + (1 - \sigma)\alpha_L(\Pi_L^e - \Pi^v)] \quad (5.11)$$

$$r\Pi_i^e = y - w_i + q(\Pi^v - \Pi_i^e) \quad (5.12)$$

As we can see from equation (5.11), opening a vacancy has a cost of h in a unit of time. With probability $m(\theta)\sigma\alpha_H$, this job will be filled with a high MS worker and yield $(\Pi_H^e - \Pi^v)$ to the firm. On the other hand, with probability $m(\theta)\sigma\alpha_L$ a low MS worker will get the job and the profit arising from this match will bring $(\Pi_L^e - \Pi^v)$ to the firm. Notice that Π_H^e

is expected to be smaller than Π_L^e since forming a match with a high MS worker yields a higher cost to the firm due to the difference between wage levels $w_H > w_L$. For the same level of productivity, hiring a high MS worker is more costly to a firm. However, forming a match with a high MS worker is more likely and thus it speeds up the matching process yielding a lower cost to the firm.

Equation (5.12) represents the discounted expected utility from a filled job. Each job will disappear with a rate q which is exogenous and identical for every worker. Since the workers are homogeneous in terms of their productivity, y will be the same for each filled position. However, high MS workers earn higher wage than low MS workers $w_H > w_L$ due to their different outside options caused by their different MS levels. Thus, the firm is better off if the worker is low MS type since the wage level of low MS type is lower for the same level of productivity. However, the matching probability is also lower for low MS worker that prolongs the matching process.

5.2.3 Labor Demand

At every moment, firms create new positions as long as the profit expected from a vacant job is positive. So at the free entry condition $\Pi^v = 0$, the value of an unfilled job goes to zero. Applying this equity to both (5.11) and (5.12), and equalizing the terms Π_e to each other we get the following:

$$\frac{h}{m(\theta)} = \frac{\sigma\alpha_H(y - w_H) + (1 - \sigma)\alpha_L(y - w_L)}{r + q} \quad (5.13)$$

The left-hand side of the equation (5.13) shows the average cost of a vacant job. Since a vacant position remains unfilled for a period of $1/m(\theta)$ on average, and the firm has a cost of h for each period, the average cost to open a position equals $h/m(\theta)$. The right-hand side is the expected profit of a filled job. With the free entry condition, the firm's labor demand shows up as the above equation where the average expected cost of vacancies equals the expected profit of a filled job.

Notice that the expected profit of a filled job is the weighted average of the profit obtained from employing two types of workers. The expected profit directly depends on the

composition of unemployed workers, the matching skill parameter, and wages. As mentioned above, we know that $y - w_L$ is higher than $y - w_H$. Thus, hiring a low MS worker would yield a higher profit to a firm if we ignored the MS parameter difference $\alpha_H > \alpha_L$ and the unemployment pool composition σ . However, the less frictional structure of high MS workers in the labor market makes them desirable to realize the match. The profitability of low MS type workers through lower wages is compensated to some degree with higher friction. So the net impact will be determined in equilibrium.

5.3 Wage Bargaining

The wage is determined through the standard Nash bargaining process. Every match produces a surplus in the economy, and it is therefore shared between the employee and the employer. The employee's share is the wage, and the employer's share is the profit. The workers' contribution to the Nash criterion is $V_i^e - V^u$ while that of firms is $\Pi_i^e - \Pi^v$ where $i = H, L$. The maximization problem with respect to w_i is represented in equation (5.14), where $\beta \in [0; 1]$ represents the bargaining power of employees.

$$\max_{w_i} (V_i^e - V_i^u)^\beta (\Pi_i^e - \Pi^v)^{1-\beta} \quad (5.14)$$

Total surplus S is represented as in equation (5.15). After the bargaining process, each part shares the total surplus in accordance with their relative bargaining power. The result of this negotiation is written as following equations:

$$S = V_i^e - V_i^u + \Pi_i^e - \Pi^v \quad (5.15)$$

$$V_i^e - V_i^u = \beta S \quad (5.16)$$

$$\Pi_i^e - \Pi^v = (1 - \beta)S \quad (5.17)$$

Using definitions (5.9) and (5.12), the profit from a filled job for employer and utility expected from employment to worker, can be expressed as follows:

$$V_i^e - V_i^u = \frac{y - w_i - r\Pi^v}{r + q} \quad (5.18)$$

We can also express total surplus using (5.9) and (5.12) as:

$$S = \frac{y - r(V_i^u - \Pi^v)}{r + q} \quad (5.19)$$

$$\Pi_j^e - \Pi^v = \frac{w_i - rV^u}{r + q} \quad (5.20)$$

Moreover, if we combine (5.16), (5.17) and using free entry condition $\Pi^v = 0$, we arrive at the following negotiated wage equation:

$$w_i = \beta y + (1 - \beta)rV^u \quad (5.21)$$

Equations (5.10) and (5.19) at the free entry condition give us the following equation in terms of θ and MS parameter:

$$rV_i^u = \frac{b(r + q) + \alpha_i \beta y \theta m(\theta)}{r + q + \alpha_i \beta \theta m(\theta)} \quad (5.22)$$

Finally, if we replace rV^u from above equation into (5.21), we get the relationship between the wage and tightness:

$$w_i = \beta y + (1 - \beta) \left[\frac{b(r + q) + \alpha_i \beta y \theta m(\theta)}{r + q + \alpha_i \beta \theta m(\theta)} \right] \quad (5.23)$$

The interpretation of the relations (5.21), (5.22) and (5.23) is as follows. First, when a worker has no bargaining power ($\beta = 0$) the employer possesses all the surplus which means that the wage is equal to worker's outside option rV^u . On the contrary, if an employer is in the same condition where ($\beta = 1$), then the employee garners the whole production generated from the match. If neither of the cases hold ($0 < \beta < 1$), then the wage is the weighted average of bargaining power of two sides. Second, as we have mentioned before both workers have the same level of productivity y . So the first component of the right-hand side yields the same amount to any worker. However, from (5.22) we see that H-type workers have greater outside option since α_i is an increasing function of rV_i^u . From (5.23), we reach the following:

$$w_H = \beta y + (1 - \beta) \left[\frac{b(r + q) + \alpha_H \beta y \theta m(\theta)}{r + q + \alpha_H \beta \theta m(\theta)} \right] > w_L = \beta y + (1 - \beta) \left[\frac{b(r + q) + \alpha_L \beta y \theta m(\theta)}{r + q + \alpha_L \beta \theta m(\theta)} \right] \quad (5.24)$$

Wage level and the tightness of the labor market change in the same direction as the MS parameter. As the labor market tightness increases, say the proportion of vacant jobs to unemployed workers, workers (firms) face positive (negative) externality. Thus, the tighter labor market benefits workers in a way that tends to push wages up as firms find it more challenging to hire workers. The relation is called the wage curve (WC), which replaces the labor supply curve.

It is more profitable for firms to form a match with low MS workers than high MS workers because of different wages associated with types. Since the outside option of a high MS worker is higher than the low MS type, the former's wage level will be higher. So the high level of wage returns firms at a higher cost. But considering the possibility of a successful match, firms instead to encounter high MS workers. Because to face a high MS type of worker is less costly to the firm.

5.4 Free Entry Condition

Firms post new vacancies if they foresee a positive profit. If a vacant job's expected value is inferior to zero, they do not post any vacancy. In order to state the free entry condition, we first employ equation (5.13). At the free entry condition, when $\Pi^v = 0$, we get the following relation:

$$\frac{h}{m(\theta)} = \sigma\alpha_H\Pi_H^e + (1 - \sigma)\alpha_L\Pi_L^e \quad (5.25)$$

Now, substituting for Π_H^e and Π_L^e in equation (5.25) for each type of worker, we finally get the following formula:

$$\frac{h}{m(\theta)} = (1 - \beta)(y - b) \left[\frac{\sigma\alpha_H}{r + q + \beta\alpha_H\theta m(\theta)} + \frac{(1 - \sigma)\alpha_L}{r + q + \beta\alpha_L\theta m(\theta)} \right] \quad (5.26)$$

(5.26) represents our second fundamental equation of the model. The right-hand side of the above equation represents the value of profit expected from a filled job in an extended form, and the left-hand side still represents the average cost. It is worth noting that as θ goes up, the expected profit decreases while the average cost of a vacant job climbs in tandem. Thus, the above relation gives us a the unique value of θ for a given σ . The equilibrium value of θ changes with σ .

At this moment, we define the second relationship between σ and θ which can be seen as the labor demand effect. First, we define a new function $\Omega(h, \theta, \sigma, y, b, r, q, \alpha_i) = 0$ as in (5.27). By differentiating implicitly the equation (5.27), we find that the effect of the composition of unemployment pool on the labor market tightness is positive i.e.: $\frac{d\theta}{d\sigma} > 0$.

$$\Omega = \frac{h}{m(\theta)} - (1 - \beta)(y - b) \left[\frac{\sigma\alpha_H}{r + q + \beta\alpha_H\theta m(\theta)} + \frac{(1 - \sigma)\alpha_L}{r + q + \beta\alpha_L\theta m(\theta)} \right] \quad (5.27)$$

$$\frac{\partial\theta}{\partial\sigma} = -\frac{\partial\Omega/\partial\sigma}{\partial\Omega/\partial\theta} = -\frac{(1 - \beta)(y - b)[(r + q)(\alpha_L - \alpha_H)/[(r + q + \beta\alpha_H\theta m(\theta))[(r + q + \beta\alpha_L\theta m(\theta))]]}{-m'(\theta)h/[m(\theta)]^2 + \sigma(1 - \beta)(y - b)[m(\theta) + \theta m(\theta)][\beta\alpha_H^2 + \beta\alpha_L^2]} > 0 \quad (5.28)$$

The equation (5.26), together with (5.6), implies that we reach at the unique equilibrium point between θ and σ . The free entry equation (5.26) represents an upward sloping relation between these two variables. We understand from this free entry equation curve that σ has a positive impact on labor market tightness.

Usually, one could expect an employer wants to meet a low MS worker since the w_L is lower than w_H for the same level of productivity. However, as we can see from (5.28), firms prefer high MS workers to exist in the unemployment pool. High MS workers speed up the matching process and lower firms' average cost for vacant jobs. Nevertheless, at the end of the matching process, the market ends up with lots of low MS workers, as high MS workers quickly leave the unemployment pool. Thus, an increase in the proportion of high MS type in the pool, namely σ , will lead firms to increase their vacancies and, therefore, labor market tightness. An increase in high skilled workers' proportion in the pool will reduce the cost of a firm since a vacant job will remain idle for a shorter period. This will cause firms to augment the number of vacant positions, and the labor market tightness increases.

Consequently, we have two equations that build our model's equilibrium. While (5.6) states that an increase in tightness causes a reduction in unemployment pool composition σ , (5.26) expresses that σ increase entails a higher labor market tightness. These relations give us a unique θ and σ . If we know those two values at equilibrium, we can manage to find other values of the model.

Figure 5 identify the free entry condition curve and the composition of unemployment

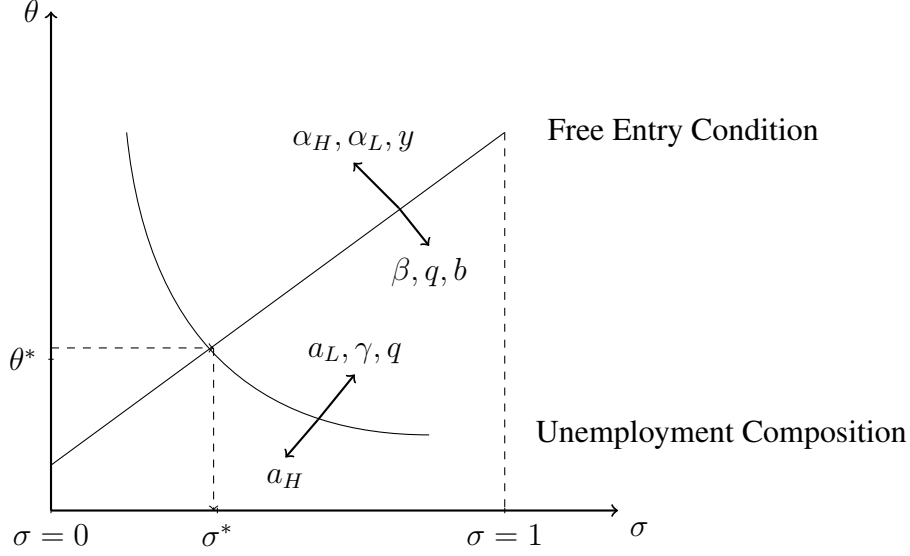


Figure 5: The Composition of Unemployment and Labor Market Tightness

where θ^* and σ^* represents the equilibrium values. As we noted above, θ is an increasing function of σ and (5.26) gives us the equilibrium θ for a given σ . However, for $\sigma = 0$ and $\sigma = 1$, when there exist only one type of workers in the population, θ is determined in (5.26). The detailed comparative static analysis is presented in the following section.

5.5 Comparative Statics

Beveridge Curve

$$u_i = \frac{q}{q + \alpha_i \theta m(\theta)}$$

$$\frac{\partial u}{\partial \theta} < 0, \quad \frac{\partial u}{\partial q} > 0, \quad \frac{\partial u}{\partial \alpha_i} < 0 \quad (5.29)$$

The effects of parameters q and θ on the steady-state unemployment rate for both types of workers are as follows: An increase in q can be considered as the inverse impact of matching technology. If q increases, any job survives for a shorter term, causing the unemployment rate to increase.

If the labor market tightness increases, the unemployment rate decreases since it yields a higher probability of finding a job to a worker. The same impacts of tightness apply for matching probability parameters. As α_H goes up, the steady-state unemployment rate for type-H decreases, and the same effect applies for type-L. Again, the magnitude will be higher for the type-H. It is also worth noting that the matching function's efficiency has the same effect as θ .

Composition of Unemployment (σ)

In this part we see how $\theta, \gamma, \alpha_L, \alpha_H, q$ affect σ . What happens to the composition of unemployment if the total number of type-H workers in labor force or job destruction rate increases¹¹ ?

$$\frac{\partial \sigma}{\partial \theta} < 0 \quad \frac{\partial \sigma}{\partial q} > 0 \quad \frac{\partial \sigma}{\partial \gamma} > 0 \quad \frac{\partial \sigma}{\partial \alpha_H} < 0 \quad \frac{\partial \sigma}{\partial \alpha_L} > 0 \quad (5.30)$$

Labor Market Tightness

The impact of θ on the composition of unemployment is explained in detail in section 5.1. A unit increase in θ will decrease the total population in unemployment. However, type-H workers will be more affected than their counterparts, which causes the unemployment pool to end up with more type-L workers. The increase in the share of L-type workers will reduce the unemployment composition parameter.

Job Destruction Rate

Following a rise in job destruction rate, taking the partial derivative of equation (5.6) with respect to q , the sign will be positive. The reasoning is that an increase in job loss rate implies that workers lose their jobs more frequently in a given period. We know that at each period, $(N_H)(1 - u_H)q$ type-H workers and $(N_L)(1 - u_L)q$ type-L workers lose their jobs. We know that the relation about the employment rates $(1 - u_H) > (1 - u_L)$ hold since the steady-state unemployment rate for low MS type workers is lower. Consequently, any change in q will affect type-H workers more than their counterparts. This impact directly comes from a proportional shift.

The Composition of Population (γ)

The higher share of type-H workers in the total population will have a positive impact on σ . We see a definite link between γ and σ from 5.8.

Matching Skill of H-type Worker (α_L)

If the market becomes less frictional for type H workers, it means that they face less friction and leave the pool easier than before. The outcome will be clearly negative on composition.

¹¹See Appendix 7.4 for calculations

Matching Skill of L-type Worker (α_L)

For α_L , we observe the exact opposite. The less frictional market for L-type workers will provide unemployment pool to end up with less of their type compared to other party. Finally, the impact of θ on σ is negative and as explained in section 5.1.

Free Entry Equation

The comparative statics properties of labor market equilibrium can be found by examining figure 5 and using equation (5.27).

$$\Omega = \frac{h}{m(\theta)} - (1 - \beta)(y - b) \left[\frac{\sigma \alpha_H}{r + q + \beta \alpha_H \theta m(\theta)} + \frac{(1 - \sigma) \alpha_L}{r + q + \beta \alpha_L \theta m(\theta)} \right]$$

$$\frac{\partial \theta}{\partial \sigma} > 0 \quad \frac{\partial \theta}{\partial b} < 0 \quad \frac{\partial \theta}{\partial \beta} < 0 \quad \frac{\partial \theta}{\partial q} < 0 \quad \frac{\partial \theta}{\partial y} > 0 \quad \frac{\partial \theta}{\partial \alpha_H} > 0 \quad \frac{\partial \theta}{\partial \alpha_L} > 0 \quad (5.31)$$

Composition of Unemployment

Firms prefer high MS workers to exist in the unemployment pool as they speed up the matching process and lower the firms' average cost. Yet, at the end of the matching process, the market ends up with many low MS workers as high MS workers quickly leave the unemployment pool. Thus, an increase in the proportion of high MS type in the pool will lead firms to increase vacancies and labor market tightness. An increase in high skilled workers' ratio in the pool will reduce the cost of a firm since a vacant job will remain idle for a shorter period. This will cause firms to augment the number of vacant posts.

Unemployment Benefit

An augmentation in benefit parameter, a possible extension of potential benefit period or replacement rate, will lower the value of θ for a given σ . From the wage equation, we expect upward pressure on wages. This hike will cause firms to lessen the number of vacant jobs since an upcoming match will be less profitable for an employer. On the other hand, workers become more willing to extend their unemployment period due to the rise in the value of unemployment. Both impacts cause a reduction in the number of vacant jobs and an increase in unemployment. These effects together will decrease the labor market tightness. Subsequent to a decline in θ , we expect the number of high MS type workers to increase in the unemployment pool. The reason for this is the negative effect of θ on σ . Since the unemployment compensation does not

directly influence the composition of unemployment, we move along the curve to a new level where θ is lower, and σ is higher.

Bargaining Power

Parameter β reflects the negotiation power of the employee. For a given value of θ , a rise in the bargaining power pushes wages up. This wage rise diminishes the expected profit of a filled job. At free entry equilibrium, lower expected profit from a filled job must be compensated through lower cost of vacancy. Thus, the number of vacant jobs falls which is equivalent to a diminution of θ . Consequently, since β does not effect the unemployment composition, free entry curve moves right to a point where θ is lower.

Job Destruction Rate

The rise of job loss rate means that a match lives for a shorter time. Therefore, the firm's expected profit declines, which induces a drop in θ . The job destruction rate influences both the free entry equation and the composition of unemployment. We have seen that the impact of q on the composition of unemployment is positive. Overall, both curves shift right, and while the final effect on σ is unambiguously positive, the impact on θ is not clear.

Productivity

The total production (surplus) to be shared between firms and workers increases after a rise in productivity. Firms benefit from extra profit while workers enjoy the enhancement in wages. However, the rise in wage level entails firms to diminish the number of vacant jobs. On the other hand, as the total growth in production is split between two sides, firms' expected profit increases, which evokes opening up more vacancies and thus to a higher θ . Overall, the wage increase corresponds to a lower vacancy level, while production increase gives firms an opposing incentive to increase vacancy. Still, the implicit differentiation of (5.26) gives us the ultimate impact on θ as positive. Although the enhancement of productivity does not influence σ directly, one might anticipate a negative effect through an increase of θ . However, this indirect effect is not prominent.

Matching Skill of H-type Worker (α_H)

The impact of α_H is positive on the value of θ since firms become more willing to create new vacancies due to a decline in the expected cost of a vacant position. Even though less friction puts upward pressure on wages, firms are willing to increase the number of open vacancies due

to a reduction in vacancy costs. Thus, for a given σ , the level of θ increases. However, an increase in α_H , holding α_L constant, causes high MS type workers to leave the unemployment pool faster. Thus, their proportion in the unemployment pool will be lower. A higher share of low MS workers in the unemployment pool decreases the value of a vacant job. Through decline in σ , we expect an undirect effect leading to a fall in θ since $\partial\theta/\partial\sigma > 0$. Now, high MS workers are more infrequent than before in the unemployment pool, which reduces the level of θ . This controversy raises an ambiguity on the ultimate sign of θ . We will be able to discuss the ultimate sign of θ in the computational exercise in the following section.

Matching Skill of L-type Worker (α_L)

If the friction for low MS workers decreases, firms open up more vacancies since now type-L workers are more likely to realize a match, and so the firm's potential profit increases. This is a direct increasing effect on θ . The second impact comes from the composition of the unemployment pool. The population of low MS workers in the unemployment pool decreases after the rise of α_L , which indicates the raise of σ . Consequently, both impacts point out an absolute increase of θ and σ .

The main comparative statics are calculated in the previous section. However, these impacts are calculated for given values of γ and σ . For example, we have seen that more generous unemployment benefit reduces labor market tightness through upward pressure on wages for a given σ . We have taken the ratio of type-H workers in total population (γ) as given. The magnitudes are expected to vary for different values of γ . For this purpose, we offer a simple computational exercise in the following section.

5.6 Computational Exercise

Employing the model's two fundamental equations (5.6) and (5.26), we make a simple quantitative exercise. Initially, we have chosen the parameter values as given in Table 6 below. Table 6 shows the initial equilibrium values of labor market tightness, the composition of unemployment, wage level, and the unemployment rate for assigned values. We have assumed a matching function of the Cobb-Douglas form such that $M(U, V) = V^{1-\lambda}U^\lambda$ equalizing $\lambda=0.5$. We have arbitrarily chosen other parameters, so they do not reflect a specific economy, and therefore results must be treated from a qualitative viewpoint. However, they are chosen to

Table 6: Calibration Parameters and Equilibrium Values

<i>Parameters</i>	Notation	Value
Productivity	y	1
Vacancy Cost	h	0.4
Discount rate	r	0.05
Job Destruction Rate	q	0.1
Unemployment Benefit	b	0.1
Bargaining Power	β	0.3
Matching Elasticity	λ	0.5
MS of type-H worker	α_H	0.8
MS of type-L worker	α_L	0.4
The Ratio of type-H workers in Population	γ	0.4
<i>Equilibrium Values</i>		
Market Tightness	θ	3.32
The Ratio of type-H Workers in Unemployment	σ	0.26
Wage Level of type-H worker	w_H	0.83
Wage Level of type-L Worker	w_L	0.74
Unemployment Rate of type-H workers	u_H	0.06
Unemployment Rate of type-L workers	u_L	0.12
Unemployment Rate	u	0.09

Source: Author's calculation

return consistent and reasonable results on endogenous variables. Tables 7 and 8 represent the results of the change in unemployment benefit level for different levels of γ . Tables 9 and 10, on the other hand, show the changes in α_H for different levels of γ . We represent the changes in α_L for the same values of γ in Tables 11 and 12. In Table 13 the impact of changes in γ on equilibrium values is described.

Tables 7 and 8 present the changes in the unemployment benefit level for $\gamma = 0.4$ and $\gamma = 0.6$, respectively. For the former, when there is no UI in the economy, the unemployment rate is equal to %9.2 with $u_H = \%6$ and $u_L = \%11.3$. First, as the UI system becomes more generous, the value of unemployment, and workers' outside option increases. Since wages are determined through bargaining, the average wage level increases, causing firms to reduce the number of job postings due to a reduction in the prospective profit level. This reduction causes

labor market tightness to decline, which eventually raises the equilibrium unemployment rate. Second, following a benefit shock, we naturally expect to see an increment in wages for all workers. However, we observe that low-skilled workers' wage level grows more, narrowing the wage gap between workers. Thus, we may assert that UI serves as a welfare-increasing institution in terms of wage inequality, as in the basic job search model. Third, following a reduction in market tightness, we expect an increase of σ . Although, the results are in line with our predictions, the impact of θ on σ seems confined.

Table 7: Changes in Unemployment Benefits for $\gamma = 0.4$

b	θ	σ	w_H	w_L	u_H	u_L	u
0	3.77	0.261	0.82	0.72	0.060	0.113	0.092
0.05	3.54	0.261	0.83	0.73	0.062	0.117	0.095
0.10	3.32	0.261	0.83	0.74	0.064	0.120	0.098
0.15	3.09	0.262	0.84	0.75	0.066	0.124	0.101
0.20	2.87	0.262	0.84	0.76	0.068	0.128	0.104
0.25	2.65	0.263	0.85	0.77	0.071	0.132	0.108
0.30	2.43	0.263	0.86	0.78	0.074	0.137	0.112
0.35	2.22	0.264	0.865	0.79	0.077	0.143	0.117
0.40	2.01	0.264	0.87	0.80	0.081	0.149	0.122

Source: Author's calculation

The same interpretation is valid for the case $\gamma = 0.6$ in Table 8. However, when there exists more high-skilled workers in the economy, the equilibrium value of θ , and naturally σ is higher. The firms are more inclined to post new vacancies in an economy with lots of high-skilled workers. The unemployment rate for both skill groups is lower due to higher level of θ . The population unemployment rate on the other hand, is now even lower compared to case $\gamma = 0.4$. Wages experience an increase compared to the case $\gamma = 0.4$, but the change remains limited to decimals even when we have checked for other values of γ . We find that the unemployment rate decreases with γ as expected.

Table 8: Changes in Unemployment Benefits for $\gamma = 0.6$

b	θ	σ	w_H	w_L	u_H	u_L	u
0	3.96	0.442	0.83	0.72	0.059	0.111	0.080
0.05	3.72	0.443	0.83	0.73	0.060	0.114	0.082
0.10	3.49	0.443	0.84	0.74	0.062	0.117	0.084
0.15	3.26	0.443	0.84	0.75	0.064	0.121	0.087
0.20	3.03	0.444	0.85	0.76	0.066	0.125	0.090
0.25	2.80	0.445	0.85	0.77	0.069	0.129	0.093
0.30	2.58	0.445	0.86	0.78	0.072	0.135	0.097
0.35	2.36	0.446	0.86	0.79	0.075	0.139	0.101
0.40	2.13	0.447	0.87	0.80	0.078	0.145	0.105

Source: Author's calculation

Tables 9 and 10 show variations in MS parameter α_H for $\gamma = 0.4$ and $\gamma = 0.6$. First, an improvement in α_H implies a less frictional market for type-H workers and, holding other factors fixed, type-H workers spend relatively less time in the unemployment pool, causing both σ and the unemployment rate to decline. Also, we would expect to see the market tightness to increase. However, the decline in σ prevents labor market tightness from increasing to its anticipated level. For values 0.8 - 1.1 of α_H , we see the increasing effect of α_H on θ , but then, the rise in α_H reduces σ so much that it restrains the increase of θ even more. Thus, as the value of σ declines, it represses the influence of α_H on θ . Second, the wages of type-H workers increase due to the increased value of unemployment. Nevertheless, type-L workers' wage level does not change because of the influence on θ stays limited. Furthermore, since θ does not change much, the impact on the wage level and type-L workers' unemployment rate stays limited. We conclude that the increase of job finding ability of type-H workers does not show significant externality effects on type-L workers.

Table 10 reveals the fact that type-L workers' wage level is lower when γ is higher. However, their unemployment rate is lower due to the higher level of θ . The increase in θ is more visible compared to the case above due to the higher initial value of σ . When the value of γ is high, the impact on low-skilled workers' unemployment rate is positive, but on the equilibrium wage level is found to be negative. Higher γ yields more decrease in type-L workers' unemployment rate than of type-H workers'. The population unemployment rate is

lower due to both higher γ and θ .

Table 9: Changes in MS of a Type-H Worker When $\gamma = 0.4$

α_H	θ	σ	w_H	w_L	u_H	u_L	u
0.8	3.320	0.26	0.83	0.74	0.064	0.1206	0.098
0.9	3.335	0.24	0.85	0.74	0.057	0.1203	0.095
1	3.342	0.22	0.86	0.74	0.051	0.1202	0.092
1.1	3.344	0.20	0.87	0.74	0.047	0.1202	0.091
1.2	3.343	0.19	0.88	0.74	0.043	0.1202	0.089
1.3	3.340	0.18	0.89	0.74	0.040	0.1203	0.088

Source: Author's calculation

Table 10: Changes in MS of a Type-H Worker When $\gamma = 0.6$

α_H	θ	σ	w_H	w_L	u_H	u_L	u
0.8	3.962	0.442	0.83	0.73	0.059	0.111	0.008
0.9	3.994	0.415	0.84	0.73	0.052	0.111	0.076
1	4.013	0.391	0.86	0.73	0.047	0.110	0.072
1.1	4.023	0.369	0.87	0.73	0.043	0.110	0.070
1.2	4.027	0.350	0.88	0.73	0.039	0.110	0.068
1.3	4.028	0.333	0.88	0.73	0.036	0.110	0.066

Source: Author's calculation

Tables 11 and 12 represent the change in α_L for $\gamma = 0.4$ and $\gamma = 0.6$, respectively. The final impact on θ is unambiguously positive since the two mechanisms function in the same direction. Nevertheless, the increase in MS of type-L workers raises workers' wage levels and lowers the unemployment rate since all workers benefit from the absolute rise in θ . We can conclude that the increase of α_L shows positive externality on type-H workers, which was not the case in the α_H . The wages of type-L workers w_L grow more than type-H workers' wages since w_H is only affected by the increase in θ . Thus, the decrease in u_H stays limited. Moreover, when there is no heterogeneity among workers in the case $\alpha_H = \alpha_L = 0.8$, the wages and unemployment rates equalize.

Table 11: Changes in MS of a Type-L Worker When $\gamma = 0.4$

α_L	θ	σ	w_H	w_L	u_H	u_L	u
0.3	2.91	0.21	0.83	0.68	0.068	0.163	0.125
0.4	3.32	0.26	0.83	0.74	0.064	0.120	0.098
0.5	3.59	0.30	0.84	0.78	0.061	0.095	0.082
0.6	3.77	0.33	0.84	0.81	0.060	0.079	0.071
0.7	3.90	0.37	0.84	0.83	0.059	0.067	0.064
0.8	4	0.4	0.85	0.85	0.058	0.058	0.058

Source: Author's calculation

Table 12: Changes in MS of a Type-L Worker When $\gamma = 0.6$

α_L	θ	σ	w_H	w_L	u_H	u_L	u
0.3	3.16	0.38	0.83	0.69	0.065	0.157	0.102
0.4	3.49	0.44	0.84	0.74	0.062	0.117	0.084
0.5	3.70	0.49	0.84	0.78	0.060	0.094	0.074
0.6	3.84	0.53	0.84	0.81	0.059	0.078	0.067
0.7	3.93	0.56	0.84	0.83	0.059	0.067	0.062
0.8	4	0.6	0.85	0.85	0.058	0.058	0.058

Source: Author's calculation

Table 13: Changes in γ

γ	θ	σ	w_H	w_L	u_H	u_L	u
0.2	3.18	0.11	0.83	0.74	0.065	0.122	0.111
0.4	3.32	0.26	0.83	0.74	0.064	0.120	0.098
0.6	3.49	0.44	0.84	0.74	0.062	0.117	0.084
0.8	3.71	0.67	0.84	0.75	0.060	0.114	0.071

Source: Author's calculation

Table 13 shows the equilibrium values of the economy for different levels of γ . $\gamma = 0.4$ reflects our baseline parametrization. There is a direct link between σ and γ , so the increment in γ causes θ to improve. The impact comes directly from σ . It can also be seen that as γ augments, u_H , and u_L declines. If the population of type-H workers is high, the unemployment pool also contains more type-H workers.

In this chapter, we have analyzed the general equilibrium effects of coexistence of heterogeneous workers' in an economy. Unlike the previous model, we presented the firms' value

functions so that we could analyze their behavior in an environment with heterogeneous workers. In the partial model, the wage offer came from a uniformly distributed wage distribution with an upper bound. Since the wage offer was exogenous, workers reacted to benefit changes by adjusting their reservation wages and search efforts. Workers' behavior plays a decisive role in determining the unemployment rate or the duration of unemployment. We also have shown that generous UI compensation has deteriorating impacts on both variables.

Nevertheless, in the search-and-matching environment, wages are determined through a bargaining process in which the total productivity is split between two parties. There is no pre-determined upper level of wage since it is an increasing function of the productivity level of workers. The UI compensation and productivity increase the bargaining power of workers, which grows the anticipated wages of workers. In the former, the worker's outside option increases since the value of unemployment rises, while in the latter, there is simply *a bigger cake to share*. Overall, a more generous benefits system prolongs the duration of unemployment since it increases the value of unemployment and workers increase their wage expectations.

The composition of unemployment appears as another leading endogenous variable in this environment. We have seen that in the two-sided search model, a more generous benefits system changes both the composition of unemployment and the unemployment rate. The impact came from both the demand and supply sides of the economy. For the demand side of the economy, the composition of unemployment affected firms' behavior since employers prefer more high MS workers to exist in the unemployment pool, benefiting from lower cost per vacancy. Supply-side effects are the standard disincentive effects yielding a rise in the value of unemployment. In the partial model, however, the shift in wage and search effort is caused by the worker's behavior only. Since low-skilled workers are more sensitive to modifications in the benefits scheme, a rise of benefits increases their population in the composition of unemployment. However, the results in the changes in the composition of unemployment are not so sharp as expected. It is also worth stating that workers' initial ratio in the unemployment pool is variant depending on the skill levels.

6 CONCLUSION

In this dissertation, we analyzed the effect of UI on the behavior of heterogeneous workers. Our results suggest that the basic job search model and the search-and-matching model provide opposing effects on the composition of the unemployment pool following an increase in unemployment benefits in a labor market with heterogeneous workers. This difference became visible due to the introduction of the composition of the unemployment parameter in both models. In the basic job search model, a more generous UI system increased the reservation wage and decreased effort levels of all workers. However, we found that low skilled workers are more sensitive to changes in UI, causing their expected duration in unemployment to extend more. We also show that changes in varying magnitudes in the reservation wage and the effort level alters the composition of the unemployment pool. Since low matching skill workers reduce their search efforts more than high skilled workers, the ratio of low skilled workers in the unemployment pool increases. The mechanism operates through only labor supply in this first model. Another finding is that low skilled workers increase their reservation wage more than high skilled workers; therefore, UI may help close the wage gap between workers at different skill levels. This outcome implies that UI can reduce wage inequality. Since low skilled workers are more sensitive to changes in the design of UI, any policy change related to benefits becomes a more powerful tool in a labor market populated with low skilled workers.

In the second part, we constructed a search-and-matching model by incorporating firm behavior into the model. This model allowed us to examine firms' reactions to different levels of the composition of workers in the population, and the heterogeneity of workers on both labor supply and labor demand through different mechanisms. First, the increase in unemployment benefits affected workers' outside option and put upward pressure on wages. That leads firms to lessen the number of vacant jobs and, ultimately, the drop in labor market tightness. This shock decreased the probability of finding a job of high-skilled workers more. Thus, the ratio of high skilled workers in the composition of the unemployment pool raised. Nevertheless, this secondary effect on σ is modest as we see in numerical exercise. Second, the increase in the MS of type-L workers presents positive externality on type-H workers, although the same is not valid for the MS of type-H workers due to the limited impact on the market tightness. We also confirm our findings in the first model on the impact of UI benefits on wage inequality. We

conclude that UI benefits lower wage inequality among heterogeneous workers.



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7 APPENDIX

7.1 Unemployment Rate

$$u \Big|_{\alpha_H=0.8}^{b=20} = \frac{0.03}{0.03 + 0.8 \times 6.07(100 - 93.92)/100} = \%9.2 \quad u \Big|_{\alpha_H=0.8}^{b=30} = \frac{0.03}{0.03 + 0.8 \times 5.67(100 - 94.32)/100} = \%10.4 \quad (22)$$

$$u \Big|_{\alpha_L=0.4}^{b=20} = \frac{0.03}{0.03 + 0.4 \times 5.84(100 - 88.31)/100} = \%9.8 \quad u \Big|_{\alpha_L=0.4}^{b=30} = \frac{0.03}{0.03 + 0.4 \times 5.43(100 - 89.12)/100} = \%11.2 \quad (23)$$

$$u \Big|_{\alpha_L=0.2}^{b=20} = \frac{0.03}{0.03 + 0.2 \times 5.40(100 - 78.38)/100} = \%11.3 \quad u \Big|_{\alpha_L=0.2}^{b=30} = \frac{0.03}{0.03 + 0.2 \times 5(100 - 80)/100} = \%13 \quad (24)$$

$$u \Big|_{\alpha_L=0.1}^{b=20} = \frac{0.03}{0.03 + 0.1 \times 4.63(100 - 62.93)/100} = \%14.8 \quad u \Big|_{\alpha_L=0.1}^{b=30} = \frac{0.03}{0.03 + 0.1 \times 4.24(100 - 66)/100} = \%17.2 \quad (25)$$

$$u \Big|_{\alpha_L=0.05}^{b=20} = \frac{0.03}{0.03 + 0.05 \times 3.48(100 - 44.26)/100} = \%23.6 \quad u \Big|_{\alpha_L=0.05}^{b=30} = \frac{0.03}{0.03 + 0.05 \times 3.14(100 - 49.7)/100} = \%27.5 \quad (26)$$

7.2 Unemployment Durations for Different Values of α

$$D \Big|_{\alpha_i=0.8}^{b=20} = \frac{1}{0.8 \times 6.07 \times [100 - 93.91]/100} = 3.38 \quad , D \Big|_{\alpha_i=0.4}^{b=20} = \frac{1}{0.8 \times 5.67 \times [100 - 94.32]/100} = 3.88 \quad (27)$$

$$D \Big|_{\alpha_i=0.8}^{b=20} = \frac{1}{0.4 \times 5.84 \times [100 - 88.3]/100} = 3.65 \quad D \Big|_{\alpha_i=0.4}^{b=20} = \frac{1}{0.4 \times 5.43 \times [100 - 89.12]/100} = 4.23 \quad (28)$$

$$D \Big|_{\alpha_L=0.2}^{b=20} = \frac{1}{0.2 \times 5.40(100 - 78.38)/100} = 4.28 \quad D \Big|_{\alpha_L=0.2}^{b=30} = \frac{1}{0.2 \times 5(100 - 80)/100} = 5 \quad (29)$$

$$D \Big|_{\alpha_L=0.1}^{b=20} = \frac{1}{0.1 \times 4.63(100 - 62.93)/100} = 5.82 \quad D \Big|_{\alpha_L=0.1}^{b=30} = \frac{1}{0.1 \times 4.24(100 - 66)/100} = 6.93 \quad (30)$$

$$D \Big|_{\alpha_L=0.05}^{b=20} = \frac{1}{0.05 \times 3.48(100 - 44.26)/100} = 10.3 \quad D \Big|_{\alpha_L=0.05}^{b=30} = \frac{1}{0.05 \times 3.14(100 - 49.7)/100} = 12.6 \quad (31)$$

7.3 Decomposition

$$D_{\alpha_i=0.8} = \frac{1}{0.8 \times 5.67 \times [100 - 93.92]/100} = 3.62 \quad (32)$$

$$D_{\alpha_i=0.4} = \frac{1}{0.4 \times 5.43 \times [100 - 88.31]/100} = 3.93 \quad (33)$$

$$D_{\alpha_i=0.2} = \frac{1}{0.2 \times 5 \times [100 - 78.38]/100} = 4.62 \quad (34)$$

$$D_{\alpha_i=0.1} = \frac{1}{0.1 \times 4.24 \times [100 - 62.93]/100} = 6.36 \quad (35)$$

$$D_{\alpha_i=0.05} = \frac{1}{0.05 \times 3.14 \times [100 - 44.26]/100} = 11.42 \quad (36)$$

Taking the difference 3.88-3.62=0.26, the complementary part comes from the reservation wage, and 3.62-3.38=0.24 comes from the search effort. Overall, %52 belongs to the change in the reservation wage while %48 to search effort.

When $\alpha_i=0.4$ the result is 4.22-3.93=0.29 from the reservation wage impact and 3.93-3.66=0.27 comes from the search effort. Overall, %51.7 belongs to the change in the reservation wage while %48.3 to search effort.

The case for $\alpha_i = 0.2$ equals 5-4.62=0.38. The complementary part comes from the reservation wage impact and 4.62-4.28=0.34 comes from the search effort. Overall, %52.7 belongs to the change in the reservation wage while %47.3 to search effort.

Taking the difference 6.93-6.36=0.57 which corresponds to the difference from the reservation wage impact and 6.36-5.82=0.54 comes from the search effort. Overall, %51.3 belongs to the change in the reservation wage while %48.7 to search effort.

Taking the difference 12.66-11.42=1.24, the complementary part comes from the reservation wage impact and 11.42-10.31=1.11 comes from the search effort. Overall, %52.7 belongs to the change in the reservation wage while %47.3 to search effort.

7.4 Comparative Statics of Unemployment Composition Equation

$$\sigma = \frac{\gamma(q + \alpha_L \theta m(\theta))}{q(1 - \gamma)(q + \alpha_H \theta m(\theta)) + \gamma q(q + \alpha_L \theta m(\theta))} \quad (5.6)$$

$$\frac{\partial \sigma}{\partial \theta} = \frac{[m(\theta) + \theta m'(\theta)][\gamma q(1 - \gamma)(\alpha_L - \alpha_H)]}{[q(1 - \gamma)(q + \alpha_H \theta m(\theta)) + \gamma q(q + \alpha_L \theta m(\theta))]^2} < 0 \quad (5.8)$$

$$\frac{\partial \sigma}{\partial q} = \frac{\gamma[q + \alpha_H \theta m(\theta) + \gamma(\alpha_L - \alpha_H)\theta m(\theta)] - \gamma q - \gamma \alpha_L \theta m(\theta)}{[q(1 - \gamma)(q + \alpha_H \theta m(\theta)) + \gamma q(q + \alpha_L \theta m(\theta))]^2} > 0 \quad (37)$$

$$\frac{\partial \sigma}{\partial \gamma} = \frac{q^2 + q \alpha_H \theta m(\theta) + q \alpha_L \theta m(\theta) + \alpha_L \alpha_H [\theta m(\theta)]^2}{[q(1 - \gamma)(q + \alpha_H \theta m(\theta)) + \gamma q(q + \alpha_L \theta m(\theta))]^2} > 0 \quad (38)$$

$$\frac{\partial \sigma}{\partial \alpha_H} = \frac{-[\gamma q + \gamma \alpha_L \theta m(\theta)][\theta m(\theta) - \gamma \theta m(\theta)]}{[q(1 - \gamma)(q + \alpha_H \theta m(\theta)) + \gamma q(q + \alpha_L \theta m(\theta))]^2} < 0 \quad (39)$$

$$\frac{\partial \sigma}{\partial \alpha_L} = \frac{[\theta m(\theta)]^2 [\gamma \alpha_H + \gamma^2(\alpha_L - \alpha_H) - \gamma^2 \alpha_L] + q \gamma \theta m(\theta) - \gamma^2 q \theta m(\theta)}{[q(1 - \gamma)(q + \alpha_H \theta m(\theta)) + \gamma q(q + \alpha_L \theta m(\theta))]^2} > 0 \quad (40)$$

7.5 Comparative Statics of Free Entry Equation

$$\Omega = \frac{h}{m(\theta)} - (1 - \beta)(y - b) \left[\frac{\sigma \alpha_H}{r + q + \beta \alpha_H \theta m(\theta)} + \frac{(1 - \sigma) \alpha_L}{r + q + \beta \alpha_L \theta m(\theta)} \right] \quad (5.22)$$

$$\frac{\partial \theta}{\partial \sigma} = -\frac{\partial \Omega / \partial \sigma}{\partial \Omega / \partial \theta} = -\frac{(1 - \beta)(y - b)[(r + q)(\alpha_L - \alpha_H) / [(r + q + \beta \alpha_H \theta m(\theta))[(r + q + \beta \alpha_L \theta m(\theta))]]}{-m'(\theta)h/[m(\theta)]^2 + \sigma(1 - \beta)(y - b)[m(\theta) + \theta m(\theta)][\beta \alpha_H^2 + \beta \alpha_L^2]} > 0 \quad (41)$$

$$\frac{\partial \theta}{\partial b} = -\frac{\partial \Omega / \partial b}{\partial \Omega / \partial \theta} = -\frac{(1 - \beta) \left[\frac{\sigma \alpha_H}{r + q + \beta \alpha_H \theta m(\theta)} + \frac{(1 - \sigma) \alpha_L}{r + q + \beta \alpha_L \theta m(\theta)} \right]}{-m'(\theta)h/[m(\theta)]^2 + \sigma(1 - \beta)(y - b)[m(\theta) + \theta m(\theta)][\beta \alpha_H^2 + \beta \alpha_L^2]} < 0 \quad (42)$$

$$\frac{\partial \theta}{\partial \beta} = -\frac{\partial \Omega / \partial \beta}{\partial \Omega / \partial \theta} = -\frac{(y - b) \left[\frac{(\sigma^2 \alpha_H)(r + q + \beta \alpha_H [\theta m(\theta)]^2 + \alpha_H^2 (1 - \beta))}{[r + q + \beta \alpha_H \theta m(\theta)]^2} + \frac{((1 - \sigma)^2 \alpha_L)(r + q + \beta \alpha_L [\theta m(\theta)]^2 + \alpha_L^2 (1 - \beta))}{[r + q + \beta \alpha_L \theta m(\theta)]^2} \right]}{-m'(\theta)h/[m(\theta)]^2 + \sigma(1 - \beta)(y - b)[m(\theta) + \theta m(\theta)][\beta \alpha_H^2 + \beta \alpha_L^2]} < 0 \quad (43)$$

$$\frac{\partial \theta}{\partial q} = -\frac{\partial \Omega / \partial q}{\partial \Omega / \partial \theta} = -\frac{(1 - \beta) \left[\frac{(y - b) \sigma \alpha_H}{[r + q + \beta \alpha_H \theta m(\theta)]^2} + \frac{(y - b)(1 - \sigma) \alpha_L}{[r + q + \beta \alpha_L \theta m(\theta)]^2} \right]}{-m'(\theta)h/[m(\theta)]^2 + \sigma(1 - \beta)(y - b)[m(\theta) + \theta m(\theta)][\beta \alpha_H^2 + \beta \alpha_L^2]} < 0 \quad (44)$$

$$\frac{\partial \theta}{\partial y} = -\frac{\partial \Omega / \partial y}{\partial \Omega / \partial \theta} = -\frac{-\left[\frac{(1-\beta)\sigma\alpha_H}{r+q+\beta\alpha_H\theta m(\theta)} + \frac{(1-\beta)(1-\sigma)\alpha_L}{r+q+\beta\alpha_L\theta m(\theta)} \right]}{-m'(\theta)h/[m(\theta)]^2 + \sigma(1-\beta)(y-b)[m(\theta) + \theta m(\theta)][\beta\alpha_H^2 + \beta\alpha_L^2]} > 0 \quad (45)$$

$$\frac{\partial \theta}{\partial \alpha_H} = -\frac{\partial \Omega / \partial \alpha_H}{\partial \Omega / \partial \theta} = -\frac{-(1-\beta)(y-b)\sigma(r+q)/[r+q+\beta\alpha_H\theta m(\theta)]^2}{-m'(\theta)h/[m(\theta)]^2 + \sigma(1-\beta)(y-b)[m(\theta) + \theta m(\theta)][\beta\alpha_H^2 + \beta\alpha_L^2]} > 0 \quad (46)$$

$$\frac{\partial \theta}{\partial \alpha_L} = -\frac{\partial \Omega / \partial \alpha_L}{\partial \Omega / \partial \theta} = -\frac{-(1-\beta)(y-b)(1-\sigma)(r+q)/[r+q+\beta\alpha_L\theta m(\theta)]^2}{-m'(\theta)h/[m(\theta)]^2 + \sigma(1-\beta)(y-b)[m(\theta) + \theta m(\theta)][\beta\alpha_H^2 + \beta\alpha_L^2]} > 0 \quad (47)$$

TEZ ONAY SAYFASI

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