MEASURING UNEMPLOYMENT INSURANCE

GENEROSITY AND EFFICIENCY

A Thesis Submitted to the College of

Graduate Studies and Research

In Partial Fulfillment of the Requirements

For the Degree of Master of Arts

In the Department of Economics

University of Saskatchewan

Saskatoon

By

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ABSTRACT

The objective of this study is to measure and compare unemployment insurance (UI) policies among different countries based on generosity and efficiency. A modified modeling framework from Pallage, Scruggs, and Zimmermann (2013) is utilized that excludes savings by agents but incorporates endogenous job search intensities.

To measure UI generosity two models are created: 1) a simple model where everyone is eligible for UI and receives benefits indefinitely until re-employment; and 2) a complex model, based on realistic UI policy, which incorporates a waiting period, a UI entitlement status, benefit payments and durations, as well as social assistance policies. The models are calibrated to match an unemployment rate and a share of short-term unemployment of a specific country. The only difference between the two models is the UI policy in place. The generosity metric is then calculated as the replacement ratio in the simple model such that agents are indifferent between the simple UI scheme and the complex (realistic) UI policy. Alongside the generosity metric, an efficiency measure is created that measures the utility loss from moving from the benchmark UI system (offering optimum level of benefits) to the realistic UI system. The countries investigated are Canada, United States, France, and Germany post and pre Hartz reforms.

The main results show that Germany pre-reform is the most generous system followed by USA, Germany post-reform, France, and Canada. Rankings based on efficiency display similar pattern. A welfare comparison between Germany pre and post Hartz reform showed that the reform reduced UI generosity, decreased UI efficiency, and caused welfare to either decline or slightly increase depending on the specified risk aversion coefficient. Finally, the sensitivity results reveal that USA is the least generous UI system when housing assistance is removed from the social assistance benefit calculations.

ACKNOWLEDGEMENTS

I would like to express my deepest gratitude to my supervisor, professor **Andreas Pollak**, for his guidance, support, and patience.

Also I would like to give a special thanks to my fiancé **Klaudia Sieminska** for her love and support.

DEDICATION

This thesis is dedicated to my loving parents.

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1. INTRODUCTION

The purpose of unemployment insurance (UI) policies is to ease the transition from employment to unemployment in times of job loss or recessions. Internationally, these systems share some common elements such as offering benefits with limited duration and eligibly criteria, however, they each have their own unique program structure. The purpose of this thesis is to measure and compare UI policies among different countries based on generosity and efficiency. This task may seem straightforward, however one would have to account for many factors of UI policy other than benefit amounts. These factors can include benefit durations, strictness of UI qualifications, economic conditions (high or low unemployment), and what happens after benefits are exhausted (social assistance).

Traditionally, UI generosity is measured by calculating a replacement ratio, which represents the portion of expected income received during unemployment relative to previous income. This measure is primarily used by the Organisation for Economic Co-Operation and Development (OECD) to compare UI generosity among countries. However, there is no single replacement ratio; rather, there is a range of replacement ratios that correspond to employment history, prior income, age, and household composition. Replacement ratio calculations focus solely on benefits relative to income but fail to account for other important factors in regards to UI such as eligibility criteria, duration of benefits, and economic conditions. These other factors are important since UI policies differ; some UI programs may offer high benefits but have strict qualification criteria while others may offer low benefits but have lax qualifications criteria. A better measure of UI generosity should account for other factors of UI policy than just the benefits amounts relative to prior income.

This thesis implements a modified methodology from Pallage, Scruggs, and Zimmermann (2013) to measure UI generosity and efficiency. Pallage et al. (2013) approach allows for modeling UI policy that incorporates a waiting period (if applicable), a minimum and maximum UI entitlement status, varying benefit payments and durations based on UI entitlement, as well as social assistance policies. The authors use a heterogeneous agents model with savings to generate a measure of UI generosity. To measure generosity for a single country, the authors construct two models. The first is a simple model where everyone is eligible for UI

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and receives benefits indefinitely until re-employment. The second is a model that contains all the relevant features of the UI policy such as a waiting period, qualification criteria, and a social assistance program for those who fail to qualify for UI, and et cetera. The only difference between the models is the UI policy in place. The models are calibrated to match the countries' unemployment rate and average unemployment duration. Generosity is determined by the replacement ratio that makes agents indifferent between the simple UI policy model and the realistic UI model. This replacement ratio that makes the agents indifferent is the measure of UI generosity. Essentially, a replacement rate is found in the simple model such that it produces the same average utility as the realistic model.

The methodology of this paper follows closely the work of Pallage et al. (2013) but with some modifications: a) savings by agent have been excluded from the model, and b) endogenous job search intensities are implemented into the model. A model with Bellman state equations is utilized to generate a measure of generosity and efficiency of a country's UI system. Pallage et al. (2013) match the simple UI policy model to the realistic UI model based on the criterion of average utility. The matching criterion in this paper uses the ratio of average utility of unemployment to employment, which measures consumption loss from moving from employment to unemployment. For better interpretation, utility will be converted to consumption equivalents; hence a consumption equivalent ratio will be used as the matching criterion. A replacement rate is found in the simple model such that it produces the consumption loss as the realistic model. Efficiency is also investigated: the realistic UI model is compared to a benchmark UI system where benefits offer the highest possible welfare. In terms of average utility, the efficiency metric measures the efficiency loss from moving from the benchmark UI system to the realistic UI system.

The primary goal of this paper is to compare the UI policies of Canada, United States, France, and Germany in terms of generosity and efficiency, and to make welfare comparison pre and post Hartz reforms[1] in Germany. The secondary goal of this paper is to investigate whether the use of a different matching criterion, the ratio of utility of unemployment to employment, yields different results as opposed to using average utility. This is investigated because the ratio,

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[1]   The Hartz reforms made significant labour market changes in regards to the structure of UI

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which measures the utility loss from moving from employment to unemployment, may be more relevant when it comes to UI generosity than using the average of utilities across all states.

The paper is organized in the following order. Chapter 2 contains a literature review of studies measuring UI generosity. The chapter covers replacement ratio studies. Additionally, other measures are discussed such as index and model based measures. Further, the chapter explores in more detail the methodology and the results from the papers of Pallage et al. (2013) and Pallage, Scruggs, and Zimmermann (2008), who measure UI generosity using model-based approach.

Chapter 3 describes UI and other social insurance policies of Canada, United States, Germany and France using information from 2013. Germany is also summarized using 2002 information so that a comparison can be made between Germany pre-Hartz reform and post-Hartz reform. The country UI descriptions detail the eligibility criteria, benefit amount calculations, and benefit duration calculations. Similar descriptions are done for unemployment assistance programs, if applicable, and social assistance policies. The descriptions assume an individual of non-retirement age with no dependents or children. Therefore, any child benefits or family assistance programs are not considered.

Chapter 4 describes the modeling framework of this thesis that uses a simplified model by Pallage et al. (2013) but with an addition of endogenous job search intensities. The assumptions made in this thesis also simplify the Bellman equation used in Pallage et al. (2013) into a set of Bellman state equations, where each equation represents a possible state such as unemployment with UI benefits, employment with no UI coverage, et cetera. The chapter goes over the assumptions and specifications of the modeling framework and each country-specific model.

Chapter 5 describes the specifics of generosity and efficiency metrics used in this paper. Also, generosity measure from Pallage et al. (2013) is summarized.

Chapter 6 details the results of the paper along with an overview of assumption on functional forms of the model and model parameters in regards to income, benefit amounts, eligibly criteria, unemployment rate, and share of short-term on unemployment. The analysis is divided into a calibration section, results, comparisons, and sensitivity analysis. The calibration

section outlines the results from the calibrated models followed by the UI generosity and efficiency metrics results. The generosity measure from Pallage et al. (2013) is re-created, using the modeling framework of this paper and it is compared to the main results. Additionally, comparisons are made against OECD generosity measures (net replacement ratios). Welfare comparisons of Germany pre and post-Hartz are also presented. Finally, sensitivity analysis is conducted using different risk aversion parameters and different USA policy/model assumptions to investigate their impact on the results.

The conclusions are presented in Chapter 7, along with discussion and limitations of the paper.

2. LITERATURE REVIEW

2.1.   Measuring UI Generosity

Studies measuring UI generosity are divided into two main categories: replacement ratio measures focusing on a single dimension of UI (percent of expected unemployment income presented as a fraction of prior income); and, index based or multi-dimensional measures constructed to capture aspects of UI policies. Measures of UI generosity generally "consider the following elements of UI benefits: the legislated replacement rate, the percentage of the labour force covered by UI (coverage rate), the maximum number of benefit weeks for a minimally qualified claimant, and the minimum number of working weeks needed to qualify for UI" (Hornstein & Yuan, 1999) (p. 15).

The majority of literature that measures UI generosity calculates a replacement ratio or a replacement rate defined as the ratio of expected income from unemployment benefits while unemployed (and other social benefits) to the expected income from work. This may seem like a relatively straightforward task, but as Martin (1996) points out:

"There is no such thing as the replacement rate in any OECD country, rather there are a myriad of replacement rates corresponding to the specific personal and family characteristics of the unemployed, their previous history of work and unemployment, and the different structures and entitlements of unemployment insurance (UI) and social assistance (SA) systems in OECD countries and the ways in which these systems interact with tax systems. Once one tries to grapple with these complexities in order to compute replacement rates for the purpose of international comparisons, the task becomes a daunting one." (p. 2)

The replacement ratio only captures one aspect of an UI system; hence, the measure is only one-dimensional. Other features, such as benefit duration and qualification criteria, are overlooked despite their influence on individual behaviour. The calculated replacement ratios serve as a metric for UI generosity, higher ratios implying higher generosity.

An OECD research paper by Martin (1996) compares unemployment benefit entitlements in OECD countries by generating a set of gross and net replacement ratios. The OECD paper computes the replacement ratios under a number of cases based on income, previous earnings, and duration of unemployment spells; this approach considers a 40-year-old worker. Each year

gross replacement ratios are calculated for 20 countries from 1961 to 1995; net replacement ratios are calculated for 18 countries using 1995 data. For the replacement ratio, calculations of unemployment insurance, family/child benefits and housing benefits are counted as unemployment income. In 1995, the gross (net) average replacement ratios for Canada was 27% (43%), for USA it was 12% (16%), Germany was 26% (54%) and France was 38% (55%); the highest ranked country was Denmark with a gross (net) replacement ratio of 71% (81%). For all OECD countries altogether, the average gross replacement ratio was found to be 31% while the net ratio was estimated at 50%, two-thirds larger than the gross replacement ratio. A strong correlation, Spearman's rank correlation coefficient, of Q=0.73 was discovered between gross and net replacement ratios for 1995. Martin concluded that benefit entitlements, for the OECD countries, have been on the rise from 1961 to 1995, and that replacement rates are always higher when the effects of taxation are accounted for.

$$OECD\ Replacement\ Ratio = \frac{unemployment\ benefits + housing\ benefits}{earnings + housing\ benefits} \qquad (2.1)$$

A paper done by the Dutch Central Planning Bureau (CPB) (1995) performs a similar study as Martin (1996) and calculates net replacement ratios using data from 1993. The study done by the CPB, calculates replacement ratios using incomes from unemployment insurance, unemployment assistance, family benefits and housing benefit. The paper focuses on EU member countries and 3 states in the USA, including New York, Texas and California. Three types of households (single person, married couple with children and married couple without children,) and two income levels (average production worker (APW) and minimum wage) are examined. The average net replacement ratios for the United States, Germany and France were 41%, 68% and 75%, respectively; the highest ranked country was Denmark with a replacement ratio of 90%. The study finds that couples with children/dependents have the highest replacement ratios due to tax advantages and family/child benefits. Additionally, the individuals least affected from the income loss of moving from employment to unemployment were those working at the minimum wage level; the average income loss was less than 10% for minimum wage workers.

$$CPB\ Net\ Replacement\ Ratio\ (NRR) = \frac{net\ unemployment\ benefits + housing\ benefits}{net\ earnings + housing\ benefits} \qquad (2.2)$$

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In another example, seven European countries, referred to as the Group of Seven, conducted a coordinated study measuring UI generosity via replacement ratios (Seven Country Group, 1996). The countries involved were Germany, France, Denmark, Finland, Netherlands, and the United Kingdom. Similar to the OECD and CPB studies, gross and net replacement ratios are calculated for six different levels of income and eight household compositions. Housing benefits and child/family allowances are counted towards unemployment income if it applies to the household type and income level. The paper finds that for all studied countries, the replacement ratios were 80% or higher for those with lower income. Similarly to the CPB study, replacement ratios were found to be higher for households with children/dependents. Table 2.1 presents comparable net replacement ratios from Martin (1996), Central Planning Bureau (CPB) (1995), and Seven Country Group (1996). The replacement ratios in Table 2.1 calculate the unemployment benefits over a 5-year unemployment spell.

$$Group\ of\ Seven\ \ NRR = \frac{net\ unemployment\ benefits + housing\ benefits - housing\ costs}{net\ earnings + housing\ benefits - housing\ costs} \tag{2.3}$$

Table 2.1 Comparable Replacement Ratios From OECD, CPB, and Group of Seven

Country	Net Replacement Ratios (% of prior income)		
	OECD (1994/1995)	CPB (1993)	Group of Seven (1994)
Belgium	65	66	n/a
Denmark	81	90	73
Finland	83	n/a	75
France	68	75	52
Germany	68	68	55
Greece	n/a	28	n/a
Ireland	49	67	n/a
Italy	19	61	n/a
The Netherlands	82	78	67
Portugal	n/a	44	n/a
Spain	53	59	n/a
Sweden	86	n/a	67
United Kingdom	69	63	46
United States	19	41	n/a

Note. Table taken from Martin (1996). *Source.* Martin (1996), Central Planning Bureau (CPB) (1995), and Seven Country Group (1996)

The economic literature investigating the impact of UI on the unemployment rate has primarily used a replacement ratio, r, or some other composite measure as a measure of UI generosity. Papers such as Grubel, Maki, and Sax (1975), Grubel and Maki (1976) and Miller (1987) used replacement ratios, r, as a measure of UI generosity. A paper by Fortin (1989) uses a

measure of UI generosity which is the product of three variables: the *coverage* (proportion of labour force ensured); the replacement rate; and, the duration ratio (*D/M,* the ratio of maximum duration of benefits to minimum duration of benefits). The measure by Fortin, *coverage*r**(*D/M*), is based on a classical labour supply model (Fortin, 1984). Other utilized UI generosity measures are *r*coverage* (Keil & Symons, 1990), *r**(*D/M*) (Lemieux & MacLeod, 2000) and the maximum UI benefit duration (Milbourne, Purvis, & Scoones, 1991). Schulze (2005) measures UI generosity for Germany by formulating 14 different indices based on replacement rates, eligibility, coverage, and duration ratio (*D/M*). The author finds that, for almost all indices, UI generosity from 1986 to 2003 increased contrary to the replacement rate studies that show a steady decline over that same time period. The remaining literature review will cover papers that measure UI generosity using an alternative method to replacement ratios.

A European Commission Paper by Stovicek and Turrini (2012) compares unemployment benefit systems among European countries using a 'synthetic' indicator. One of the goals of the paper is to rank the unemployment benefit policies of European countries in terms of generosity. The synthetic indicator takes into account unemployment benefits and duration of benefits. The generosity measure is shown in equation (2.4) and according to Esser, Ferrarini, Nelson, Palme, and Sjöberg (2013) "The indicator corresponds to the sum of all benefits received during the unemployment spell in terms of previous labour earnings" (p. 11).

$$UBgenerosity = \sum_{i=1}^{k} nrr_{UI_i} * duration_{UI_i} + nrr_{UA} * duration_{UA} \qquad (2.4)$$

Here, "*nrr* stands for net replacement rate, UI and UA at the pedix of variables denote, respectively, unemployment insurance and unemployment assistance, the index *i* refers to the different replacement levels for unemployment insurance over the unemployment spell" (Esser et al., 2013) (p. 12). The authors find, using their metric, that UI generosity remained stable between 2001 and 2011 for the EU countries that had no UI reforms. " The overall generosity of unemployment benefit systems exhibits a high degree of variation across EU countries, with Belgium, Malta, Austria, Denmark, Ireland, Finland and Portugal having much more generous benefit systems than EU average while opposite is the case in the Czech Republic, Lithuania, Slovakia, Italy, Poland, Hungary, Latvia and Estonia." (Esser et al., 2013) (p. 17).

A paper by Sargent (1995) creates an index that measures the generosity of the Canadian EI System using a model-based approach (labour-leisure decision model). The measure by Sargent (1995) takes into account the EI policies of Canada, the replacement rate, eligibility requirements and coverage. The index of EI generosity is actually a measure of disincentives caused by the presence of UI. As described by Sargent (1995), the index is based on a model where agents, who prefer leisure and work, choose their labour force participation, and optimal duration of employment and unemployment based on the EI policy parameters. Labour force participation choices for an agent are: full employment; partial employment and receive EI; or, leave the labour force entirely. The model is based on the labour-leisure model with perfect certainty. The Sargent index of UI generosity is the estimated unemployment rate u^* from the model defined as:

$$u^* = \frac{D+A}{D+A+M} \left[1 - \left(\frac{1 - pD/(D+A)}{1 + pD/M} \right)^{\theta} \right] \tag{2.5}$$

Here, D is the maximum duration of EI benefits, M is the minimum required employment for EI coverage, p is the replacement ratio, and A is the duration of the waiting period. "The parameter θ is the scale parameter from a Pareto distribution and it is estimated as the coefficient of the [natural log] ln of the labour force participation rate on ln(1+ρD/M), which Sargent estimates as 0.199" (Grey & L'Italien, 2002) (p. 20). The Sargent index is reported with the estimated unemployment rate (Equation 2.5) for 1970 as the reference year; the index value for 1970 is set at 100 and index values before 1970 are set at zero. Results shown in Figure 2.1 indicate that the Sargent index has declined steadily from 1976 to 2000.

Figure 2.1 Sargent Index for Canada's EI System
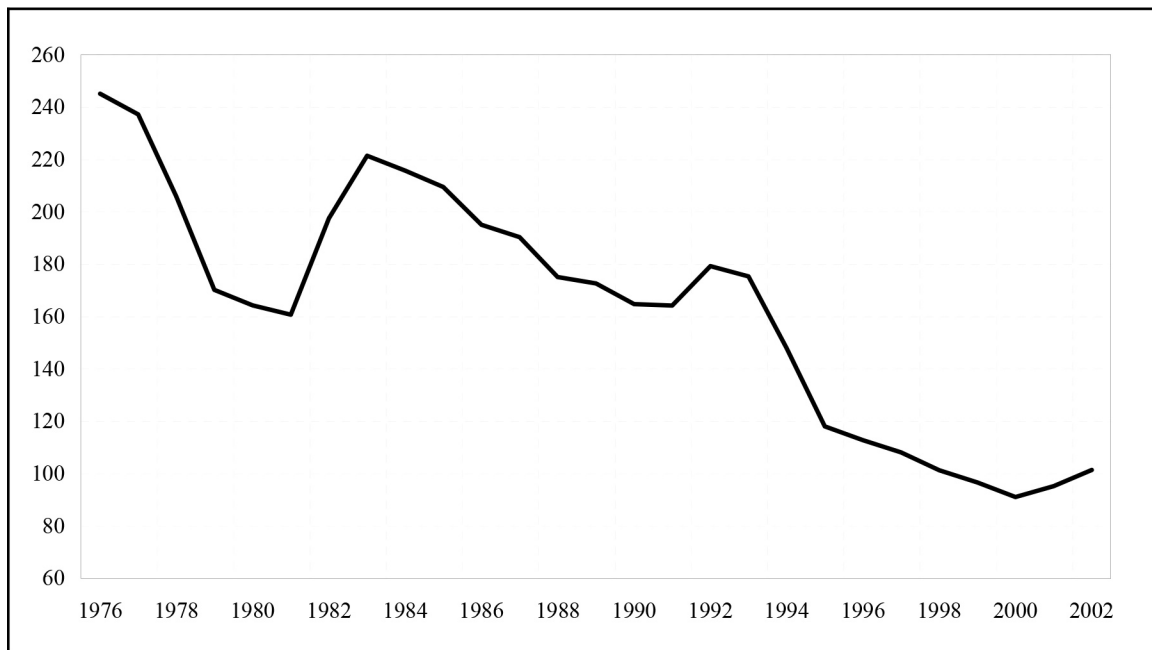
Another paper by Grey and L'Italien (2002) modifies the Sargent (1995) methodology by adding elements from a standard job search model. Uncertainty is added to original framework by allowing the arrival of job offers to be unknown. However, the authors' findings conclude that the addition of uncertainty, via the arrival of job offers, have very little impact compared to the trends and results of the original methodology (Sargent, 1995).

This summarizes the variety of studies done on measuring UI generosity. The most common method for comparing UI generosity internationally is to calculate a replacement ratio for each country. However, no single replacement rate can summarize UI generosity; a range of replacement rates would have to be calculated that corresponds to age, unemployment history, prior earnings and household composition. While replacement ratio studies are common, a replacement ratio can only measure one aspect of UI policy and it ignores policy features such monitoring, economic climate, benefit duration, qualification criteria. Other authors attempt to find an alternative to the replacement ratio methodology. These alternative measures involve using an index measure that incorporates variables such as qualification criteria and benefit durations. However, one flaw of these indices is that there is no clear way of judging which

index metric is appropriate for measuring UI generosity. And finally, a paper by Sargent (1995) uses a model-based approach of a labour-leisure model to measure disincentive from UI. The model-approach is a step towards a more grounded way of measuring UI generosity. The next section will cover a genuine model-based framework for measuring UI generosity, which also incorporates the unemployment rate and average unemployment duration of the country.

2.2.   Pallage, Scruggs and Zimmermann (PSZ) Generosity Measure

The model-based measure created by Pallage et al. (2013) produces a metric of UI generosity based on different aspects of UI such as the benefit duration, replacement ratios, qualification criteria, and economic conditions. The methodology involves simulating two economies, one that is modeled after a country's UI program and another of a simple UI system that offers UI benefits indefinitely. The models are similar in every way but the UI system in place. The generosity measure is calculated as the replacement ratio in the simpler UI model that makes the agent indifferent to both UI policies. This thesis utilizes the framework by Pallage et al. (2013), consequently this section provides a more comprehensive overview of the utilized methodology and findings of the study.

The models used by Pallage et al. (2013) feature heterogeneous agents that can self-insure against future unemployment spells via saving but have no access to credit markets. Agents in the model optimize consumption and leisure to maximize an infinite stream of discounted (expected) utilities. Employment opportunities are randomly drawn in each period of unemployment and an agent can receive a job offer that can be either accepted or declined. The probability of receiving a job offer is dependent on whether a job was offered last period. A tax rate is applied to all income and unemployment benefits that fund the entire UI program with a balanced budget.

Pallage et al. (2013) simulate two dynamic general equilibrium models. One model parameterizes a realistic UI program with waiting periods, a duration of eligibility, an UI benefit schedule, and social program benefits. The second model describes a simple system where UI benefits are offered indefinitely until employment occurs. The agent's household problem is formulated into a recursive Bellman equation. Both models are calibrated to match the country's average unemployment duration and unemployment rate. From the realistic UI model, the

expected value of the welfare program (ω), the average utility, is calculated. Using the expected value of the welfare program, a level of UI benefits is found in the simplistic UI system, which produces welfare equal to ω. The UI generosity measure is the replacement ratio in the simple UI model that makes the agent indifferent to both UI policies.

The authors apply the described methodology to the United Kingdom (UK) in order to study the evolution of UI generosity from 1972-2002. The results conclude that generosity has sharply dropped since the 1980's and has been on a steady decline. These results contradict replacement rate studies of the UK, which generally show that UI generosity has increased via increasing replacement rates. Additionally, Pallage et al. (2013) compare their UI generosity measure to a naïve measure of UI generosity. This naïve measure of UI generosity is constructed by calculating the present value of benefits received during an unemployment spell; this measure does not take into account UI program specifics. When applied to the UK between 1972-2002, the naïve measure found a steady decline in UI generosity. However, the naïve measure fails to capture the sharp drop in the early 1980's found in their model-based measure. Pallage et al. (2013) use this exercise to highlight the fact that one-dimensional generosity metrics fail to measure UI generosity.

In another paper by Pallage et al. (2008), a similar methodology is used to compare the United States (more specifically, Ohio) to France in terms of UI generosity. Their generosity metric calculates a value of 50% and 15% for France and United States, respectively. The authors conclude that France is three times more generous than the United States for the year 2005. Along with the main results, robustness checks were conducted to examine how the generosity measures changed depending on the calibration parameters. The most significant change in the results came from reducing the risk aversion parameters from 2.5 to 1.1, making UI generosity measures similar in both countries. The authors reason that "The basic intuition is that when agents do not care much about fluctuations in consumption and leisure, fluctuations in income matter little as well and whether the labor market conditions are different or the system is designed in various ways has little impact (Pallage et al., 2008)". Overall, changes in calibration parameters did not change the conclusion of the paper.

The Pallage et al. (2013) methodology for measuring UI generosity incorporates many

features of UI systems. The modeling includes eligibility criteria, UI benefit durations, a waiting period, and a social assistance alternative for those who fail to qualify for UI coverage. Additionally, the models are calibrated to match the country's unemployment rate and average unemployment duration. However, Pallage et al. (2013) methodology for measuring UI generosity is not without problems. The matching algorithm based on average utility may not be measuring generosity: by matching two systems based on welfare/average utility it is measuring how efficient the UI system relative to the simple UI scheme, in terms of consumption-smoothing (i.e. stable consumption from employment to unemployment). The measure in this study is a metric of how efficient the realistic UI program is relative to the simple UI scheme where benefits are paid indefinitely. To measure generosity, another matching criteria should be used. This thesis will utilize a simplified version of the model developed by Pallage et al. (2013) and an alternative matching criteria to measure UI generosity.

3. COUNTRY OVERVIEWS: UI AND WELFARE POLICIES

This chapter provides an overview of unemployment benefits and social assistance/welfare policies of the countries studied in this paper. The unemployment benefit systems of Canada, the United States, Germany (pre-reform and post-reform) and France are summarized. The overview of UI and social assistance policies pertains to a single person with no dependents/children. Hence, information for family benefits, lone parent benefits, child benefits etc. are not presented here. Country data and information uses 2013 as a reference except for Germany pre-reform, which uses 2002 as the reference year. Section 3.5 summarizes the UI and social assistance/welfare polices for all the countries.

Information for each country came from government websites and documents, however the primary source came from the benefit system overviews done by the OECD (2015). The systematic overviews are done for all OECD countries and provide detailed information in regards to unemployment benefits, social assistance, housing benefits, family benefits, lone-parent benefits, employment-conditional benefits, and the tax treatment of benefits. The reports are done for each year spanning from 2001 to 2013 and were last updated March 2015.

3.1. Canada

In Canada, the UI system is named Employment Insurance (EI) and pays out a proportion of past income, which is financed by contributions paid by employers and employees. The EI program is compulsory and offers four different types of benefits including regular benefits, maternity benefits, fishing benefits, work-sharing benefits, and special benefits. Focus is on regular benefits as they are offered when an individual loses their job that causes a loss or interruption in income for a minimum of seven days (Employment Insurance Act). The EI system divides Canada into 58 employment regions, where benefit durations and eligibility are determined by the regional unemployment rate. A higher regional unemployment rate extends the duration of benefits and makes it easier to qualify for EI. Each province in Canada is in charge of handling and administering social assistance. Ontario's social assistance program, Ontario Works, is detailed in this section. Ontario Works is a needs-tested benefit that pays out an allowance to cover a proportion of housing costs and basic needs. Information for Canada is derived from OECD (2015), Employment Insurance Act, Leonard (2010) and Service Canada (2014).

Eligibility for EI is based on the number of hours worked in the *qualifying period*. The qualifying period is a period before job loss that is usually set at 52 weeks. The rules pertaining to the number of work hours required to qualify, depend on a mechanism called the Variable Entrance Requirement (VER). The VER mechanic makes it easier to qualify for benefits; the mechanism also extends the duration of benefits payable when regional unemployment rises and vice versa. Qualification for EI benefits requires between 420 and 700 hours of work in the qualifying period. If regional unemployment is under 6%, 700 hours of work are required in the qualifying period and if unemployment is above 13%, 420 work hours are required in the qualifying period. How regional unemployment affect EI qualification work hours is outlined in Table 3.1. Along with the work hours requirement, it is also required that the claimant is able to work and is actively searching for employment.

Table 3.1 EI Entrance Requirements

Regional rate of unemployment (%)	Required number of insured hours of employment
6 and under	700
Over 6 to 7	665
Over 7 to 8	630
Over 8 to 9	595
Over 9 to 11	550
Over 10 to 11	525
Over 11 to 12	490
Over 12 to 13	455
Over 13	420

Note. Table adapted from Employment Insurance Act. S.C. 1996, c. 23. Canada.

The duration of EI benefits range from a minimum of 14 weeks to a maximum of 45 weeks and is determined by the amount of work hours in the qualifying period. The maximum

and minimum duration vary slightly with the regional unemployment rate; higher unemployment rates increase the minimum/maximum benefit durations and reduce the amount of work hours required. For regional unemployment rate of 6% and under, the minimum benefit duration is 14 weeks and maximum is 36 weeks, which requires 700 work hours and 1820+ work hours, respectively. Before the benefit period begins, there is a mandatory 2-week waiting period in which no benefits are paid out; this does not affect the payment schedule but the timing the first payment is received. Appendix C contains more information on this topic.

The EI benefit amount is calculated based on the weekly insurable earnings of the claimant. For 2013, the maximum yearly insurable earnings (MIE) were capped at a maximum of CAD 47,400 corresponding to a weekly cap of CAD 912. The MIE is determined through the Employment Insurance Act, by using the average weekly industrial wage multiplied by 52. The weekly insurable earnings for a claimant are calculated based on the total insurable wages earned in the rate calculation period (RCP); the RCP is the last 26 weeks of the qualification period. The weekly insurable earnings are calculated by taking the total insurable earnings in the RCP and dividing them by the larger of the two divisors, that is, either the total number of weeks worked during the RCP (a maximum of 26), or a divisor that is determined by the regional rate of unemployment (Table 3.2). The weekly benefits received are 55% of weekly insurable earnings, which can be paid up to a maximum of CAD 501 per week. Finally, EI benefits are taxable and paid out at weekly intervals.

Table 3.2 EI Benefit Divisors

Regional rate of unemployment (%)	Divisor
6 and under	22
Over 6 to 7	21
Over 7 to 8	20
Over 8 to 9	19
Over 9 to 11	18
Over 10 to 11	17
Over 11 to 12	16
Over 12 to 13	15
Over 13	14

Note. Table adapted from Employment Insurance Act. S.C. 1996, c. 23. Canada.

Income from EI is subject to taxes that are deducted from each payment. Federal, provincial or territorial taxes are deducted from EI benefits. Benefits from EI can be subject to repayment. If income for the tax year is 1.25 times greater than the maximum insurable earnings, a claimant must pay back a portion of EI benefits received. The amount repaid is equal to 30% of the amount above the maximum insurable earnings times 1.5 or the total benefits received in the tax year, whichever is lower.

The social assistance in Canada is determined by each province and territory. Ontario's social assistance program, named Ontario Works, is used to represent Canada's social assistance policies; Ontario Works is needs tested and offers an allowance that covers the cost of housing and basic needs such as food. The allowance is non-taxable and is paid out at a monthly frequency. For a single person with no children, the maximum allowance for 2013 was set at CAD 606 (CAD 230 basic allowance + CAD 376 housing allowance; Table 3.3). The maximum

allowance is augmented by the presence of children of a spouse (Table 3.3). Benefits are paid indefinitely as long as the claimant remains eligible.

Table 3.3 Ontario Works Monthly Maximum Allowances

| Family structure | (Basic allowance + Housing allowance) | |
	Single	Couple
No children	CAD 606 (230+376)	CAD 1043 (453+590)
One child aged 0 - 17	CAD 940 (350+590)	CAD 1094 (453+641)
Two children aged 0 - 17	CAD 991 (350+641)	CAD 1148 (453+695)

Note. Table adapted from OECD (2015, March). "Social Policies and Data." <u>Benefits and Wages: Country Specific Information</u>. Retrieved May 1, 2015, from http://www.oecd.org/els/soc/benefits-and-wages-country-specific-information.htm.

3.2.   United States

In the United States, unemployment insurance is administered at the state level and is overseen by the Federal government. UI policies for each state follow rules set out by the US Department of Labor; however, each state varies in eligibility criteria, benefit duration, and maximum benefit amount. Michigan is detailed in this section and is used to represent the United States' UI system. Michigan's UI pays a weekly benefit based on a percentage of prior employment wages. Eligibility and benefit duration are determined by employment history and past wages. The UI program is compulsory in the United States and is funded by taxes and contributions from employers. In regards to welfare, this paper classifies the Supplemental Nutrition Assistance Program (SNAP) as social assistance. The program is administered by the Food and Nutrition Services under the Department of Agriculture and it provides allowance for nutrition and food costs. Additionally, housing assistance is counted as social assistance as SNAP only provides allowance to cover basic food needs. Information for the United States came from OECD (2015), Supplemental Nutrition Assistance Program (SNAP) (2015), UIA (2015), and United States Department of Labor (2011).

A basic prerequisite for Michigan's UI benefits is that the claimant is able to work and will seek employment opportunities while receiving benefits. Eligibility for UI benefits are determined by *high quarter wages* (HQW) and wages earned in the *base period*. High quarter wages are the total wages from the highest earning quarter in the base period. The base period is defined as the first four quarters of the last five calendar quarters prior to the claim.

There are two ways to qualify for UI benefits. The 'regular' qualifying criteria requires that wages must be earned in at least two quarters of the base period, earning at least USD 2,871 in one of the quarters; total wages in the base period must be at least 1.5 times the HQW. For 2013, the total wages in the base period were required to be at least USD 4,307 to qualify for UI benefits. The second way to qualify with the 'alternative' criteria is that wages must be earned in at least two quarters and total wages in base period must equal 20 times the state's minimum wage. With the alternative criteria[2], for 2013, total wages must be at least USD 17,868 for at least two quarters.

The amount of UI benefits payable is determined by the HQW in the base period. UI benefits per week equal 4.1% of the HQW plus an additional USD 6 for each dependent, up to a maximum of USD 30. For 2013, the maximum UI benefit was set at USD 362 with a minimum benefit of USD 117. Benefits are paid out at a weekly frequency; income from UI benefits is taxable and subjected to both Federal and State taxation. However, not all States make UI benefits taxable at the State level.

UI benefits are offered for a maximum of 20[3] weeks and a minimum of 14 weeks. The number of weeks of UI entitlement is calculated by multiplying the total base wages by 0.40 then dividing by the weekly UI benefit amount and rounding down to the nearest half-week. Benefits are payable immediately with no required waiting period.

In times of high unemployment, there are two programs that can be enacted on the State level that allow UI to be extended once benefits have been exhausted. The two programs are the Emergency Unemployment Compensation (EUC) program and the Extended Benefits (EB)

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[2]   The alternative qualifying criteria is more restrictive since it looks at those with less work history (2 quarters versus 4 quarters of work)

[3]   The maximum duration was reduced from 26 weeks to 20 weeks in 2013. It was previously 26 weeks (2003-2013).

program. The EUC program is a Federal program that provides temporary extension of unemployment benefits. It is a four-tier program with each tier extending benefits by a set amount. Each tier is activated if the 3-month seasonally adjusted total unemployment rate is above a certain threshold. Table 3.4 outlines the guidelines for EUC; Tier 1, 2, 3, and 4 extend the maximum duration of benefits by 14, 14, 9 and 7 weeks, respectively. Tiers are activated in ascending order with duration extensions of each tier being additive. The legislation for the EUC program (EUC08) was authorized by the Federal government in 2008 and was set to expire at the end of December 2013.

Along with EUC, the EB program provides an extension of unemployment benefits once UI and EUC benefits have been exhausted. The program is enacted once the state unemployment rate has reached a certain threshold. EB offers a maximum of 13-week extension of benefits. During high unemployment, the maximum extension of benefits increases from 13 to 20 weeks (Table 3.4). For Michigan, the EB program was last initiated from January 25, 2009 to February 18, 2012 and was not enacted in 2013.

Table 3.4 United States Overview of UI Program[4]

UI Benefits Programs	State Qualification	Enacted in Michigan? (2013)	Maximum Number of Weeks	Benefit Amount (USD)
Regular UI Benefits (Michigan)	-	Always	20	USD 117 – USD 362
Emergency Unemployment Compensation (EUC) – Tier 1	All States Qualify	Yes	14 weeks or 80% of the regular state maximum UI duration	Same as regular state UI Benefits
Emergency Unemployment Compensation (EUC) – Tier 2	State must have a total unemployment rate of at least 6 percent	Yes	14 weeks or 54% of the regular state maximum UI duration	Same as regular state UI Benefits
Emergency Unemployment Compensation (EUC) – Tier 3	State must have a total unemployment rate of at least 7 percent	Yes	9 weeks or 50% of the regular state maximum UI duration	Same as regular state UI Benefits
Emergency Unemployment Compensation (EUC) – Tier 4	State must have a total unemployment rate of at least 9 percent	No	13 weeks or 80% of the regular state maximum UI duration	Same as regular state UI Benefits
Extended Benefits (EB)	State with a 13-week UR of 5 percent or higher, and 120 percent above the UR rate for the corresponding 12-week period in the two previous years	No	13 (20) weeks or 50% (80%) of the regular state maximum UI duration (During periods of unemployment of at least 9 percent)	Same as regular state UI Benefits

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[4] The maximum duration, benefit amounts, and State qualifications are for 2013. The rules changed in 2013. For State qualifications (2010) that is used in the modeling process see Appendix C.

Social assistance will be represented by SNAP (formerly known as the Food Stamps program) and the Housing Choice Voucher Program (Section 8). SNAP is designed to provide low-income households with enough income to cover food costs. To qualify for SNAP a household must pass a means test; the household's gross monthly income must not exceed 130% of the poverty guideline and counted/net monthly must not exceed 100% of the poverty guideline. For 2011, the net income guideline was USD 1,838 per month. The benefit amount is calculated based on family size and monthly income. Table 3.5 shows the eligibility criteria and maximum benefits for a given household size. For a one-person household, monthly net and gross income not exceeding USD 931 and USD 1211, respectively, entitles the claimant a maximum allowance of USD 200. Benefits are paid out indefinitely as long the claimant remains eligible. The allowance is non-taxable and is paid out at a monthly frequency.

The Section 8 rental assistance program, for low-income households, covers a proportion of the cost for rent and utilities. The program is administered by the local public housing agencies and is funded federally by the U.S. Department of Housing and Urban Development (HUD). In general, to qualify for the program, the household's average income must be below 50% the local area median income. Recipients are expected to contribute 30% of their income towards rent. The allowance for housing is paid as the difference between the *Fair Market Rents* (FMR) of the area and the income contributed towards the rent. The FMR is calculated by the HUD, which determines the average (gross) rent based on number of bedrooms, geographical location and the cost of utilities. The allowance is paid directly to the landlord and the utilities company. For Detroit, Michigan, the FMR in 2013 for a one-bedroom and a two-bedroom rental unit was USD 629 and USD 821 respectively. On a national scale, the average FMR for a one-bedroom unit was USD 755 and for a two-bedroom was USD 945. Housing assistance is non-taxable and it is offered as long as the household qualifies.

Table 3.5 SNAP Allowance and Eligibility Criteria

Household Size (Persons)	Maximum Benefit (USD)	Gross Income Eligibility Limit (USD)	Net Income Eligibility Limit (USD)
1	200	1211	931
2	367	1640	1261
3	526	2069	1591
4	668	2498	1921
5	793	2927	2251
6	952	3356	2581
7	1052	3785	2911
8	1202	4214	3241
Each additional person	+150	+429	+330

Note. Table adapted from OECD (2015, March). "Social Policies and Data." <u>Benefits and Wages: Country Specific Information</u>. Retrieved May 1, 2015, from http://www.oecd.org/els/soc/benefits-and-wages-country-specific-information.htm.

3.3. Germany

The overview of the UI mechanism in Germany is divided into two sections. Presented first is the pre-reform UI and welfare policies using 2002 as a reference. Second, post-reform UI and welfare policies are summarized using 2013 as the reference year. It should be noted that the post-reform UI policies between 2008 and 2013 remained the same.

German labour market policies, called the Hartz Reforms, were instituted between 2003 and 2005. The goal of the reforms according to Jacobi and Kluve (2006) were:

"(a) Improving employment services and policy measures, (b) activating the unemployed, and (c) fostering employment demand by deregulating the labour market. To this end, the

reform radically modernized the organizational structure of public employment services, modified many of the already existing measures of Active Labour Market Policy (ALMP) and introduced a set of new ones." (p. 4)

In terms of UI structure, in 2005, unemployment assistance and social welfare were combined into one benefit that paid an amount less than social welfare in year's prior. Jacobi and Kluve (2006) also states "the reform fundamentally changed the institutional and legal framework that determines the rights and duties of the unemployed, most importantly, the benefit system. Furthermore, employment protection was reduced in some segments of the labour market."

3.3.1. Germany Pre-Reform (2002)

In Germany, before the Hartz reforms of 2003-2005, the unemployment benefits system consisted of unemployment insurance and unemployment assistance. Unemployment insurance, known as *Arbeitslosenversicherung*, was a benefit that paid out a portion of insured income for a limited duration. The benefit payout period was determined by employment history. Unemployment assistance (*Arbeitslosenhilfe*) was a means-tested income support measure that paid out a proportion of prior income, as long as the claimant remained eligible. Social assistance or *Sozialhilfe* was a means-tested program that paid out a standard rate plus a percentage of the standard rate for each additional family member. The UI benefits were compulsory in Germany and non-taxable with unemployment insurance being contributions funded and unemployment assistance being tax funded. Information for Germany (pre-reform/2002) came from OECD (2015), and Adema, Gray, and Kahl (2003).

Qualification for unemployment insurance, *Arbeitslosenversicherung,* was based on employment and contribution history. A claimant had to be employed for at least 12 months and contribute for at least 12 months in the last 3 years. The claimant had to also register at a local Public Employment Center (PES). By registering at the PES, the claimant was able to accept suitable job opportunities from the PES and partake in employment (activation) programs. The claimant had an opportunity to decline job offers if the employment offered substantially less than their last job. For the first three months of unemployment, the claimant had an option to reject job offers that paid 80% or less, after three months the threshold decreased to 70% and after a six-month period all job offers that offered wages higher than UI benefits had to be accepted.

Unemployment insurance benefits were calculated based on prior net income and whether the claimant had dependents. The benefit amount was calculated using the average of net monthly income with gross monthly income capped at EURO 4,700. The benefit amount equalled 67% of net average income of the last six months for an individual with children younger than 18 years old; it paid out 60% in any other case. The income from UI was non-taxable and was considered a net benefit since it paid out a proportion of net income. Benefits were paid out every 30 days.

The duration of benefits was based on the duration of continuous paid contributions prior to unemployment. Assuming a person is younger than 45 years of age, the benefit period ranged from a minimum of 6 months to a maximum of 12 months. To qualify for the maximum benefit durations, a claimant had to be employed/make contributions for 24 months (Table 3.6). Individuals age 55 or older were entitled to higher maximum benefit durations if proper contributions were paid (Table 3.6). Benefits were paid immediately with no waiting period.

Table 3.6 Germany (Pre-Reform) Unemployment Insurance Benefit Duration Calculations

Contribution period (months)	Employment period (years)	Benefit payment duration (months) Varying with age				
		Up to 45	45 and over	47 and over	52 and over	57 and over
12	3	6	6	6	6	6
16	7	8	8	8	8	8
20	7	10	10	10	10	10
24	7	12	12	12	12	12
28	7		14	14	14	14
32	7		16	16	16	16
36	7		18	18	18	18
40	7			20	20	20
44	7			22	22	22
48	7				24	24
52	7				26	26
56	7					28
60	7					30
64	7					32

Note. Table adapted from OECD (2015, March). "Social Policies and Data." Benefits and Wages: Country Specific Information. Retrieved May 1, 2015, from http://www.oecd.org/els/soc/benefits-and-wages-country-specific-information.htm.

Unemployment assistance, *Arbeitslosenhilfe*, was available to those who exhausted UI benefits, those who did not qualify for full UI benefits or those who received unemployment insurance/assistance benefits within the previous year. The benefit amount was calculated using the average of monthly income with gross monthly income capped at EURO 4,700. That benefit

was means-tested and paid out 53% of previous net earnings or 57% if the claimant had at least one dependent child. The duration of benefits were indefinite as long as the claimant remained eligible. Benefits were non-taxable and were paid out every 7 days.

Social assistance, *Sozialhilfe,* was viewed as a minimum income support benefit that paid an allowance that covered the cost of living. Benefits were non-taxable and were paid out every 7 days. To be entitled for social assistance, the claimant had to be between the age of 15 and 65 years of age, pass a means test, and capable of work. The means test looked at the income of the claimant, and other family members. The (monthly) standard benefit amounts for a single person or head of a household were EURO 292 and EURO 282 for East and West Germany, respectively. For additional household members the benefit increased by a proportion of the standard rate (Table 3.7). Along with the standard rate, there was a monthly housing and heating allowance. From Table 3.8, for a person living alone, the estimated housing benefit amount for heating and house were EURO 302 a month in 2002 (OECD, 2015). Social assistance benefits were offered indefinitely as long as the claimant remained eligible.

Table 3.7 Germany (Pre-Reform) Social Assistance Standard Benefit Amounts

Household Size (Person)	Monthly Benefit Allowance (EURO)
Head of Household/Living Alone	Standard Rate (SR) = EURO 292/282 (West/East Germany)
Up to 6 Years Old	50% of SR or 55% of SR for Single Parent
7 year old – 13 year old	65% of SR
14 year old – 17 year old	90% of SR
18 years old +	80% of SR

Note. Table adapted from OECD (2015, March). "Social Policies and Data." <u>Benefits and Wages: Country Specific Information</u>. Retrieved May 1, 2015, from http://www.oecd.org/els/soc/benefits-and-wages-country-specific-information.htm.

Table 3.8[5] Germany (Pre-Reform) Estimated Monthly Housing and Heating Cost/Benefit

	1st Person (EURO)	1st Person (EURO)	Per Child (EURO)
Housing cost	260	80	56
Heating cost	42	16	4

Note. Table adapted from OECD (2015, March). "Social Policies and Data." <u>Benefits and Wages: Country Specific Information</u>. Retrieved May 1, 2015, from http://www.oecd.org/els/soc/benefits-and-wages-country-specific-information.htm.

3.3.2. Germany Post-Reform (2013)

Beginning January 1, 2005 the unemployment assistance and social assistance policies were reformed in Germany. The former social assistance (*Sozialhilfe*) and unemployment assistance (*Arbeitslosenhilfe*) programs were combined into one unemployment assistance/social benefit; the benefit offered is set at the same level of benefits as the prior social assistance program. The UI program, unemployment benefit I (*Arbeitslosengeld* I), pays out a benefit equal to a portion of average monthly income net of taxes. Unemployment benefit I eligibility is determined by employment history and contributions. The UI program is compulsory with contributions taken from each paycheque. Unemployment benefit II/social benefit (*Arbeitslosengeld* II / *Sozialgeld*) is a means-tested and needs-based income support that covers necessary subsistence for as long as the claimant is eligible. Information for Germany (post-reform) came from OECD (2015), European Commission (2013b), Unemployment Benefits (2015) and Bundesagentur für Arbeit (2015).

Eligibility for unemployment benefit I is based upon the length of former employment and contributions paid. To qualify for UI benefits, a claimant must have been employed for a minimum of 12 months and must have made at least 12 months of contributions in the last 24 months. Along with these requirements, a claimant must be registered as unemployed with the employment office, actively looking for employment, and must be younger than retirement age.

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[5] The rent and heating costs were calculated from the Federal Statistical Office data (Federal Statistical Office, Fachserie 13: Reihe 4 "Wohngeld", 1995). See OECD (2015) for detailed information

The duration of benefits is dependent on the claimant's age and contribution history. The benefit duration ranges from 6 months to 48 months. For a claimant less than 50 years old, a contribution period of 12 months gives 6 months of UI benefits and contributions of 24 months or higher gives benefits for a maximum of 12 months. Claimant between the age of 50 and 58 are able to receive longer duration of benefits. For older persons the maximum benefit duration is 24[6] months if contributions were made for the past 48 months (Table 3.9). Table 3.9 outlines the benefit duration calculation in regards to contribution time and age.

Table 3.9 Germany (Post-Reform) Unemployment Benefit I Duration Calculations

Contribution Period (months)	Benefit Payment Duration (months)
12	6
16	8
20	10
24	12
30 (Age 50+)	15
36 (Age 55+)	18
48 (Age 58+)	24

Note. Table adapted from OECD (2015, March). "Social Policies and Data." Benefits and Wages: Country Specific Information. Retrieved May 1, 2015, from http://www.oecd.org/els/soc/benefits-and-wages-country-specific-information.htm.

Unemployment benefits I are based on the net prior earnings and are paid out every 30 days with no waiting period. Average monthly earnings, from the past 12 months, are used to calculate the benefit amount, with the maximum monthly amount (gross) capped at EURO 4,900 for East Germany and EURO 5,600 for West Germany. Benefits are paid at 60% of net average monthly earnings and at 67% for those with children. For a claimant without children, the

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[6]   Between 2006 and 2007 the maximum benefit duration was 18 months.

maximum monthly benefit amount is EURO 2,940 in East Germany and EURO 3,360 in West Germany. The UI benefits are non-taxable and are based on net income rather than gross income.

Unemployment benefit II/Social benefit combines the pre-reform programs of social assistance and unemployment assistance into one benefit program. The combined benefit is non-taxable and is needs based and means-tested. The basic prerequisites are that a claimant must be between the age of 15 and 65, and do not have sufficient means to meet a basic level of subsistence. Those who exhausted unemployment benefits I can apply but must also be capable of working and searching for employment. The unemployment benefit II/social benefit covers the cost of food, personal hygiene, household and everyday items. Also, an additional housing allowance may cover the cost of housing and utilities if it is within reason; the square meters of a dwelling generally determine what is deemed acceptable for housing benefits. For a single person with no dependents, the acceptable housing size was 50 to 60 square meters (Table 3.12). For a single adult the monthly allowance was EURO 382 with a maximum possible housing allowance of EURO 413 (Table 3.10 & 3.11). Tables 3.10 and 3.11 outline the benefit amounts for each household member. Additional benefits may be allowed for pregnant mothers, lone parents, and persons with expensive nutritional diet requirements as a result of medical conditions. Duration of benefits is granted indefinitely as long as claimants are in need, however, every six months claimants have to prove they still qualify for benefits.

Table 3.10 Germany (Post-Reform) Unemployment Benefit II/Social Benefit Allowance

Household Unit	Benefit Amount per month (EURO)
Single adult	382
Adult Partner	345
19 year old – 25 year old	306
15 year old – 18 year old	289
7 year old – 14 year old	255
Up to 6 years old	224

Note. Table adapted from OECD (2015, March). "Social Policies and Data." <u>Benefits and Wages: Country Specific Information</u>. Retrieved May 1, 2015, from http://www.oecd.org/els/soc/benefits-and-wages-country-specific-information.htm.

Table 3.11 Germany (Post-Reform) Unemployment Benefit II/Social Benefit Housing Allowance

Household Unit	Maximum Housing Allowance per month (EURO)
1 person	413
2 persons	495
3 persons	587
4 persons	665
5 persons	787
Additional persons	95

Note. The maximum housing allowance was determined using Berlin as a reference. Table adapted from OECD (2015, March). "Social Policies and Data." <u>Benefits and Wages: Country Specific Information</u>. Retrieved May 1, 2015, from http://www.oecd.org/els/soc/benefits-and-wages-country-specific-information.htm.

Table 3.12 Germany (Post-Reform) Reasonable Housing Size for Housing Allowance

Household Unit	Acceptable Housing Criteria
1 person	45-50 square meters
2 persons	60 square meters or 2 bedrooms
3 persons	75 square meters or 3 bedrooms
4 persons	85-90 square meters or 4 bedrooms
Additional person	An additional 12 square meters or bedroom

Note. Table adapted from OECD (2015, March). "Social Policies and Data." Benefits and Wages: Country Specific Information. Retrieved May 1, 2015, from http://www.oecd.org/els/soc/benefits-and-wages-country-specific-information.htm.

3.4. France

The unemployment insurance scheme in France is called *l'allocation d'aide au retour à l'emploi* (ARE). The UI system pays out a proportion of prior income every month. Eligibility is dependent on past contributions with a minimum requirement of four months worked. Duration of UI benefits follows the philosophy of 'one day worked is one day covered'. Those who exhaust UI benefits may apply for unemployment assistance (Allocation de Solidarité Spécifique) and receive benefits that are means-tested. Unemployment assistance benefits are paid out as long as the claimant remains eligible. Social Assistance (Revenu de solidarité) is a means-tested program that pays out a minimum amount of income to cover subsistence, which is offered indefinitely as long as the claimant qualifies. Both unemployment insurance and social assistance pay the same amount of maximum benefits. The UI system is compulsory with the system being funded through contributions paid by employees. Information for France came from OECD (2015), European Commission (2013a), Unemployment Benefits in France (2015) and Aides Sociales (2015).

Eligibility for ARE is based on the amount of time contributions were made in the *qualifying period*. The qualifying period, for those under the age of 50, is 28 months before employment end, and 36 months for those age 50 and older. To qualify for ARE, a claimant is required to have a minimum of 120 days of contribution in their qualifying period. Along with

the contributions requirement, a claimant is expected to be able to work, search for employment and be registered as unemployed with "Pôle employ".

The duration of benefits is determined by and equal to the contribution time in the qualifying period. For example, a person with 200 days of contributions would receive benefits for 200 days. For those under 50 years of age, the maximum time the benefits can be received is set at 24 months; the maximum duration is 36 months for individuals 50 years of age and over. Benefits are not paid out immediately as a 7-day waiting period is required before the first payment is made.

The ARE benefit amounts are calculated using the average gross monthly income and the *daily reference wage/salaire journalier de reference* (SJR) of the claimant. The gross monthly income and the daily reference wage/SJR is based on the total wages earned 12 months prior to job loss. A claimant who made a total of EURO 30,000 in the last 12 months would have a SJR of EURO 82.20 per day (EURO 30,000/365) and gross monthly average of EURO 2,500. The maximum gross monthly income is capped at EURO 12,344. The amount of AER benefits payable falls into 4 categories and depends on the gross monthly income. Table 3.13 describes the relation between the gross monthly income and the daily benefit amount. The AER daily benefit cannot exceed 75% of SJR and cannot be below EURO 28.38. Incomes from AER benefits are taxable and paid out at a monthly frequency.

Table 3.13 France ARE Benefit Calculation

Average gross monthly salary (EURO)	Average gross monthly salary
Less than 1,135	75% of gross salary
Between 1,135 and 1,243	28.38 per day
Between 1,243 and 2,054	40.4% of SJR + 11.64
Between 2,054 and 12.344	57.4% of SJR

Note. Table adapted from OECD (2015, March). "Social Policies and Data." Benefits and Wages: Country Specific Information. Retrieved May 1, 2015, from http://www.oecd.org/els/soc/benefits-and-wages-country-specific-information.htm.

Unemployment assistance in France is called Allocation de Solidarité Spécifique (ASS) or 'Solidarity Benefit' and is a means-tested benefit. The ASS is only available to those who exhausted their UI benefits (ARE). Similar to the ARE, a claimant must be able to work and actively search for employment. To be eligible, the claimant must have been employed for 5 years, in the last 10 years, preceding the period before the last day of employment. Also, the composite household monthly income, from other sources, must be below EURO 1,277.10 for a single person or EURO 1,772.10 for a couple living together to qualify. The benefit amount from the ASS pays a maximum of EURO 16.11 per day, which is equivalent to EURO 483.30 a month. To qualify for maximum benefits a single person and a couple must have a monthly income below EURO 644.40 and EURO 1,288.80, respectively (Table 3.14 & 3.15). It is possible to receive benefits for up to 12 months, that reduce over time, if a claimant is re-employed with 78 hours of work a month (Table 3.16). The duration of benefits are fixed at 6-month intervals and can be renewed indefinitely as long as the claimant remains eligible. The ASS benefits are taxable and paid out every month.

Table 3.14 France ASS Benefit Amount for Single Person

Net Monthly Income (EURO)	ASS Benefit (EURO/month)
Less than 644.40	483.30 (16.11 per day)
Between 664.40 and 1,277.10	Difference between 1,277.10 and Monthly Income
Above 1,277.10	No Benefit

Note. Table adapted from OECD (2015, March). "Social Policies and Data." Benefits and Wages: Country Specific Information. Retrieved May 1, 2015, from http://www.oecd.org/els/soc/benefits-and-wages-country-specific-information.htm.

Table 3.15 France ASS Benefit Amount for Couple/Household of Two

Net Monthly Income (EURO)	ASS Benefit (EURO/month)
Less than 1,288.80	483.30 (16.11 per day)
Between 1,288.80 and 1,772.10	Difference between 1,772.10 and monthly income
Above 1,772.10	No Benefit

Note. Table adapted from OECD (2015, March). "Social Policies and Data." <u>Benefits and Wages: Country Specific Information</u>. Retrieved May 1, 2015, from http://www.oecd.org/els/soc/benefits-and-wages-country-specific-information.htm.

Table 3.16 France ASS Benefit while Employed

Gross Monthly Income (EURO)	During Month 1 – Month 6 of Employment	During Month 6 – Month 12 of Employment
Less than 722.69	ASS paid in full	The number of days compensated is reduced by 40% of the gross monthly earnings divided by the daily ASS benefit
Equal or Exceed 722.69	The number of days compensated is reduced by 40% of gross monthly earnings exceeding 722.69 divided by the daily ASS benefit	The number of days compensated is reduced by 40% of the gross monthly earnings divided by the daily ASS benefit

Note. Table adapted from OECD (2015, March). "Social Policies and Data." <u>Benefits and Wages: Country Specific Information</u>. Retrieved May 1, 2015, from http://www.oecd.org/els/soc/benefits-and-wages-country-specific-information.htm.

The social assistance equivalent in France is called Revenu de solidarité (RSA) or 'Active Solidarity Income'. RSA is designed to guarantee a minimum amount of income to cover subsistence and housing costs. RSA takes into account all income of the household to determine eligibility and it is made available to the unemployed and employed who have a low level of income. To qualify for the RSA, the total monthly income cannot exceed 1.4 times the monthly minimum wage. Also, the claimant must be at least 25 years of age, however exceptions can be made for those between the ages of 18 and 24. The payable benefit amount depends on family

situation and is described in Tables 3.17 & 3.18. For a single person with no dependents, the maximum monthly RSA basic allowance equals EURO 483.24 and the RSA maximum housing allowance equals EURO 57.99 (Table 3.17 & 3.18). The allowance income is non-taxable and paid out every month. The duration of the RSA is indefinite as long as monthly income is below the threshold; however, allowances are updated every 3 months to reflect any changes in monthly income or the claimant's situation.

Table 3.17 France RSA Monthly Basic Allowance

Number of Child/Dependents (under the age of 25)	Single (EURO)	Family (EURO)
0	483.24	724.86
1	724.86	869.83
2	869.83	1,014.80
Per Additional Child/Dependent	193.30	193.30

Note. Table adapted from OECD (2015, March). "Social Policies and Data." <u>Benefits and Wages: Country Specific Information</u>. Retrieved May 1, 2015, from http://www.oecd.org/els/soc/benefits-and-wages-country-specific-information.htm.

Table 3.18 France Monthly RSA Housing Allowance

Household Size	Maximum RSA Housing Allowance (EURO)
1	57.99
2	114.98

Note. Table adapted from OECD (2015, March). "Social Policies and Data." <u>Benefits and Wages: Country Specific Information</u>. Retrieved May 1, 2015, from http://www.oecd.org/els/soc/benefits-and-wages-country-specific-information.htm.

3.5. Country Summaries

This section briefly summarizes the social insurance (UI, UA, and SA) policies of each country. The descriptions refer to a single person of non-retirement age with no children or dependents. Tables 3.19 to 3.21 provide an additional visual overview of the UI, UA, and SA policies of each country.

Canada's UI system contains a feature named the Variable Entrance Requirement (VER), where the maximum/minimum possible UI benefit duration increases if the regional unemployment rises. Also, VER makes it easier to qualify for UI when regional unemployment is high and vice versa. Qualification for UI is based on the number of work hours in the last 52 weeks; requiring between 420 and 700 work hours, depending on the VER. UI benefits are paid weekly and are calculated at 55% of the maximum insurance earnings (MIE) divided by 52. The MIE for 2013 was CAD 47,40 with the maximum weekly benefit amount at CAD 501. A mandatory two-week waiting period is required before UI benefits are paid. UI benefits are payable for a minimum of 14 weeks to a maximum of 45 weeks. Social assistance in Canada is means-tested and pays out a flat benefit depending on household composition. For a single person with no benefits the monthly SA amount was CAD 606.

The United States (Michigan) social insurance policies for the unemployed consist of UI and SA. Qualification for UI is based on prior wages from the last five quarters. The UI benefit amount equals a proportion of prior earnings with benefits being capped at USD 362. The duration of benefits range from a minimum of 14 weeks to a maximum of 20 weeks. In times of high unemployment, the Emergency Unemployment Compensation (EUC) program and the Extended Benefits (EB) program may extend unemployment insurance benefit durations. These programs are enacted if state unemployment reaches a certain level. SNAP and Section 8 (housing assistance) are classified in this paper as social assistance. SNAP provides allowance for basic food needs while Section 8 provides allowance for rental housing. For a single person with no dependents, the maximum monthly allowance for SNAP in 2013 was USD 200. Housing assistance allowance is calculated based on the fair market rent of the region and the number of bedrooms.

For France, the social insurance policies for the unemployed include UI, UA, and SA. Qualification for UI requires that the claimant must have paid contributions for at least 120 days within the last 2 years. The duration of UI benefit equals the number of contribution days in the last 2 years; the maximum duration is capped at 24 months. Before benefits are paid there is a mandatory 7-day waiting period. UI benefits are based on the prior monthly gross income. The minimum UI benefit for 2013 was EURO 851.40 per month. UA is a means-tested benefit and is only available to those who exhaust UI benefits. UA pays a maximum benefit of EURO 483.30 a

month and it is paid indefinitely as long as the claimant is eligible. SA is a means-tested benefit and pays a maximum allowance of EURO 483.24.

For Germany (pre-reform), the social insurances policies for the unemployed consisted of UI, UA and SA. To qualify for UI, contributions must be made for a minimum of 12 months in the last 3 years and individuals must have been employed for a minimum of 12 months. UI benefits are paid monthly and are calculated at 60% of prior net monthly income. Duration of benefits lasts a minimum of 6 months to a maximum of 12 months, depending on contribution history during the last 3 years. UA is means-tested and is available to those who exhaust UI benefits. UA pays a weekly amount that equals 53% of prior net weekly income and is offered as long as the claimant qualifies. SA is means-tested and offers a standard allowance depending on a household size. For 2002, a single person with no dependents received EURO 594 a month.

For Germany (post-reform), the social insurance policies are similar to the pre-reform polices except for the past UA and SA programs were combined into one program where benefits equal to previous SA amounts. In order to qualify for UI, the claimant must have been employed for a minimum of 12 months and with contributions being made for a minimum of 12 months in the last 2 years. UI benefits are calculated at 60% of prior net monthly income and last for a minimum of 6 months to a maximum of 12 months. UA/SA is a means-tested benefit that offers a standard allowance depending on household size. For 2013, a single person with no dependents would receive EURO 796 a month.

Table 3.19 Country Unemployment Insurance Policy Overview

Country	Eligibility Conditions	Waiting Period (Days)	Max Benefit Duration (Weeks)	UI Benefit	UI Benefits Taxable
Canada (2013)	400-700 hours worked +contributions	14	45	55% of Insurable Earnings (Gross)	Yes
United States (2013)	26 weeks worked + minimum earnings	None	20*	4.1% of High Quarter Wages (Gross)	Yes
Germany (2002)	12 months worked + 12 months of contribution in last 3 years	None	52	60% of prior income (Net)	Yes
Germany (2013)	12 months worked + 12 months of contribution in last 2 years	None	52	60% of prior income (Net)	Yes
France (2013)	4 months of contributions in last 36 months	7	52	Between 57% and 75% of income	Yes

Note. *USA's maximum benefit duration, for 2013, reported ignores the possible extension from EUC Tier1-4 and EB Program. The maximum benefit duration including the extensions program would be around 24 months.

Table 3.20 Country Unemployment Assistance Policy Overview

Country	Eligibility Conditions	Waiting Period	Benefit Duration	UA Benefit	UA Benefits Taxable
Germany (2002)	Exhausted UI benefits + must pass means test	None	No Limit	53% of prior income (net)	No
France (2013)	Exhausted UI benefits + must pass means test	None	6 months (renewable)	Fixed Amount	Yes

Note. *Germany 's Unemployment benefit II/Social Benefit (2013) can be classified as UA and/or SA. For the sake of simplicity it will be classified as SA and therefore included in Table 3.21.

Table 3.21 Country Social Assistance Policy Overview

Country	Eligibility Conditions	Waiting Period	Benefit Duration	SA Benefit	SA Benefits Taxable
Canada (2013)	Must pass means test	No	No Limit	Fixed Amount	No
United States (2013)	Must pass means test	No	No Limit	Fixed Amount	No
Germany (2002)	Must pass means test	No	No Limit	Fixed Amount	No
Germany (2013)	Must pass means test	No	No Limit	Fixed Amount	No
France (2013)	Must pass means test	No	No Limit	Fixed Amount	No

4. MODELING STRATEGY

4.1. Model Foundation

A simplified model of the one developed in Pallage et al. (2013) (Section 2.2) is used to generate a metric of generosity. Two models are constructed, the first is a complex UI model that contains features specific to a country's UI policy such as a waiting period, eligibility criteria, UI benefit durations et cetera. The second is a simplistic UI model where everyone is eligible for UI benefits; benefits in this simple model are paid indefinitely until re-employment. These models are calibrated to match a country's unemployment rate and share of short-term unemployment (unemployment lasting a maximum of 3 months); the only difference in the models is the UI policies. The two calibrated models are used to compute a metric of 'generosity' and efficiency for a country-specific UI policy. Chapter 5 will elaborate on the generosity and efficiency metrics. What follows is a summary of the modeling foundation and assumptions.

The framework follows the methodology laid out by Pallage et al. (2013) but with some simplifications. Following in the spirit of Hopenhayn and Nicolini (1997), this paper assumes that agents have no other sources of income, and no assets and that consumption in all periods, employed and unemployed, is predetermined. Therefore, consumption in each period is given exogenously and income equates to consumption; therefore, an agent cannot save or borrow to smooth consumption. Without this assumption, agents would exhibit a new behaviour in the form of precautionary savings; agents would save a portion of their income to insure against future unemployment spells. This assumption is different from the Pallage et al. (2013) paper since agents in their methodology can self-insure through savings.

Another assumption made is that agents in the model are assumed to be homogeneous in terms of income and assets. This is unlike the Pallage et al. (2013) methodology where agents are heterogeneous due to the accumulation of assets via savings. However, there is some heterogeneity in the model due to agents being in different states of employment or unemployment. The model contains infinitely-lived agents and it is assumed that time is discrete. All transition probabilities of moving from one state to another (i.e. employment to unemployment) are exogenously or endogenously determined and unchanging over time. The

transition probabilities such as the average duration of UI benefits[7], conditional on being unemployment, are exogenously determined. The transitional probabilities of leaving unemployment, via job search, are endogenously chosen by the agents in the model. The models in this paper utilize a set of Bellman equations, where each equation represents a possible state such as unemployment with UI benefits, employment with no UI entitlement and etc.

An important feature of the model is the incorporation of endogenous search intensities Costain (1997), which are not present in the original Pallage et al. (2013) methodology. Search intensities are associated with a cost-of-job-search function, which describes a disutility to the agent. The cost of job search is denoted as $\varphi(p)$, where p is the job search intensity and is normalized as a probability of finding employment next period; the search intensity is bounded between 0 and 1. The cost-of-search function will ideally be a strictly convex function such that $\varphi'(p) > 0, \varphi''(p) > 0$ and chosen such that the solution is interior. These properties ensure that increasing search intensities become more costly at an increasing rate. Agents in these models only care about job search intensities. Since agents cannot self-insure, because consumption is pre-determined, the agents' only optimizing decision is their search intensities while unemployed.

When modeling UI it is important to recognize the importance of moral hazard. In this framework, moral hazard is present due to the implementation of endogenous job search intensities. Job search is considered a disutility and an agent can influence the probability of finding employment; the search intensity is equal to the probability of finding employment. Therefore, an increase in UI benefits will cause the marginal benefit of search to decrease, which leads to lower search intensities and longer unemployment durations. This is similar to the works of Costain (1997), Hopenhayn and Nicolini (1997), and Pissarides (2000). However, it differs from Pallage et al. (2013) as they implement moral hazard in their sensitivity analysis by using imperfect monitoring from Hansen and Imrohoroglu (1992); in their approach agents who decline job offers have a predetermined probability to stay unemployed and receive UI benefits.

Finally, it is assumed that the government funds all social insurance programs through taxation. A proportional tax rate is calculated such that it exactly funds the UI program and other

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[7]   The average duration of being in a state, in this modeling framework, is equal to 1 divided by the probability of transitioning out that state.

social insurance programs (social assistance and unemployment assistance). The proportional tax rate is applied to both wages and benefits.

It is important to note that the duration spent in each state by the agent is stochastic and not deterministic. As described later, the states in the model are calibrated for their respective average duration and not for a fixed duration. For example, UI benefits may last for a maximum of 20 weeks therefore the average duration of UI benefit is calibrated to 20 weeks (conditional on being unemployed). The transition between states by the agent is a Markov process (discrete-time) where agents each time unit (week) face a probability of staying in their current state or moving to a different state. This is possible since transition probabilities, i.e.) the probability distribution, is unchanging over time[8]. Therefore, it is possible to solve for steady state values of being in each state and for the unemployment rate.

In summary, the framework of this paper uses a model with endogenous job search intensities, in which otherwise homogeneous agents pass through different states. Income and benefits from social programs are fixed at a pre-determined level where the accumulation of assets (savings) is not allowed. This paper uses a simplified version of the model used by Pallage et al. (2013).

4.2. Simplistic UI System

The simplified UI system consists of two states, employment and unemployment with UI benefits. Agents in this model optimize their instantaneous and expected discounted utilities via job search intensity (p). Each period an agent can either be employed (W_t) and receive an income of c_w or be unemployed (U_t) and receive a benefit of c_u, and exert an optimal level of job search. While employed, an agent can become unemployed next period with a probability of λ (job separation rate) and while unemployed an agent can become employed next period with a probability p (job search intensity). For simplicity, the job search intensity is normalized as a probability of finding employment next period. The following value state equations are specified in Equation (4.1) and (4.2). Where t is the time index, $u(.)$ the utility function, $\varphi(.)$ cost of job search, β the discount factor, τ is the tax rate that fully funds the UI system, and E [.] the expected value operator.

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[8]   This is possible since endogenous search intensities are not dependent on time.

$$W_t = u(c_w(1 - \tau)) + \beta E[U_{t+1} + W_{t+1}] \tag{4.1}$$

$$U_t = \max_p \{u(c_u(1 - \tau)) - \varphi(p) + \beta E[W_{t+1} + U_{t+1}]\} \tag{4.2}$$

Equation (4.1) and (4.2) can be simplified further since we assume in the model that the job separation rate (λ), income (c_w), benefits (c_u), and transition probabilities[9] are constants regardless of the time index (t). As a result, all state values of W_t and U_t are constant over time. Therefore, $W_t = W_{t+1} = W$ and $U_t = U_{t+1} = U$ for all values of t. The new value state equations are shown in Equation (4.3) and (4.4).

$$W = u(c_w(1 - \tau)) + \beta[\lambda U + (1 - \lambda)W] \tag{4.3}$$

$$U = \max_p \{u(c_u(1 - \tau)) - \varphi(p) + \beta[pW + (1 - p)U]\} \tag{4.4}$$

Equation (4.3) represents the value of working. While an agent is in a working state he receives an income of c_w with a utility of $u(c_w)$, and an expected utility between unemployment and employment. Also, the agent faces the risk of job loss next period with a probability λ and a probability of $(1 - \lambda)$ of staying employed next period. Figure 4.1 shows the Markov process for the simplistic UI system.

Equation (4.4) represents the value of unemployment with UI benefits. While an agent is in an unemployed state, the agent receives a benefit of c_u with a utility of $u(c_U)$, and optimizes via search intensity, p, to maximize the current state value of unemployment. Furthermore, agents receive a disutility from search effort $\varphi(p)$. With a probability of p an agent can become employed next period and with a probability $(1 - p)$ stay unemployed next period (Figure 4.1).

The agent chooses the job search intensity p such that it maximizes the value of their current (unemployment) value state. The optimal search intensity satisfies Equation (4.5) where the marginal cost of job search, $\varphi'(p)$, is equal to the marginal (discounted) benefit of job search, $\beta[W - U]$.

$$-\varphi'(p) + \beta[W - U] = 0 \tag{4.5}$$

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[9]   Transition probabilities are the probabilities of moving from one state to another (unemployment to employment and vice versa).

Figure 4.1 Simple UI Model Markov Process
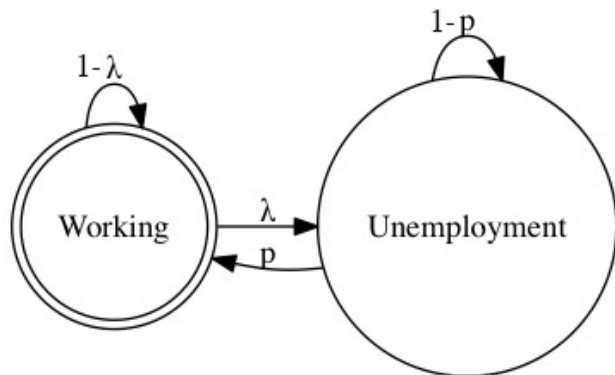
4.3. Complex UI Systems

The complex UI model can consist of many different states of unemployment and employment depending on the country being modeled. Presented in this section are the complex models of each country. These models will be similar to the simplistic UI system but with the incorporation of conditional transition probabilities.[10] The transition probabilities are represented by t_X^X, where the transition probability of moving from state X to state Y is $t_{State\,X}^{State\,Y}$ and the probability of staying in the same state X next period is $t_{State\,X}^{State\,X}$.

4.3.1. Canada

Unemployment Insurance in Canada is called Employment Insurance (EI) and will be referred to as such in this section. The modeling of Canada will incorporate:

a) Employment without EI entitlement: working but not entitled to EI benefits.

b) EI minimum qualification criteria: those who are working without EI entitlement for a certain duration, on average, will quality for minimum EI entitlement[11].

c) EI maximum qualification criteria: those who are working for a certain duration with minimum EI entitlement, on average, will quality for maximum EI entitlement[12] (max benefit duration).

---

[10]   The transition probabilities are conditional on the agent being unemployed or employed next period.

[11]   Minimum EI/UI Entitlement status refers to being qualified for EI/UI with minimum conditions met

d) Employment with EI entitlement: working and entitled to EI benefits.

e) A waiting period: a standard waiting period before receiving EI benefits.

f) Employment Insurance (EI): while unemployed receive EI benefits that last, on average, for a predetermined benefit duration. EI benefit amount and duration is dependent on EI entitlement status.

g) Social Assistance: is paid to the unemployed who exhaust their EI benefits or those who failed to qualify for EI and is paid until re-employment occurs.

This system will be modeled with three different states of employment and five different states of unemployment. The value state equations for Canada are stated in Equations (4.6) to (4.13) where W_{NoEn} is the state of working without EI entitlement, W_{MinEn} is the state of working with minimum EI entitlement, W_{MaxEn} is the state of working with maximum EI entitlement, $U_{MinWait}$ / $U_{MaxWait}$ is the waiting period state before receiving EI benefits, U_{MinEI} / U_{MaxEI} is the state of receiving EI benefits, and U_{SA} is the state of receiving social assistance benefits.[13]

$$W_{NoEn} = u(c_w(1-\tau)) + \beta\left[\lambda U_{SA} + (1-\lambda)\{t_{NoEn}^{NoEn}W_{NoEn} + t_{NoEn}^{MinEn}W_{MinEn}\}\right] \tag{4.6}$$

$$W_{MinEn} = u(c_w(1-\tau)) + \beta\left[\lambda U_{MinWait} + (1-\lambda)\{t_{MinEn}^{MinEn}W_{MinEn} + t_{MinEn}^{MaxEn}W_{MaxEn}\}\right] \tag{4.7}$$

$$W_{MaxEn} = u(c_w(1-\tau)) + \beta\left[\lambda U_{MaxWait} + (1-\lambda)W_{MaxEn}\right] \tag{4.8}$$

$$U_{MinWait} = \max_{p_{MinWait}}\left\{u(c_{Minwait}(1-\tau)) - \varphi(p_{MinWait})\right. \tag{4.9}$$
$$\left. + \beta\left[p_{MinWait}W_{NoEn} + (1-p_{MinWait})\{t_{MinWait}^{MinWait}U_{MinWait} + t_{MinWait}^{MinEI}U_{MinEI}\}\right]\right\}$$

$$U_{MaxWait} = \max_{p_{MaxWait}}\left\{u(c_{Maxwait}(1-\tau)) - \varphi(p_{MaxWait})\right. \tag{4.10}$$
$$\left. + \beta\left[p_{MaxWait}W_{NoEn} + (1-p_{MaxWait})\{t_{MaxWait}^{MaxWait}U_{MaxWait} + t_{MaxWait}^{MaxEI}U_{MaxEI}\}\right]\right\}$$

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[12]   Maximum EI/UI Entitlement status refers to being qualified for EI/UI that ensures the maximum benefit duration.

[13]   The 'max' and 'min' prefixes on the state equations denote the states related to the maximum or minimum EI/UI entitlement status. For example, an agent with the max EI entitlement would go through the $U_{MaxWait}$ and U_{MaxEI} state when unemployed.

$$U_{MinEI} = \max_{p_{MinEI}} \{u(c_{MinEI}(1-\tau)) - \varphi(p_{MinEI}) + \beta[\, p_{MinEI}W_{NoEn} \tag{4.11}$$

$$+ (1 - p_{MinEI})\{t_{MinEI}^{MinEI}U_{MinEI} + t_{MinEI}^{SA}U_{SA}\}\,]\}$$

$$U_{MaxEI} = \max_{p_{MaxEI}} \{u(c_{MaxEI}(1-\tau)) - \varphi(p_{MaxEI}) + \beta[\, p_{MaxEI}W_{NoEn} \tag{4.12}$$

$$+ (1 - p_{MaxEI})\{t_{MaxEI}^{MaxEI}U_{MaxEI} + t_{MaxEI}^{SA}U_{SA}\}\,]\}$$

$$U_{SA} = \max_{p_{SA}} \{u(c_{SA}(1-\tau)) - \varphi(p_{SA}) + \beta[\, p_{SA}W_{NoEn} + (1 - p_{SA})U_{SA}\,]\} \tag{4.13}$$

Depending on the state, an agent receives a predetermined level of income c_{state} with utility of $u(c_{State})$, and exerts an optimal level of search intensity p_{State} while unemployed. If the agent is in an unemployed state, the agent receives a disutility of $\varphi(p_{State})$ from job search. Additionally, a proportional tax rate τ is applied to all wages and benefits that fully fund the social insurance system (EI and SA).

The agent chooses the job search intensity p_{State} such that it maximizes the value of their current (unemployment) value state. The optimal set of search intensities satisfies Equations (4.14- 4.18).

$$-\varphi'(p_{MinWait}) + \beta[\, W_{NoEn} - \{t_{MinWait}^{MinWait}U_{MinWait} + t_{MinWait}^{MinEI}U_{MinEI}\}] = 0 \tag{4.14}$$

$$-\varphi'(p_{MaxWait}) + \beta[\, W_{NoEn} - \{t_{MaxWait}^{MaxWait}U_{MaxWait} + t_{MaxWait}^{MaxEI}U_{MaxEI}\}] = 0 \tag{4.15}$$

$$-\varphi'(p_{MinEI}) + \beta[\, W_{NoEn} - \{t_{MinEI}^{MinEI}U_{MinEI} + t_{MinEI}^{SA}U_{SA}\}\,] = 0 \tag{4.16}$$

$$-\varphi'(p_{MaxEI}) + \beta[\, W_{NoEn} - \{t_{MaxEI}^{MaxEI}U_{MaxEI} + t_{MaxEI}^{SA}U_{SA}\}\,] = 0 \tag{4.17}$$

$$-\varphi'(p_{SA}) + \beta[\, W_{NoEn} - U_{SA}\,] = 0 \tag{4.18}$$

The optimal search intensities for each (unemployment) value state is chosen such that the marginal cost of job search equates to the discounted marginal benefit. Since the value states are time-invariant this implies that the optimal search intensities are time-invariant as well.

Figure 4.2 shows the Markov process for the Canada model. For this model, agents who are not entitled to EI benefits (W_{NoEn}) and are unemployed next period will receive social assistance (U_{SA}). To be qualified for minimum EI entitlement (W_{MinEn}), an agent must work without EI entitlement (W_{NoEn}) for an average duration of $1/t_{NoEn}^{MinEn}$. To qualify for maximum EI entitlement (W_{MaxEn}), an agent must work for an average duration of $1/t_{MinEn}^{MaxEn}$ while entitled to

minimum EI benefits. If unemployment occurs while working with EI entitlement ($W_{StatusEn}$), an agent will go to a waiting period ($U_{StatusWait}$) before receiving EI benefits ($U_{StatusEI}$)[14]. Once EI benefits are exhausted an agent will move to social assistance (U_{SA}) During the unemployed states of the waiting period, EI benefits, and social assistance the agent has a probability of re-employment with a probability of $p_{StatusWait}$, $p_{StatusEI}$ and p_{SA}, respectively. All those who are re-employed must re-qualify for benefits and thus enter the W_{NoEn} state.

Figure 4.2 Canada Model Markov Process
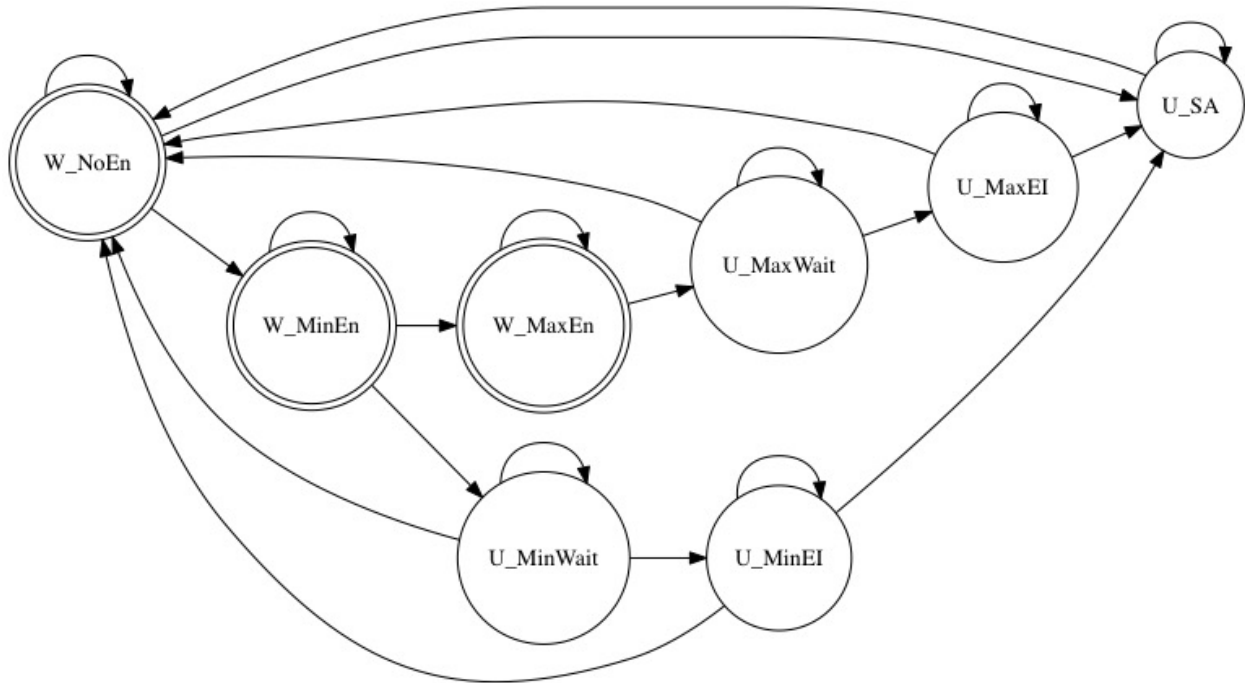
4.3.2. United States

The modeling of the United States will incorporate:

a) Employment without UI entitlement: working but not entitled to UI benefits.

b) UI qualification criteria: those who are working for a certain duration, on average, will quality for maximum UI entitlement[15] (max benefit duration).

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[14]   The prefix 'status' refers to EI Entitlement status (minimum, maximum).

[15]   Min UI Entitlement has been excluded due to the high average income data for the USA. Those who qualify with the minimum UI requirements also qualify for the maximum benefit amount, and duration (Max UI entitlement).

c) Employment with UI entitlement: working and entitled to UI benefits.

d) Unemployment Insurance: while unemployed receive UI benefits that last, on average, for a predetermined benefit duration.

e) Emergency Unemployment Compensation Tier 1-3[16]: is paid to those who exhaust UI benefits and is an extension of UI benefits.

f) Social Assistance: is paid to the unemployed who exhaust their UI benefits (including EUC Tier 1-2 benefits) or those who failed to qualify for UI and is paid until re-employment occurs

This system will be modeled with two different states of employment and two different states of unemployment. The value state equations for the United States are stated in Equations (4.19) to (4.22) where W_{NoEn} is the state of working without UI entitlement, W_{En} the state of working with UI entitlement, U_{UI} and U_{SA} is the state of receiving social assistance benefits. The state of U_{UI} also includes EUC Tier 1, 2 and 3 programs since they only provided an extension of UI benefits, which pay the same benefit amount as UI.

$$W_{NoEn} = u(c_w(1-\tau)) + \beta[\lambda U_{SA} + (1-\lambda)\{t_{NoEn}^{NoEn} W_{NoEn} + t_{NoEn}^{En} W_{En}\}] \tag{4.19}$$

$$W_{En} = u(c_W(1-\tau)) + \beta[\lambda U_{UI} + (1-\lambda)W_{En}] \tag{4.20}$$

$$U_{UI} = \max_{p_{UI}} \{u(c_{UI}(1-\tau)) - \varphi(p_{UI}) + \beta[p_{UI}W_{NoEn} + (1-p_{UI})\{t_{UI}^{UI} U_{UI} + t_{UI}^{SA} U_{SA}\}]\} \tag{4.21}$$

$$U_{SA} = \max_{p_{SA}} \{u(c_{SA}(1-\tau)) - \varphi(p_{SA}) + \beta[p_{SA} W_{NoEn} + (1-p_{SA})U_{SA}]\} \tag{4.22}$$

Depending on the state, an agent receives a predetermined level of income c_{state} with utility of $u(c_{State})$, and exerts an optimal level of search intensity p_{State} while unemployed. If the agent is in an unemployed state, the agent receives a disutility of $\varphi(p_{State})$ from job search. Additionally, a proportional tax rate τ is applied to all wages and benefits that fully fund the social insurance system (UI and SA).

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[16] EUC Tier 4 and Extended Benefits (EB) Program are excluded due to the average harmonized unemployment rate (2003-2013) being below the unemployment rate triggers for EUC Tier 3 and EB.

The agent chooses the job search intensity p_{State} such that it maximizes the value of their current (unemployment) value state. The optimal set of search intensities satisfies Equations (4.23 - 4.24).

$$-\varphi'(p_{UI}) + \beta[\, W_{NoEn} - \{t_{UI}^{UI} U_{UI} + t_{UI}^{SA} U_{SA}\} = 0 \tag{4.23}$$

$$-\varphi'(p_{SA}) + \beta[\, W_{NoEn} - U_{SA}\,] = 0 \tag{4.24}$$

The optimal search intensities for each (unemployment) value state is chosen such that the marginal cost of job search equates to the discounted marginal benefit.

Figure 4.3 shows the Markov process for the United States model. For this model, agents who are not entitled to UI benefits (W_{NoEn}) and are unemployed next period will receive social assistance (U_{SA}). To be qualified for UI entitlement (W_{En}), an agent must work without UI entitlement (W_{NoEn}) for an average duration of $1/t_{NoEn}^{En}$. If unemployment occurs while working with UI entitlement (W_{En}), an agent will go to a state that pays UI benefits (U_{UI}). Once UI benefits are exhausted, including the benefit duration extension from EUC Tier 1 to Tier 3, an agent will move to social assistance (U_{SA}). During the unemployed states of UI benefits and the social assistance, an agent has a probability of re-employment with a probability of p_{UI} and p_{SA}, respectively. All those who are re-employed must re-qualify for benefits and thus enter the W_{NoEn} state.

Figure 4.3 United States Model Markov Process
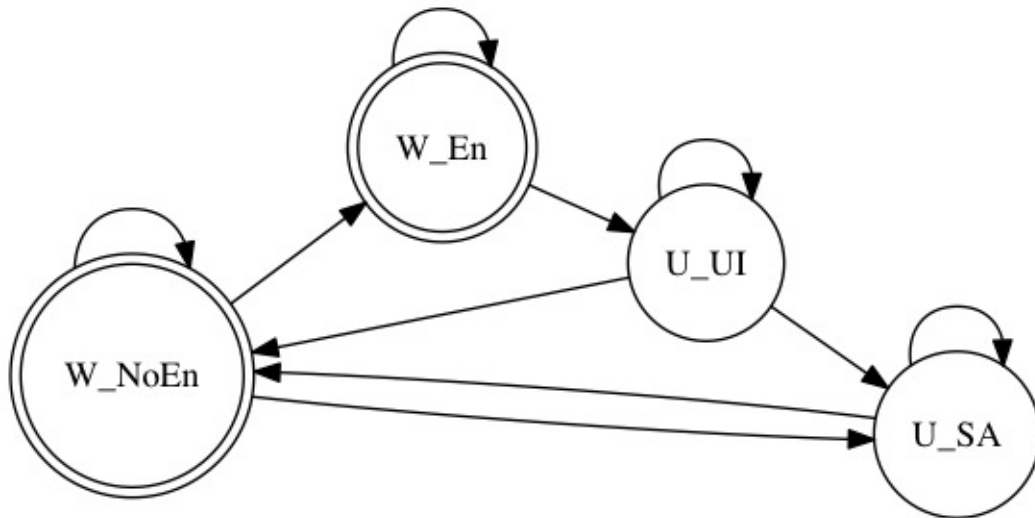
4.3.3. Germany (Pre-Reform)

The modeling of pre-reform Germany will incorporate:

a) Employment without UI entitlement: working but not entitled to UI benefits.

b) UI minimum qualification criteria: those who are working without UI entitlement for a certain duration, on average, will quality for minimum UI entitlement.

c) UI maximum qualification criteria: those who are working for a certain duration with minimum UI entitlement, on average, will quality for maximum UI entitlement (max benefit duration).

d) Unemployment Insurance: while unemployed receive UI benefits that last, on average, for a predetermined benefit duration. UI benefit amount and duration is dependent on EI entitlement status.

e) Unemployment Assistance[17]: is paid to the unemployed who exhaust their UI benefits or those who failed to qualify for UI and is paid until re-employment occurs.

This system will be modeled with three different states of employment and three different states of unemployment. The value state equations for Germany (pre-reform) are stated in Equations (4.25) to (4.30) where W_{NoEn} is the state of working without UI entitlement, W_{MinEn} is the state of working with minimum UI entitlement, W_{MaxEn} is the state of working with maximum UI entitlement, U_{MinUI} / U_{MaxUI} is the state of receiving UI benefits, and U_{UA} is the state of receiving unemployment assistance (UA) benefits.

$$W_{NoEn} = u(c_w(1-\tau)) + \beta\left[\lambda U_{UA} + (1-\lambda)\{t_{NoEn}^{NoEn}W_{NoEn} + t_{NoEn}^{MinEn}W_{MinEn}\}\right] \tag{4.25}$$

$$W_{MinEn} = u(c_w(1-\tau)) + \beta\left[\lambda U_{MinUI} + (1-\lambda)\{t_{MinEn}^{MinEn}W_{MinEn} + t_{MinEn}^{MaxEn}W_{MaxEn}\}\right] \tag{4.26}$$

$$W_{MaxEn} = u(c_w(1-\tau)) + \beta\left[\lambda U_{MaxUI} + (1-\lambda)W_{MaxEn}\right] \tag{4.27}$$

$$U_{MinUI} = \max_{p_{MinUI}} \{u(c_{MinUI}(1-\tau) - \varphi(p_{MinUI}) \tag{4.28}$$
$$+ \beta\left[p_{MinUI}W_{NoEn} + (1-p_{MinUI})\{t_{MinUI}^{MinUI}U_{MinUI} + t_{MinUI}^{UA}U_{UA}\}\right]\}$$

---

[17]   Social Assistance has been omitted due to the UA qualification criteria and use of an Infinite-Horizon Model. See Section 6.2 (UI Policy Calibration) for more details.

$$U_{MaxUI} = \max_{p_{MaxUI}} \{u(c_{MaxUI}(1 - \tau) - \varphi(p_{MaxUI}) \tag{4.29}$$

$$+ \beta[\, p_{MaxUI}W_{NoEn} + (1 - p_{MaxUI})\{t_{MaxUI}^{MaxUI} U_{MaxUI} + t_{MaxUI}^{UA} U_{UA}\}\,]\}$$

$$U_{UA} = \max_{p_{UA}} \{u(c_{UA} - \tau) - \varphi(p_{UA}) + \beta[\, p_{UA}W_{NoEn} + (1 - p_{UA})U_{UA}\,]\} \tag{4.30}$$

Depending on the state, an agent receives a predetermined level of income c_{state} with utility of $u(c_{State})$, and exerts an optimal level of search intensity p_{State} while unemployed. If the agent is in an unemployed state, the agent receives a disutility of $\varphi(p_{State})$ from job search. Additionally, a proportional tax rate τ is applied to all wages and benefits that fully fund the social insurance system (UI and UA).

The agent chooses the job search intensity p_{State} such that it maximizes the value of their current (unemployment) value state. The optimal set of search intensities satisfies Equations (4.31- 4.33).

$$-\varphi'(p_{MinUI}) + \beta[\, W_{NoEn} - \{t_{MinUI}^{MinUI} U_{MinUI} + t_{MinUI}^{UA} U_{UA}\}\,] \tag{4.31}$$

$$-\varphi'(p_{MaxUI}) + \beta[\, W_{NoEn} - \{t_{MaxUI}^{MaxUI} U_{MaxUI} + t_{MaxUI}^{UA} U_{UA}\}\,] \tag{4.32}$$

$$-\varphi'(p_{SA}) + \beta[\, W_{NoEn} - U_{SA}\,] \tag{4.33}$$

The optimal search intensities for each value state is chosen such that the marginal cost of job search equates to the discounted marginal benefit.

Figure 4.4 shows the Markov process of the Germany pre-reform model. To qualify for minimum UI entitlement (W_{MinEn}) an agent will have to work an average duration $1/t_{NoEn}^{MinEn}$ without UI entitlement (W_{NoEn}) and an agent can work an additional average duration of $1/t_{MinEn}^{MaxEn}$ to quality for maximum UI entitlement (W_{MaxEn}). Agents that become unemployed without UI coverage will receive unemployment assistance (U_{UA}) next period until re-employment occurs. For those who become unemployed with UI coverage will receive UI benefits next period ($U_{StatusUI}$) up to a maximum duration determined by UI entitlement status. Those who exhausted UI benefits will receive unemployment assistance (U_{UA}) until re-employment occurs. During all states of unemployment $U_{StatusUI}$, and U_{UA} agents have a probability of employment at probability $p_{StatusUI}$ and p_{UA}, respectively. All those who are re-employed must re-qualify for benefits and thus enter the W_{NoEn} state.

Figure 4.4 Germany (Pre-Reform) Model Markov Process
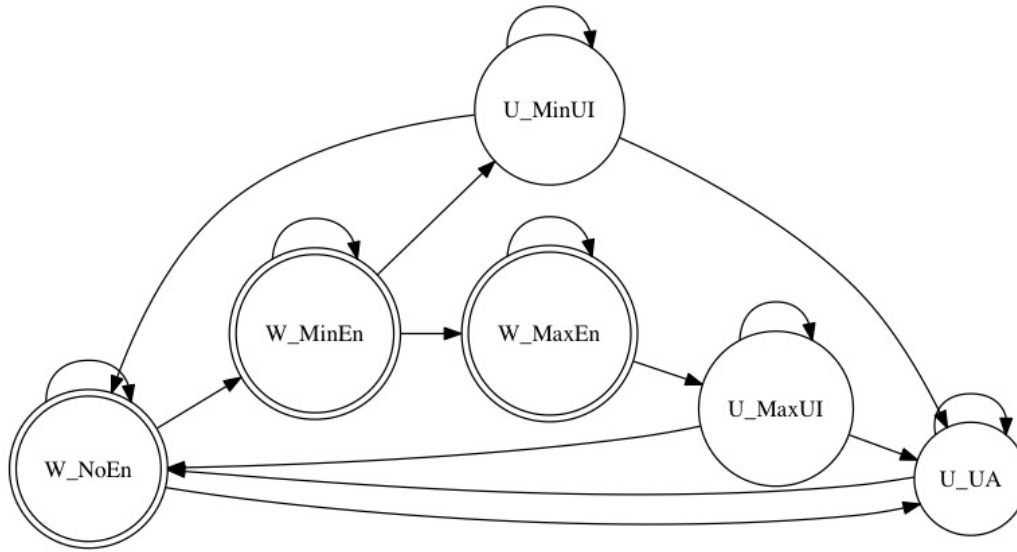
4.3.4. Germany (Post-Reform)

The modeling of post-reform Germany will incorporate:

a) Employment without UI entitlement: working but not entitled to UI benefits.

b) UI minimum qualification criteria: those who are working without UI entitlement for a certain duration, on average, will quality for minimum UI entitlement.

c) UI maximum qualification criteria: those who are working for a certain duration with minimum UI entitlement, on average, will quality for maximum UI entitlement (max benefit duration).

d) Unemployment Insurance: while unemployed receive UI benefits that last, on average, for a predetermined benefit duration. UI benefit amount and duration is dependent on EI entitlement status.

e) Unemployment Assistance/Social Assistance: is paid to the unemployed who exhaust their UI benefits or those who failed to qualify for UI and is paid until re-employment occurs.

This system will be modeled with three different states of employment and three different states of unemployment. The value state equations for Germany (post-reform) are stated in

Equations (4.34) to (4.39) where W_{NoEn} is the state of working without UI entitlement, W_{MinEn} is the state of working with minimum UI entitlement, W_{MaxEn} is the state of working with maximum UI entitlement, U_{MinUI} / U_{MaxUI} is the state of receiving UI benefits, and $U_{UA/SA}$ is the state of receiving unemployment assistance/social assistance benefits.

$$W_{NoEn} = u(c_w(1 - \tau)) + \beta\big[\lambda U_{UA/SA} + (1 - \lambda)\{t_{NoEn}^{NoEn} W_{NoEn} + t_{NoEn}^{MinEn} W_{MinEn}\}\big] \qquad (4.34)$$

$$W_{MinEn} = u\big(c_w(1 - \tau)\big) + \beta\big[\lambda U_{MinUI} + (1 - \lambda)\{t_{MinEn}^{MinEn} W_{MinEn} + t_{MinEn}^{MaxEn} W_{MaxEn}\}\big] \qquad (4.35)$$

$$W_{MaxEn} = u\big(c_w(1 - \tau)\big) + \beta\big[\lambda U_{MaxUI} + (1 - \lambda) W_{MaxEn}\big] \qquad (4.36)$$

$$U_{MinUI} = \max_{p_{MinUI}} \{u(c_{MinUI}(1 - \tau) - \varphi(p_{MinUI}) \qquad (4.37)$$
$$+ \beta\big[p_{MinUI} W_{NoEn} + (1 - p_{MinUI})\{t_{MinUI}^{MinUI} U_{MinUI} + t_{MinUI}^{UA/SA} U_{UA/SA}\}\big]\}$$

$$U_{MaxUI} = \max_{p_{MaxUI}} \{u(c_{MaxUI}(1 - \tau) - \varphi(p_{MaxUI}) \qquad (4.38)$$
$$+ \beta\big[p_{MaxUI} W_{NoEn} + (1 - p_{MaxUI})\{t_{MaxUI}^{MaxUI} U_{MaxUI} + t_{MaxUI}^{UA/SA} U_{UA/SA}\}\big]\}$$

$$U_{UA/SA} = \max_{p_{UA/SA}} \{u\big(c_{UA/SA} - \tau\big) - \varphi\big(p_{UA/SA}\big) + \beta\big[p_{UA/SA} W_{NoEn} + \big(1 - p_{UA/SA}\big)U_{UA/SA}\big]\} \qquad (4.39)$$

Depending on the state, an agent receives a predetermined level of income c_{state} with utility of $u(c_{State})$, and exerts an optimal level of search intensity p_{State} while unemployed. If the agent is in an unemployed state, the agent receives a disutility of $\varphi(p_{State})$ from job search. Additionally, a proportional tax rate τ is applied to all wages and benefits that fully fund the social insurance system (UI and UA/SA).

The agent chooses the job search intensity p_{State} such that it maximizes the value of their current (unemployment) value state. The optimal set of search intensities satisfies Equations (4.40- 4.42).

$$-\varphi'(p_{MinUI}) + \beta\big[W_{NoEn} - \{t_{MinUI}^{MinUI} U_{MinUI} + t_{MinUI}^{UA/SA} U_{UA/SA}\}\big] \qquad (4.40)$$

$$-\varphi'(p_{MaxUI}) + \beta\big[W_{NoEn} - \{t_{MaxUI}^{MaxUI} U_{MaxUI} + t_{MaxUI}^{UA/SA} U_{UA/SA}\}\big] \qquad (4.41)$$

$$-\varphi'(p_{UA/SA}) + \beta\big[W_{NoEn} - U_{UA/SA}\big] \qquad (4.42)$$

The optimal search intensities for each value state is chosen such that the marginal cost of job search equates to the discounted marginal benefit.

Figure 4.5 shows the Markov process of the Germany post-reform model. To qualify for minimum UI entitlement (W_{MinEn}) an agent will have to work an average duration $1/t_{NoEn}^{En}$ without UI entitlement (W_{NoEn}) and work an additional average duration of $1/t_{MinEn}^{MaxEn}$ to qualify for maximum UI entitlement (W_{MaxEn}). Only those with UI coverage will receive UI benefits ($U_{StatusUI}$) when unemployment occurs; maximum duration of UI benefits depend on UI entitlement status. Those who exhausted UI benefits or failed to have UI entitlement (W_{NoEn}) will receive unemployment assistance/social assistance ($U_{UA/SA}$) until re-employment occurs. All those who are re-employed must re-qualify for benefits and thus enter the W_{NoEn} state.

Figure 4.5 Germany (Post-Reform) Model Markov Process
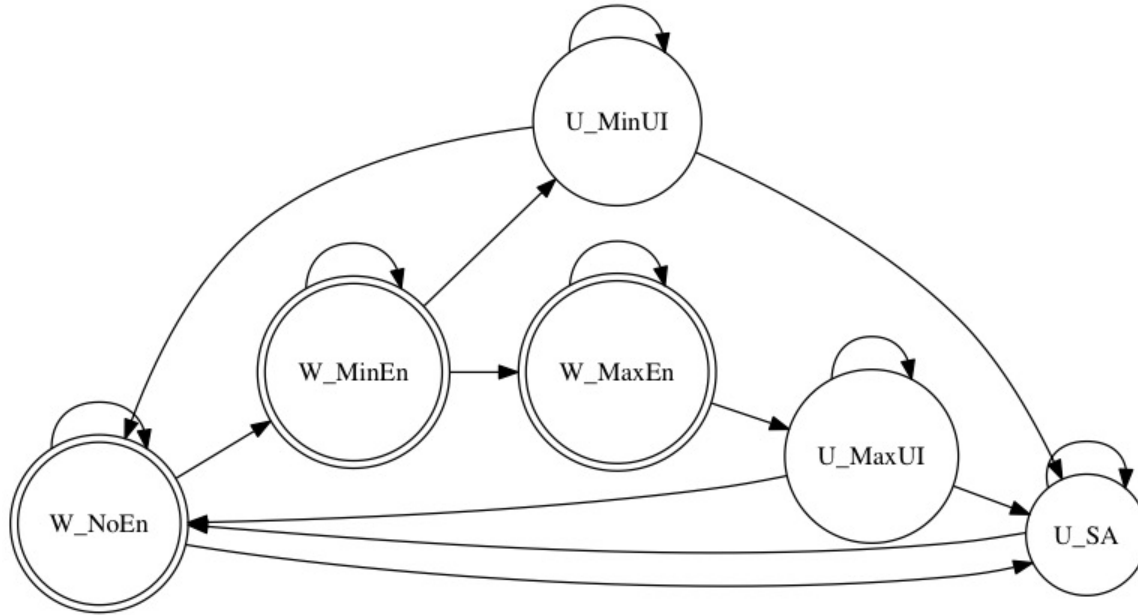
4.3.5. France

The modeling of France will incorporate:

a) Employment without UI entitlement: working but not entitled to UI benefits.

b) UI minimum qualification criteria: those who are working without UI entitlement for a certain duration, on average, will quality for minimum UI entitlement.

c) UI maximum qualification criteria: those who are working for a certain duration with minimum UI entitlement, on average, will quality for maximum UI entitlement (max benefit duration).

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d) Employment with UI entitlement: working and entitled to UI benefits.

e) A waiting period: a standard waiting period before receiving UI benefits.

f) Unemployment Insurance: while unemployed receive UI benefits that last, on average, for a predetermined benefit duration. UI benefit amount and duration is dependent on EI entitlement status.

g) Social Assistance[18]: is paid to the unemployed who exhaust their UI benefits or those who failed to qualify for UI and is paid until re-employment occurs.

This system will be modeled with three different states of employment and five different states of unemployment. The value state equations for France are stated in Equations (4.43) to (4.50) where W_{NoEn} is the state of working without UI entitlement, W_{MinEn} is the state of working with minimum EI entitlement, W_{MaxEn} is the state of working with maximum UI entitlement, $U_{MinWait}$ / $U_{MaxWait}$ is the waiting period state before receiving UI benefits, U_{MinEI} / U_{MaxEI} is the state of receiving EI benefits, and U_{SA} is the state of receiving social assistance benefits.

$$W_{NoEn} = u(c_w(1-\tau)) + \beta\left[\lambda U_{SA} + (1-\lambda)\{t_{NoEn}^{NoEn} W_{NoEn} + t_{NoEn}^{MinEn} W_{MinEn}\}\right] \tag{4.43}$$

$$W_{MinEn} = u(c_w(1-\tau)) + \beta\left[\lambda U_{MinWait} + (1-\lambda)\{t_{MinEn}^{MinEn} W_{MinEn} + t_{MinEn}^{MaxEn} W_{MaxEn}\}\right] \tag{4.44}$$

$$W_{MaxEn} = u(c_w(1-\tau)) + \beta\left[\lambda U_{MaxWait} + (1-\lambda)W_{MaxEn}\right] \tag{4.45}$$

$$U_{MinWait} = \max_{p_{MinWait}} \{u(c_{Minwait}(1-\tau)) - \varphi(p_{MinWait}) \tag{4.46}$$
$$+ \beta\left[p_{MinWait} W_{NoEn} + (1-p_{MinWait})\{t_{MinWait}^{MinWait} U_{MinWait} + t_{MinWait}^{MinUI} U_{MinUI}\}\right]\}$$

$$U_{MaxWait} = \max_{p_{MaxWait}} \{u(c_{Maxwait}(1-\tau)) - \varphi(p_{MaxWait}) \tag{4.47}$$
$$+ \beta\left[p_{MaxWait} W_{NoEn} + (1-p_{MaxWait})\{t_{MaxWait}^{MaxWait} U_{MaxWait} + t_{MaxWait}^{MaxUI} U_{MaxUI}\}\right]\}$$

$$U_{MinUI} = \max_{p_{MinUI}} \{u(c_{MinUI}(1-\tau)) - \varphi(p_{MinUI}) + \beta[p_{MinUI} W_{NoEn} \tag{4.48}$$
$$+ (1-p_{MinUI})\{t_{MinUI}^{MinUI} U_{MinUI} + t_{MinUI}^{SA} U_{SA}\}]\}$$

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[18]   Unemployment Assistance has been removed since Social Assistance pays out the same benefit amount and UA is offered for an indefinite duration similar to Social Assistance.

$$U_{MaxUI} = \max_{p_{MaxUI}} \{u(c_{MaxUI}(1-\tau)) - \varphi(p_{MaxUI}) + \beta[\,p_{MaxUI}W_{NoEn} \tag{4.49}$$

$$+ (1-p_{MaxUI})\{t_{MaxUI}^{MaxUI}U_{MaxUI} + t_{MaxUI}^{SA}U_{SA}\}\,]\}$$

$$U_{SA} = \max_{p_{SA}} \{u(c_{SA}(1-\tau)) - \varphi(p_{SA}) + \beta[\,p_{SA}W_{NoEn} + (1-p_{SA})U_{SA}\,]\} \tag{4.50}$$

Depending on the state, an agent receives a predetermined level of income c_{state} with utility of $u(c_{State})$, and exerts an optimal level of search intensity p_{State} while unemployed. If the agent is in an unemployed state, the agent receives a disutility of $\varphi(p_{State})$ from job search. Additionally, a proportional tax rate τ is applied to all wages and benefits that fully fund the social insurance system (UI, UA, and SA).

The agent chooses the job search intensity p_{State} such that it maximizes the value of their current (unemployment) value state. The optimal set of search intensities satisfies Equations (4.51- 4.55).

$$-\varphi'(p_{MinWait}) + \beta[\,W_{NoEn} - \{t_{MinWait}^{MinWait}U_{MinWait} + t_{MinWait}^{MinUI}U_{MinUI}\}] = 0 \tag{4.51}$$

$$-\varphi'(p_{MaxWait}) + \beta[\,W_{NoEn} - \{t_{MaxWait}^{MaxWait}U_{MaxWait} + t_{MaxWait}^{MaxUI}U_{MaxUI}\}] = 0 \tag{4.52}$$

$$-\varphi'(p_{MinUI}) + \beta[\,W_{NoEn} - \{t_{MinUI}^{MinUI}U_{MinUI} + t_{MinUI}^{SA}U_{SA}\}\,] = 0 \tag{4.53}$$

$$-\varphi'(p_{MaxUI}) + \beta[\,W_{NoEn} - \{t_{MaxUI}^{MaxUI}U_{MaxUI} + t_{MaxUI}^{SA}U_{SA}\}\,] = 0 \tag{4.54}$$

$$-\varphi'(p_{SA}) + \beta[\,W_{NoEn} - U_{SA}\,] = 0 \tag{4.55}$$

The optimal search intensities for each value state is chosen such that the marginal cost of job search equates to the discounted marginal benefit.

Figure 4.6 shows the Markov process for the France model. To qualify for minimum UI entitlement, and move to state W_{MinEn}, an agent must work for an average duration of $1/t_{NoEn}^{MinEn}$ without UI coverage (W_{NoEn}) and an additional average duration of $1/t_{MinEn}^{MaxEn}$ for maximum UI entitlement (W_{MaxEn}). If unemployment occurs while the agent is not entitled to UI benefits, they move to social assistance (U_{SA}) next period and will remain in that state until re-employment occurs. If unemployment occurs while the agent is entitled to UI benefits, the agent moves to a mandatory waiting period ($U_{StatusWait}$) before UI benefits begin ($U_{StatusUI}$); the duration of UI benefits depends on UI entitlement status. When the agent exhausts UI benefits the agents moves

to social assistance (U_{SA}) until re-employment occurs. While the agent is unemployed in state $U_{StatusWait}$, $U_{StatusUI}$, or U_{SA} the probability of re-employment is $p_{StatusWait}$, $p_{StatusUI}$, and p_{SA}, respectively. All those who are re-employed must re-qualify for benefits and thus enter the W_{NoEn} state.

Figure 4.6 France Model Markov Process
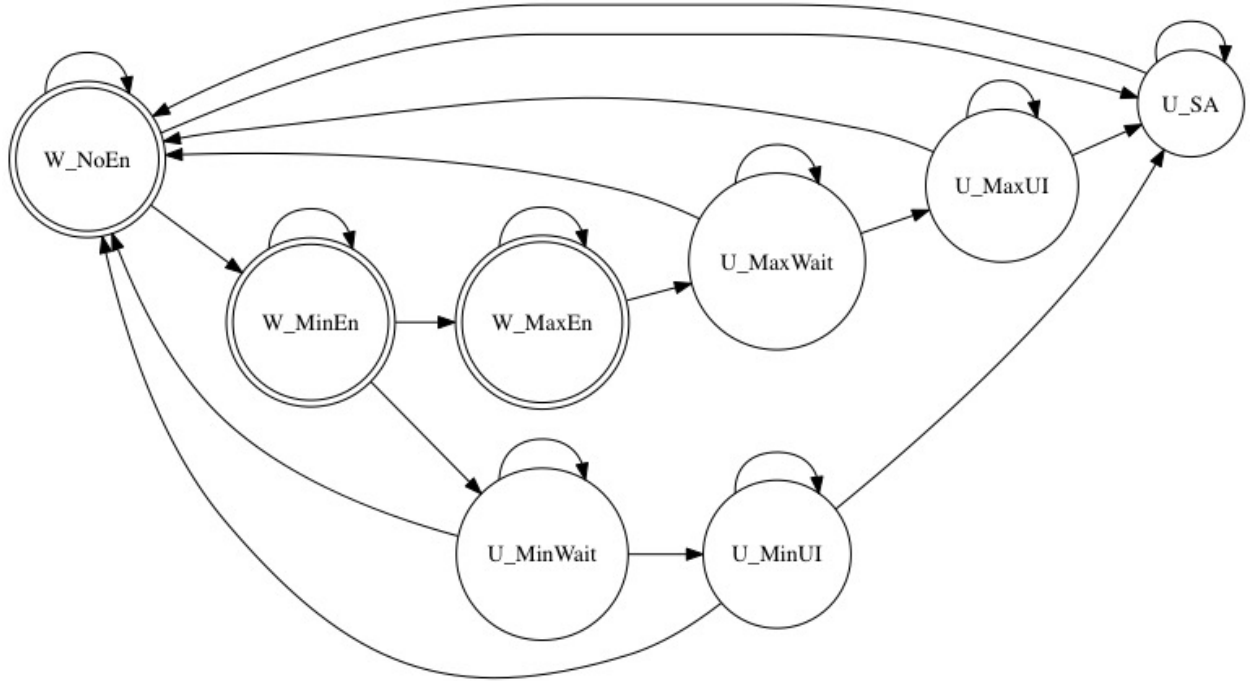
5. MEASUREMENT STRATEGY

5.1. Generosity Metric

 To measure the generosity of a country's UI system, an approach similar to Pallage et al. (2013) is utilized. In their paper, the authors first calculate the average utility from their complex UI model. Next, the simple model is solved for a replacement ratio where agents are indifferent between the complex and simple UI policies in terms of average utility. Thus, the replacement ratio is determined such that the average utility in the simple model equates to the one in the complex model. This paper will use the same technique but with a different matching criterion.

The generosity metric, in this paper, uses the ratio of the utility from unemployment to employment as the matching criterion. Utility units are converted to consumption equivalents for easier interpretation. It must be noted that the use of utility or consumption equivalents yields identical results.

The ratio of consumption equivalents of unemployment to unemployment will be referred to as the consumption equivalent ratio. The generosity metric will first involve converting the welfare of employment and unemployment into its consumption equivalent. Using utility functions, the consumption equivalent solves for the consumption required to obtain a level of welfare or utility. For the simple model, the consumption equivalent of employment ($\bar{C}_w$) and unemployment ($\bar{C}_u$) is formulated as:

$$W = \sum_{s=t}^{\infty} \beta^{s-t} U(\bar{C}_w) \quad \rightarrow \quad (1-\beta)W = U(\bar{C}_w) \quad \rightarrow \quad \bar{C}_w = U^{-1}((1-\beta)W) \tag{5.1}$$

$$U = \sum_{s=t}^{\infty} \beta^{s-t} U(\bar{C}_u) \quad \rightarrow \quad (1-\beta)U = U(\bar{C}_u) \quad \rightarrow \quad \bar{C}_u = U^{-1}((1-\beta)U) \tag{5.2}$$

Where $U^{-1}(.)$[19] is the inverse of the utility function and W and U represent total welfare of employment and unemployment. It should be noted that the values of $(1-\beta)W$ and $(1-\beta)U$ reduce the welfare values into the average period utility of being employed and

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19   Assuming natural log utility, the inverse utility function would be the exponent function.

unemployed, respectively. The consumption equivalent ratio (Ω_S) is defined for the simple model in Equation 5.3.

$$\Omega_S = \frac{\overline{C}_U}{\overline{C}_W} = \frac{U^{-1}(\frac{1}{1-\beta}U)}{U^{-1}(\frac{1}{1-\beta}W)} \tag{5.3}$$

Equation (5.3) measures the equivalent consumption between employment and unemployment. It can be thought of in two ways, either as a consumption equivalent replacement ratio between unemployment and employment, or as a consumption drop from employment to unemployment (1-Ω_S). For example, a value of 0.3 would signify a replacement ratio of 0.3 where 30% of consumption equivalent income in the working period is earned while unemployed, or it can also be interpreted as the inverse where consumption drops by 70% when going from employment to unemployment.

Similarly for the complex model the consumption equivalent ratio is stated in Equation (5.4), where $\widetilde{W}$ and $\widetilde{U}$ are the welfare values of employment and unemployment, and $\bar{c}_{\widetilde{W}}$ and $\bar{c}_{\widetilde{U}}$ are the consumption equivalents of $\widetilde{W}$ and $\widetilde{U}$.

$$\Omega_C = \frac{\overline{C}_{\widetilde{W}}}{\overline{C}_{\widetilde{U}}} = \frac{U^{-1}((1-\beta)\widetilde{W})}{U^{-1}((1-\beta)\widetilde{U})} \tag{5.4}$$

To measure generosity, the simple model's consumption equivalent ratio (Ω_S) is matched to the complex model's consumption equivalent ratio (Ω_C). To match the consumption equivalent ratios, a replacement ratio in the simple model is calculated such that it satisfies Equation (5.5).

$$\Omega_C = \Omega_S = \frac{\overline{C}_W}{\overline{C}_U} = \frac{U^{-1}((1-\beta)\widetilde{W})}{U^{-1}((1-\beta)\widetilde{U})} = \frac{U^{-1}((1-\beta)W)}{U^{-1}((1-\beta)U)} \tag{5.5}$$

The replacement ratio in the simple UI system that satisfies Equation (5.5) is the measure of generosity. This final generosity metric will be defined as θ, where:

$$\theta = f(Simple\ UI\ Model, \Omega_C) \text{ such that } \theta \text{ equates } \Omega_S = \Omega_c$$

5.2.   Pallage, Scruggs and Zimmermann (PSZ) Generosity Metric

The generosity measure used by Pallage et al. (2013) is briefly summarized here; the generosity metric by Pallage et al. (2013) will be referred to as the PSZ metric. The calculation of the PSZ metric is identical to the generosity metric in the previous section, but with one difference: the average period utility is used as the matching criteria instead of the utility drop from moving from employment to unemployment (consumption equivalent ratio).

Using the same approach as the previous section, the PSZ generosity measure is calculated by matching the simple model and the complex model based on average period utility. Average period utility is first calculated from the complex model. The replacement ratio/benefit that make agents in the simple model indifferent to the complex model, in terms of average period utility, is the measure of PSZ generosity.

Alongside the generosity metric and efficiency metric (see next section), the PSZ measure will be generated. In the results sections, comparisons will be made between the PSZ metric and generosity metric of this paper.

5.3.   Efficiency Metric

Measuring generosity alone may not be enough to compare different UI policies. A country may be generous, by our definition, but it says very little about the cost or efficiency of the UI policy itself. Therefore, another metric will be investigated to give another dimension of comparison when evaluating different UI systems.

Along with generating a measure of generosity, another metric will be used to compare the efficiency of each UI system. The average utility from the complex model will be compared to the average utility of a benchmark system[20]. Efficiency, in this context, is based on the criterion of average utility/welfare relative to a benchmark system. The benchmark system will be defined as the simple model that pays out an optimal amount of UI benefits such that the total welfare/average utility is maximized.[21] It should be noted that the optimal UI benefits in the

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[20]   This cannot be called an efficient system because the model may not be a globally efficient system.

[21]   The reason why the simple model or simple UI scheme is used is because it has only one variable to optimize welfare with (UI benefits). Using a more complex UI system as the benchmark would

benchmark model do not equal or exceed employment wages due to the inclusion of tax. As benefits increase, the tax rate rises proportionally in order to fund the UI program; to the agent, there is always a cost to increasing UI benefits. Without this assumption, increases in UI benefits will always make agents better off. Finally, the efficiency measure will be reported as the percentage change in average period utility of moving from the benchmark system to the realistic UI system. The purpose of adding an efficiency measure is to facilitate comparisons of UI systems along two dimensions.

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complicate the optimization problem since there many UI parameters to optimize with such as benefit duration, qualification criteria and benefit payouts schemes.

6. ANALYSIS

6.1. Functional Form Assumptions

The modeling up to this point has been generalized with no specifics given on the functions and values of some parameters. The time unit in these models is calibrated assuming weekly intervals. What follows is a comprehensive overview of the assumptions and functions of the models.

Discount Factor: Since the time unit is weekly, the discount rate will be equal to β=0.999014077 which corresponds to an annual discount rate of 5%.

Utility Function: The constant relative risk aversion (CRRA) utility function is used in this study. It is specified in Equation (6.1), where c is consumption and γ is the coefficient of risk aversion. The baseline case will assume a risk aversion $\gamma = 3$. The sensitivity analysis will run results for $\gamma = 1$ and $\gamma =5$.

$$U(C) = \frac{(c^{1-\gamma})}{1 - \gamma} \ for \ \gamma > 0 \ and \ \gamma \neq 1 \tag{6.1}$$

$$= \ln(C) \quad for \ \gamma = 1$$

Consumption Equivalent: The consumption equivalent calculations involve the present value of welfare for W or U (average period utility) and the inverse functions of the utility function. The inverse functions for CRRA utility functions are shown below in Equation (6.2) where CE is consumption equivalent, ω the welfare value (of unemployment or employment), β the discount factor, and γ the coefficient of risk aversion.

$$CE = ((1 - \beta)(\omega)(1 - \gamma))^{\frac{1}{(1-\gamma)}} \ for \ \gamma > 0 \ and \ \gamma \neq 1 \tag{6.2}$$

$$= \exp\big((1 - \beta)\omega\big) \quad for \ \gamma = 1$$

Risk Aversion: The risk aversion parameter of the utility function, γ, in the base case, is initially set at 3. Other risk aversion parameters will be investigated in the sensitivity analysis.

Job Search Cost Function: The cost of job search function is taken from Kroft and Notowidigdo (2010). Equation (6.3) represents the cost of job search function, where p is the search intensity,

α is a scalar and δ is the elasticity of search costs with respect to search effort. Hence, higher δ increases the marginal cost of job search (Kroft & Notowidigdo, 2010). The 'exponent' parameter will be set at $\delta = 2$.

$$\varphi(p) = \alpha \frac{p^\delta}{\delta}$$
(6.3)

Search Intensities: Job search intensities, p, are bounded between 0 and 1 and are simplified to the probability of entering employment next period.

6.2.   UI Policy Calibration

This section elaborates on the assumptions made when modeling the UI polices of each country. These assumptions will determine on how to model UI in terms of parameters. What follows are the UI policy and modeling assumptions.

UI Policy: The UI systems of the United States and Canada have policies that depend on the unemployment rate. For Canada, eligibility and benefit duration vary depending on the *regional* unemployment rate. For the United States, the EUC Tier 1-3 and Extended Benefits (EB) program are triggered if the *state* unemployment rate surpasses a pre-determined threshold. It is assumed the UI polices are based on the average unemployment rate used in the calibration process. For the United States, EUC Tier 4 and EB were not modeled due to the average unemployment rate being below the unemployment triggers. For Canada, the maximum benefit duration of 45 weeks is reduced to 40 weeks. Additionally, the modeling of UI policy uses 2010 (2002 for Germany pre-reform) as the reference year; for all countries, except USA, policy rules through out their respective study periods remained the same. Before 2008, the EUC and EB programs were not implemented in the USA. A longer study period is used for the USA to obtain better long-run values for the unemployment rate and share of short-term unemployment.

Unemployment/Social Assistance Policy: For Germany (Pre-Reform) and France some unemployment benefit programs have been removed from the modeling process. France's unemployment assistance program was not modeled due to its similarity to the social assistance program in place; UA paid out the same benefit amount and is also offered for an indefinite duration after UI benefits are exhausted. Germany's (Pre-Reform) social assistance program is omitted from the model because of the UA qualification criteria and use of an infinite-horizon

model. The qualifying criterion for UA was essentially one day of UI or UA benefits within the last year (and other conditions). This means that once someone qualifies for UI benefits at some point in his life, he will (in this model) always qualify at least for UA (when he loses the job, he either qualifies for UI or he has only been working for a very short time, i.e. he received UA benefits recently, therefore he qualifies for UA again. In an infinite-horizon model, everyone eventually qualifies for UA, so social assistance is omitted from the model.

Qualification for UI: Agents in the model can qualify for UI with the minimum or the maximum UI entitlement. Agents must first qualify for the minimum UI entitlement, which requires the minimum conditions to be met. Those with minimum UI entitlement can progress to maximum UI entitlement (max UI duration) if additional requirements (work-hours) are met. This was done for all countries except the United States. Due to the average income level for the United States, agents who qualify with the minimum requirements for UI are automatically entitled to the maximum benefit amount and benefit duration.

Duration of UI: Due to the previous assumption, agents will receive UI benefits, on average, for the minimum or maximum possible benefit duration (depending UI entitlement status).

Waiting Period: It is assumed for the countries, with a mandatory waiting period, that income during the waiting period equals the benefits from social assistance. The role of social assistance is to guarantee a minimum amount of income for basic needs and shelter. Therefore, it is assumed that that no person should receive less than the minimum amount of income, determined by the government, necessary for basic needs and shelter. The income during the waiting period will be funded by taxes. This can be thought of as savings by the agent, but collected and distributed by the government.

6.3. Data

This section will detail how average income and benefits from unemployment insurance, unemployment assistance, and social assistance are calculated for each country. Additionally, a brief explanation is provided on the calculation of the unemployment rate and the share of short-term unemployment for use during the calibration process. Data for the harmonized unemployment rates, unemployment by duration, consumer price indices, and average/net

income data was collected from the OECD. Additional data on UI and SA benefits amounts over the years was also obtained from OECD (2015).

Study Period: The data for the income and benefit calculations, unemployment rate, and the share of short-term unemployment by duration will utilize data collected over a long time period instead of a single year. In regards to the unemployment rate and the short term-unemployment data, this is done to average out any effects of business cycle fluctuations of those variables. For Canada, United States, and France data is collected from 2003 to 2013 (ten years). Data is taken from 2000-2005 for Germany (pre-reform) and 2008-2013 for Germany (post-reform).

Unemployment Rate & Unemployment by Durations: For each country, the harmonized unemployment rates and unemployment by durations were averaged over the study period to give the average unemployment rate and the share of short-term unemployment (unemployment lasting a maximum of 3 months) used in the calibration of the models.

Calculation of Average Income: Income data is taken from the OECD Taxing Wages Reports from 2000 to 2013. For each year the OECD calculates the average gross and net annual wages of a full time worker who is employed in manual or non-manual labour. For this paper, the average annual wages for each year were adjusted for inflation, using 2010 currency, and averaged to give the *adjusted*[22] average income used in the models. This was done for each country and was calculated using net income. Due to the use of average full-time wages it is assumed that agents in the model are employed full-time.

Income and Benefits: The results of this paper use net average income and net benefits from unemployment (when applicable).

Calculation of Net Unemployment Benefits: Gross benefits amounts, during unemployment, are calculated using 2010 policy data. When applicable, the calculation of taxes payable for unemployment benefits is based on the annualised benefit amount. The tax calculation uses 2010 taxation rules for each country to determine the net benefits.

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[22]   Adjusted is used to differentiate between the OECD average income estimates for each year and the average income calculated for use in this paper.

Social Assistance Benefits: Social assistance for Canada, France, and Germany includes a housing allowance component. For United States this is not the case, therefore housing assistance benefits are included in the calculation of social assistance benefits.

Treatment of Income and Benefits: adjusted average income and *adjusted* benefits are normalized such that income in the working period equals 1 and benefits while unemployed equal a percentage relative to income. This can be alternatively viewed as a replacement ratio i.e. UI benefits equal 55% of average wage, SA benefits equal 23% of average wage and employment income equals 100%. Net and replacement ratios are calculated.

Table 6.1 Adjusted Income and Benefits Used In Models (in 2010 Country Currency)

Country	Time Period	Currency (2010)	Average Gross Income	Average Net Income	Net Min/Max UI Benefits (Week)	Net UA Benefits (Week)	Net SA Benefits (Week)
Canada	2003-2013	CAD	43,875	33,704	346/420	N/A	135
United States	2003-2013	USD	44,084	33,556	337	N/A	210
France	2003-2013	EURO	34,010	24,424	199/338	N/A	119
Germany (post-reform)	2008-2013	EURO	41,829	25,016	289	N/A	170
Germany (pre-reform)	2000-2005	EURO	41,368	23,736	274	242	N/A

Note. All benefits & wages were adjusted for inflation using 2010 currency (of the respective country). See Appendix A for more details. The value presented here are the *adjusted* amounts (previously mentioned)

6.4. Numerical Solution Algorithm

Due to the complexity of the models, a numerical solution algorithm is used to solve the agent's optimization problem and find the tax rate that funds the social insurance policies. The

solution algorithm is based on the work of Pollak (2007) and Costain (1997). What follows is the algorithm used to solve the complex models. The algorithm uses simplified version of the Canada model[23] as an example.

Algorithm:

1) Guess initial values of states: W_{NoEn}, W_{En}, U_{Wait}, U_{EI}, U_{SA}

    a. Set initial tax rate to 0

2) Optimize the agent's problem in state U_{Wait}

    a. Update state values of W_{NoEn}, W_{En}, U_{Wait}, U_{EI}, U_{SA}

3) Optimize the agent's problem in state U_{EI}

    a. Update state values of W_{NoEn}, W_{En}, U_{Wait}, U_{EI}, U_{SA}

4) Optimize the agent's problem in state U_{SA}

    a. Update state values of W_{NoEn}, W_{En}, U_{Wait}, U_{EI}, U_{SA}

5) If first-order conditions of U_{Wait}, U_{EI} and U_{SA} are sufficiently close to zero than the solution has been found. If not, return to step 2

6) Calculate the tax rate such that it funds the social insurance policies

7) Repeat Step 2 –Step 6 with updated tax rate until tax converges

    a. Tax convergence is defined as the absolute difference between current tax value and last tax value is less than 1e-06

The first order conditions for the simplified Canada model are:

$$-\varphi'(p_{Wait}) + \beta[\, W_{NoEn} - \{t_{Wait}^{Wait} U_{Wait} + t_{Wait}^{EI} U_{EI}\}] = 0 \tag{6.4}$$

$$-\varphi'(p_{EI}) + \beta[\, W_{NoEn} - \{t_{EI}^{EI} U_{EI} + t_{EI}^{SA} U_{SA}\}] = 0 \tag{6.5}$$

$$-\varphi'(p_{SA}) + \beta[\, W_{NoEn} - U_{SA}] = 0 \tag{6.6}$$

In each (unemployment) state, the agent selects a search intensity, p_{State}, where it maximizes their current (unemployment) state value; the optimal search intensity is selected such that the marginal cost of search and marginal, discounted, benefit of search equal.

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[23] This simplified version assumes the agent is either qualified or not qualified for UI. There is no progression from minimum UI entitlement to maximum UI entitlement.

6.5. Calibration

The complex models of each country are calibrated to represent their country. The parameters in the models are calibrated such that the models match key characteristics of the economy and UI policies; these characteristics include the unemployment rate, the share of short-term unemployment and the maximum durations of benefit programs. The share of short-term unemployment is defined as the proportion of unemployment that lasts for 3 months or less.

To calibrate the country specific models, first the conditional transition probabilities between states are determined. These probabilities are chosen such that they match specific duration data. For example, if unemployment insurance benefits last for a maximum of 26 weeks, the conditional transition probability of leaving the UI state would be 1/26. This is a conditional probability of being unemployed; the duration of benefits is on average 26 weeks since one divided by the probability of leaving a state equals average duration. After the conditional transition probabilities have been determined, the model is calibrated using α and λ (job separation rate) to match the unemployment rate and share of short-term unemployment for the specific country. Table 6.2 outlines the calibration targets for each country. A quick glance would reveal that the European countries have low shares of short-term unemployment (less than 30%) while Canada and the United States have high shares of short-term unemployment (greater than 50%).

Table 6.2 Calibration Targets

Country Data	Unemployment Rate	Share of Short-Term Unemployment
Canada	7.12%	63%
United States	6.80%	52%
France	8.93%	27%
Germany (Post-Reform)	6.41%	23%
Germany (Pre-Reform)	9.35%	17%

For clarification, only the complex country models are calibrated; the simple UI models are not calibrated to match the unemployment rate and the share of short-term unemployment of their respective country. The parameters that calibrate the complex UI model α and λ (job separation rate) will be used in the simple UI model. This is done so agents in both models are the same in regards to utility preferences, the cost of job search preferences, and the job separation rate. Based on our generosity metric formulation, the differences between the simple model and the complex model should be the UI policy in place. What follows are the calibration results using the net income data and the risk aversion coefficient $\gamma = 3$ (base case). Additionally, calibration results for $\gamma = 1$ and $\gamma = 5$ are presented also for use in the sensitivity analysis section. The summaries for each country's calibration results will assume $\gamma = 3$, the base case.

Table 6.3 Canada Calibrations Parameters and Results

Variable		Values	
	$\gamma = 1$	$\gamma = 3$	$\gamma = 5$
		(Base Case)	
Normalized Net Wage Rate		1	
Normalized Net Waiting Period Benefits		0.20828	
Normalized Net Benefits (Min/Max)		0.53447/ 0.64740	
Normalized Net Social Assistance Benefits		0.20828	
EI Qualification Duration (Min/Max)		15.75/ 45.5 weeks	
Waiting Period Duration		2 weeks	
EI Benefit Duration (Min/Max)		17/ 40 weeks	
Social Assistance Duration		Indefinite	
τ Tax Rate	0.0358	0.0370	0.0374
λ Job Separation Rate	0.0057	0.0058	0.0057

Variable	Values		
	$\gamma = 1$	$\gamma = 3$	$\gamma = 5$
		(Base Case)	
α Cost Function Scalar	270.81	1,355.1	14,865.3
Unemployment Rate	7.12%	7.12%	7.12%
Share of Short-term Unemployment	63%	63%	63%
Average Unemployment Duration	13.38 weeks	13.33 weeks	13.36 weeks

Table 6.3 summarizes key variables and durations of the calibrated model for Canada. The conditional transition probabilities between unemployment states were calculated using the duration data of the waiting period, EI, and the average time to qualify for EI. The average duration for EI qualification was calculated based on the amount of working hours required to qualify for the minimum/maximum benefit duration. Assuming a 40-hour workweek (full-time), 17 weeks is the average work duration to qualify for EI and 45.5 weeks is the average work duration to qualify for maximum EI benefits, and duration.

The calibrated models of Canada produces an unemployment rate of 7.12% and 63% share of short-term unemployment, matching the calibration targets. For a risk aversion coefficient of 3 (base case), the two parameters that calibrated the model where $\alpha = 1355.1$, and $\lambda = 0.0058$. The job separation rate of 0.0058 corresponds to 172.41 weeks (3.32 years) of average employment between two unemployment spells. Additionally, the average duration of unemployment, in the base case, was 13.33 weeks.

Table 6.4 United States Calibrations Parameters and Results

Variable		Values	
	$\gamma = 1$	$\gamma = 3$	$\gamma = 5$
		(Base Case)	
Normalized Net Wage Rate		1	
Normalized Net UI Benefits		0.52179	
Normalized Net Social Assistance Benefits		0.32507	
UI Qualification Duration		26 weeks	
UI (Basic) Benefit Duration		26 weeks	
Emergency Unemployment Compensation Tier 1 Duration		20 weeks	
Emergency Unemployment Compensation Tier 2 Duration		14 weeks	
Emergency Unemployment Compensation Tier 3 Duration		13 weeks	
Total UI Benefit Duration		73 weeks	
Social Assistance Duration		Indefinite	
τ Tax Rate	0.0336	0.0341	0.0345
λ Job Separation Rate	0.0041	0.0041	0.0041
α Cost Function Scalar	450.44	1,279.4	4,970.7
Unemployment Rate	6.80%	6.80%	6.80%
Share of Short-term Unemployment	52%	52%	52%
Average Unemployment Duration	17.98 weeks	17.75 weeks	17.75 weeks

Presented in Table 6.4 are the calibration details for the United States. Based on UI eligibility criteria and average income, in order to receive UI benefits, a worker must work for a minimum 26 weeks. The US model was calibrated to the unemployment rate and the share of short-term unemployment of 6.8% and 52%, respectively. For the base case, the parameters that calibrated the model are $\alpha = 1,279.4$, and $\lambda = 0.0041$. The transition probabilities, as usual, were calculated using the duration data in the table. From the job separation rate, the average employment duration between two unemployment spells is 243.9 weeks (4.69 years). Also, the average unemployment duration for the US model was 17.75 weeks.

Table 6.5 France Calibrations Parameters and Results

Variable	Values		
	$\gamma = 1$	$\gamma = 3$	$\gamma = 5$
		(Base Case)	
Normalized Net Wage Rate		1	
Normalized Net Waiting Period Benefits		0.25317	
Normalized Net UI Benefits (Min/Max)		0.42296/ 0.72023	
Normalized Net Social Assistance Benefits		0.25317	
UI Qualification Duration (Min/Max)		17/ 104 weeks	
Waiting Period Duration		1 week	
UI Benefit Duration (Min/Max)		17/ 104 weeks	
Social Assistance Benefit Duration		Indefinite	
τ Tax Rate	0.0523	0.0539	0.0545
λ Job Separation Rate	0.0025	0.0026	0.0025
α Cost Function Scalar	1,953.9	8,176.9	67,753.2
Unemployment Rate	8.93%	8.93%	8.93%

Variable	Values		
	$\gamma = 1$	$\gamma = 3$	$\gamma = 5$
		(Base Case)	
Share of Short-term Unemployment	27%	27%	27%
Average Unemployment Duration	39.23 weeks	38.31 weeks	38.62 weeks

The calibration results for France are detailed in Table 6.5. To qualify for minimum and maximum duration of UI benefits, the UI eligibility duration was set at 52 and 104 weeks, respectively. The France model was calibrated to the unemployment rate and the share of short-term unemployment of 8.93% and 27%, respectively. The parameters that calibrated the model are $\alpha = 8{,}176.9$ and $\lambda = 0.0026$. The transition probabilities were calculated using the duration data from the table. From the job separation rate, the average employment duration between two unemployment spells is 384.62 weeks (7.01 years). Additionally, the average unemployment duration of the calibrated model was 38.31 weeks.

Table 6.6 Germany (Post-Reform) Calibrations Parameters and Results

Variable	Values		
	$\gamma = 1$	$\gamma = 3$	$\gamma = 5$
		(Baseline)	
Normalized Net Wage Rate		1	
Normalized Net UI Benefits		0.60	
Normalized Net UA/Social Assistance Benefits		0.35353	
UI Qualification Duration (Min/Max)		52/104 weeks	
UI Duration (Min/Max)		26/ 52 weeks	

Variable	Values		
	$\gamma = 1$	$\gamma = 3$ (Baseline)	$\gamma = 5$
UA/Social Assistance Benefit Duration		Indefinite	
τ Tax Rate	0.0318	0.0320	0.0323
λ Job Separation Rate	0.0015	0.0015	0.0015
α Cost Function Scalar	3,185.5	10,168.6	43,782.8
Unemployment Rate	6.41%	6.41%	6.41%
Share of Short-term Unemployment	23%	23%	23%
Average Unemployment Duration	46.65 weeks	46.04 weeks	X weeks

The calibration details for Germany (post-reform) are outlined in Table 6.6. To qualify for UI benefits, 52 weeks of employment were required (UI qualification duration) and 104 weeks of employment were required to receive the maximum UI benefit duration. The model was calibrated to match the unemployment rate and the share of short-term unemployment of 6.41% and 23%, respectively; the parameters that calibrated the model are $\alpha = 10,168.6$ and $\lambda = 0.0015$. The transition probabilities, as usual, were calculated using the duration data in the table. From the calibrated model, the average employment duration between two unemployment spells was 666 weeks (12.81 years), with average unemployment duration being 46.04 weeks.

Table 6.7 Germany (Pre-Reform) Calibrations Parameters and Results

Variable	Values		
	$\gamma = 1$	$\gamma = 3$	$\gamma = 5$
		(Base Case)	
Normalized Net Wage Rate		1	
Normalized Net UI Benefits		0.60	
Normalized Net UA Benefits		0.53	
UI Qualification Duration (Min/Max)		52/ 104 weeks	
UI Benefit Duration (Min/Max)		26/52 weeks	
UA Benefit Duration		Indefinite	
τ Tax Rate	0.0545	0.0545	0.0545
λ Job Separation Rate	0.0015	0.0016	0.0016
α Cost Function Scalar	4,207.9	8,962.3	21,975.2
Unemployment Rate	9.35%	9.35%	9.35%
Share of Short-term Unemployment	17%	17%	17%
Average Unemployment Duration	67.7 weeks	66.38 weeks	65.81 weeks

The calibration details for Germany (pre-reform) are outlined in Table 6.7. The UI minimum and maximum qualification duration was set at 52 and 104 weeks, respectively. Additionally, transition probabilities were calculated using duration data from the table. The model for Germany (pre-reform) was calibrated to match the unemployment rate and the share of short-term unemployment of 9.35% and 17%, respectively; the parameters that calibrated the model are $\alpha = 8,962.3$ and $\lambda = 0.0016$. From the calibrated model, the average employment

duration between two unemployment spells was 625 weeks (12.02 years), with average unemployment duration being 66.38 weeks.

6.6.   Results

This section presents the generosity and efficiency metric results. Main results utilize net replacement rates and assume the risk aversion coefficient set at 3 (base case). Following sections run comparisons and sensitivity analysis/robustness checks. Comparisons are made to see if the rankings of countries are similar across different measures (OECD and PSZ measure). A welfare comparison is done between Germany pre and post Hartz reform using common calibration parameters. And finally, sensitivity analysis is done to test assumptions and whether the use of different risk aversion coefficients alters the results/conclusions of the base case.

The main results, the generosity and efficiency metric for each country, are presented in Table 6.8. The table also shows the consumption equivalent and consumption equivalent ratio from the complex model, generosity metric θ and tax rate τ_θ that funds the social insurance policies in the simple model, as well as the efficiency metric. Additional outputs can be found in Appendix B, which contains information on average time and duration spent in each state, job search intensities, and optimal replacement ratios in the benchmark UI system (efficiency measure).

Table 6.8 Generosity & Efficiency Metric Results

Variable	Values ($\gamma = 3$)				
	Canada	USA	France	Germany Post Reform	Germany Pre Reform
Consumption Equivalent[24]	0.6586	0.7811	0.6805	0.7730	0.8048
Consumption Equivalent Ratio	0.2427	0.3375	0.2956	0.3186	0.4444
Generosity Metric θ	0.3220	0.4376	0.3812	0.4114	0.5482
θ Tax Rate τ_θ	0.0201	0.0320	0.0382	0.0293	0.0547
Efficiency Metric[25]	-14.98%	-4.05%	-8.69%	-4.37%	-0.63%

From general inspection, the results indicate that, in terms of generosity, Germany (pre-reform) is the most generous country followed by USA, Germany (post-reform), France, and Canada. Germany (pre-reform) has a generosity value θ of 0.5482 or 54.82%, which is about 1.25 times more generous than the next generous system USA (43.76%). In terms of values, USA, Germany (post-reform), and France were clustered closely together with generosity values of 43.76%, 41.14%, and 38.12%, respectively. Canada was ranked last with a generosity value of 32.2%. Between the most generous system and the least generous system, Germany (pre-reform) was 1.7 times more generous that Canada.

In terms of average utility, the efficiency metric represents the efficiency loss from moving from the benchmark UI system to the realistic system; the benchmark system[26] offers UI benefits such that it maximises average utility. Germany (post-reform) ranked first with the lowest efficiency loss of -0.63% followed by USA with an efficiency loss of -4.05%. The third

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[24]   Average period utility converted to consumption equivalent.
[25]   The optimal replacement rates in the benchmark model: Canada (65.71%), USA (65.91%), France (64.13%), Germany post-reform (65.36%), and Germany pre-reform (65.35%)
[26]   The benchmark system is similar in structure to the simplistic model

and fourth countries were Germany (post-reform) and France with efficiency loss values of -4.37% and -8.69%, respectively. Finally, the country with the highest efficiency loss was Canada with a loss of -14.98%. Between the most efficient system and the least efficient system, Germany (pre-reform) is 14.35 percentage points more efficient than Canada. Rankings based on efficiency are identical to the rankings based on generosity.

6.7.   PSZ Generosity Metric and OECD Replacement Ratio Comparisons

This section presents the PSZ generosity measure for each country along with OECD net replacement rates. The PSZ measure θ_{PSZ}[27] is created using average utility as the matching criterion, similar to Pallage et al. (2013), but with the model framework of this paper. The OECD measure, the net replacement rate (θ_{NRR}), is based on the average unemployment benefits (including social assistance) over 60 months of unemployment between two income levels (100% AW [28] and 67% AW). The OECD measure used is for a single person with no children/dependents. Comparisons are made between the different measures of UI generosity to investigate if they show similar results in terms of ranking UI generosity. Table 6.9 summarizes the three generosity results.

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[27]   The PSZ generosity measure is calculated as the replacement ratio in the simple model such that it has the same average period utility as the complex model. The generosity measure in this paper uses consumption loss (or utility loss) from moving from employment to unemployment.

[28]   Average Wage (AW) is the average income (net & gross) calculated by the OECD for a full time worker. This income dataset is also used in this paper.

Table 6.9 PSZ Metric and OECD Replacement Ratios

Variable	Values ($\gamma = 3$)				
	Canada	USA	France	Germany Post-Reform	Germany Pre-Reform
Consumption Equivalent	0.6586	0.7811	0.6805	0.7730	0.8048
PSZ Measure θ_{PSZ}	0.3060	0.4464	0.3768	0.4321	0.5682
PSZ Tax Rate τ_{PSZ}	0.0216	0.0334	0.0373	0.0326	0.0597
OECD Measure θ_{NRR}	0.32	0.18	0.53	0.45	0.57*
Generosity Metric θ	0.3220	0.4376	0.3812	0.4114	0.5482

Note. *Net Replacement Ratios θ_{NRR} from the OECD are from 2013 except Germany (Pre-Reform), which is from 2002. The θ_{NRR} accounts for social assistance and is taken for a single person with no children/dependents

Using the re-created PSZ measure, the countries ranked from the most generous to the least generous are Germany (pre-reform), USA, Germany (post-reform), France, and Canada. The rankings are identical to generosity metric θ. Also, the PSZ measure θ_{PSZ} show very similar values to the generosity metric θ. Overall, the use of the PSZ metric and generosity metric θ yields similar conclusions.

At first glance, the OECD measure (net replacement ratio) and generosity metric values for Canada, Germany pre and post reform are similar to one another while USA and France yields different values. It is important to note for comparative purposes that the OECD measure is solely based on benefits of from UI and the generosity metric in this paper is calculated using a model-based measure; therefore, comparisons should be based on rankings rather than values. Under the OECD measure, ranked from the most generous to the least generous are Germany (pre-reform), France, Germany (post-reform), Canada, and USA. The OECD rankings differ from the base case results of this paper; the main difference is that the United States is ranked last with θ_{NRR} of 18% while the country is very generous according to θ (ranked second highest). Also, the OECD ranks France ahead of Germany (post-reform) with a net replacement rate of 53% and 45%, respectively; based on the generosity metric θ it is the opposite with Germany (post-

reform) θ=41% and France θ=38%. When compared to OECD net replacement rates, the generosity metric θ yields different results in terms of rankings and generosity values; all values of θ are clustered close together.

6.8. Germany Pre and Post Hartz Reforms: Welfare Comparisons

A comparison is provided between Germany pre and post Hartz reforms. To properly make welfare comparison of a policy change, a common set of calibration parameters (utility preferences and job separation rate) is used. The pre and post reform Germany models are therefore re-calibrated with identical parameters to their respective unemployment rates and share of short-term unemployment. The models are run for the base case (risk aversion of 3) and risk aversion of 1.

Table 6.10 Germany Pre and Post Reform: Common Parameters Results

Variables		Values			
		$\gamma = 1$		$\gamma = 3$	
		Germany Pre-Reform	Germany Post-Reform	Germany Pre-Reform	Germany Post-Reform
λ	Job Separation Rate	0.0016	0.0016	0.0015	0.0015
α	Cost Function Scalar	3957.6	3957.6	9787.5	9787.5
τ	Tax Rate	0.0545	0.0373	0.0545	0.0315
Unemployment Rate		9.36%	7.60%	9.36%	6.30%
Share of Short-term Unemployment		17.3%	21.0%	16.4%	23.3%
Average Unemployment Duration		65.58 weeks	52.28 weeks	69.44 weeks	45.24 weeks
Consumption Equivalent		0.8574	0.8578	0.8048	0.7764
Consumption Equivalent Ratio		0.3517	0.2191	0.4443	0.3191

Variables	Values			
	$\gamma = 1$		$\gamma = 3$	
	Germany Pre-Reform	Germany Post-Reform	Germany Pre-Reform	Germany Post-Reform
Generosity Metric θ	0.5501	0.4264	0.5475	0.4122
θ Tax Rate τ_θ	0.0545	0.0353	0.0547	0.0288
Efficiency Metric	+0.16%	+0.20%	-0.63%	-4.30%

The models, with common parameters, calibrate both the pre and post reform models within a 20% range of the calibrations targets (unemployment rate and share of short-term unemployment). Assuming the base case, the pre-reform period had a consumption equivalent value of 80.48% of average income, generosity measure of 54.75%, and efficiency loss value of -0.63%. During the post-reform period, the consumption equivalent value is 77.64% of average income, generosity measure is 41.22%, and efficiency loss value is -4.30%.

The Hartz reforms, according to the models (base case), caused a -24.71% change in UI generosity and a 3.67 percentage point decrease in UI efficiency with a welfare/consumption equivalent drop of 3.53%. Interestingly, for a risk aversion coefficient of one there was a small welfare increase (0.047%). That is, depending on the risk aversion coefficient there was either a 3.53% drop in welfare or 0.047% increase in welfare. Overall, the reforms had the effect of decreasing UI generosity, which was intended by the Hartz reforms.

6.9. Sensitivity Analysis

6.9.1. Risk Aversion

This section presents the generosity and efficiency metrics using different risk aversion parameters in the model. This is done to examine if results are consistent with different risk aversion coefficients. Table 6.11 shows the generosity metric results for each country with a risk aversion of $\gamma = 1$ and $\gamma = 5$; for reference results for $\gamma = 3$ are also included. Similarly, Table

6.12 shows the efficient metric results for varying risk aversion coefficients; calibration results for $\gamma = 1$ and $\gamma = 5$ are presented in Section 6.5.

Table 6.11 Generosity Metric for Different Risk Aversions

Country	Generosity Metric (Tax Rate τ_θ) Values		
	$\gamma = 1$	$\gamma = 3$ (Base Case)	$\gamma = 5$
Canada	0.4118 (0.0307)	0.3220 (0.0201)	0.2727 (0.0206)
United States	0.4520 (0.0326)	0.4376 (0.0320)	0.4231 (0.0313)
France	0.4687 (0.0455)	0.3812 (0.0382)	0.3282 (0.0341)
Germany Post-Reform	0.4336 (0.0300)	0.4114 (0.0293)	0.3958 (0.0288)
Germany Pre-Reform	0.5494 (0.0545)	0.5482 (0.0547)	0.5468 (0.0551)

Table 6.12 Consumption Equivalent/Average Period Utility for Different Risk Aversions

Countries	Values					
	$\gamma = 1$		$\gamma = 3$ (Base Case)		$\gamma = 5$	
	CE	CE Ratio	CE	CE Ratio	CE	CE Ratio
Canada	0.8579	0.1942	0.6586	0.2427	0.4320	0.2341
United States	0.8747	0.2313	0.7811	0.3375	0.6529	0.3646
France	0.8402	0.2597	0.6805	0.2956	0.4849	0.2849
Germany Post-Reform	0.8789	0.2210	0.7730	0.3186	0.6293	0.3426
Germany Pre-Reform	0.8587	0.3518	0.8048	0.4444	0.7402	0.4805

Note. CE stands for consumption equivalent

The most interesting results from varying the risk aversion parameters is its effect on the generosity values for Canada and France, more specifically, the UI system that have a mandatory waiting period. The generosity values for the other countries (USA, Germany (post-reform), and

Germany (pre-reform)) stayed relatively stable over different risk aversion coefficients; declining slowly as risk aversion rises. For Canada and France, however, the generosity values decline sharply as risk aversion rises. This is due to the fact that there is a mandatory waiting period before benefits are paid; the agents in the model are subjected to a sharp drop in utility/consumption while waiting for UI benefits. When the risk coefficient is increased the agent becomes much more risk averse towards drops in income. For this paper, it is assumed that benefits during the waiting period equal the same benefit amount from social assistance. This was done so that agents are not punished as severely while waiting for UI benefits[29]. With the risk aversion coefficient set at 1 (natural log utility), France becomes the second most generous UI system with all other rankings staying relatively the same.

Table 6.13 Efficiency Metric for Different Risk Aversions

Country	Efficiency Metric Values		
	$\gamma = 1$	$\gamma = 3$ (Base Case)	$\gamma = 5$
Canada	-0.76%	-14.98%	-39.69%
United States	-0.027%	-4.05%	-13.00%
France	+0.078%	-8.69%	-25.36%
Germany Post-Reform	+0.081%	-4.37%	-14.17%
Germany Pre-Reform	+0.175%	-0.63%	-3.41%

The efficiency metric, for all countries, displayed larger efficiency losses as the risk aversion coefficient was increased. It would appear that countries with a mandatory waiting period (Canada and France) are most affected (higher efficiency loss) by increasing risk aversion. This is due to the large drop in utility when an agent enters the waiting period; this effect is larger as the risk aversion coefficient rises and hence causes lowers average utility. Interestingly

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[29]   Income during the waiting period cannot be zero because of the CRRA utility function. If risk coefficient equals one (natural log utility) a value approaching zero goes towards negative infinite.

with a low risk aversion coefficient of 1, efficiency values are near zero; Germany (pre-reform), Germany (post-reform), and France are slightly more efficient than the benchmark systems.

6.9.2. United States Model

This section presents the generosity and efficiency metrics using different policy and assumptions for the USA model. First, the USA model is run without any UI benefit extension programs (EUC and EB) while holding everything else fixed (UI benefit duration reduced from 73 weeks to 26^{30} weeks). Second, the model is run without the inclusion of housing assistance benefits in the social assistance benefit calculations[31]. And finally, the model is run with a 26-week UI benefit duration and the exclusion of housing assistance benefits in the SA calculations; this is done to compare results from Pallage et al. (2008) where the authors find that France is three times more generous than the United States. Results are run for a risk aversion coefficient of 1 and 3. Table 6.13 and 6.14 summarize the results.

Table 6.14 United States Results with Different Policy and Assumptions (Risk Aversion=3)

Variable	Values ($\gamma = 3$)			
	Benefit Extension Program (2008-2013)		No Benefit Extension Program (2003-2007)	
	Housing Assistance included in SA*	Housing Assistance excluded in SA**	Housing Assistance included in SA	Housing Assistance excluded in SA**
Consumption Equivalent	0.7811	0.3973	0.7396	0.2690
Consumption Equivalent Ratio	0.3375	0.1167	0.2947	0.0740
Generosity Metric θ	0.4376	0.1573	0.3859	0.1009
θ Tax Rate τ_θ	0.7811	0.0120	0.0290	0.0082

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[30]   The maximum duration of UI benefits was 26 weeks between 2003-2008
[31]   In the USA model, housing assistance benefits was included in the calculation for SA The reasoning for this is to keep the definition of social assistance consistent between countries since USA, for a single person with no dependents, does not offer a housing allowance component in social assistance benefits.

Variable	Values ($\gamma = 3$)			
	Benefit Extension Program (2008-2013)		No Benefit Extension Program (2003-2007)	
	Housing Assistance included in SA*	Housing Assistance excluded in SA**	Housing Assistance included in SA	Housing Assistance excluded in SA**
Efficiency Metric	-4.05%	-54.94%	-6.46%	-90.74%
PSZ Measure θ_{PSZ}	0.4464	0.1580	0.4031	0.1074
PSZ Tax Rate τ_{PSZ}	0.0334	0.0121	0.0319	0.0093

Note. *This is the main USA result (for reference). **The net replacement ratio for social assistance dropped from 32.51% to 7.15%

Table 6.15 United States Results with Different Policy and Assumptions (Risk Aversion=1)

Variable	Values ($\gamma = 1$)			
	Benefit Extension Program (2008-2013)		No Benefit Extension Program (2003-2007)	
	Housing Assistance included in SA*	Housing Assistance excluded in SA**	Housing Assistance included in SA	Housing Assistance excluded in SA**
Consumption Equivalent	0.8747	0.8381	0.8646	0.7906
Consumption Equivalent Ratio	0.2313	0.1185	0.1872	0.0456
Generosity Metric θ	0.4520	0.3141	0.4028	0.1865
θ Tax Rate τ_θ	0.0326	0.0232	0.0295	0.0143
Efficiency Metric	-0.03%	-1.21%	-0.11%	-1.55%
PSZ Measure θ_{PSZ}	0.4841	0.2874	0.4464	0.1961
PSZ Tax Rate τ_{PSZ}	0.0365	0.0204	0.0347	0.0153

Note. *This is the main USA result (for reference). **The net replacement ratio for social assistance dropped from 32.51% to 7.15%

The exclusion of the EUC Tier 1, 2 and 3 programs from the main model[32] reduced UI generosity and increased the efficiency loss in the UI system. For a risk aversion coefficient of three, UI generosity decreased from 43.76% to 38.59% (11.81% drop), and decreased 10.88% for a risk aversion coefficient of one. Additionally, the efficiency loss value changed by -2.41 and -0.08 percentage points for a risk aversion of three and one, respectively.

The removal of housing assistance from the calculation of social assistance benefits had a drastic effect on UI generosity[33]. Assuming the benefit extension programs are active, UI generosity dropped from 43.76% to 15.73% (-64% change) for a risk aversion coefficient of three and dropped from 45.20% to 31.41% (-31% change) for a risk aversion of one when housing assistance was removed from the model. The results, assuming no benefit extension programs, show a similar percentage change decreases of 74% and 54% for a risk aversion of three and one, respectively. The effect is larger with higher risk aversion coefficients since agents in the model become more averse to drops in utility since social assistance benefits are lower when housing assistance benefits are removed.

The removal of housing assistance benefits from the model, assuming risk aversion of three, makes USA the least generous UI system in the study and aligns the results with the OECD generosity rankings ($\theta_{NRR} = 18\%$). The high UI generosity found in the main results is not from the UI program itself but what comes afterwards (social assistance with housing assistance).

In the paper by Pallage et al. (2008), a comparison is made between the USA and France; the authors conclude that France is 3.33 times more generous than the United States. For comparability, the USA model in this paper is re-run assuming UI benefit duration of 26 weeks and that the social assistance does not include housing assistance benefits. Assuming risk aversion coefficient of 3, the recreated PSZ measures show that USA and France have a PSZ generosity measure of 10.74% and 37.68%, respectively France is 3.5 times more generous than the USA (Table 6.9 and 6.13). This matches the results found by Pallage et al. (2008), which

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[32]   The main USA model assumes that extended benefits programs are in place and that housing assistance is included in the calculation of SA benefits.
[33]   Social assistance benefits dropped from 32.5% of working income to 7.15% when housing assistance benefits are removed from SA calculations.

show that the modeling framework of this paper is capable of producing similar results to Pallage et al. (2008).[34]

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7. DISCUSSION AND CONCLUSIONS

7.1.   Discussion

This section summarizes results and findings of this paper. Beginning with the main results, the set of generosity results of all countries were much more clustered than expected. The range of generosity values for France, Germany (post-reform), and USA were between 38% and 44%, which would suggest that UI generosity for those countries are relatively the same. In terms of rankings, Germany (pre-reform) (54.82%) is most generous followed by USA (43.76%), Germany (post-reform) (41.14%), France (38.12%), and Canada (32.2%). When compared to the OECD net replacement ratios, USA is ranked very high in terms of generosity. The OECD measure ranks USA last, while the main results show the USA has the second highest UI generosity.

The efficiency metric represents the efficiency loss, in terms of average utility, from moving from the benchmark UI system to the realistic system; the benchmark system offers UI benefits such that it maximises average utility. The main results show that Germany (pre-reform) ranked first with the lowest efficiency loss of -0.63% follow by USA (-4.05%), Germany post-reform (-4.37%), France (-8.69%), and Canada (-14.98%).

For the United States, housing assistance benefits were included in the calculation of SA benefits. This was done so that the definition of social assistance stayed consistent between countries; the USA was the only country in the study to not provide a housing allowance component in SA benefits (for a single person with no dependents). The USA model was tested without the incorporation of housing benefits in SA calculations. The UI generosity for the United States dramatically fell by 64%, causing USA to be ranked last behind Canada; USA and Canada had generosity values of 15.73% and 32.2%, respectively. The removal of housing assistance benefits makes the results more in line with the OECD rankings (USA ranked last by a large margin). Finally, the findings suggest that the contributing factor for the high UI generosity for the USA, in the main results, is not UI itself but the benefits that come afterwards, social assistance with housing assistance benefits. This also highlights the fact that the specification of what constitutes unemployment benefits/social assistance can greatly vary generosity results.

The PSZ metrics were re-created using the matching criterion of average utility; replacement ratio is found in the simple model such that it matches the complex model's average utility (criterion). In this paper, the matching criterion is the ratio of average utility of unemployment relative to employment (converted into a consumption equivalent ratio) and it represents the utility/consumption loss when moving from employment to unemployment. This ratio is investigated since measuring utility/consumption loss may be a better criterion for measuring UI generosity than using the average utility across all states. The results show, however, that the difference between using either criterion is very small with generosity measures being virtually identical. Therefore, this would suggest that the use of average utility, or a ratio of average utility of unemployment to employment, does not make a major difference in the results.

As another step, welfare comparison was done between Germany pre and post Hartz reforms using common calibration parameters. The models were calibrated within a 20% range of calibration targets. Overall, the Hartz reforms decreased UI generosity, which was the main purpose of Hartz reforms. The reforms also decreased UI efficiency and caused a 3.53% drop in welfare. However, when the risk aversion coefficient was decreased from 3 to 1 there was a small welfare increase of 0.047%.

The sensitivity results revealed that generosity values for UI systems, with a mandatory waiting period, were most affected by increasing the risk aversion coefficient. Increasing the coefficient of risk aversion considerably dropped generosity values for Canada and France while the value for other countries slightly declined. This is due to the fact that agents cannot save and agents are essentially 'punished' with a high drop in utility before UI benefits can be paid. Additionally, efficiently loss increases as risk aversion rises with France and Canada (waiting periods) being most affected.

7.2. Policy

The main purpose of this study was to create single summary measures of UI generosity and efficiency that takes into account different aspects of UI policy and economics conditions. These summary measures in turn were used to compare UI policies among different countries

along two dimensions (generosity and efficiency). While not the primary objective, there are some policy implications that could be made from the results of this paper.

The base case results (risk aversion coefficient of three) suggest that the more generous the UI policy is the more efficiency it is as well.[35] This however, would be an incorrect interpretation. For example, when UI benefits are increased the generosity metric will increase as well.[36] Generosity is monotonically increasing with benefit. However, in terms of efficiency (utility) when benefits are increased utility will rise to an optimal point than fall. This occurs due to the inclusion of taxes within the system. When benefits are past the optimal point, the cost of the funding the UI system is too much for agents and utility falls due to high tax rates. The policy implications that can be taken from this paper are that the countries with low generosity and efficiency (Canada, USA, and France) could increase generosity as to increase efficiency. Generosity will have to be increased up to a certain point such that efficiency is close to the optimum.

Overall, policy implications should be taken with a grain of salt, as the objective of this study was to compare UI policy based on generosity and efficiency, and not on finding an optimum of generosity and efficiency for each country. These policy implications only focus on generosity and efficiency. Most likely it is not desirable to increase the generosity of an UI system if it causes high moral hazard problems, high unemployment rates, and higher costs[37].

7.3.   Limitations and Recommendations

This thesis is not without its limitations. This section presents limitations of the utilized methodology with possible recommendations for future works. The methodology of this paper focuses primarily on the household sector, while ignoring firms and labour markets. It is assumed that job offers are given at a fixed wage: job offers are given at an endogenously[38] chosen rate of λ where agents always accept the job offer. These assumptions simplify the

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[35]   For example, Germany pre reform is the most generous and most efficiency UI system.

[36]   Generosity rises when benefits are increased due to two effects. First, average utility while unemployed increases as a direct results from the higher benefits. Second, average utility increases due to lower job search intensity (dis-utility from job search). The average utility while unemployed increases and increases the CE ratio, which in turn increases generosity.

[37]   A dollar spent funding the UI system might be better spent on other social welfare programs.

[38]   The variable λ is endogenously chosen/calibrated to match the unemployment rate.

model. Ideally, a more complete model would include: a) the firms' profit maximization problem where firms choose the optimal number of job vacancies each period; b) the incorporation of wage bargaining; and, c) the option for agents to decline job offers. Additionally, agents in the model are not allowed to save. The incorporation of consumption smoothing, via savings, would also make the methodology much more complete. Instead of the assumption that waiting period benefits equal SA benefits, agents would save a proportion of their income to smooth consumption between job loss and UI benefits (i.e. waiting period). The main modification in the modeling framework in this paper, of that developed by Pallage et al. (2013), is the omission of savings; this also represents the main limitation of this paper.

Besides the major modeling changes suggested, there are smaller issues that could be dealt with in future works. It is assumed that the household unit in the model is a single person with no dependents. Future works could model a household assuming an average family unit, i.e. one wage earner, spouse (non wage earner), and two children; this would also allow for the incorporation of other benefit programs such as family benefits. Additionally, the annual wage is set at the average annual income calculated by the OECD. Similarly to the OECD's net replacement ratio studies, it would be interesting to calculate different generosity metrics assuming various levels of annual income. For example, one could assume a 67% of average income, 100%, of average income, and 167% of average income. This is relevant, as those with lower average income would be most affected by the generosity of UI versus those with higher income.

7.4. Conclusions

The primary goal of this thesis was to provide an alternative way of measuring UI generosity and comparing different UI policies. The common approach for measuring UI generosity is to calculate a so-called replacement ratio, which is represented as the proportion of income received during unemployment relative to prior employment income. The approach in this thesis is based on the work of Pallage et al. (2013) but with several modification to simplify the model. The findings of this paper show that generosity results for France, USA, Germany (post-Hartz reforms) are much closer in terms of UI generosity than what a traditional replacement ratio would suggest. Additionally, the specification of what constitute 'social assistance' can greatly vary results. That is, the United States, with housing assistance included

in SA, is the second most generous UI system but without housing assistance benefits, USA is ranked last with the next generous system being two times more generous. The models were also used to compare UI policy changes between Germany pre and post-Hartz reforms. In this case, the models were capable of capturing unemployment rate drops and share of short-term unemployment increases. The findings show that the reforms decreased UI generosity, worsened UI efficiency, and caused welfare to either decline or slightly increase depending on the used risk aversion coefficient. The secondary goal of the paper was to a use a different matching criterion than the one used in Pallage et al. (2013). However, the use of the ratio of utility from unemployment to employment as the matching criterion proved to be no different than using average lifetime utility as the matching criterion. Overall, although the model in this paper was modified from its original form, the findings support the results presented by Pallage et al. (2008) and those reported by the OECD.

DATA SOURCES

1) Average Gross and Net Income: Income data was taken from the OECD, specifically the OECD Taxing Wages 2015 Report: http://dx.doi.org/10.1787/888933197478

2) Consumer Price Index (CPI): CPI data was provided by OECD Statistics (OECD.StatExtracts): https://stats.oecd.org/Index.aspx?DataSetCode=G20_PRICES

3) Harmonised Unemployment Rate: Unemployment rates were provided by the OECD Statistics (OECD.StatExtracts): http://stats.oecd.org/index.aspx?queryid=36324

4) Unemployment by Duration: Unemployment rates were provided by the OECD Statistics (OECD.StatExtracts): https://stats.oecd.org/Index.aspx?DataSetCode=DUR_D

5) UI Benefits Data: UI Benefit amounts were taken from official government websites & documents. Data was supplemented by OECD Social Insurance Policy Overviews: http://www.oecd.org/els/benefits-and-wages-policies.htm

6) SA Benefits Data: SA Benefit amounts were taken from official government websites & documents. Data was supplemented by OECD Social Insurance Policy Overviews: http://www.oecd.org/els/benefits-and-wages-policies.htm

7) Fair Market Rents: Data on Fair Market Rents (For the calculation of USA's rental assistance program allowance; Section 8) were extracted from the U.S Department of Housing and Urban Development: http://www.huduser.org/portal/datasets/fmr.html

8) Net Replacement Ratio (OECD): Net replacement ratios used in Section 6.7 for comparisons came from the OECD, Directorate For Employment, Labor, and Social Affairs: http://www.oecd.org/els/benefits-and-wages-statistics.htm

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APPENDIX A – DATA

Appendix A contains all the data used in the study. This includes the unemployment rate, share of short-term unemployment (unemployment lasting a maximum of three months), CPI, average net income and net unemployment benefits for all countries.

A.1 Unemployment Rate and Share of Short-term Unemployment

Economic variables were taken from the OECD. The harmonized unemployment rate and share of short-term unemployment (unemployment lasting a maximum of three months) is collected for each year, of the study period, and averaged over the time period to give the variables used in the study (Table A.1).

Table A.1 Unemployment Rate and Share of Short-term Unemployment

Country	Time Period	Harmonized Unemployment Rate	Share of Short-term Unemployment
Canada	2003-2013	0.07123	0.63090
United States	2003-2013	0.06807	0.52158
Germany (Post-Reform)	2003-2013	0.06415	0.22798
Germany (Pre-Reform)	2000-2005	0.09357	0.17404
France	2003-2013	0.08931	0.26548

A.2 Calculation of Average Net Income

The following tables (Table A.2 to A.5) present the data used to calculate the inflation adjusted net average income (of a specific time period). The data was taken from the OECD, and is specific to a single worker with no dependents. Table A.5 presents the final net average income used in this paper.

Table A.2 Consumer Price Index

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
CAN	N/A	N/A	N/A	88.2	89.9	91.9	93.7	95.7	98	98.3	100	102.9	104.5	105.5
USA	N/A	N/A	N/A	88.1	90.2	91.9	93.7	95.2	98.2	98.3	100	102.3	104.6	105.6
DE	85.2	86.8	88	88.9	90.5	92.2	93.9	96	98.6	98.9	100	102.5	104.7	106.3
FR	N/A	N/A	N/A	88.1	90.2	91.9	93.7	95.2	98.2	98.3	100	102.3	104.6	105.6

Table A.3 Net Average Income (APW/AW From OECD)

Country	Currency (2010)	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
CAN	CAD	N/A	N/A	N/A	29,000	29,636	30,283	30,644	3212 9	32,877	32,955	34,459	35,221	36,329	37,074
USA	USD	N/A	N/A	N/A	27,273	27,785	28,502	29,765	31,615	33,235	33,966	34,807	36,189	36,838	36,737
DE	EURO	19,539	20,407	20,872	21,067	21,993	22,363	22,505	23,195	23,842	23,871	25,374	26,088	26,682	27,075
FR	EURO	N/A	N/A	N/A	20,500	21,086	21,661	22,675	23,415	24,250	24,628	25,032	25,582	26,029	26,377

Table A.4 Inflation Adjusted (2010 Currency) Net Average Income Over Time

Country	Currency (2010)	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
CAN	CAD	N/A	N/A	N/A	32,879	32,965	32,952	32,704	33,573	33,548	33,525	34,459	34,228	34,765	35,141
USA	USD	N/A	N/A	N/A	32,314	32,084	31,810	32,213	33,244	33,672	34,518	34,807	35,067	34,984	34,398
DE	EURO	22,933	23,510	23,718	23,698	24,301	24,255	23,967	24,161	24,180	24,136	25,374	25,452	25,484	25,471
FR	EURO	N/A	N/A	N/A	23,269	23,377	23,570	24,200	24,596	24,694	25,054	25,032	25,007	24,885	24,978

Table A.5 Inflation Adjusted Net Average Income

Country	Time Period	Currency (2010)	Inflation Adjusted Net Average Income
Canada	2003-2013	CAD	33,704
United States	2003-2013	USD	33,556
Germany (Post-Reform)	2003-2013	EURO	25,016
Germany (Pre-Reform)	2000-2005	EURO	23,736
France	2003-2013	EURO	24,424

A.3 Taxation of Unemployment Benefits

This section presents a breakdown of the taxes payable on annualized unemployment benefits. The taxes owed are calculated using tax rules from 2010 and assumes the person is single with no dependents. Social assistance benefits for all countries are not subject to taxation. Additionally, UI benefits from minimum UI entitlement in France are excluded from taxation.

Table A.6 Breakdown of Taxes and Contributions Payable on Annualized UI Benefits

Variables	Values			
	Canada (Min UI entitlement	Canada (Max UI entitlement)	USA	France (Max UI Entitlement)
Currency	CAD	CAD	USA	EURO
Weekly Gross Benefit Amount	365	457	362	375
Annualized Benefit Amount	23,764	19,003	18,824	19,522
Federal and Provincial/State Taxes	1,944	990	1315	662
Social Security Contributions	N/A	N/A	N/A	1,269
Total Taxes and Contributions Payable	1,944	990	1315	1,931
Effective Tax Rate	8.18%	5.20%	6.98%	9.89%
Annualized Net Benefit Income	21,820	18,014	17,509	17,591
Net Weekly Benefit Amount	420	346	337	338

APPENDIX B – ADDITIONAL RESULTS

Appendix B contains calibration information and additional outputs not presented in the results section. The additional outputs include the average duration and share of time spent in each state, and search intensity. Also included are the optimal replacements ratios used in the benchmark models (efficiency metric).

B.1 Canada

Table B.1 Canada Additional Results

State	Risk Aversion=1			Risk Aversion=3			Risk Aversion=5		
	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity
Working with no EI entitlement	7.73%	14.52	N/A	7.76%	14.52	N/A	7.74%	14.52	N/A
Working with minimum EI entitlement	12.47%	25.54	N/A	12.5%	25.53	N/A	12.49%	25.53	N/A
Working with maximum EI entitlement	72.68%	174.46	N/A	72.61%	173.75	N/A	72.65%	174.14	N/A
Maximum EI Entitlement: Waiting Period	0.78%	1.87	0.0667	0.79%	1.88	0.0643	0.78%	1.88	0.0636
Maximum	4.14%	11.36	0.0646	4.41%	12.00	0.0598	4.51%	12.28	0.0579

State	Risk Aversion=1			Risk Aversion=3			Risk Aversion=5		
	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity
EI Entitlement: EI Benefits									
Minimum EI Entitlement: Waiting Period	0.13%	1.85	0.0807	0.13%	1.85	0.0837	0.13%	1.84	0.0842
Minimum EI Entitlement: EI Benefits	0.45%	7.45	0.0801	0.45%	7.36	0.0818	0.45%	7.38	0.0816
Social Assistance	1.61%	9.75	0.1026	1.35%	7.81	0.1280	1.25%	7.15	0.1399

B.2 United States

Table B.2 United States Additional Results

State	Risk Aversion=1			Risk Aversion=3			Risk Aversion=5		
	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity
Working with no UI entitlement	8.93%	23.60	N/A	9.04%	23.58	N/A	9.04%	23.57	N/A
Working with maximum UI entitlement	84.26%	246.23	N/A	84.15%	243.05	N/A	84.15%	243.02	N/A
Maximum UI Entitlement: UI Benefits	5.24%	15.31	0.0524	5.46%	15.78	0.0504	5.67%	16.38	0.0480
Social Assistance	1.57%	15.04	0.0665	1.34%	12.41	0.0806	1.13%	10.20	0.0981

B.3 France

Table B.3 France Additional Results

State	Risk Aversion=1			Risk Aversion=3			Risk Aversion=5		
	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity
Working with no UI entitlement	3.79%	16.65	N/A	3.88%	16.63	N/A	3.85%	16.64	N/A
Working with minimum UI entitlement	15.57%	71.38	N/A	15.87%	71.08	N/A	15.77%	71.19	N/A
Working with maximum UI entitlement	71.70%	400.02	N/A	71.32%	390.61	N/A	71.46%	393.83	N/A
Maximum UI Entitlement: Waiting Period	0.18%	1	0.0209	0.18%	1	0.0196	0.18%	1	0.0189
Maximum UI Entitlement: UI Benefits	5.77%	32.87	0.0210	6.11%	34.14	0.0199	6.24%	35.03	0.0191
Minimum UI	0.03%	1	0.0319	0.04%	1	0.0351	0.04%	1	0.0349

State	Risk Aversion=1			Risk Aversion=3			Risk Aversion=5		
	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity
Entitlement: Waiting Period									
Minimum UI	0.43%	11.37	0.0321	0.43%	10.97	0.0355	0.42%	10.98	0.0354
Entitlement: UI Benefits									
Social Assistance	2.52%	28.69	0.0349	2.17%	23.68	0.0422	2.05%	22.23	0.0450

B.4 Germany Post-Reform

Table B.4 Germany Post-Reform Additional Results

State	Risk Aversion=1			Risk Aversion=3			Risk Aversion=5		
	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity
Working with no UI entitlement	6.65%	48.37	N/A	6.73%	48.33	N/A	6.85%	48.27	N/A
Working with minimum UI entitlement	6.18%	48.37	N/A	6.25%	48.33	N/A	6.35%	48.27	N/A
Working with maximum UI entitlement	80.75%	680.52	N/A	80.60%	671.71	N/A	80.39%	659.64	N/A
Maximum UI Entitlement: UI Benefits	3.10%	26.10	0.0195	3.20%	26.69	0.0186	3.29%	27.03	0.0181
Minimum UI Entitlement: UI Benefits	0.16%	17.11	0.0208	0.16%	17.12	0.0208	0.16%	17.05	0.0210
Unemployment Assistance/Social Benefit	3.16%	42.72	0.0234	3.05%	39.92	0.0251	2.96%	37.54	0.0266

B.5 Germany Pre-Reform

Table B.5 Germany Pre-Reform Additional Results

State	Risk Aversion=1			Risk Aversion=3			Risk Aversion=5		
	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity
Working with no UI entitlement	6.67%	48.25	N/A	6.79%	48.18	N/A	6.84%	48.15	N/A
Working with minimum UI entitlement	6.18%	48.25	N/A	6.26%	48.18	N/A	6.33%	48.15	N/A
Working with maximum UI entitlement	77.80%	655.80	N/A	77.57%	643.14	N/A	77.47%	637.62	N/A
Maximum UI Entitlement: UI Benefits	3.57%	30.10	0.0143	3.63%	30.12	0.0142	3.68%	30.32	0.0140
Minimum UI Entitlement: UI Benefits	0.18%	19.06	0.0146	0.19%	19.00	0.0147	0.19%	19.00	0.0147
Unemployment Assistance	5.61%	66.22	0.0151	5.54%	64.04	0.0156	5.48%	62.50	0.0160

B.6 Germany Pre and Post Reforms (Common Calibration Parameters)

Table B.6 Germany Pre-Reform (Common Calibration Parameters): Additional Results

State	Risk Aversion=1			Risk Aversion=3		
	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity
Working with no UI entitlement	6.87%	48.14	N/A	6.51%	48.34	N/A
Working with minimum UI entitlement	6.35%	48.14	N/A	6.04%	48.34	N/A
Working with maximum UI entitlement	77.43%	635.37	N/A	78.09%	672.75	N/A
Maximum UI Entitlement: UI Benefits	3.62%	29.70	0.0147	3.56%	30.68	0.0136
Minimum UI Entitlement: UI Benefits	0.19%	18.89	0.0150	0.17%	19.22	0.0141
Unemployment Assistance	5.55%	64.11	0.0156	5.62%	67.10	0.0149

Table B.7 Germany Post-Reform (Common Calibration Parameters): Additional Results

State	Risk Aversion=1			Risk Aversion=3		
	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity
Working with no UI entitlement	7.00%	48.14	N/A	6.73%	48.34	N/A
Working with minimum UI entitlement	6.47%	48.14	N/A	6.25%	48.34	N/A
Working with maximum UI entitlement	78.93%	635.37	N/A	80.72%	672.75	N/A
Maximum UI Entitlement: UI Benefits	3.43%	27.60	0.0173	3.18%	26.46	0.0189
Minimum UI Entitlement: UI Benefits	0.18%	17.78	0.0185	0.16%	17.00	0.0211
Unemployment Assistance/Social Benefit	3.99%	48.30	0.0207	2.97%	39.12	0.0256

B.7 United States Sensitivity

Table B.8 United States Sensitivity: Calibration Results (Risk Aversion=1)

Variables	Values (Risk Aversion=1)			
	Benefit Extension Program (2008-2013)		No Benefit Extension Program (2003-2007)	
	Housing Assistance included in SA*	Housing Assistance excluded in SA	Housing Assistance included in SA	Housing Assistance excluded in SA
Normalized Net Wage Rate	1	1	1	1
Normalized Net UI Benefits	0.52179	0.52179	0.52179	0.52179
Normalized Net Social Assistance Benefits	0.32507	0.07152	0.32507	0.07152
UI Qualification Duration	26 weeks	26 weeks	26 weeks	26 weeks
UI (Basic) Benefit Duration	26 weeks	26 weeks	26 weeks	26 weeks
Emergency Unemployment Compensation Tier 1 Duration	20 weeks	20 weeks	N/A	N/A
Emergency Unemployment Compensation Tier 2 Duration	14 weeks	14 weeks	N/A	N/A
Emergency Unemployment Compensation Tier 3 Duration	13 weeks	13 weeks	N/A	N/A
Total UI Benefit Duration	73 weeks	73 weeks	26 weeks	26 weeks
Social Assistance Duration	Indefinite	Indefinite	Indefinite	Indefinite
τ Tax Rate	0.0336	0.0310	0.0310	0.0245

Variables	Values (Risk Aversion=1)			
	Benefit Extension Program (2008-2013)		No Benefit Extension Program (2003-2007)	
	Housing Assistance included in SA*	Housing Assistance excluded in SA	Housing Assistance included in SA	Housing Assistance excluded in SA
λ Job Separation Rate	0.0041	0.0041	0.0041	0.042
α Cost Function Scalar	450.4	658.3	518.4	956.3
Unemployment Rate	6.80%	6.80%	6.80%	6.80%
Share of Short-term Unemployment	52%	52%	52%	52%
Average Unemployment Duration	17.98 weeks	17.74 weeks	17.81 weeks	17.27 weeks

Note. *This is the main USA result (for reference)

Table B.9 United States Sensitivity: Calibration Results (Risk Aversion=3)

Variables		Values (Risk Aversion=3)			
		Benefit Extension Program (2008-2013)		No Benefit Extension Program (2003-2007)	
		Housing Assistance included in SA*	Housing Assistance excluded in SA	Housing Assistance included in SA	Housing Assistance excluded in SA
τ	Tax Rate	0.0341	0.0327	0.0313	0.0253
λ	Job Separation Rate	0.0041	0.0041	0.0042	0.0043
α	Cost Function Scalar	1,279.4	12,331	1,744.7	30,243
Unemployment Rate		6.80%	6.80%	6.80%	6.80%
Share of Short-term Unemployment		52%	52%	52%	52%
Average Unemployment Duration		17.75 weeks	17.99 weeks	17.45 weeks	17.13 weeks

Note. *This is the main USA result (for reference).

Table B.10 United States Sensitivity: Benefit Extension Programs Active

State	Benefit Extension Program (2008-2013)											
	Risk Aversion=1						Risk Aversion=3					
	Housing Assistance included in SA*			Housing Assistance excluded in SA			Housing Assistance included in SA*			Housing Assistance excluded in SA		
	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity	Share of time spent in state	Average duration spent in state	Search Intensity	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity
Working with no UI entitlement	8.93%	23.60	N/A	9.04%	23.57	N/A	9.04%	23.58	N/A	8.93%	23.61	N/A
Working with maximum UI entitlement	84.26%	246.23	N/A	84.15%	242.98	N/A	84.15%	243.05	N/A	84.27%	246.43	N/A
Maximum UI Entitlement: UI Benefits	5.24%	15.31	0.0524	5.54%	15.98	0.0495	5.46%	15.78	0.0504	5.91%	17.29	0.0447
Social Assistance	1.57%	15.04	0.0665	1.27%	11.62	0.0861	1.34%	12.41	0.0806	0.89%	7.86	0.1272

Note. *This is the main USA result (for reference)

Table B.11 United States Sensitivity: No Benefit Extension Programs

State	No Benefit Extension Programs (2003-2007)											
	Risk Aversion=1						Risk Aversion=3					
	Housing Assistance included in SA			Housing Assistance excluded in SA			Housing Assistance included in SA			Housing Assistance excluded in SA		
	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity	Share of time spent in state	Average duration spent in state (Weeks)	Search Intensity
Working with no UI entitlement	9.01%	23.58	N/A	9.26%	23.51	N/A	9.18%	23.54	N/A	9.33%	23.50	N/A
Working with maximum UI entitlement	84.18%	243.91	N/A	83.93%	236.58	N/A	84.01%	238.92	N/A	83.86%	234.62	N/A
Maximum UI Entitlement: UI Benefits	3.90%	11.29	0.0521	4.11%	11.59	0.0497	4.06%	11.53	0.0502	4.30%	12.02	0.0465
Social Assistance	2.91%	16.27	0.0615	2.69%	14.22	0.0703	2.75%	14.74	0.0678	2.51%	12.71	0.0787

B.8 Efficiency Measure: Optimal UI Benefits in Benchmark Models

Table B.12 Optimal UI Benefits in Benchmark Models: Main Results

Country	Replacement Ratios in Benchmark System		
	Risk Aversion=1	Risk Aversion=3	Risk Aversion=5
Canada	0.5389	0.6571	0.6937
United States	0.5173	0.6597	0.7180
France	0.6139	0.6413	0.6830
Germany (Post-Reform)	0.5029	0.6536	0.7295
Germany (Pre-Reform)	0.5600	0.6535	0.7239
Germany (Post-Reform): Common Parameters	0.5604	0.6538	N/A
Germany (Pre-Reform): Common Parameters	0.5604	0.6538	N/A
USA (No HA)	0.5918	0.6174	N/A
USA (No EB/EUC)	0.5346	0.6617	N/A
USA (No HA and NO EB/EUC)	0.7075	0.6264	N/A

Note. No HA stands for housing assistance omitted from social assistance calculation. No EB/EUC means no benefit extensions programs are active (Extended Benefits or Emergency Unemployment Compensation).

APPENDIX C – ADDITIONAL TABLES

Appendix C contains tables or information omitted from the main paper.

C.1 Canada's EI Benefit Duration

This section contains information regarding the calculation of Canada's EI benefit duration. Canada's EI Benefit duration is based on the regional unemployment rate and number of insured work hours in the qualifying period; this relationship is shown in Table C.1.

Table C.1 EI Benefit Duration Calculation

Insured Hours of Work	Regional Unemployment Rate (%)											
	6% and under	Over 6% to 7%	Over 7% to 8%	Over 8% to 9%	Over 9% to 10%	Over 10% to 11%	Over 11% to 12%	Over 12% to 13%	Over 13% to 14%	Over 14% to 15%	Over 15% to 16%	Over 16%
420-454	0	0	0	0	0	0	0	0	26	28	30	32
455-489	0	0	0	0	0	0	0	24	26	28	30	32
490-524	0	0	0	0	0	0	23	25	27	29	31	33
525-559	0	0	0	0	0	21	23	25	27	29	31	33
560-594	0	0	0	0	20	22	24	26	28	30	32	34
595-629	0	0	0	18	20	22	24	26	28	30	32	34
630-664	0	0	17	19	21	23	25	27	29	31	33	35
665-669	0	15	17	19	21	23	25	27	29	31	33	35
700-734	14	16	18	20	22	24	26	28	30	32	34	36
735-769	14	16	18	20	22	24	26	28	30	32	34	36
770-804	15	17	19	21	23	25	27	29	31	33	35	37
805-839	15	17	19	21	23	25	27	29	31	33	35	37
840-874	16	18	20	22	24	26	28	30	32	34	36	38
875-909	16	18	20	22	24	26	28	30	32	34	36	38
910-944	17	19	21	23	25	27	29	31	33	35	37	39
945-979	17	19	21	23	25	27	29	31	33	35	37	39
980-1014	18	20	22	24	26	28	30	32	34	36	38	40
1015-1049	18	20	22	24	26	28	30	32	34	36	38	40
1050-1084	19	21	23	25	27	29	31	33	35	37	39	41
1085-1119	19	21	23	25	27	29	31	33	35	37	39	41
1120-1154	20	22	24	26	28	30	32	34	36	38	40	42
1155-1189	20	22	24	26	28	30	32	34	36	38	40	42
1190-1224	21	23	25	27	29	31	33	35	37	39	41	43
1225-1259	21	23	25	27	29	31	33	35	37	39	41	43
1260-1294	22	24	26	28	30	32	34	36	38	40	42	44
1295-1329	22	24	26	28	30	32	34	36	38	40	42	44
1330-1364	23	25	27	29	31	33	35	37	39	41	43	45

Insured Hours of Work	Regional Unemployment Rate (%)											
	6% and under	Over 6% to 7%	Over 7% to 8%	Over 8% to 9%	Over 9% to 10%	Over 10% to 11%	Over 11% to 12%	Over 12% to 13%	Over 13% to 14%	Over 14% to 15%	Over 15% to 16%	Over 16%
1365-1399	23	25	27	29	31	33	35	37	39	41	43	45
1400-1434	24	26	28	30	32	34	36	38	40	42	44	45
1435-1469	25	27	29	31	33	35	37	39	41	43	45	45
1470-1504	26	28	30	32	34	36	38	40	42	44	45	45
1505-1539	27	29	31	33	35	37	39	41	43	45	45	45
1540-1574	28	30	32	34	36	38	40	42	44	45	45	45
1575-1609	29	31	33	35	37	39	41	43	45	45	45	45
1610-1644	30	32	34	36	38	40	42	44	45	45	45	45
1645-1679	31	33	35	37	39	41	43	45	45	45	45	45
1680-1714	32	34	36	38	40	42	44	45	45	45	45	45
1715-1749	33	35	37	39	41	43	45	45	45	45	45	45
1750-1784	34	36	38	40	42	44	45	45	45	45	45	45
1785-1819	35	37	39	41	43	45	45	45	45	45	45	45
1820 and over	36	38	40	42	44	45	45	45	45	45	45	45

Note. Table adapted from OECD (2015, March). "Social Policies and Data." <u>Benefits and Wages: Country Specific Information</u>. Retrieved May 1, 2015, from http://www.oecd.org/els/soc/benefits-and-wages-country-specific-information.htm.

C.2 United States' UI Program (2010)

The United States UI policy is modeled using information from 2010. The table below shows the policy overview for the unemployment benefits programs in the USA (2010); more specifically, State qualification of EUC and EB programs. It should be noted that Table C.2 differs from the table presented in the United States UI Overview Section, since the table presented there is for 2013.

Table C.2 United States' Overview Of UI Program (2010)

UI Benefits Programs	State Qualification	Enacted in Michigan? (2013)	Maximum Number of Weeks	Benefit Amount (USD)
Regular UI Benefits (Michigan)	-	Always	26	USD 117 – USD 362
Emergency Unemployment Compensation (EUC) – Tier 1	All States Qualify	Yes	20 weeks or 80% of the regular state maximum UI duration	Same as regular state UI Benefits
Emergency Unemployment Compensation (EUC) – Tier 2	State must have a total unemployment rate of at least 6 percent	Yes	14 weeks or 54% of the regular state maximum UI duration	Same as regular state UI Benefits
Emergency Unemployment Compensation (EUC) – Tier 3	State must have a total unemployment rate of at least 6 percent	Yes	13 weeks or 50% of the regular state maximum UI duration	Same as regular state UI Benefits
Emergency Unemployment Compensation (EUC) – Tier 4	State must have a total unemployment rate of at least 8 percent	No	6 weeks or 24% of the regular state maximum UI duration	Same as regular state UI Benefits
Extended Benefits (EB)	States with a 3-month seasonally adjusted UR of 6.5 percent or higher, and 110 percent above the UR rate for the corresponding 3-months period in either or both of the two preceding calendar years.	No	13 weeks or 50% of the regular state maximum UI duration In periods of total unemployment of	Same as regular state UI Benefits

UI Benefits Programs	State Qualification	Enacted in Michigan? (2013)	Maximum Number of Weeks	Benefit Amount (USD)
			at least 8 percent: 20 weeks or 80% of the regular state maximum UI duration	

Note. Table adapted from OECD (2015, March). "Social Policies and Data." <u>Benefits and Wages: Country Specific Information</u>. Retrieved May 1, 2015, from http://www.oecd.org/els/soc/benefits-and-wages-country-specific-information.htm.