Universitat Autònoma de Barcelona

# Ph.D. Thesis:
# Essays on Labor Market Dynamics and Policies


Arnau Valladares-Esteban

International Doctorate in Economic Analysis (IDEA)
Departament d'Economia i Història Econòmica
Facultat d'Economia i Empresa


Supervised by:

Dr. Sekyu Choi    Dr. Nezih Guner

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*"Per tu, per mi*

*i per tot el que hem viscut*

*els anys, les pors*

*i el que hem abandonat."*

Fragment de la cançó *Porca Misèria* de Joel Joan

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# General Introduction

This thesis studies the interactions between labor market dynamics and family structure, and how these interactions affect public policy. In the US economy, we observe very different patterns regarding labor force participation, employment, and unemployment between single and married individuals. Even after controlling for the different composition of the two groups, we still observe that married and single individuals exhibit very different outcomes in the labor market. The explanation proposed in this thesis is simple: individuals take different decisions when they belong to a family than when they are alone. Departing from this premise, this thesis assess two fundamental issues. First, the question of which part of the labor market dynamics we observe in the data can be accounted for by the family. Secondly, whether the implications of one of the most important labor market policies, the unemployment insurance, are significantly changed when we introduce the family in the analysis.

In the first chapter, entitled *Unemployment Heterogeneity Across Households and Time: Evidence and a Quantitative Theory* and co-authored with Sekyu Choi, we document a sizable and stable gap between the unemployment rates of married and single workers in the U.S. economy. Using a standard flow-decomposition exercise, we account for the driving forces behind this difference both over time and across gender/household type. We estimate the fraction of the gap unaccounted for observable characteristics and, using the underlying trends in the demographics of marriage (the fraction of married workers is declining over time), we argue that selection into marriage of *better workers* cannot be the only reason for this gap. We then put forward a simple model of the labor market, with heterogeneous agents with respect to income shocks, assets, gender and marital status. We show that the family generates two counterbalancing effects on the unemployment rate. On the one hand, because it is a completing-markets device, it reduces the incentives to work which reduces employment and, ceteris paribus, increases the unemployment rate. On the other hand, it also increases the propensity of agents to transit from unemployment to non-participation which reduces the unemployment rate. We calibrate the model to the 1970s and the 2000s and argue that the importance of the family explaining the unemployment marriage gap has been increasing over time mainly due to the increase in labor market participation of married women.

In the second chapter, entitled *Labor Market Dynamics of Married Couples* and co-authored with Nezih Guner and Yuliya Kulikova, we study joint labor market transitions of married couples. The existing empirical literature on labor market dynamics mainly focuses on movements between employment and unemployment, and has ignored, as far as the cyclical movements in unemployment are concerned, the movements of individuals in and out of the labor force. Another key feature of the existing literature is its focus on individual transitions among labor market states (employment, unemployment, and out of labor force). We study joint labor market transitions of husbands and wives among the three labor market states. We use data from the Current Population Survey (CPS) that has been widely used to study labor market dynamics. The results show that joint labor market transitions are important to understand cyclical movements in unemployment as well as the secular rise in aggregate employment. Married men and women differ in their labor market dynamics. Transitions in and out of labor force play a more important role for unemployment dynamics of females than they do for those of males. Hence modeling out of labor force as a distinct state is critical to understand joint labor market dynamics of married couples. The results also show that joint labor market transitions of husbands and wives imply an important degree of coordination between labor market activities of household members.

In the third chapter, entitled *Unemployment Insurance in an Economy with Single and Married Households*, I depart from the fact that in the US economy married individuals are less likely to be unemployed than their non-married counterparts. At the same time, the family has long been identified as one of the main providers of insurance against multiple types of uncertainty, including the one generated by labor market frictions. Motivated by these two facts, I study an unemployment insurance program, resembling the one in place in the US, in a framework where the main source of heterogeneity among agents is the type of household they live in, that is, some agents live alone while others live with their spouses as a family. The central finding is that the unemployment insurance program improves the welfare of single households but not of married households. This result does not depend on the different characteristics between married people and singles. For single individuals living with their clones as a family, the unemployment insurance program is not welfare-improving, while for married individuals living apart as singles, unemployment insurance does improve welfare. Hence, the main reason why married households do not benefit from the unemployment insurance program is that the family, with its two earners, is able to provide enough insurance.

# Chapter 1

# Unemployment Heterogeneity Across Households and Time: Evidence and a Quantitative Theory

Written jointly with Sekyu Choi.

## 1.1 Introduction

The unemployment rate of married workers is systematically lower than for singles in the US economy.[1] On the other hand, the share of not-married workers in the US labor force has increased steadily for the last 30 years. Using both differences in the cross-section and across time, in this paper we aim to quantitatively asses the importance of within household specialization, household insurance and labor market shocks as competing factors explaining this marriage unemployment gap. Understanding how labor market forces (shocks) interplay with forces from within the household (self-insurance) is key for policy analysis and welfare assessment regarding unemployment.[2]

Empirically, we analyze monthly data from the Current Population Survey (CPS) and compute unemployment rates and worker flows between employment, unemployment and non-participation by marital status and gender. We document the evolution of all transition probabilities by type of household and, following a similar decomposition method as in Shimer (2012), we find that for males, higher employment exit probabilities for singles determine the gap, while for females, the participation decision (transitions between out of the labor force and both employment and unemployment) plays a fundamental role. More importantly, we find that the contribution of these transitions to the gap is very stable over time; given observed increases in female labor force participation and wage volatility (specially for married individuals) this hints at changes also in self-insurance and specialization within the household.

When we take into consideration differences in observable characteristics across the married and single population, we find some interesting patterns. For women, the marriage unemployment gap at the beginning of the sample (1976) is entirely explained by differences in observables (the gap after controlling for them is zero). However, in time, the unexplained portion of the gap increases. For men, the unexplained portion of the marriage unemployment gap declines up to around the year 2000, and starts increasing after that date. Given the relatively steady decrease in the proportion of married individuals in the labor force over the sample period, these results pose a challenge to the notion that a simple selection mechanism into marriage of better/more employable workers is at play. If better workers (those who find jobs faster or lose them at a slower rate) are more likely to get married also,

[1] Throughout this paper we use the terms single and non-married interchangeably, referring to any person who is labeled as "never married", "separated", "divorced" or "widowed" in the Current Population Survey (CPS). We ignore cohabiting individuals, given the inability to distinguish them in a non-arbitrary way in the CPS.

[2] A related literature tries to analyze endogenous demographic change, taking as given labor market conditions, as in Regalia and Ríos-Rull (2010), Greenwood and Guner (2008) and **?** among others. We view this paper as complementary to this line of work.

then, why is the unexplained portion of the gap evolving in different directions for males and women? Why is it increasing for both after 2000?

The full resolution to these questions is beyond the scope of this paper. However, we are able to provide some insights by exhausting the explanatory power of labor market shocks in a standard incomplete markets heterogeneous agent model, in the spirit of Chang and Kim (2007) and Krusell et al. (2011): we introduce agents who differ by gender and marital status. In our model, agents face both uninsurable income and employment risk (job-offer and job-losing shocks), and chose how much to consume, save and whether to work or not, thus making labor supply discrete and endogenous. For married individuals the problem is compounded: they face more risk (both spouses are subject to shocks) but can self-insure by pooling income and enjoying public consumption inside the household. This setup has the advantage of providing a clean way of distinguishing the unemployed from all the not working, by way of computing for whom the expected value of working versus not-working is higher, conditional on currently not working (and the household's current asset status). Given that the participation decision is important to account jointly for the lower unemployment rates of both married male and female agents, we prefer this over the classical Diamond-Mortensen-Pissarides framework, where there are only 2 labor market states (employment and unemployment) and labor supply decisions are trivial.

We calibrate our model to match the facts of the U.S. economy in two separate periods: the 1970s (January of 1976 to December 1979) and the 2000s (January of 2000 to December 2005). We then compute differences in unemployment and employment rates across married and single households when we shut down both employment and wage risk differentials. The result can be interpreted as gaps induced only by within household mechanisms (insurance and specialization). Our main finding is that the family can serve as a mechanism to reduce unemployment because married agents can exit unemployment through non-participation. In our model, the family introduces two main forces which affect unemployment rates. First, because the family acts as a completing-markets mechanism, it reduces the willingness of agents to work, which reduces employment and, ceteris paribus, increases the unemployment rate. Secondly, precisely because married agents are less inclined to work, they are more likely to give up on being unemployed if the labor market situation of their spouse improves. Hence, the family can also reduce the unemployment rate.

For the 1970s, we find that when single agents have the characteristics of married, the unemployment gap is completely reversed. When we perform the same experiment for the 2000s, the unemployment gap for males is not reversed and the magnitude of the reversal for females is much smaller. We interpret this result as evidence that in the 2000s the effect of the family reducing the unemployment through non-participation dominates its opposite effect of increasing unemployment through less employment. Our explanation is that, apart from any change in selection into marriage that may have occurred during this period, the power of the family to reduce unemployment has been augmented because of the increase in the participation of married females.

Considering the relationship between household specialization, marriage self-insurance and the aggregate unemployment rate may change how we think about standard government policies, like optimal unemployment insurance. For example. Hansen and Imrohoroglu (1992) show that when agents face uninsurable labor market shocks, a publicly provided unemployment insurance generates significant improvements in welfare. If within household specialization and marriage self-insurance have a substantial role affecting unemployment, the welfare implications of standard unemployment insurance might be different. The importance of considering household interactions applies also to the case of men labor supply, as shown by Knowles (2013) and to the case of taxation, as shown by Guner et al. (2012a) and Guner et al. (2012b).

Our paper is related closely to Ek and Holmlund (2010) and Guler et al. (2012): we extend a standard single-agent framework to incorporate decision units formed by two agents and analyze its predictions with respect to equilibrium unemployment rates. The baseline model in Ek and Holmlund (2010) is standard the Diamond-Mortensen-Pissarides one, where both married and singles have the same unemployment rate, given the same overall exogenous separation and aggregate job finding rates. Using that framework the authors study optimality of different unemployment insurance schemes. On the other hand, Guler et al. (2012) use the optimal stopping model in McCall (1970), and show the analytical properties of the two-searcher solution. Their results show that in a wide array of model configurations, married workers face higher unemployment rates than singles, a counterfactual result given our evidence.

## 1.2 Data Analysis

We use the monthly files from the Current Population Survey (CPS) as our main data source. We use the fact that individuals are followed for up to four consecutive months and use a standard age/sex/race matching procedure to match worker information across months.[3] We consider all workers aged 16 and above, although our results are robust to different sample restrictions. From the data we recover the proportion of workers at each month in three labor market states: employment ($E$), unemployment ($U$) and inactivity/out of the labor force ($O$). We also compute monthly transition probabilities $\gamma_t^{jk}$, as the number of workers

[3]See Shimer (2012) for a description of the methodology.

who were in state $j \in \{E, U, O\}$ in month $t$, who are then observed in state $k \in \{E, U, O\}$ in month $t+1$, divided by the total number of workers in state $j$ during $t$.

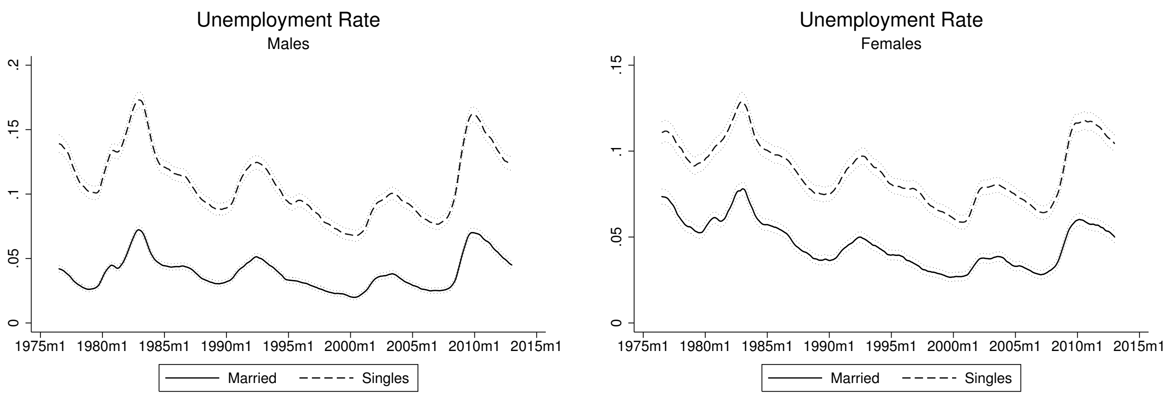



Figure 1.1: Unemployment rate by marital status. Source: Monthly CPS, 1976:1-2013:6. Original series smoothed using a 12-month moving average. *Married* denotes all workers who are married at the time of the survey. *Single* category represents everyone else. All workers aged 16 and older.

In Figure 1.1 we present unemployment rates $U_t/(E_t+U_t)$ for married versus non-married individuals in the U.S. economy, between January of 1976 and July of 2013. The married group is defined as workers claimed to be married at the time of the survey, thus in the *single* group, we pool individuals who are single, separated and divorced. One problem with the CPS, is that cohabiting couples appear as singles, but might behave as regular married couples. More troubling for our discussion, is the increase in this type of household during our sample period. As noted by Gemici and Laufer (2011), cohabiting couples differ from married ones in terms of labor supply, behaving closer to singles. To address partially this issue, we perform robustness exercises, imposing restrictive definitions of who are *single* (workers living alone or not living with a non-relative of the opposite sex). Our results are quite robust.[4]

We show a 12-month moving average of monthly data, in order to remove seasonality effects. From the figure we can see that the difference between unemployment rates is significant (upwards of 4%) and persistent over the entire sample for both men and women.

[4]The robustness exercise is available upon request.

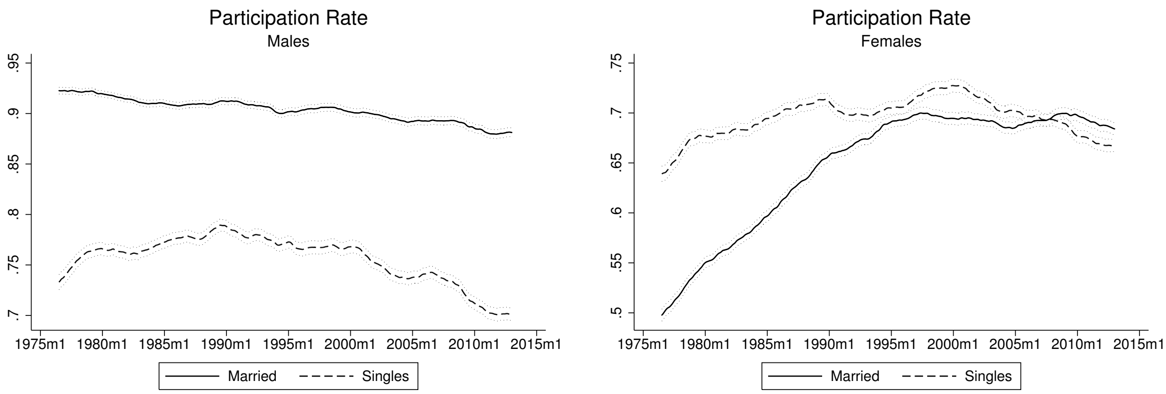



Figure 1.2: Participation rate by marital status. Source: Monthly CPS, 1976:1-2013:6. Original series smoothed using a 12-month moving average. *Married* denotes all workers who are married at the time of the survey. *Single* category represents everyone else. All workers aged 16 and older.

The stability of the marriage unemployment gap for both men and women however, doesn't seem to have the same root. This is hinted at when we inspect figure 1.2, where we present participation rates $(E_t + U_t)/(E_t + U_t + O_t)$ over the same time period. While the fraction of male workers participating in the labor market has remained stable for both married and singles (with a relatively stable gap), the most dramatic change comes from the participation of married women, who close the gap between them and their single counterparts by the mid 1990s. If we only use the evidence for male workers, one would be tempted to assume a very stable labor market, where some stable observed and/or unobserved factor determines the marriage unemployment gap, given the stability of unemployment and participation rates. However, the evidence for women hints at something else at play. Next in this section, figure 1.3 shows the fraction of married individuals over the working age population. This fraction has a marked downward trend for both males and females.

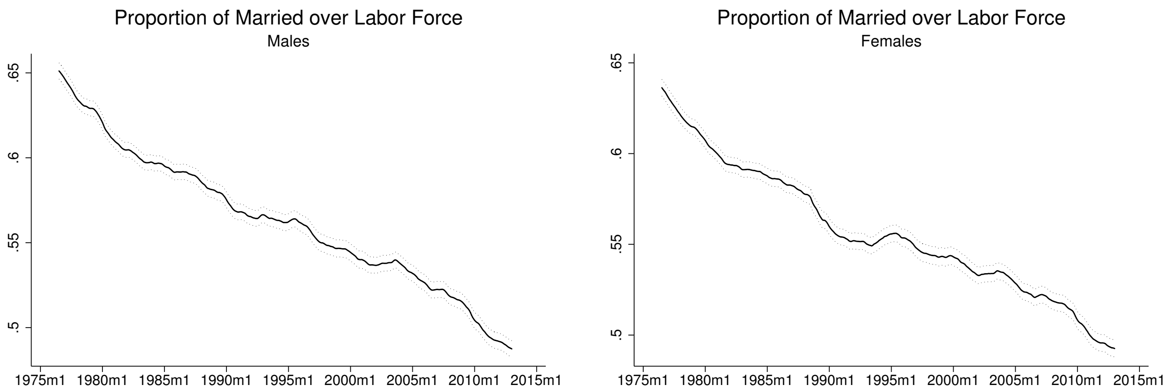



Figure 1.3: Percentage of married workers in the labor force. Source: Monthly CPS, 1976:1-2013:6. Original series smoothed using a 12-month moving average. *Married* denotes all workers who are married at the time of the survey. *Single* category represents everyone else. All workers aged 16 and older.

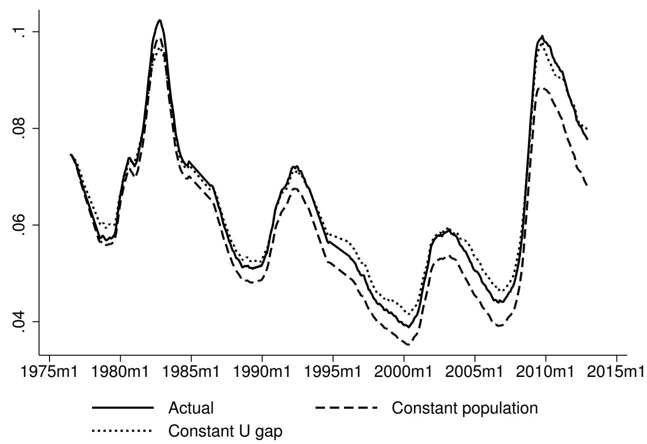



Figure 1.4: Aggregate effects of marital composition in the labor force. The figure shows the *Actual* unemployment rate, a counterfactual with the share of married and single workers fixed as of January, 1976 (*Constant population*) and a counterfactual where the unemployment rate of the married group is held as a constant fraction (average from 1976:1 to 1979:12) of the single group (*Constant U gap*). Source for actual rates: Monthly CPS, 1976:1-2013:6. Original series smoothed using a 12-month moving average. *Married* denotes all workers who are married at the time of the survey. *Single* category represents everyone else. All workers aged 16 and older.

These figures suggest a significant role for demographics in shaping aggregate labor market outcomes. This is similar to findings in Jaimovich and Siu (2009), who study aggregate hours volatility and the role of the age composition of the labor force. Here, we find a similar link, in terms of propensity of marriage in the population and the aggregate unemployment rate. We summarize the trends shown before in figure 1.4, where we plot the actual unemployment rate versus a counterfactual where we keep the population share in terms of single and married workers as of January 1976 (*Constant Population* line) and an additional counterfactual where we use the actual married/single shares, but we keep the unemployment gap between those groups as in the 70s, (*Constant U gap* line).[5]

As seen from the figure, the *constant population* unemployment rate is lower than the actual one, reflecting the fact that the unemployment rate in the married group is lower. Also, the gap between actual and counterfactual rates is relatively stable for most of the sample period. Since the trend in the share of married workers is monotonically decreasing in time, the fact that the gap between actual and counterfactual rates doesn't increase with time hints at some other mechanism operating on top of the mere composition of the working population. As for the *Constant U gap* counterfactual, the figure shows that it closely resembles the actual rate, which indicates an overall modest contribution of changes in the actual unemployment probability differences across marital groups.

In the next section, we dissect mechanically these differences in unemployment rates by marital status and look at the role of transition probabilities across all labor market states. In this way, we can derive candidate mechanisms as to why the marriage unemployment gap is so stable across periods and genders.

### 1.2.1 A Decomposition Exercise

As described above, we compute simple transition probabilities between three labor market states using monthly CPS data. Figures 1.5 and 1.6 present our results, which are raw computations, unadjusted by time aggregation nor misclassification error.[6]

For male workers, the figure shows that there are relatively constant differences between single and married workers, with single workers experiencing more "churning" inside the labor market, given that all transition probabilities are higher for them over the entire sample. However, there are two exceptions to this, which are the out-of-the-labor force to employment ($OE$) and the employment to out-of-the-labor force ($EO$) transition probabilities, which show

[5] We compute this counterfactual using actual shares of married/single male and female workers in the unemployment pool, as well as the observed unemployment rate of single workers while making the unemployment of the married group be a constant fraction of the single group (as computed from 1976:1 to 1979:12).

[6] As noted by **?** and others, even though time aggregation bias (the fact that some transitions might not be recorded due to sampling of workers at fixed time intervals) or the simple misclassification of workers into different labor market states might be important at the individual level, these issues have small implications in the aggregate, given that individual error washes away.

a marked downward trend, with $OE$ converging across marital states at the end of the period (great recession). This means that the pool of single workers now contains individuals who resemble more over time workers in the married group, in terms of participation decisions and direct movements in and out of employment from inactivity. Considering that the relative importance of married workers is diminishing, this could be interpreted as a change in the characteristics of the single working population.


Figure 1.5: Transition probabilities, MALE workers. Source: Monthly CPS, 1976:1-2013:6. Original series smoothed using a 12-month moving average. *Married* denotes all workers who are married at the time of the survey. *Single* category represents everyone else. All workers aged 16 and older.

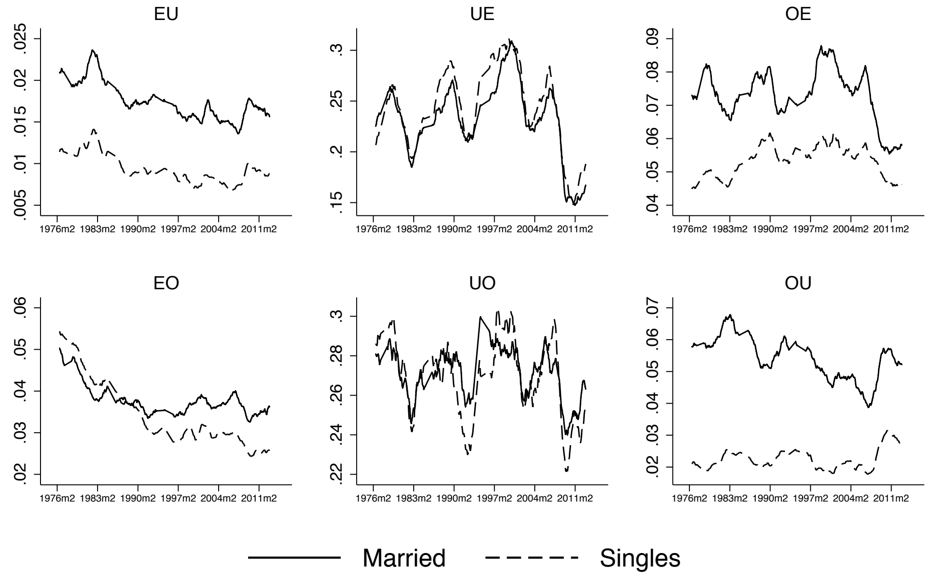



Figure 1.6: Transition probabilities, FEMALE workers. Source: Monthly CPS, 1976:1-2013:6. Original series smoothed using a 12-month moving average. *Married* denotes all workers who are married at the time of the survey. *Single* category represents everyone else. All workers aged 16 and older.

On the other hand, figure 1.6 shows that the single-married difference for women in terms of transition probabilities has remained quite stable across all computed flows and over the entire sample. How to interpret these facts is not so easy, since the pool of female workers is the one that has experienced the most dramatic change: in conjunction of an overall decrease in the stock of married female workers, it is precisely workers in this latter group the ones who have taken more jobs over the last three decades. However, looking solely at the evidence of transition probabilities for women, there is no visible change in the difference between married and single female workers over time, which implies that the group characteristics female workers, across marital states, has remained stable between the beginning and the end of the sample.

In order to provide a more objective analysis, in this section we use a decomposition method which follows closely the one in Shimer (2012). If we assume that at each point in time, we are at a steady state equilibrium between inflows and outflows from each considered state $\{E, U, O\}$, we can approximate the measure of individuals in each of them (up to a common multiplicative factor $\kappa$) by solving the following linear system of equations

$$\begin{aligned}
\left(\gamma_t^{EU}+\gamma_t^{EO}\right)E_t &= \gamma_t^{UE}U_t+\gamma_t^{OE}O_t\\
\left(\gamma_t^{UE}+\gamma_t^{UO}\right)U_t &= \gamma_t^{EU}E_t+\gamma_t^{OU}O_t\\
\left(\gamma_t^{OE}+\gamma_t^{OU}\right)O_t &= \gamma_t^{EO}E_t+\gamma_t^{UO}U_t
\end{aligned}$$

the interpretation of these equations is straightforward. The left hand side represents the outflow of workers from states $\{E,U,O\}$ respectively, at the end of month $t$. The right hand side accounts for the number of workers transiting into those same states. These two numbers must be the same, assuming stationary transition probabilities $\gamma_t^{jk}$ inside the month. Solving for the states, we get functional forms that relate them to transition probabilities only:

$$\begin{aligned}
E_t &= \kappa E(\gamma_t^{UE},\gamma_t^{UO},\gamma_t^{OE},\gamma_t^{OU})\\
U_t &= \kappa U(\gamma_t^{EU},\gamma_t^{EO},\gamma_t^{OE},\gamma_t^{OU})\\
O_t &= \kappa O(\gamma_t^{EU},\gamma_t^{EO},\gamma_t^{UE},\gamma_t^{UO})
\end{aligned}$$

the presence of $\kappa$ above shows that the method cannot account for the scale in each labor market state, which is of no importance, since $\kappa$ drops off when calculating rates. Thus, we can construct "theoretical" unemployment rates ($U_t/(E_t+U_t)$) using the above equations and our estimates for each $\gamma_t^{jk}$ from the previous section, we get:

$$\frac{U_t}{U_t+E_t}=\frac{\gamma_t^{OE}\gamma_t^{EU}+\gamma_t^{OU}(\gamma_t^{EU}+\gamma_t^{EO})}{\gamma_t^{OE}(\gamma_t^{UO}+\gamma_t^{EU})+\gamma_t^{UE}(\gamma_t^{OE}+\gamma_t^{OU})+\gamma_t^{OU}(\gamma_t^{EU}+\gamma_t^{EO})} \tag{1.1}$$

As in Shimer (2012), these theoretical constructs line up remarkably well with the actual rates.[7] More importantly, the equation above provides an intuitive way of accounting for the underlying forces which shape the unemployment rates. For example, if one is interested in which transition probability $\gamma_t^{jk}$ is more responsible for the variability of the unemployment rate across time, one can take equation (1.1) and replace each transition probability by its sample average, except for one, which would be responsible for all movement in the resulting counterfactual. We perform this exercise in figure 1.7 for males and figure 1.8 for females.

[7] We don't present figures comparing actual versus theoretical rates here, since the theoretical rates almost perfectly mimic actual unemployment rates by gender and marital status.

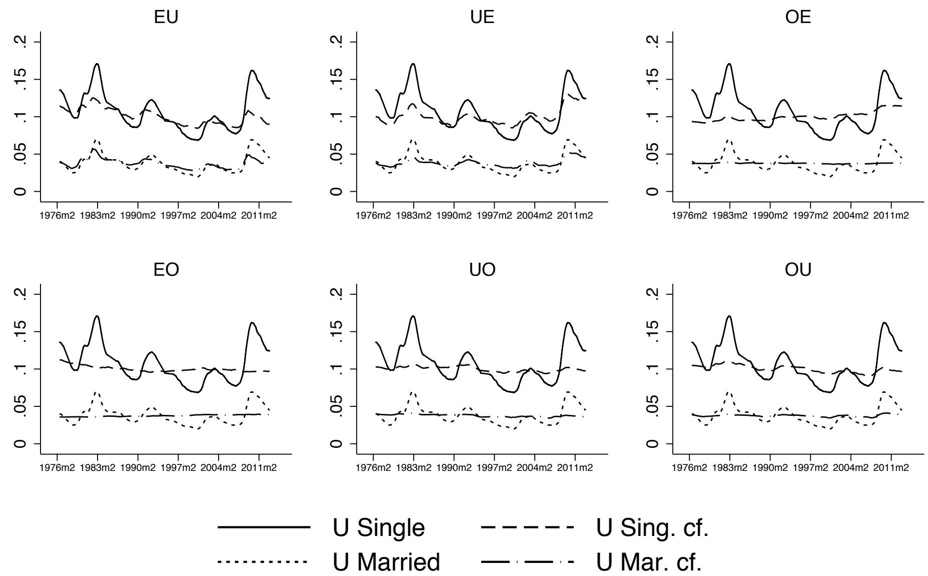



Figure 1.7: Counterfactual analysis for unemployment *volatility*, MALE workers. The counterfactual (cf.) lines are constructed by using the theoretical value of the unemployment rate in equation (1.1) replacing each transition probability by its sample mean, with the exception of the one in the subtitle. Source for actual rates: Monthly CPS, 1976:1-2013:6. Original series smoothed using a 12-month moving average. *Married* denotes all workers who are married at the time of the survey. *Single* category represents everyone else. All workers aged 16 and older.

The figures are interpreted as follows. The counterfactual (cf.) lines are computed as stated above, using the theoretical equation for the unemployment rate (1.1) and replacing all transition probabilities by their sample means, except for the one stated in each subfigure. For example, the first graph in figure 1.7 shows the actual unemployment rates (Married and Single lines) and the resulting theoretical constructs if only transition probability $\gamma_t^{EU}$ were to move as in the data, with the rest of transitions constant through the exercise. Thus, the closer the counterfactual (cf.) line is to the observed one, the higher the contribution of the particular transition probability to the overall variability of the unemployment rate over time.

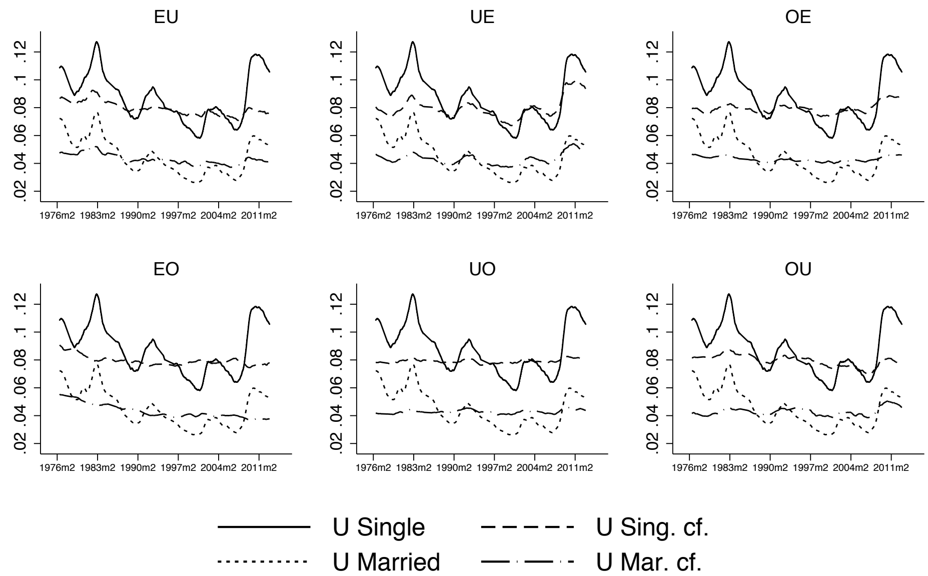



Figure 1.8: Counterfactual analysis for unemployment *volatility*, FEMALE workers. The counterfactual (cf.) lines are constructed by using the theoretical value of the unemployment rate in equation (1.1) replacing each transition probability by its sample mean, with the exception of the one in the subtitle. Source for actual rates: Monthly CPS, 1976:1-2013:6. Original series smoothed using a 12-month moving average. *Married* denotes all workers who are married at the time of the survey. *Single* category represents everyone else. All workers aged 16 and older.

This exercise shows that the job separation probability $\gamma_t^{EU}$ and the job finding probability out of unemployment $\gamma_t^{UE}$ are the ones most responsible for the volatility of unemployment rates over time (mostly for males, both single and married) since their counterfactual lines move closer to the actual ones. However, for female workers we don't see such clear patterns. Further, the participation margin, represented by transitions out of inactivity $\gamma_t^{OE}$ and $\gamma_t^{OU}$ also seem to affect the volatility of unemployment for women. The effect seems stronger for married women by the end of the sample, i.e., during the great recession.

Besides this first decomposition exercise, which is useful to understand the factors behind the cyclical component of unemployment rates, we explore a different route below. Using again the theoretical equation for the unemployment rate, we construct a hybrid unemployment rate, consisting of the one that would apply for single individuals, in that we use all the transition probabilities for singles, with the exception of one, which we replace with the one of the married group. Hence, if the particular transition probability is important to explain the marriage unemployment gap, the counterfactual unemployment rate would resemble that of married workers.

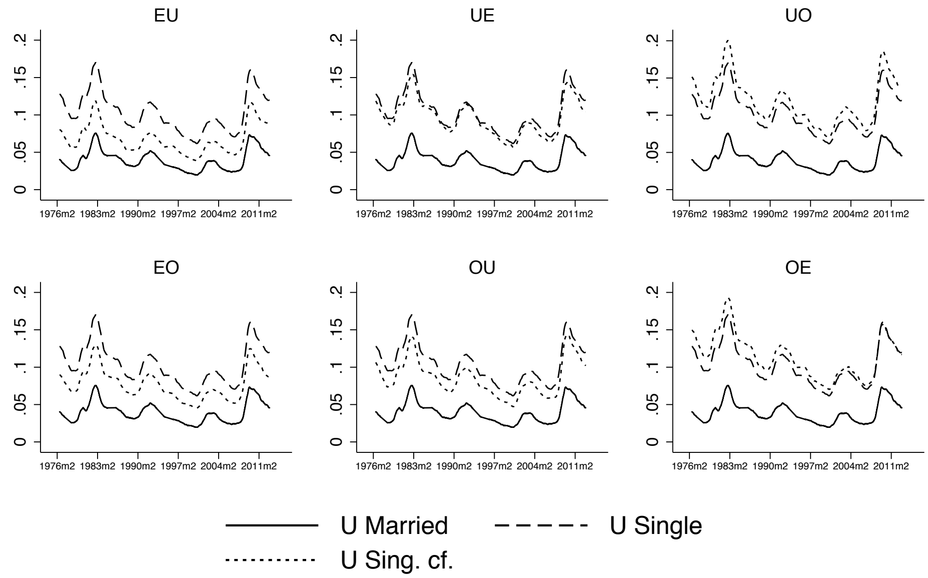



Figure 1.9: Counterfactual analysis for *SINGLE-MARRIED* unemployment differences, MALE workers. The counterfactual (cf.) line is constructed by using the theoretical value of the unemployment rate in equation (1.1) using transition probabilities for single workers, with the exception of the one in the subtitle, which corresponds to the married workers. Source for actual rates: Monthly CPS, 1976:1-2013:6. Original series smoothed using a 12-month moving average. *Married* denotes all workers who are married at the time of the survey. *Single* category represents everyone else. All workers aged 16 and older.

In figure 1.9 we present the exercise for male workers. From the figure we see that both transitions out of employment, namely $\gamma_t^{EU}$ and $\gamma_t^{EO}$ are the ones that make the counterfactual unemployment rate closer to the married one. This means that if single individuals faced the same probability of leaving employment (to either unemployment or inactivity) as their married counterparts, ceteris paribus, their unemployment rate would be lower and closer to the married one. One possible interpretation from this decomposition is that the pool of single workers is composed of individuals who are less attached to the labor force. This could be the case of younger workers deciding between work and study, workers who are unsure of a career path or simply workers selecting for whatever reason less stable occupations (seasonal jobs). Note that the dramatic decrease of the $OE$ transition probability for single workers depicted in figure 1.5 does not contribute at all in explaining the marriage unemployment gap for males, as seen in the top right sub-plot in figure 1.9.

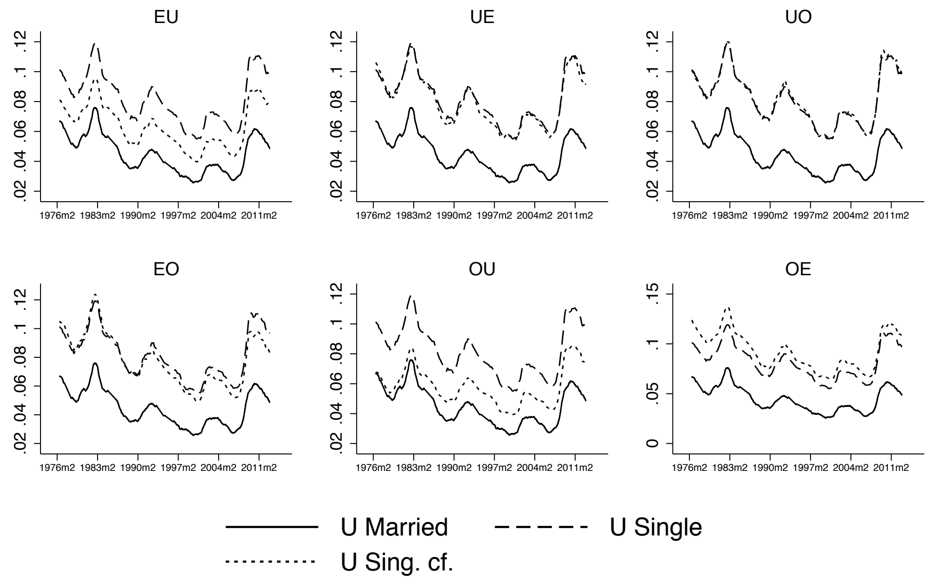



Figure 1.10: Counterfactual analysis for *SINGLE-MARRIED* unemployment differences, FEMALE workers. The counterfactual (cf.) line is constructed by using the theoretical value of the unemployment rate in equation (1.1) using transition probabilities for single workers, with the exception of the one in the subtitle, which corresponds to the married workers. Source for actual rates: Monthly CPS, 1976:1-2013:6. Original series smoothed using a 12-month moving average. *Married* denotes all workers who are married at the time of the survey. *Single* category represents everyone else. All workers aged 16 and older.

More puzzling seems to be the case for women, in figure 1.10. As opposed to men, the transition from employment to unemployment is important to explain the marriage unemployment gap, while the transition from employment to inactivity doesn't have any power. On the other hand, the transition between inactivity to unemployment is the most important factor explaining the gap for women. Looking at figure 1.6, we see that the probability that a single female worker transits from out of the labor force to unemployment is several times higher than the one for a married one. This margin is hard to identify with a specific demographic in the population. Are young single female workers the ones more likely to transit from inactivity to look for a job? Or is that married women don't have the incentives to look for a job once they are out of the labor force? Have these forces changed in the last three decades, and if so, how are they dispersed among the married/single female populations?

The main conclusion of this section is that the simple accounting exercise shows that the forces behind the marriage unemployment gap have been operating in quite a stable fashion across time. Given the patterns in labor force participation and marriage rates, this result hints at the importance of changing patterns in self-insurance and other household characteristics. We explore the role of observables next.

### 1.2.2 The Role of Observables

Observable characteristics of the average worker in either the single or the married group might differ significantly: young individuals are less likely to be married, and individuals with different educational attainments might get married at different rates, as documented by Greenwood et al. (2011). In this section we obtain measures of the marriage unemployment gaps which are cleaned from differences in observable characteristics

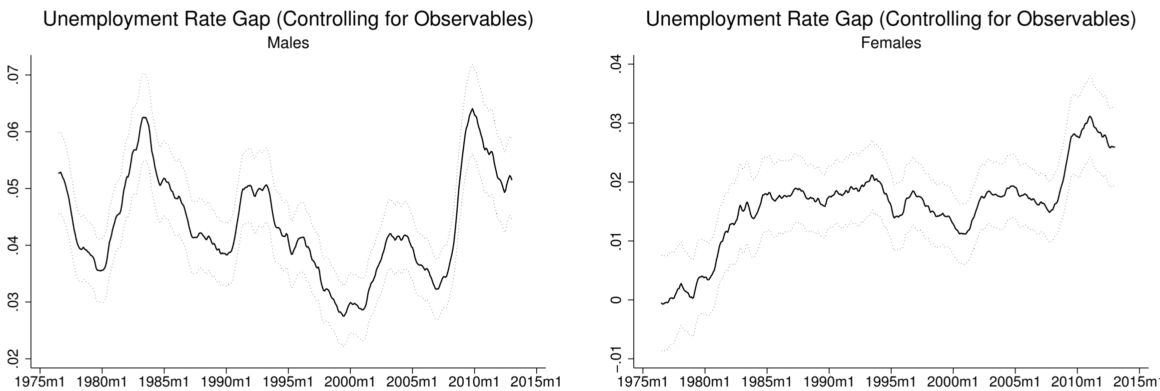



Figure 1.11: Source: Monthly CPS, 1976:1-2013:6. The lines represent the value of a marriage dummy inside a linear regression of unemployment rates on age, cohort, education, race and state controls for each month in our sample. The resulting series are smoothed using a 12-month moving average. *Married* denotes all workers who are married at the time of the survey. *Single* category represents everyone else. All workers aged 16 and older.

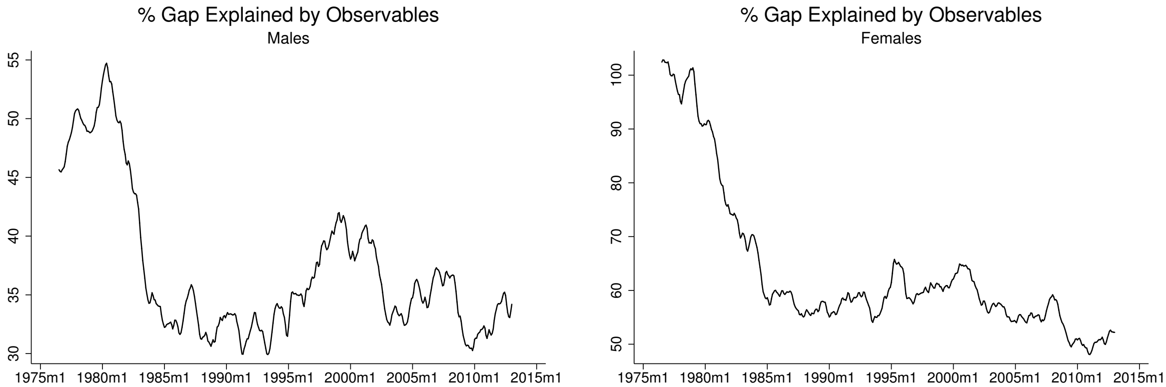



Figure 1.12: Source: Monthly CPS, 1976:1-2013:6. The lines represent the value of a marriage dummy inside a linear regression of unemployment rates on age, cohort, education, race and state controls for each month in our sample. The resulting series are smoothed using a 12-month moving average. *Married* denotes all workers who are married at the time of the survey. *Single* category represents everyone else. All workers aged 16 and older.

We proceed by estimating simple linear regressions on unemployment rates (separating samples by gender), controlling for age, education, race, number of children in the household, state and marriage dummies for each month in our sample.[8] In figure 1.11 we plot the value of the resulting coefficients associated with the marriage dummy, joint with 95% confidence intervals. In what follows, we label these as conditional or residual gaps.

Again, the stories for male and female workers are remarkably different. For men, the conditional gap (left panel of figure 1.11) is always significantly different from zero and shows no clear time trend. However, it exhibits a significant amount of cyclical volatility, following closely the aggregate unemployment series. This latter fact hints at the idea that employment exit probabilities ($\gamma_t^{EU}$ and $\gamma_t^{EO}$) are not correlated strongly with observables. Since they also are the most responsible for the cyclical variability of male unemployment rates (figure 1.7), they must account for a significant fraction of the residual gap in unemployment.

The residual gap for women (right panel of the same figure) shows a much constant trend, for much of the sample, with the exception of the start of the sample (late 1970s) and the great recession (after 2008) when the residual gap shows a positive trend. Note also that the residual gap is technically zero at the beginning of the sample, which suggests that the marriage unemployment gap for women was entirely driven by differences in the observable characteristics across single and married female workers. However, the conditional

[8]This procedure produces very similar results as the marginal effects computed from a Probit/Logit regression, with the benefit of much faster computation times.

gap becomes positive and significant almost immediately and the long-term trend is also positive. An additional thing to note is that for women, the residual gap is lower than that for males, thus observed heterogenous characteristics across singles and married female workers seem to explain more (but not all) of the gap.

To conclude this section, we present the fraction of the marriage unemployment gap which is explained by observables in figure 1.12. Even though we find differences in driving forces across genders for both the unconditional and the residual gap, the figure reveals something new: the explained portion of the gap by differences in observable characteristics is decreasing. Even with this simple exercise, the empirical analysis suggests that the difference between married and singles is beyond innate characteristics.

## 1.3 A Model

In this section we develop a version of a standard incomplete markets model, in the spirit of Chang and Kim (2007) and Krusell et al. (2011). Time is discrete and goes on forever. The economy is populated by a continuum of infinitely lived households with total mass equal to one. There exist three different types of these households. A fraction $\Phi_f$ of households is formed by a single female; a fraction $\Phi_m$ is composed by single males; finally, the rest of households ($1 - \Phi_f - \Phi_m = \Phi_{\mathcal{M}}$) are composed of one female and one male agents. Notice that the total mass of agents in this economy is given by $2 - \Phi_f - \Phi_m$. The type of household is exogenous.

All households derive utility from consumption streams over time and pay a flow cost in terms of utility when working. Households discount the future at rate $\beta < 1$. Instantaneous preferences are represented in Equation (1.2) and Equation (1.3) for singles and married, respectively.

$$\log(c) - \alpha_{s,g} e_g \qquad g \in \{f, m\} \tag{1.2}$$

$$\log(c) - \alpha_{\mathcal{M},f} e_f - \alpha_{\mathcal{M},m} e_m - \alpha_{\mathcal{M}} e_f e_m \tag{1.3}$$

In both cases, $c \geq 0$ stands for consumption in the current period $e_g \in \{0, 1\}$ is a discrete variable describing the work decision (1 equals work) and $\{\alpha_{s,g}, \alpha_{\mathcal{M},g}, \alpha_{\mathcal{M}}\}$ are the parameters that quantify the disutility from work. For all parameters, $g \in \{f, m\}$. Notice that for married households, we are assuming a unitary framework (both agents coincide in terms of overall household utility). All consumption is public inside marriage and individual disutilities from working are suffered by both household members. Further, $\alpha_{\mathcal{M}}$ represents an additional utility cost in the case when both agents in a married household decide to work.

For agents of both genders ($f$ or $m$), irrespective of the type of household they live in ($s$ or $\mathcal{M}$), per-period, individual labor income is given by the following:

$$w \cdot z \cdot e \tag{1.4}$$

where $w$ is the equilibrium wage per efficiency units of labor $z$, and $e$ is the binary decision to work. The idiosyncratic shock $z$ follows an AR(1) stochastic process in logs and differs by gender and marital status. For singles, it is given by (in what follows, we use $'$ to denote values next period):

$$\log z_g' = \rho_{s,g} \log z_g + \varepsilon_{s,g}' \tag{1.5}$$

for $g \in \{f, m\}$. For agents living in married households, income processes are connected. Specifically, we assume that:

$$\begin{aligned} \log z_f' &= \rho_{\mathcal{M}} \log z_f + \xi_{\mathcal{M},f}' \\ \log z_m' &= \rho_{\mathcal{M}} \log z_m + \xi_{\mathcal{M},m}' \end{aligned} \tag{1.6}$$

Parameters $\{\rho_{s,g}\}$ for $g \in \{f, m\}$ and $\rho_{\mathcal{M}}$ determine the level of persistence of the shocks for singles and married agents, respectively; $\varepsilon_{s,g} \sim N(0, \sigma_{s,g})$ for $g \in \{f, m\}$ is the innovation for singles and $[\xi_{\mathcal{M},f}, \xi_{\mathcal{M},m}] \sim N([0,0], \Sigma_{\mathcal{M}})$ are the innovations for married, which follow a joint process determined by the matrix of variance-covariance $\Sigma_{\mathcal{M}}$.

Besides the discrete labor supply choice, every household can save in a risk free bond which pays a real interest rate $r$ in equilibrium. Agents cannot borrow against future income. To close the model, we assume that this is a small open economy, where agents take the wage rate and the interest as given.

### 1.3.1 The labor market

We assume that there are two labor market states (islands) in the economy: work and not-work/leisure. Only those agents who find themselves in the work state can decide to work (they have the choice to quit jobs).

At the beginning of each period, agents are confronted with the realization of several reallocation shocks, which can be thought of as the job-destruction and job-finding probabilities from standard search and matching models: agents starting the period in the work island, are subject to *iid* separation shocks $\chi$. On the other hand, agents in the leisure island (including those who relocated in the same period, i.e., those recently hit by shock $\chi$) face a probability $\lambda$ of receiving a job offer, which means that they can *choose* to work. When solving the model, we allow these parameters to be different by marital status, but to ease the exposition, we drop that dependency in what follows.

For single agents, the model is a trivial extension of a standard Aiyagari-Bewley-Hugget economy, with employment risk on top of income fluctuations. Our setup adds the complication of couples, so agents inside a marriage need to keep track of what happens with their spouses. For simplicity, we treat all these reallocation shocks as *iid* across couples.

At this point, we have a clear distinction between those who choose to work and those who, by means of exogenous shocks or by choice, choose not to work. In this framework, however we can make a further distinction between those unemployed and those out of the labor force. We will label as unemployed those agents who end the period in the leisure island, but who would prefer being in the work island (this assessment is trivial given value functions below). Assuming a sufficiently low cost of performing job search, this description matches the standard definition of unemployed workers.[9]

### 1.3.2 Single households

For single households, individual state variables consist of the location/island where the agent starts the period, the level of assets ($k$), and productivity ($z_g$). Let $W(k, z_g)$ for $g \in \{f, m\}$ denote the value function for a single household when the agent works. Alternatively, $N(k, z_g)$ stands for the value function when the agent doesn't work. Then, define $V(k, z_g)$ as:

$$V(k, z_g) = \max\{W(k, z_g), N(k, z_g)\} \tag{1.7}$$

The Bellman equation for $W$ is given by:

$$\begin{gathered} W(k, z_g) = \max_{c,k' \geq 0} \quad \log(c) - \alpha_{s,g} + \beta E_{z'_g} \left[ \begin{array}{c} (1-\chi+\chi\lambda) V(k', z'_g) \\ +\chi(1-\lambda) N(k', z'_g) \end{array} \right] \\ s.t. \quad c + k' = rk + wz_g + (1-\delta)k \end{gathered} \tag{1.8}$$

The value of starting the period in the no-work island, $N$, is given by

$$\begin{gathered} N(k, z_g) = \max_{c,k' \geq 0} \quad \log(c) + \beta E_{z'_g} \left[ \begin{array}{r} \lambda V(k', z'_g) \\ +(1-\lambda) N(k', z'_g) \end{array} \right] \\ s.t. \quad c + k' = rk + (1-\delta)k \end{gathered} \tag{1.9}$$

Both equations are subject to the process in Equation (1.5). For each one of these optimiza-

[9]See the discussion in Krusell et al. (2011).

tion problems we get policy functions for the optimal level of asset holdings $k^{\star}_{W,g}(k, z_g)$ and $k^{\star}_{N,g}(k, z_g)$, when agents start the period in the work and leisure island respectively. From the definition of $V$, we obtain a decision rule for labor supply $e^{\star}_{s,g}(k, z_g)$. Notice that, in contrast to the standard framework of the Diamond-Mortensen-Pissarides framework[10], our setup has a non-trivial labor supply decision. Furthermore, $V$ is defined independently from the current location of the individual, which is what we use to compute the participation decision.

### 1.3.3 Married households

In the case of married households, the individual state is defined by the locations of the two agents who belong to the household, two labor productivities $(z_f,\, z_m)$, and one level of asset holdings, $k$. Besides our assumption of a unitary household, we assume perfect asset integration between spouses. We also assume away divorce.

Let $\mathcal{N}(k, z_f, z_m)$ denote the value function of a married household where none of their agents work. $\Omega_g(k, z_f, z_m)$ represents the value function of a married household where only agent $g \in \{f, m\}$ is working. Let $\mathcal{W}(k, z_f, z_m)$ represent the value function of a married household where both agents work. Finally, define $\mathcal{V}(k, z_f, z_m)$ as

$$\mathcal{V}(k, z_f, z_m) = \max\left\{\mathcal{W}(k, z_f, z_m), \Omega_f(k, z_f, z_m), \Omega_m(k, z_f, z_m), \mathcal{N}(k, z_f, z_m)\right\} \tag{1.10}$$

and

$$\mathcal{V}_g(k, z_f, z_m) = \max\left\{\Omega_g(k, z_f, z_m), \mathcal{N}(k, z_f, z_m)\right\} \qquad g \in \{f.m\} \tag{1.11}$$

$\mathcal{V}$ represents the value when both members of the household have the chance of working, while $\mathcal{V}_g$ does the same but when only member of gender $g$ has a job opportunity. These value functions are crucial to compute participation decisions inside the household.

The Bellman equation for $\mathcal{N}$ (both spouses are not working) is given by:

$$\mathcal{N}(k, z_f, z_m) = \max_{c,k'\geq 0} \quad \log(c) + \beta E_{z'_f, z'_m}\left[\begin{array}{rl} \lambda^2 & \mathcal{V}\left(k', z'_f, z'_m\right) \\ +\lambda(1-\lambda) & \mathcal{V}_f\left(k', z'_f, z'_m\right) \\ +\lambda(1-\lambda) & \mathcal{V}_m\left(k', z'_f, z'_m\right) \\ +(1-\lambda)^2 & \mathcal{N}\left(k', z'_f, z'_m\right) \end{array}\right] \tag{1.12}$$

$$s.t. \quad c + k' = rk + (1-\delta)k$$

[10]See Shimer (2005) and ?.

note that given our assumption of independent reallocation shocks across spouses, the conditional probability of either one or the other agent getting a job offer is exactly symmetric.

Next, for each $g \in \{f, m\}$, the Bellman equation associated to $\Omega_g$ is given by:

$$\Omega_g(k, z_f, z_m) = \max_{c,k' \geq 0} \quad \log(c) - \alpha_{\mathcal{M},g}$$
$$+\beta E_{z'_f,z'_m} \begin{bmatrix} (\chi\lambda^2 + (1-\chi)\lambda) & \mathcal{V}(k', z'_f, z'_m) \\ +(\chi(1-\lambda)\lambda + (1-\chi)(1-\lambda)) & \mathcal{V}_g(k', z'_f, z'_m) \\ +\chi\lambda(1-\lambda) & \mathcal{V}_{-g}(k', z'_f, z'_m) \\ +\chi(1-\lambda)^2 & \mathcal{N}(k', z'_f, z'_m) \end{bmatrix} \tag{1.13}$$

$$s.t. \quad c + k' = rk + wz_g + (1-\delta)k$$

where notation "$-g$" means the "opposite gender". Finally, the Bellman equation for the case when both agents are working at the beginning of the period is given by:

$$\mathcal{W}(k, z_f, z_m) = \max_{c,k' \geq 0} \quad \log(c) - \alpha_{\mathcal{M},f} - \alpha_{\mathcal{M},m} - \alpha_{\mathcal{M}} +$$
$$+\beta E_{z'_f,z'_m} \begin{bmatrix} (\chi^2\lambda^2 + (1-\chi)^2 + 2\chi(1-\chi)\lambda) & \mathcal{V}(k', z'_f, z'_m) \\ +(\chi^2\lambda(1-\lambda) + \chi(1-\chi)(1-\lambda)) & \mathcal{V}_f(k', z'_f, z'_m) \\ +(\chi^2\lambda(1-\lambda) + \chi(1-\chi)(1-\lambda)) & \mathcal{V}_m(k', z'_f, z'_m) \\ +\chi^2(1-\lambda)^2 & \mathcal{N}(k', z'_f, z'_m) \end{bmatrix} \tag{1.14}$$

$$s.t. \quad c + k' = rk + w(z_f + z_m) + (1-\delta)k$$

As in the case for non-married households, each of these Bellman equations generates a policy function for the accumulation of assets for the different couple/island combinations: $k^\star_{\mathcal{W}}(k, z_f, z_m)$, $k^\star_{\Omega_g}(k, z_f, z_m)$ and $k^\star_{\mathcal{N}}(k, z_f, z_m)$. On the other hand, $\mathcal{V}$ and $\mathcal{V}_g$ define implicitly the joint optimal labor supply decisions of the couple.

## 1.4 Parameterization

A model period is one month. To parameterize the model, we set some parameters exogenously and calibrate others to match chosen moments from labor market stocks and flows by gender and across marital states separately for the 1970s and for the 2000s. Following closely the calibration strategy in Krusell et al. (2011), we pick the employment to population ratio and the non-participation to population ratio as stocks to be matched by the model (the resulting unemployment rate comes mechanically). We also pick the employment to unemployment (E-U) and the unemployment to employment (U-E) transition probabilities as targets (again, by gender and marital status). Additionally, we target the capital to output ratio to be 2.5 at the annual frequency. We use these moments to parameterize the disutility of work, labor income shocks and labor transition shocks (one set each for singles and married, i.e., $\lambda_s$, $\lambda_{\mathcal{M}}$, $\chi_s$ and $\chi_{\mathcal{M}}$) and the discount factor of the agents ($\beta$). In total, we have 17 parameters and 17 moments to be matched.

### 1.4.1 Results

We set the fraction of married individuals at 68.0% and 57.6% for the 1970s and 2000s respectively. Table 1.1 shows the resulting parameter values. We can separate the parameters in three main groups. Those determining transitions between islands ($\chi$'s and $\lambda$'s); the ones that determine the income shocks faced by the individuals ($\rho$'s for persistence and $\sigma$'s for volatility); and those that represent individual preferences for work ($\alpha$'s). As stated above, these parameters differ by gender and marital status, with the exception of the first group (transitions) which are only marital status specific.

| Symbol | Description | . |
|---|---|---|
| $\beta$ | discount factor | .0.9961.0.9951 |
| $\chi_S$ | job-losing probability, singles | .0.0284.0.0261 |
| $\chi_{\mathcal{M}}$ | job-losing probability, married | .0.0162.0.0146 |
| $\lambda_S$ | job-offer probability, singles | .0.2961.0.2865 |
| $\lambda_{\mathcal{M}}$ | job-offer probability, married | .0.3452.0.3685 |
| $\rho_{\mathcal{M}}$ | persistence of income shocks, married | .0.9691.0.9881 |
| $\rho_{s,f}$ | persistence of income shocks, single females | .0.9464.0.9841 |
| $\rho_{s,m}$ | persistence of income shocks, single males | .0.9698.0.9888 |
| $\sigma_{\varepsilon_{\mathcal{M}}}$ | s.d. of income process, married | .0.0904.0.1177 |
| $\sigma_{\varepsilon_{s,f}}$ | s.d. of income process, single female | .0.3688.0.2990 |
| $\sigma_{\varepsilon_{s,m}}$ | s.d. of income process, single male | .0.2484.0.2272 |
| $\varrho$ | correlation of shocks, married | .0.1015.0.2196 |
| $\alpha_{\mathcal{M},f}$ | Disutility of work, married female | .0.8982.0.6079 |
| $\alpha_{\mathcal{M},m}$ | Disutility of work, married male | .0.3118.0.2597 |
| $\alpha_{\mathcal{M}}$ | Disutility of joint work, married | .0.5197.0.3978 |
| $\alpha_{s,f}$ | Disutility of work, single female | .0.9427.0.7717 |
| $\alpha_{s,m}$ | Disutility of work, single male | .0.7057.0.8413 |

Table 1.1: Calibrated parameters for the period 1976:1 to 1979:12 (1970s), and 2000:1 to 2005:12 (2000s)

The main differences across time periods, is the increase in the overall persistence of income shocks for all individuals, and an increase in the volatility of the income process for married agents, $\varepsilon_{\mathcal{M}}$. There is also a marked decrease in the volatility of income for single females. However, the overall income risk (measured as $\sigma/(1-\rho^2)^{1/2}$) increases for all groups, which is consistent with evidence in Gottschalk et al. (1994) and studied in a similar setup as this by Heathcote et al. (2010). Another salient feature from the calibration is the overall decrease in the utility cost from work (with the exception of single males) which could be attributed to technology improvements in the provision of home goods.

Within periods, the qualitative differences in parameters across groups is quite stable: the job-losing probability for singles is roughly double that one for married while the job-offer probability is slightly higher for married workers. The main difference between singles and married in our framework, is the fact that married individuals face income shocks that are correlated. We find this correlation to be positive, with $\varrho = 0.1015$ for the 1970s and $\varrho = 0.2196$. The latter value is remarkably similar to the 0.25 in Hyslop (2001) and taken together, they show an increase in the assortative matching of married couples in terms of economic characteristics, as discussed in Greenwood et al. (2011).

Next, we present the goodness of fit of the model for both stocks and transition probabilities. In table 1.2 we present results for stocks, while in table 1.3 we show model predictions for transition probabilities between the three considered labor market states.

| | 1970s | | 2000s | |
|---|---|---|---|---|
| | Data | Model | Data | Model |
| Single Males | | | | |
| Participation/pop | 81.2 | 81.1 | 80.4 | 80.6 |
| Employment/pop | 73.1 | 73.3 | 74.0 | 74.4 |
| Unemployment rate | 10.0 | 9.6 | 7.9 | 7.7 |
| Married Males | | | | |
| Participation/pop | 91.3 | 91.3 | 88.9 | 88.9 |
| Employment/pop | 88.3 | 86.9 | 86.1 | 86.1 |
| Unemployment rate | 3.3 | 4.8 | 3.1 | 3.2 |
| Singles Females | | | | |
| Participation/pop | 69.5 | 69.3 | 75.2 | 75.0 |
| Employment/pop | 63.6 | 60.5 | 70.3 | 68.5 |
| Unemployment rate | 8.5 | 12.7 | 6.5 | 8.6 |
| Married Females | | | | |
| Participation/pop | 51.6 | 52.9 | 68.6 | 68.6 |
| Employment/pop | 48.4 | 48.3 | 66.2 | 65.0 |
| Unemployment rate | 6.2 | 8.8 | 3.4 | 3.8 |

Table 1.2: Labor market stocks for US data (18 to 65 y/o, 1976:1 to 1979:12, labeled as 1970s, and 2000:1 to 2005:12, labeled as 2000s) versus model

| | 1970s | | | | 2000s | | | |
|---|---|---|---|---|---|---|---|---|
| | Females | | Males | | Females | | Males | |
| | Data | Model | Data | Model | Data | Model | Data | Model |
| Single | | | | | | | | |
| E–U | 1.7 | 1.9 | 2.7 | 2.0 | 2.1 | 1.8 | 1.5 | 1.8 |
| E–N | 3.3 | 3.2 | 3.1 | 1.5 | 2.9 | 1.1 | 3.0 | 0.6 |
| U–E | 24.8 | 28.1 | 29.7 | 28.9 | 27.9 | 28.2 | 25.2 | 28.1 |
| U–N | 24.7 | 5.0 | 14.7 | 2.2 | 19.6 | 1.3 | 23.7 | 1.8 |
| N–E | 6.1 | 2.3 | 11.0 | 1.9 | 9.6 | 0.88 | 7.7 | 0.8 |
| N–U | 4.8 | 5.4 | 6.9 | 4.7 | 5.9 | 2.2 | 4.4 | 2.0 |
| Married | | | | | | | | |
| E–U | 1.1 | 1.0 | 1.0 | 1.0 | 0.9 | 0.9 | 0.8 | 0.9 |
| E–N | 5.2 | 3.9 | 0.8 | 1.0 | 1.1 | 0.8 | 3.0 | 0.3 |
| U–E | 23.7 | 32.0 | 32.1 | 33.5 | 30.0 | 36.5 | 25.9 | 36.7 |
| U–N | 28.9 | 7.6 | 9.0 | 3.0 | 13.2 | 1.16 | 26.5 | 0.5 |
| N–E | 4.7 | 1.9 | 6.5 | 4.2 | 7.0 | 0.8 | 5.6 | 1.2 |
| N–U | 1.9 | 2.7 | 3.2 | 6.9 | 3.0 | 0.9 | 2.0 | 1.4 |

Table 1.3: Labor market transition probabilities for US data (18 to 65 y/o, 1976:1 to 1979:12, labeled as 1970s, and 2000:1 to 2005:12, labeled as 2000s) versus model.

In terms of labor market stocks, table 1.2 shows that our model predicts closely both participation to population ($p \equiv (E+U)/POP$) and the employment to population ($e = E/POP$) ratios, for both genders and marital states. The unemployment rates are seemingly not quite well matched, but this is due to their high sensibility to the other moments: the unemployment is defined as $u = (1-p-e)/(1-p)$ thus, it is sensitive to the other targets in our calibration. However, all unemployment rates are in the ballpark of what we observe in the data, and more importantly, they preserve the relative ranking of unemployment rates.

As for transition probabilities, the tables above show that the model matches quite closely both the targeted moments ($E-U$ and $U-E$ transitions) and performs well overall for the others. The exception is the transitions between unemployment and non participation. In the model, singles experience a $U-N$ transition only if the value of not working suddenly goes below the value of working. This can only happen if the current wage shock goes from very high to very low. Under our calibration, this happens very infrequently. On the other hand, transitions between unemployment and non participation are more likely for married workers: besides the mechanism explained above, unemployed agents who are married, can suddenly value non-employment over work if their spouses receive a very good wage shock. A higher wage of the working partner creates disincentives for work for the unemployed one by bringing more resources into the household in the current period (which are shared equally), and increasing the amount of assets through savings (household wealth effect).

For the 1970s, the effect of spouse labor supply on $U - N$ transition probabilities can be seen in the gap between married and single workers: for females, $U - N$ transitions are 7.6 versus 5.0 (married vs. singles), while for males, the values are 3.0 versus 2.2 (married vs singles). This positive gap shows that the effect described above is taking place: married workers (of both genders) are more likely to transit from unemployment to non participation. The effect is smaller for males, which might be a reflection of the fact that they were the most attached to the labor force in the 1970s (highest participation to population ratio in the first column of table 1.2).

When we look at the 2000s, the spouse labor supply effect actually disappears, since married $U - N$ transitions lower than those for singles. The main culprit of this reversal is the change in the correlation of income shocks: it increases significantly between the 1970s and the 2000s calibrations, muting the likelihood of a $U - N$ transition for an unemployed married agent, since shocks are much more correlated across spouses in the 2000s.

### 1.4.2 Accounting for the marriage Unemployment gap

Given the calibrated parameters, we can simulate several counterfactuals to shed light on what drives the differences in labor force attachment and in unemployment rates between married an single workers. Below, we proceed by replacing the parameters of single individuals by those of their married counterparts. With this exercise, we investigate what are the main driving factors of the marriage unemployment gap, and how they interact with each other. Moreover, we analyze how these factors interact with within household mechanisms (insurance and specialization) which remain untouched throughout. In tables 1.4 and 1.5 we show the ratio between statistics of married over singles, regarding unemployment and employment to population rates. Numbers below one for unemployment thus represent the marriage unemployment gap; numbers above one for the employment to population rate represent the idea of higher labor force attachment of married over single workers.

In both tables, we change two sets of parameters for the single population: those regarding job finding and losing probabilities (second and third rows) and those determining the volatility of wages (last four rows). For each column, we make the parameter changes in a cumulative way. Thus, the last line of each table reveals what the married/single ratios would look like if single agents faced the same labor market conditions as their married counterparts. In this exercise, preference parameters remain specific to marital status, reflecting the

| | Unemployment rate | | Employment to Pop. | |
|---|---|---|---|---|
| | Females | Males | Females | Males |
| Benchmark | 0.69 | 0.50 | 0.80 | 1.19 |
| job-offer probability | 0.79 | 0.61 | 0.80 | 1.18 |
| job-losing probability | 0.92 | 0.79 | 0.80 | 1.18 |
| persistence of income shocks, females | 1.22 | | 0.78 | |
| persistence of income shocks, males | | 0.81 | | 1.17 |
| s.d. of income process, females | 2.18 | | 0.52 | |
| s.d. of income process, males | | 1.33 | | 0.91 |

Table 1.4: Counterfactual experiments for the 1976:1-1979:12 period. Each column shows the ratio between statistics of married versus single individuals. The experiment consists of changing the parameters that characterize the situation of single household for those of married households. Each row adds the to the effect of all previous rows.

idea that they represent in a reduced form, specialization inside the household and/or the provision of public consumption goods. Furthermore, married agents also enjoy self-insurance due to income pooling.

| | Unemployment rate | | Employment to Pop. | |
|---|---|---|---|---|
| | Females | Males | Females | Males |
| Benchmark | 0.44 | 0.41 | 0.96 | 1.16 |
| job-offer probability | 0.62 | 0.58 | 0.95 | 1.14 |
| job-losing probability | 0.86 | 0.86 | 0.93 | 1.12 |
| persistence of income shocks, females | 0.95 | | 0.92 | |
| persistence of income shocks, males | | 0.84 | | 1.13 |
| s.d. of income process, females | 1.20 | | 0.73 | |
| s.d. of income process, males | | 0.96 | | 0.96 |

Table 1.5: Counterfactual experiments for the 2000:1-2005:12 period. Each column shows the ratio between statistics of married versus single individuals. The experiment consist in changing the parameters that characterize the situation of single household for those of married households. Each row adds the to the effect of all previous rows.

From table 1.4, we see that giving single agents the parameters of married agents actually reverses the marriage unemployment gap: the unemployment rates of the counterfactual singles become lower than those of married. For females, the unemployment gap ratio goes from 0.69 to 2.18, while for males, it goes from 0.50 to 1.33. As for the employment to population ratios, both the female and male columns show that the counterfactual employment rates of singles increase significantly with respect to married.

The last two rows from table 1.4 illustrate an economy in which all agents have the same productivity and employment shocks. The only difference across households is their family situation: singles live alone while married agents share consumption and insurance with their spouse. The fact that, in this counterfactual economy, married agents participate less and have higher unemployment rate than singles illustrates one of the main forces that family introduces in the model. In an incomplete markets framework, agents work to build up protection against uncertainty. In this environment, the family acts as a completing-markets mechanism, thus, reduces the incentives of agents to work. Because the unemployment rate is defined as $\frac{U}{U+E}$, where $U$ is the amount of individuals in the population who are unemployed and $E$ is the amount who are employed, less employment, ceteris paribus, increases the unemployment rate.

From table 1.5, we see that in the 2000s giving single agents the parameters of married agents also changes the marriage unemployment gap. However, in this period, we observe different patterns for males and females. For females, the unemployment gap ratio goes from 0.44 to 1.20, reversing the sign of the marriage unemployment gap, although the differences are not as big as for the counterfactual of the 1970s. For males, the unemployment gap ratio goes from 0.41 to 0.96, that is, the gap is not reversed.

In terms of participation, in this period, it is also the case that when singles receive the productivity and employment shocks of married they start to find working more appealing, i.e., their employment rates increase. However, compared to the 1970s, the response of singles to receiving the parameters of married is not of the same magnitude. The change in employment rates of counterfactual singles in the 1970s was bigger than in the 2000s. This indicates that the differences in terms of labor market shocks between singles and married in the 1970s were higher than in the 2000s. In other words, if any selection into marriage mechanism is playing a role determining the unemployment and participation differences between singles and married, it was more important in the 1970s than in the 2000s. Hence, the role of the family determining the differences between singles and married has increased over time.

The counterfactual experiment of the 2000s illustrates that the transition from not working to a job (with the unemployed time that it carries) generates more unemployment for singles than for married males. In the counterfactual economy, married and single males have a similar employment ratio. However, married males are still less likely to be unemployed than singles. Hence, the difference in employment cannot explain the difference between their unemployment rates. Consider the situation of two identical agents, one is single and the other is married to an employed female, who are currently not participating. Assume that they productivity increases so, now, they would like to work, i.e., they become unemployed.

The single agent will remain unemployed until he finds a job. However, the married agents will stay unemployed until he finds a job or his wife gets an increase in her productivity that offsets his participation decision. The same mechanism is at play for a females. However the effect of increased employment for singles, counterbalances the ease of unemployment that the family can generate. This counterfactual experiment illustrates that family can be a mechanism to exit unemployment through non-participation.

Summarizing, the family generates two counterbalancing effects in the model which affect the unemployment rate. On the one hand, because it is a completing-markets mechanism, it reduces the incentives of agents to work. On the other hand, precisely because it reduces the need for employment of the agents it also increases their propensity to give up on being unemployed. An important remark is that a necessary condition for the family to serve as a reducer of unemployment is the participation of the two spouses. If only one spouse would be able to work, the mechanism described before would be inexistent. The increase in labor force participation of married females that we observe between the 1970s and the 2000s is, then, a factor that has amplified the effect of family reducing unemployment.

## 1.5 Conclusions

In this paper, we document different patters regarding worker flows and unemployment rates between married and non-married individuals in the U.S. economy. Using monthly CPS data from 1976 to 2013, we point out that the unemployment rate of married individuals is systematically lower than for singles, both for males and females. This difference is persistent over time despite the notable changes in the composition of the U.S. labor market. Mainly, the increase of female labor force participation, the convergence between the participation rate of single and married females, the slight decrease of male's participation, and the dramatic decrease of the proportion of married individuals in the labor force.

We use monthly transitions across labor market states to perform a decomposition exercise that allows use to identify the main channels driving the different unemployment rates between singles and married. For males, the main driving force is the higher attachment of married to employment. Married males are more likely to find a job and to keep it than their single counterparts. For females, the crucial channel is the participation margin. Married females are more likely to exit unemployment through non-participation than their single counterparts.

We show that the unemployment rate gap between married and singles after controlling for observables presents different patterns for males and females. For men, it was slightly decreasing from 1976 to 2000 while it has been increasing since then. Instead, for females it has been increasing over time: at the beginning of the period the unemployment differential can be fully explained by observables while at the end of the period observables only account for half of it. We argue that the evolution of the unemployment gap controlled for observables vis-a-vis the steady decrease of married individuals in the labor force indicate that a simple selection into marriage mechanism cannot be responsible for the different unemployment rates between married and singles.

We extend a standard Aiyagari-Bewley-Huggett environment to account for the stylized facts across marital states and to quantify how much of the differences between married and singles are due to insurance and specialization inside the household. Our main finding is that the family plays two counterbalancing effects on the unemployment rate. One the one hand, the family serves as a completing-markets device that reduces the willingness of agents to work. This effect translates into less employment and, thus, more unemployment. On the other hand, precisely because the family reduces the agents' need to work, it also increases the propensity to give up on being unemployment due to improvements on the labor market situation of their spouse.

When we calibrate our model to target the economy in the 1970s, we find that the unemployment gap between singles and married is completely reversed when single agents possess the characteristics of married. Hence we conclude that the predominant effect of family in that period was the one of increasing unemployment. However, when we perform the same experiment in the 2000s, the unemployment gap for males is not reversed and the magnitude of the reversal for women is much lower. This result indicates that the predominant effect of family on unemployment has shifted over time, becoming more important the ease of unemployment through non-participation over the increase of unemployment via reduction of employment. We argue that this change is linked to the increase of labor force participation of married females.

# Chapter 2

# Labor Market Dynamics of Married Couples

Written jointly with Nezih Guner and Yuliya Kulikova.

## 2.1 Introduction

There is possibly no clearer manifestation of a recession, and one that receives the most attention by public, than the increase in unemployment. The recessions are, above all, periods of high unemployment. As a result, understanding the flows of workers between employment and unemployment, the employment exit and job finding probabilities, has been at the center of empirical work on labor market dynamics – see, among others, Blanchard et al. (1990), Fujita and Ramey (2009), Elsby et al. (2009), and Shimer (2012).

The existing empirical literature on labor market dynamics mainly focuses on movements between employment and unemployment, and has ignored, as far as the cyclical movements in unemployment are concerned, the movements of individuals in and out of the labor force. A recent paper by Elsby et al. (2013) challenges the conventional wisdom and documents that around one-third of cyclical variations in the unemployment rate can be accounted for by transitions at the participation margin.[1] In particular, they show that recessions are periods in which transitions from unemployment to out of labor force decline and those from out of labor force to unemployment increase, contributing to the rise in unemployment. They argue that one reason behind the pro-cyclical movements from unemployment to out of labor force is the changing composition of unemployed pool along the cycle. In a recession, many individuals lose their jobs and become unemployed. These recently-unemployed agents have strong attachment to the labor market that lowers unemployment to out of labor force transitions.

Another key feature of the existing literature is its focus on individual transitions among labor market states (employment, unemployment, and out of labor force). For the majority of working-age individuals, however, labor market decisions (whether to accept a job or keep looking for a better one, to quit search and move out of labor force, or to enter the labor force and search for a job) are not made in isolation but together with a partner. While only 35% of married women between ages 25 to 54 were in the labor force in 1960, today about 70% are. Hence today's married households mainly consist of two potential earners who make joint labor market decisions. Indeed, several recent papers, see, for example, Guler et al. (2012), Flabbi and Mabli (2012), and Valladares-Esteban (2013), study implications of joint search by husbands and wives for labor market dynamics and public policy.

Despite the growing importance of two-earner households in the economy, there has not been any attempts to document joint labor market transitions for husbands and wives in a

[1] Two-state (employment and unemployment) abstraction is also dominant in theoretical search and matching papers that follow Diamond-Mortensen-Pissarides model. For search and matching models with three states, see Alvarez and Veracierto (2000), Garibaldi and Wasmer (2005), Krusell et al. (2008, 2010b,a, 2011), Pries and Rogerson (2009), Veracierto (2008).

systematic way. We try to fill this gap in this paper. We study joint labor market transitions of husbands and wives among three labor market states (employment, unemployment and out of labor force). We do this using data from the Current Population Survey (CPS) that have been widely used to study labor market dynamics.

Our results show that joint labor market transitions are important to understand cyclical movements in unemployment as well as the secular rise in aggregate employment. Married men and women differ in their labor market dynamics. Transitions in and out of labor force play a more important role for the unemployment dynamics of females than they do for those of males. Hence modeling out of labor force as a distinct state is critical to understand joint labor market dynamics of married couples. Our results also show that joint labor market transitions of husbands and wives imply an important degree of coordination between labor market activities of household members.

The rest of the chapter is organized as follows. In Section 2.2 we describe the data we use and introduce key concepts. Section 2.3 documents how joint labor market states for married couples changed in last four decades. Section 2.4 focuses on labor market flows and documents how joint labor market transitions affect cyclical and secular movements in employment, unemployment, and participation. In Section 2.5 we try to understand how coordination of labor market transitions by husbands and wives affect aggregate labor market outcomes. We conclude in Section 2.6.

## 2.2 Data on Labor Market Stocks and Flows

We use monthly data from the Outgoing Rotation Groups of the CPS. Every household (address) that enters the CPS is interviewed for 4 consecutive months, then ignored (rotate out) for 8 months, and then interviewed again (rotate in) for 4 more months. This procedure implies that each month we have 8 *rotation groups* that are surveyed and 6 out of these 8 groups will be in the survey the following month as well. Hence, in principal, it is possible to follow 3/4 of individuals and match their information across two months. We follow a standard matching procedure, specified in Shimer (2012), based on matching households with the same identification code, as long as individuals' characteristics (age, sex, race and education) are consistent between two months. This procedure allows us to estimate monthly worker flows and compute associated monthly transition probabilities across labor market states. Hence, the probability that an employed worker becomes unemployed next period is the fraction of the employed in a given month who reports to be unemployed next month.

Our final sample contains, for each month, individual demographic and labor market information associated to the previous and the current month, from February 1976 until

December 2013. We restrict our sample to all couples who report to be married and living in the same household. We select only those couples for which one of the two members reports to be the head of the household. In order to minimize the effects of schooling and retirement decisions, we focus our analysis on prime age individuals, and restrict our sample to couples formed by individuals who are between 25 and 54 years old. Our restrictions result on a sample size of about 12,000 couples for each month included in the analysis.

We extend the standard concept of individual labor market status, Employment ($E$), Unemployment ($U$), and non-participation ($O$) to couples and consider nine different labor market states: both employed, husband employed - wife unemployed, husband employed - wife non-participant, etc. We label all these statuses using two letters. The first letter refers to the labor market status of the husband, while the second letter refers to the labor market status of the wife. For example, a couple with labor market status $UO$ is a couple where the husband is unemployed ($U$) and the wife is non-participant ($O$).

Given that any couple might be in 9 different labor market situations at any point in time ($EE$, $EU$, $EO$, $UE$, $UU$, $UO$, $OE$, $OU$, and $OO$), there are 72 labor market transitions, from one month to the following, that may occur (81, if one considers transitions within the same labor market state). We denote $\gamma_{kl}^{ij}$ the probability of a couple being in the state $ij$ in a given month and transiting to state $kl$ the following. For example $\gamma_{EE}^{EO}$ denotes the probability that a couple is in state $EO$ (the husband is employed and the wife is non-participant) in a given period and transits to state $EE$ (both employed) next period. To compute these probabilities for each month, we simply calculate how many couples move from one state to another and divide this number by a total number of couples in the initial state. As a result, for each month we are able to construct a 9 by 9 Markov transition matrix across all possible labor market states.

## 2.3 Labor Market Stocks

We start by documenting labor market stocks for married couples. For each possible labor market state and for each month, we compute the proportion of couples in our sample that are in that state. To compute the point estimate of the stocks for each month, we simply count (using sample weights in CPS) how many couples report to be in each state over the total number of couples in our sample. Figure 2.1 presents constructed measure of labor market stocks along with the National Bureau of Economic Research (NBER) recession dates.

The first thing that catches one's eyes in Figure 2.1 is the dramatic decline in the number of traditional (a bread winner husband and a housekeeper wife) households.[2] At the start of the sample in 1976, about 45% of households had an employed husband and an out-of-labor force wife (panel 2.1c). By the end of the sample there were less than 25% such households. As women enter the labor force, these traditional households were replaced by households in which both members work (panel 2.1a). The faction of such households increased by about 20% points between 1976 and 2013. Interestingly, there was also a rise in the fraction of households in which traditional roles of husband and wives were reversed (panel 2.1g). Figure 2.1 also reveals well-known cyclical movements in labor markets. Recessions are periods in which one or both members of a household are more likely to be unemployed.

## 2.4 Labor Market Flows

We next look at labor market transitions. We first revisit the analysis by Elsby et al. (2013) and report labor market transitions between three states ($E$, $U$ and $O$) for individuals. We do so, however, separately for males and females. We keep all other sample restrictions and hence focus on married individuals between ages 25 and 54.

Figures 2.2 and 2.3 show labor market transitions for males and females, respectively. For both male and females the transitions from employment ($E$) to unemployment ($U$) are countercyclical and transitions from employment ($E$) to unemployment ($U$) are pro-cyclical. Employment to unemployment transitions are more cyclical for males than females. This was particularly the case in the last recession in which $E$ to $U$ transitions increased much more for males than it did for females. In contrast, $U$ to $E$ transitions declined more strongly for females than it did for males in the last recession. Hence, while females were less likely to loose their jobs than males, they were at the same time less likely to move from unemployment to employment.

For both male and females, during recessions, movements from out of labor force to unemployment increase and movements from unemployment to out of labor force decline. Hence, recessions are periods in which unemployed agents are more likely to remain unemployed rather than quitting the labor force and those who are out of the labor force are more likely

[2]Since there has been a significant increase in educational attainments of females and a rise in educational assortative mating over this period, in Appendix A we also show Figure 2.1 for different types of households by the educational attainment of husbands and wives.

to enter to look for a job. The movements between unemployment and out of labor force are particularly large for females (Figure 2.3, panel 2.3f). Just before the last recession, about 30% of unemployed women decided to move out of the labor force next month. This number declined to about 22% during the recession. Similarly, while about 15% of employed men decided to quit the labor market next month, only about 9% of unemployed moved to out of labor force by the end of the recession. This suggests that if the composition effect emphasized by Elsby et al. (2013) has a bite, it is likely to be more important for females than it is for males. Figures 2.2 and 2.3 also show that The increase in $O$ to $U$ transitions during recessions is also very pronounced, especially for males. Finally, both $O$ to $E$ and $E$ to $O$ transitions decline during recessions. While the decline in $O$ to $E$ transitions are not surprising the decline in $E$ to $O$ transitions, which is stronger for females, suggest that individuals are less likely to quit their jobs during bad times or if they lose their jobs they are less likely to move out of the labor force.

| | EE | EU | EO | UE | UU | UO | OE | OU | OO |
|---|---|---|---|---|---|---|---|---|---|
| EE | 94.64 | 0.80 | 3.02 | 0.89 | 0.04 | 0.04 | 0.47 | 0.01 | 0.08 |
| EU | 24.38 | 46.71 | 25.72 | 0.53 | 1.26 | 0.56 | 0.22 | 0.30 | 0.31 |
| EO | 6.13 | 2.36 | 89.76 | 0.08 | 0.09 | 0.90 | 0.10 | 0.02 | 0.57 |
| UE | 28.03 | 0.58 | 1.11 | 58.41 | 1.14 | 1.19 | 9.02 | 0.11 | 0.40 |
| UU | 9.62 | 11.50 | 7.41 | 10.50 | 40.93 | 11.85 | 1.39 | 2.76 | 4.01 |
| UO | 2.59 | 1.67 | 27.00 | 2.54 | 4.88 | 50.79 | 0.59 | 0.42 | 9.52 |
| OE | 9.60 | 0.14 | 0.89 | 6.47 | 0.16 | 0.15 | 79.39 | 0.93 | 2.26 |
| OU | 2.75 | 3.69 | 2.50 | 1.57 | 5.39 | 2.22 | 16.35 | 41.89 | 23.64 |
| OO | 2.33 | 0.38 | 7.12 | 0.34 | 0.63 | 4.27 | 2.75 | 1.85 | 80.31 |

Table 2.1: Joint average labor market transitions for married couples, ages 25-54, 1976:2 to 2013:12. E - employed, U - unemployed, O - out of the labor force. First letter corresponds to male and second to female.

We next turn to joint labor market transitions for husbands and wives. Table 2.1 shows the 9 by 9 transition matrix for married couples for the whole sample period. Results in Table 2.1 illustrate very rich labor market dynamics that married couples exhibit.[3] While states in which one or both partners are employed or out of labor force, such as $EE$, $EO$, $OE$, and $OO$ are quite persistent, other states are more transitory. For a couple with an employed husband and an unemployed wife ($EU$) in a given moth, there is about 24% chance that both become employed next period, moving to $EE$ state. For such a household, however, it is equally likely that the wife quits the labor force and the household move to $EO$ state.

[3] In Appendix A we report Table 2.1 for different sub-periods of our sample.

Even for a couple with an employed wife and an unemployed husband ($UE$), there is a 9% probability that the husband moves out of labor force next month and the households ends up in $OE$ state.

| Female transitions | | Male employed | | | Male unemployed | | | Male OLF | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | E | U | O | E | U | O | E | U | O |
| Male employed | E | 96.12 | 0.81 | 3.07 | 91.80 | 4.15 | 4.05 | 84.46 | 1.41 | 14.13 |
| | U | 25.17 | 48.26 | 26.56 | 22.38 | 53.34 | 24.28 | 25.79 | 38.15 | 36.07 |
| | O | 6.24 | 2.40 | 91.36 | 7.67 | 8.48 | 83.86 | 13.77 | 2.50 | 83.74 |
| Male unemployed | E | 94.32 | 1.99 | 3.69 | 96.17 | 1.87 | 1.96 | 94.54 | 1.27 | 4.19 |
| | U | 32.28 | 40.66 | 27.06 | 16.92 | 64.29 | 18.79 | 19.20 | 32.93 | 47.87 |
| | O | 8.03 | 5.41 | 86.56 | 4.41 | 8.35 | 87.24 | 5.63 | 3.97 | 90.40 |
| Male OLF | E | 90.21 | 1.30 | 8.49 | 95.40 | 2.40 | 2.20 | 96.14 | 1.13 | 2.73 |
| | U | 30.57 | 41.78 | 27.65 | 17.58 | 59.29 | 23.13 | 19.79 | 51.35 | 28.86 |
| | O | 23.57 | 3.91 | 72.52 | 7.04 | 11.72 | 81.24 | 3.25 | 2.17 | 94.58 |

| Male Transitions | | Female employed | | | Female unemployed | | | Female OLF | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | E | U | O | E | U | O | E | U | O |
| Female employed | E | 98.58 | 0.93 | 0.49 | 94.29 | 4.76 | 0.96 | 95.78 | 1.30 | 2.92 |
| | U | 29.38 | 61.19 | 9.44 | 31.78 | 61.36 | 6.85 | 40.59 | 43.74 | 15.67 |
| | O | 10.06 | 6.78 | 83.16 | 11.10 | 13.24 | 75.66 | 27.24 | 4.71 | 68.05 |
| Female unemployed | E | 96.94 | 2.17 | 0.89 | 96.77 | 2.60 | 0.63 | 96.71 | 2.15 | 1.15 |
| | U | 43.05 | 50.42 | 6.53 | 21.22 | 73.67 | 5.11 | 32.01 | 50.92 | 17.07 |
| | O | 13.67 | 8.61 | 77.71 | 7.37 | 10.25 | 82.39 | 8.22 | 7.90 | 83.88 |
| Female OLF | E | 97.01 | 1.29 | 1.69 | 95.59 | 3.71 | 0.70 | 98.40 | 0.98 | 0.62 |
| | U | 43.21 | 46.71 | 10.08 | 24.13 | 70.36 | 5.51 | 30.95 | 58.15 | 10.90 |
| | O | 42.36 | 6.49 | 51.15 | 13.42 | 21.38 | 65.21 | 7.76 | 4.65 | 87.59 |

Table 2.2: Conditional average labor market transitions for married couples, ages 25-54, 1976:2 to 2013:12. E - employed, U - unemployed, O - out of the labor force.

Table 2.2 documents transitions of husbands and wives conditional on transitions of their partners.[4] The results in Table 2 show that labor market transitions are quite different for married males and females, i.e. two panels in Table 2 are not identical. Males are on average more attached to labor force than females are. As a result, independent of their partners' labor market transitions, they are less likely to transit to out of labor force. Females, on the other hand, are more likely to move to out of labor force in any given month.

[4]The results for different sub-periods are provided in the Appendix A.

The results in Table 2 also shows transitions that are rather hard to justify unless household members coordinate their labor supply behavior. First, we observe well-known added-worker effect. An out-of-the-labor force female whose husband looses his job, i.e. moves from employment to unemployment, is twice as likely to enter the labor force, either as employed or unemployed, than an out-of-the-labor force female whose husband keeps his job. Second, when a husband (wife) moves from unemployment, his (her) employed partner is quite likely to move to out of labor force as well. Hence household members seem to coordinate their labor market search or face similar labor market shocks. Finally, for couple in which one member is unemployed and the other is out-of-labor force ($UO$ or $OU$ states), there is a non negligible probability that the other member moves out of the labor force as well and the household ends up in $OO$ state. This is more likely to happen if the wife is the member who is employed.

### 2.4.1 A Decomposition Exercise

To assess the importance of each labor market transition in determining the labor market states we extend the decomposition exercise proposed in Shimer (2012) to the case of couples. The exercise consists of three steps. First, for each month using the monthly transitions calculated from the data, we compute the steady state distribution of labor market stocks in this month associated with these transitions and check if they generate a good approximation of the data. The basic idea is that each month there is a steady state distribution of couples across labor market stocks, that means that number of couples moving out of each state to other states is equal to number of couples moving into this state from other states.

In our case, computing the steady state approximation of the labor market stocks requires solving a system of 9 equations with 9 unknowns ($EE$, $EU$, $EO$, $UE$, $UU$, $UO$, $OE$, $OU$, and $OO$) which defines the steady state. Basically, each equation states that, in the steady state, the flow of workers entering one state should be equal to the flow of workers leaving that state. Let $\mathcal{S}$ denote the set of all possible states, that is, $\mathcal{S} = \{EE, EU, EO, UE, UU, UO, OE, OU, OO\}$. Then, for any state $J \in \mathcal{S}$, we can write the steady state condition as

$$\left( \sum_{I \in \mathcal{S} \setminus J} \gamma_I^J \right) \pi(J) = \sum_{I \in \mathcal{S} \setminus J} \gamma_J^I \pi(I), \tag{2.1}$$

where $\pi(J)$ and $\pi(I)$ are the steady state probabilities of state $J$ and $I$, respectively.

Second, we calculate the mean of all transitions across the entire period considered (from February 1976 until December 2013), which are reported in Table 2.1. The final step is to consider how important each transition is in determining each labor market stock. To that end, we set up all transitions equal to their average values for the sample period and allow only one transition to vary as it does in the data. We then calculate the steady state approximation of labor market stocks associated to this counterfactual transitions which combines average values for all but one transition. As a result, for each labor market stock we have 72 counterfactual steady state distributions (associated to each possible transition). Obviously, some of the transitions do not affect steady state distributions, while others do. If one, out of 72 possible transitions, accounts for all the variations in a particular joint labor market state for households, then the counterfactual associated with that particular transitions would coincide with the data. On the other hand if a particular transition has no effect on changes in a labor market states over time, the counterfactual associated with that particular transition would be a flat line.

In Figure 2.4, we present for each labor market stocks the data (the same information as in Figure 2.1), the steady state approximations, and two counterfactuals that give the closest fit to the steady state approximations. Table 2.3 shows how much of the variations in different labor market states can be accounted by the two best counterfactuals and the transitions that were allowed to vary in these counterfactuals. Finally, Figure 2.5 shows how key transitions behave over time.

| Transition | % | Transition | % | Transition | % |
|---|---|---|---|---|---|
| **EE** | | **EU** | | **EO** | |
| EE to EO | 64.11 | EU to EE | 35.24 | EE to EO | 66.18 |
| EO to EE | 18.70 | EO to EU | 20.39 | EO to EE | 10.50 |
| **UE** | | **UU** | | **UO** | |
| EE to UE | 37.35 | UO to UU | 6.72 | EO to UO | 28.19 |
| UE to EE | 29.62 | UU to EE | 7.14 | EE to EO | 10.16 |
| **OE** | | **OU** | | **OO** | |
| EE to OE | 26.60 | OO to OU | 9.69 | EO to OO | 44.09 |
| UE to OE | 19.84 | OU to OO | 3.67 | EE to EO | -28.31 |

Table 2.3: Explained variation (in %) of employment, unemployment, and participation by the two most important transitions.

Changes in some labor market stocks are quite easy to understand. During the sample period, the fraction of traditional households, with a working husband and an out-of-labor-force wife, declined while the fraction of households with two workers increased (panels 2.4c and 2.4a in Figure 2.4). These changes were mainly driven by a large decline in $EE$ to $EO$ transitions and the corresponding increase in $EO$ to $EE$ transitions between 1976 and early 1990 (panels 2.5a and 2.5b in Figure 2.5). Since early 1990s, while $EE$ to $EO$ transitions have been rather stable, there was a decline in $EO$ to $EE$ transitions. As a result, since early 1990s the fraction of household with two workers declined slightly.

The transitions that account for the fraction of households with one employed and one unemployed member differs depending on who the unemployed member is. For households in $UE$ state, with a unemployed husband and employed wife, about 67% of fluctuations are accounted by the transitions of husbands from employment to unemployment and vice versa, i.e. $EE$ to $UE$ and $UE$ to $EE$ transitions). As Figure 2.5 (panels 2.5e and 2.5j) shows $EE$ to $UE$ transitions are very pro-cyclical while those from $UE$ to $EE$ are countercyclical. When it is the female member who is unemployed, i.e. household is in *EU* state, transitions between out of labor force and unemployment also matter. In particular, *EO* to *EU* transitions, i.e. when wife moves from out of labor force to unemployment while her husband keeps his job, accounts for about 20% of variations in *EU* state. *EO* to *EU* transitions are countercyclical (panel 2.5g in Figure 2.5), i.e. recessions are periods in which women are more likely to enter the labor market and look for a job even if their husbands keep their jobs.

| Transition | All | Transition | Males | Transition | Females |
|---|---|---|---|---|---|
| **Employment** | | | | | |
| EE to EO | 61.05 | EE to UE | 13.45 | EE to EO | 66.40 |
| EO to EE | 20.73 | UE to EE | 20.27 | EO to EE | 14.22 |
| **Unemployment** | | | | | |
| EE to UE | 17.00 | EE to UE | 26.17 | EE to EO | 19.81 |
| EE to EO | 1.97 | UE to EE | 18.41 | EU to EE | 22.44 |
| **Participation** | | | | | |
| EE to EO | 72.71 | EE to OE | 21.49 | EE to EO | 68.19 |
| EO to EE | 18.77 | EE to OO | 17.93 | EO to EE | 12.69 |

Table 2.4: Explained variation (in %) of employment, unemployment, and participation by the two most important transitions.

Finally, Figures 2.6, 2.7, and 2.8 show movements in aggregate unconditional employment, unemployment, and participation rates for married males, married females and the whole married population. Table 2.4 documents the role of different joint labor market transitions in explaining these movements. The results in Table 4 confirm what we had already observed by looking at joint transitions. Movements between unemployment and out of labor force status are important to understand cyclical unemployment of females.

## 2.5 Assessing the Role of Within Household Coordination

Labor market transitions for husbands and wives reflect several factors. Each party might face idiosyncratic labor market shocks that are independent of his/her partner labor market status. Such shocks are not hard to imagine. One household member might lose his/her job due to factors that are completely independent of his/her partner. There are also shocks that are likely to affect both parties. After all, husbands and wives live in the same place, very often have similar education levels, and are likely to be of similar age. Labor market transitions, however, also reflect what one might call household coordination. Imagine one partner who decides to quit his/her job and stay at home to take care of children. Imagine an unemployed household member who declines a job offer and search for a better one because he/she can rely on his/her employed partner. Consider a household member who quits his/her job because his/her unemployed partner finds a job in another city. Such examples are abound. How important are these coordinations for labor market dynamics of married couples?

In order to answer this question, we create artificial couples who look like actual couples in the data along observable characteristics (age, education, etc.) but who are not actually married and analyze their labor market behavior. Since, by construction, these artificial couples do not coordinate labor market decisions, the difference between the behavior of actual and artificial couples tells us how important the coordination is.

In order to construct artificial couples, we follow the following steps:

1. For each month in the sample, we group all couples with similar demographic characteristics. In particular we use geographic division (9 categories corresponding to New England, Mid-Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, Mountain, and Pacific), education of the husband (2 categories, college and non-college), education of the wife (2 categories, college and non-college), whether the couple have children living at home or not, and age of the wife (3 categories, 25 to 34, 35 to 44, and 45 to 54), to place each couple into one of 216 possible cells. An example of a cell would be all college-graduate husbands and wives, where the wife is between 35 to 44 years old, who have children at home and live in New England division.

2. We then randomly match individuals within each cell. The idea is that for each husband (wife) we assign a wife (husband) who is similar to his (her) actual wife (husband) in terms of observables. This procedure provides us with an artificial sample of couples.

3. We compute labor market stocks for each month using this artificial sample.

4. We repeat steps 1, 2, and 3 for a large number of times. We compute our point estimate as the mean of the artificial samples we generate.

5. To compute confidence intervals for our estimate, we bootstrap the data and repeat steps 1 to 4.

Figure 2.9 shows 9 possible labor market states for married couples, what we had already reported in Figure 2.1, together with counterfactual data. What does Figure 2.9 tells us? The largest gaps between the data and counterfactuals are observed for labor market states in which one of the household members is out of labor force, *EO* or *OE* states. As we have already pointed out above, there has been a decline in the fraction of households where the husband is employed and the wife is out of the labor force ($EO$). At the same time, we also observe that there are more households where gender roles are reversed, that is, the wife is employed while the husband is non-participant ($OE$). Counterfactuals suggest that without coordination we would see even less households with traditional roles (husband employed and wife non-participant) and more households with the reversed roles (wife employed, husband non-participant). This suggests that couples coordinate to be in the situation where the husband is employed and the wife is non-participant, most likely when there are children in the household.

Another labor market state that is affected by the counterfactuals is $UU$ state where both partners are unemployed. In the counterfactual world, without coordination, the proportion of couples in which both are unemployed would be lower than what we observe in the data. This means that couples coordinate to be unemployed together, which might be interpreted as evidence of joint search. Counterfactual simulations also makes a difference for $OU$ state, where husband is out of labor force and the wife is unemployed, and more so in recent years. Without coordination, we would see more couples in this state. That is, couples coordinate not to be in the situation where the husband in non-participant and the wife is unemployed. When we look at the mirror situation, the $UO$ stock, we do not see that coordination plays any role. That is, couple coordinate to escape the $OU$ situation but not the $UO$, which might reflect gender prototypes in the society. Finally, when we remove the effect of coordination we see that even more couples would be $OO$ state, i.e. couples try to coordinate to avoid this situation.

## 2.6 Conclusions

We study joint labor market transitions of husbands and wives among three labor market states (employment, unemployment and out of labor force). Our results show that joint labor market transitions are important to understand cyclical movements in unemployment as well as the secular rise in aggregate employment. Married men and women differ in their labor market dynamics. Transitions in and out of labor force play a more important role for unemployment dynamics of females than they do for those of males. Hence modeling out of labor force as a distinct state is critical to understand joint labor market dynamics of married couples. Our results also show that joint labor market transitions of husbands and wives imply an important degree of coordination between labor market activities of household members.

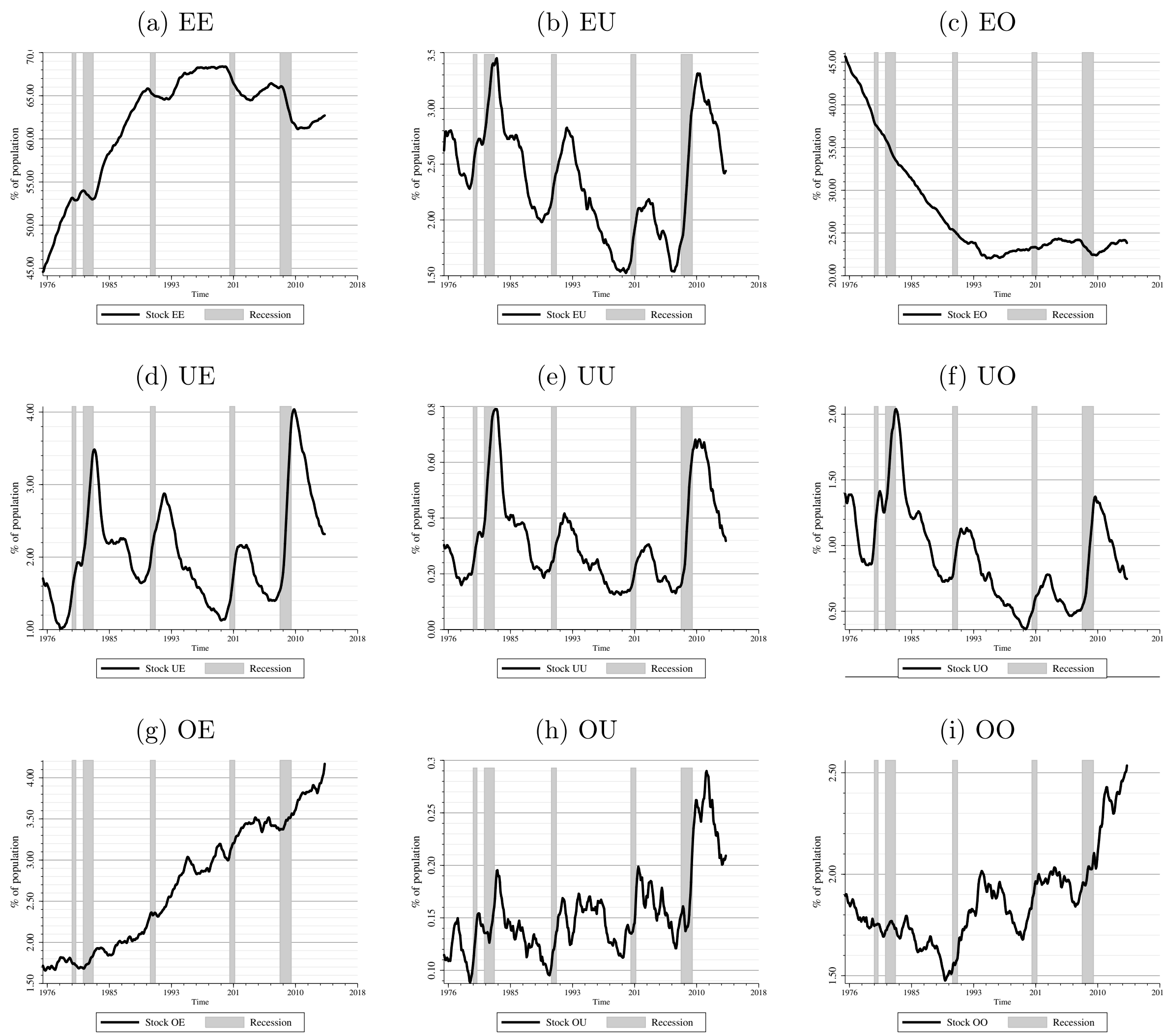



Figure 2.1: Labor market stocks for married couples, ages 25-54, 1976:2 to 2013:12. The solid line represents the seasonally adjusted fraction of the population in state XY, where X refers to the male and Y to the female. X and Y can stand for: E - employed, U - unemployed, O - out of the labor force. Grey areas represent NBER recession dates (taken from http://www.nber.org/cycles/cyclesmain.html).

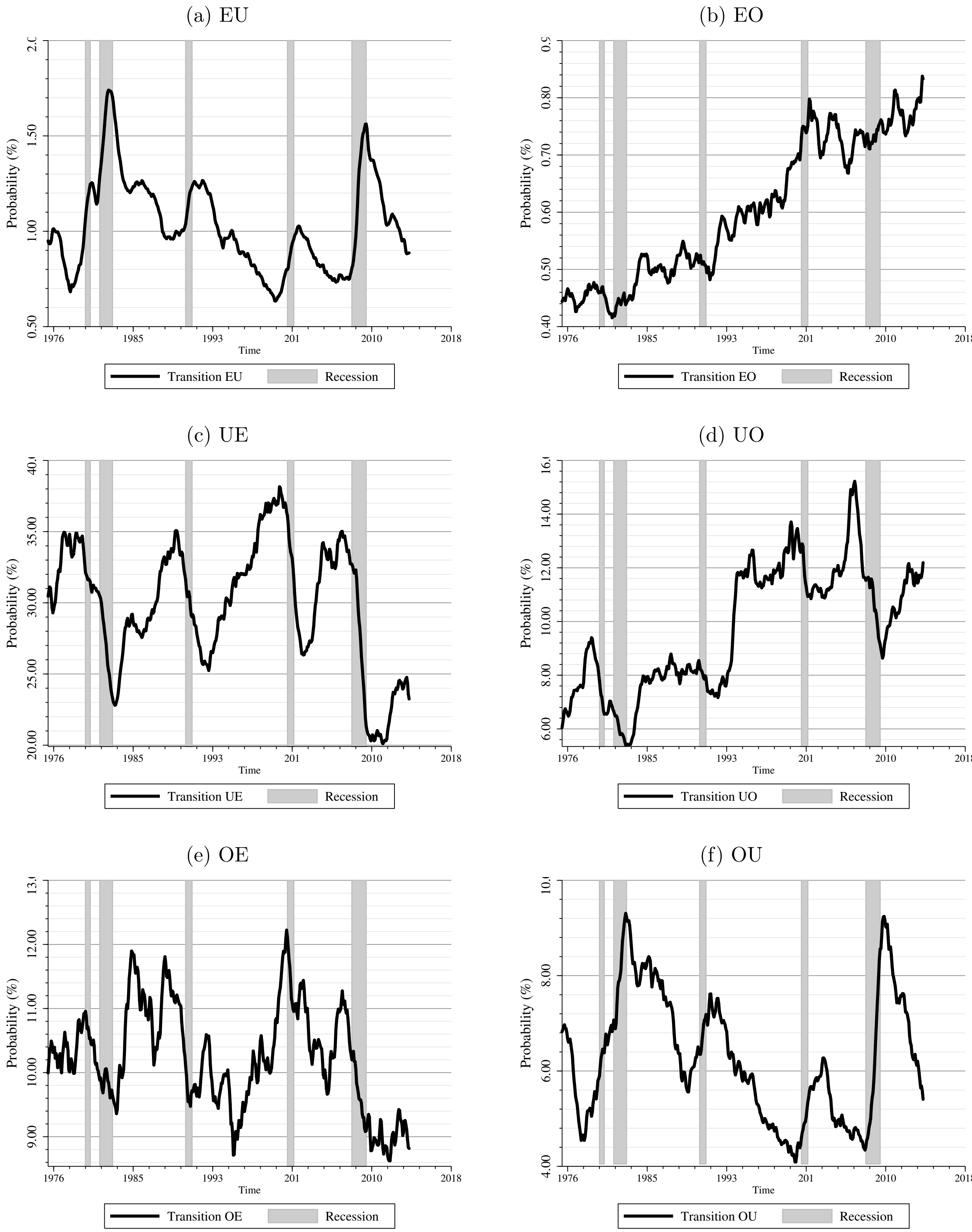
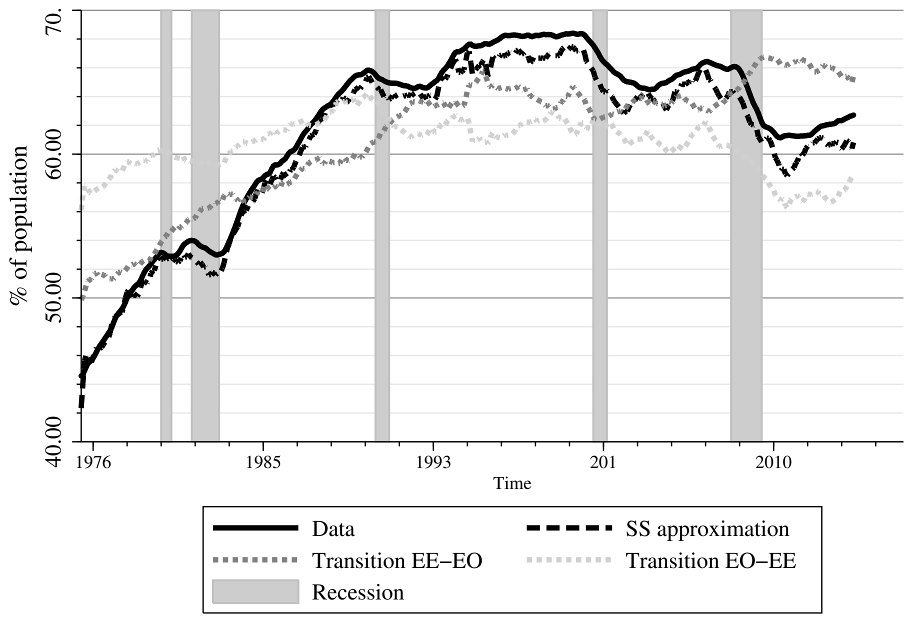


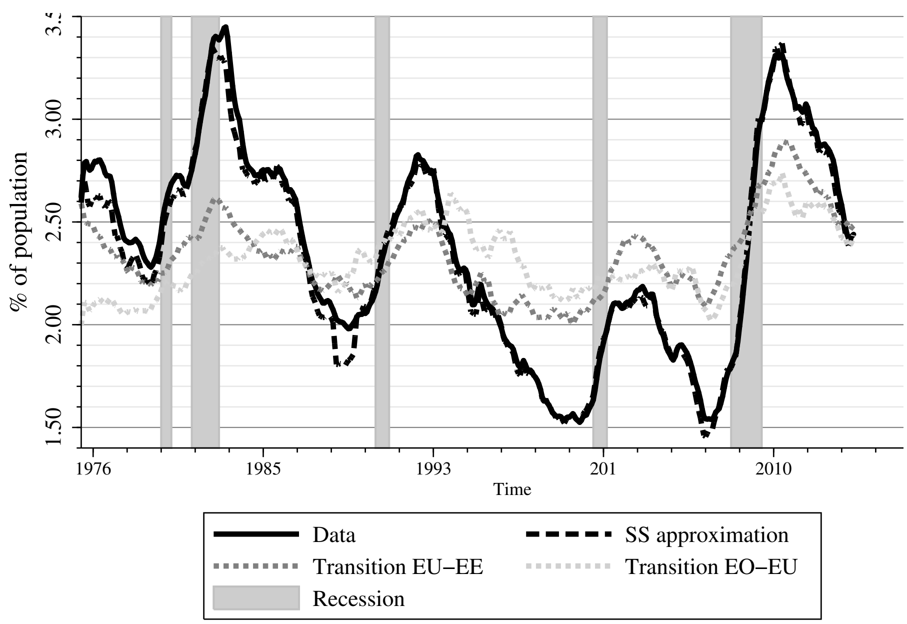

Figure 2.2: Unconditional labor market transitions for married males, ages 25-54, 1976:2 to 2013:12. The solid line represents the seasonally adjusted probability of being in state X in the current month, having been in Y in the previous month. X and Y can stand for: E - employed, U - unemployed, O - out of the labor force. Grey areas represent NBER recession dates (taken from http://www.nber.org/cycles/cyclesmain.html).


Figure 2.3: Unconditional labor market transitions for married females, ages 25-54, 1976:2 to 2013:12. The solid line represents the seasonally adjusted probability of being in state X in the current month, having been in Y in the previous month. X and Y can stand for: E - employed, U - unemployed, O - out of the labor force. Grey areas represent NBER recession dates (taken from http://www.nber.org/cycles/cyclesmain.html).

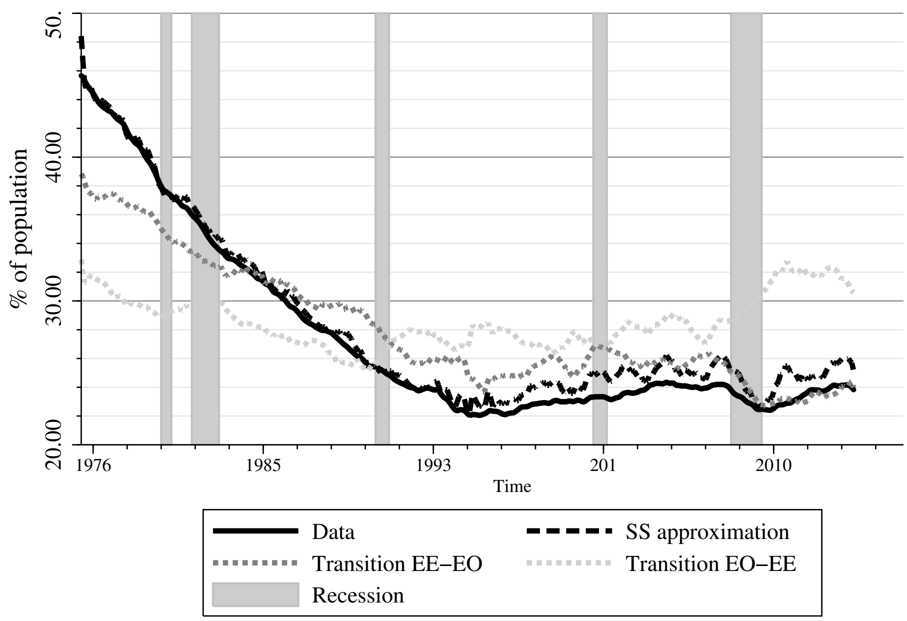
(a) EE


70.
60.00
50.00
40.00
% of population
1976
1985
1993
201
2010
Time
Data
SS approximation
Transition EE−EO
Transition EO−EE
Recession

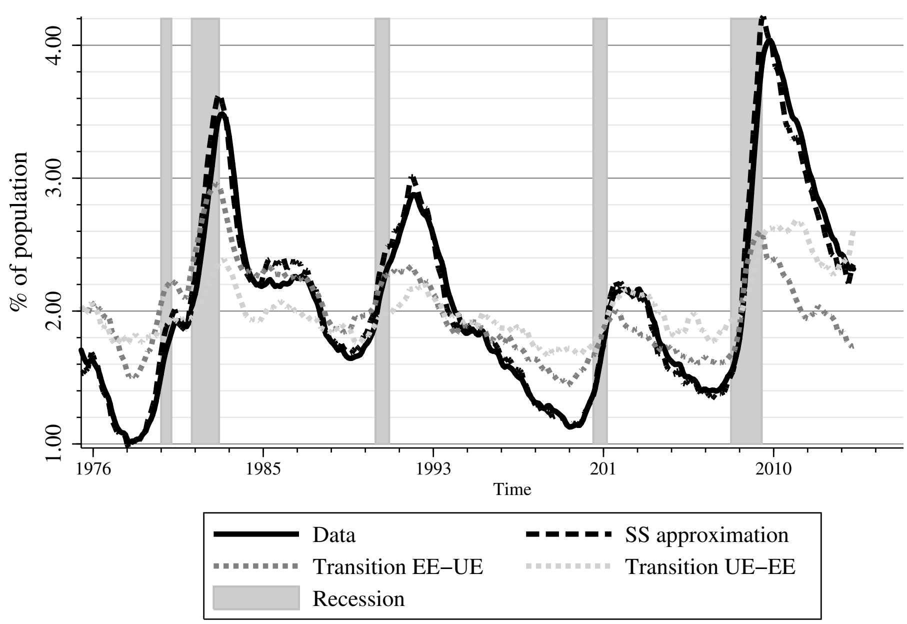
(b) EU


3.00
2.50
2.00
1.50
% of population
1976
1985
1993
201
2010
Time
Data
SS approximation
Transition EU−EE
Transition EO−EU
Recession

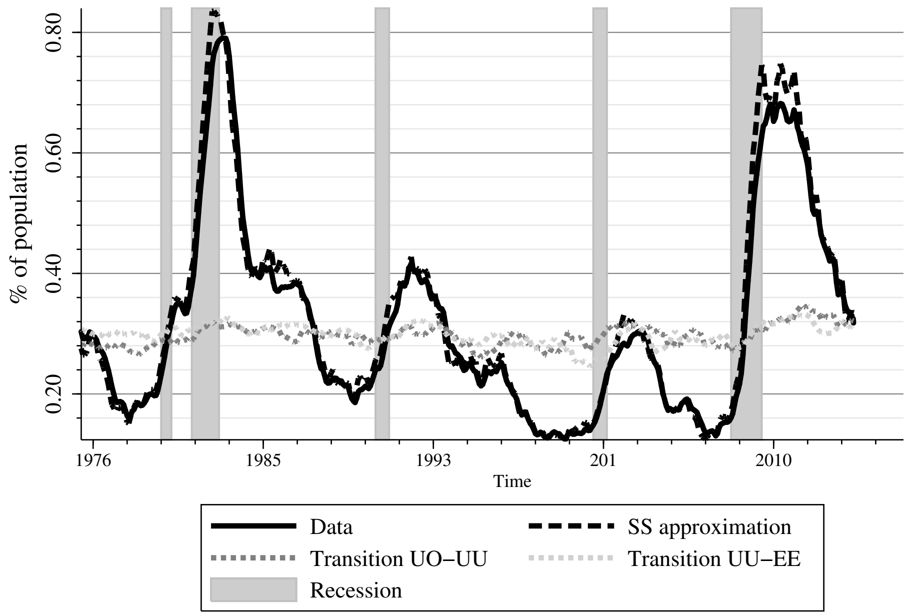
(c) EO


% of population
50.
40.00
30.00
20.00
1976
1985
1993
201
2010
Time
Data
SS approximation
Transition EE−EO
Transition EO−EE
Recession

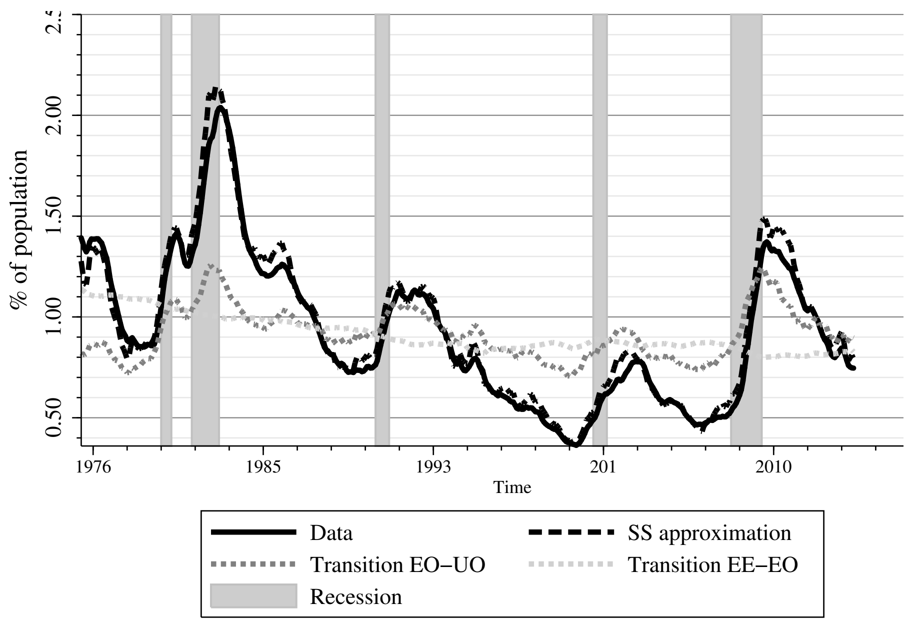
(d) UE

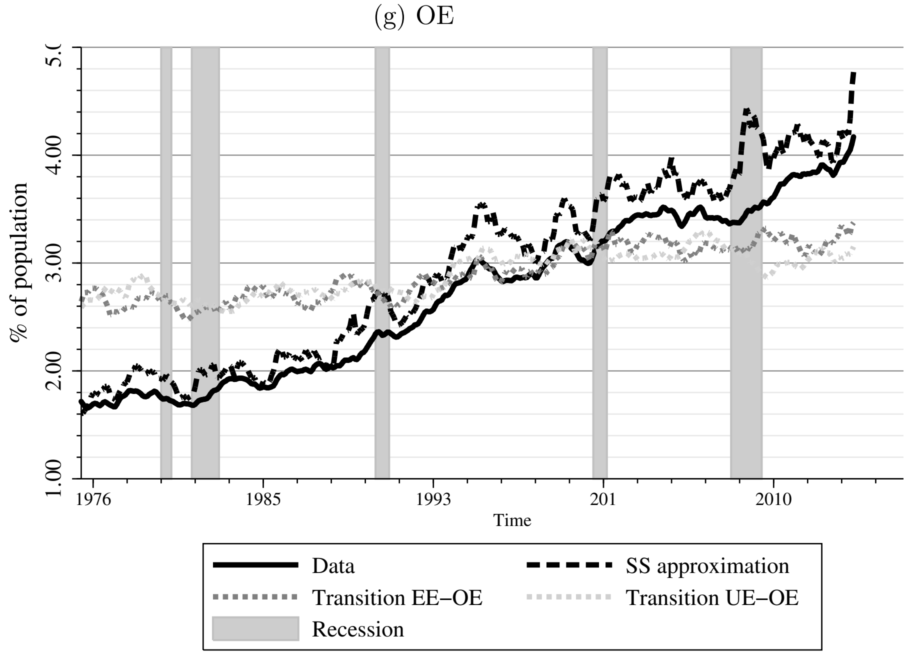

% of population
4.00
3.00
2.00
1.00
1976
1985
1993
201
2010
Time
Data
SS approximation
Transition EE−UE
Transition UE−EE
Recession

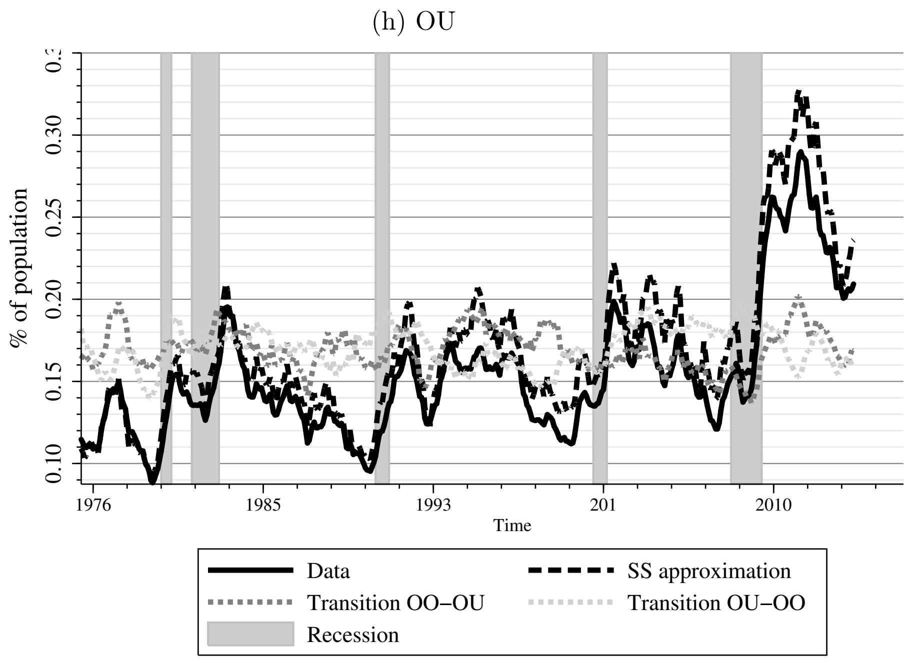
(e) UU


% of population
0.20
0.40
0.60
0.80
1976
1985
1993
201
2010
Time
Data
SS approximation
Transition UO−UU
Transition UU−EE
Recession

(f) UO


% of population
0.50
1.00
1.50
2.00
1976
1985
1993
201
2010
Time
Data
SS approximation
Transition EO−UO
Transition EE−EO
Recession


(g) OE
5.0
4.00
3.00
2.00
1.00
% of population
1976
1985
1993
201
2010
Time
Data
SS approximation
Transition EE−OE
Transition UE−OE
Recession


(h) OU
0.30
0.25
0.20
0.15
0.10
% of population
1976
1985
1993
201
2010
Time
Data
SS approximation
Transition OO−OU
Transition OU−OO
Recession

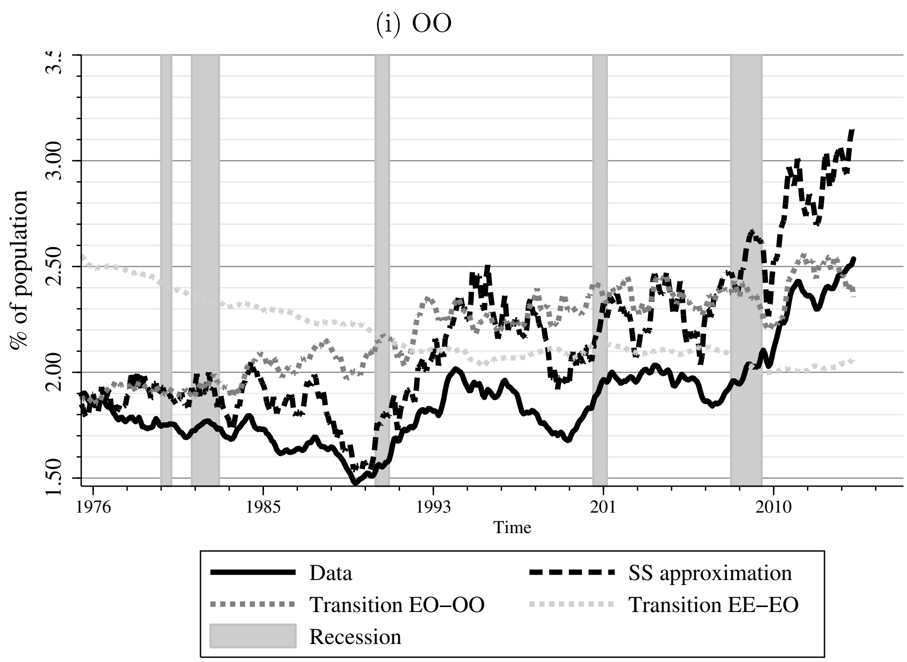
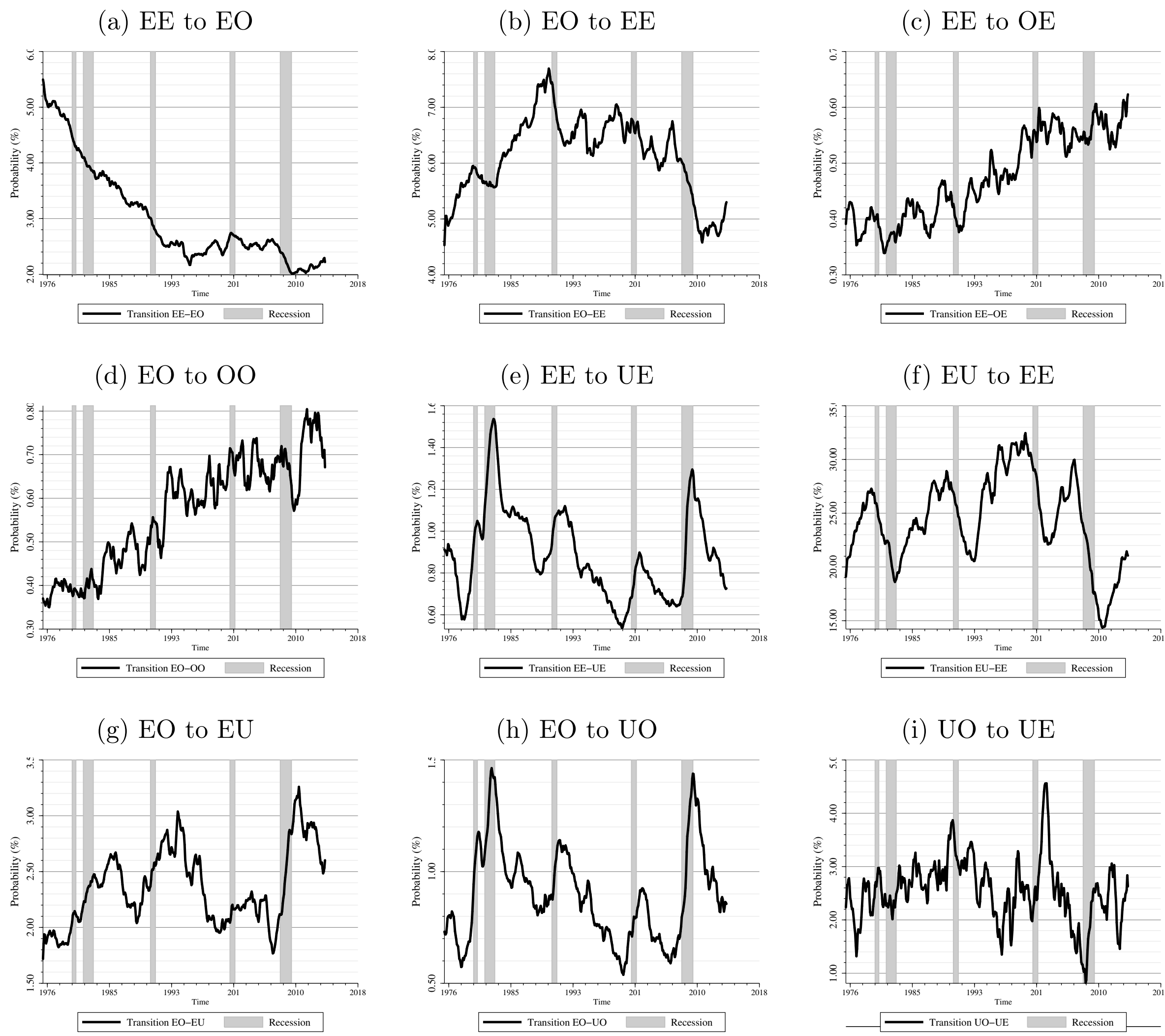



Figure 2.4: Decomposition exercise for joint labor market states, 1976:2 to 2013:12. The solid line represents the seasonally adjusted fraction of the population in state XY, where X refers to the male and Y to the female. X and Y can stand for: E - employed, U - unemployed, O - out of the labor force. The dashed black line corresponds to the stationary distribution of couples in state XY associated with the transition probabilities. The dashed dark and light gray lines correspond to the two most important transitions which contribute to the stock XY. The legend contains the description of these transitions. Grey areas represent NBER recession dates (taken from http://www.nber.org/cycles/cyclesmain.html).


(a) EE to EO
(b) EO to EE
(c) EE to OE
(d) EO to OO
(e) EE to UE
(f) EU to EE
(g) EO to EU
(h) EO to UO
(i) UO to UE
Probability (%)
Time
Transition EE–EO
Transition EO–EE
Transition EE–OE
Transition EO–OO
Transition EE–UE
Transition EU–EE
Transition EO–EU
Transition EO–UO
Transition UO–UE
Recession

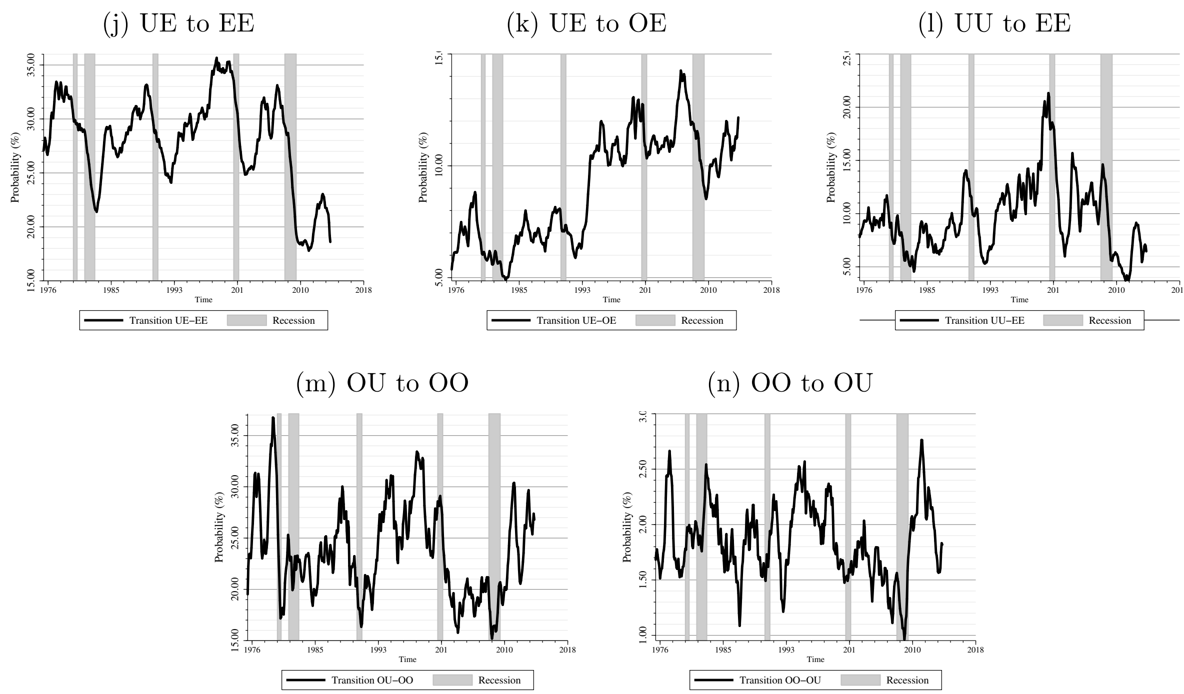



Figure 2.5: Important joint labor market transitions, 1976:2 to 2013:12. The solid line represents the seasonally adjusted probability of being in state XX in the current month, having been in YY in the previous month. X and Y can stand for: E - employed, U - unemployed, O - out of the labor force. Grey areas represent NBER recession dates (taken from http://www.nber.org/cycles/cyclesmain.html).

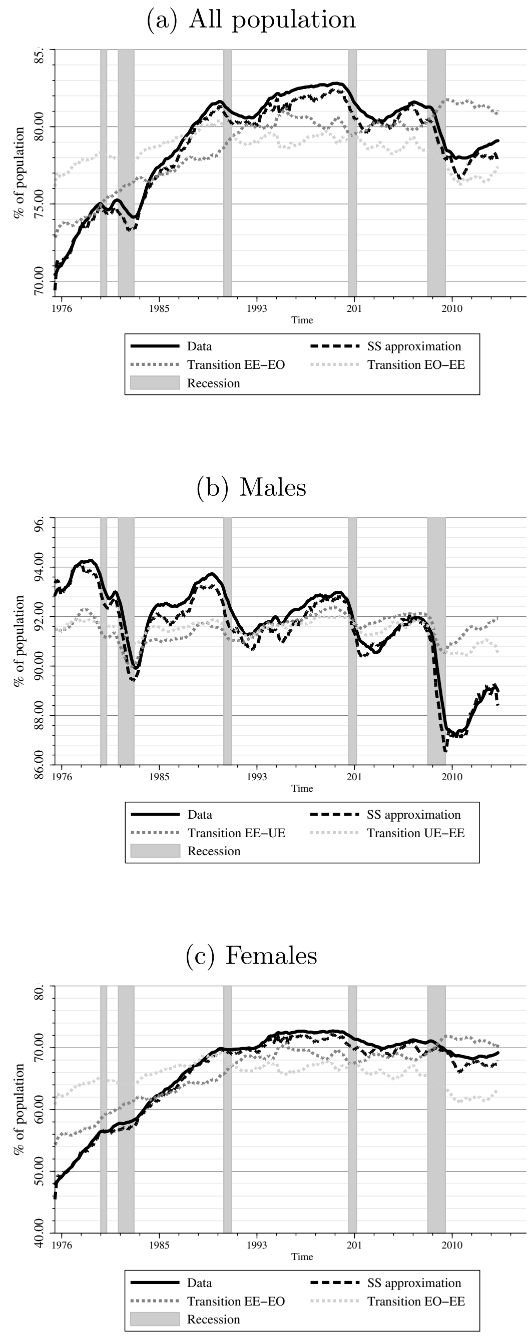



Figure 2.6: Decomposition exercise for employment rates, 1976:2 to 2013:12. The solid line represents the seasonally adjusted data. The dashed black line corresponds to the employment rate in the steady associated with the transition probabilities. The dashed dark and light gray lines correspond to the two most important transitions which contribute to the employment rate. The legend contains the description of these transitions. Grey areas represent NBER recession dates (taken from http://www.nber.org/cycles/cyclesmain.html).

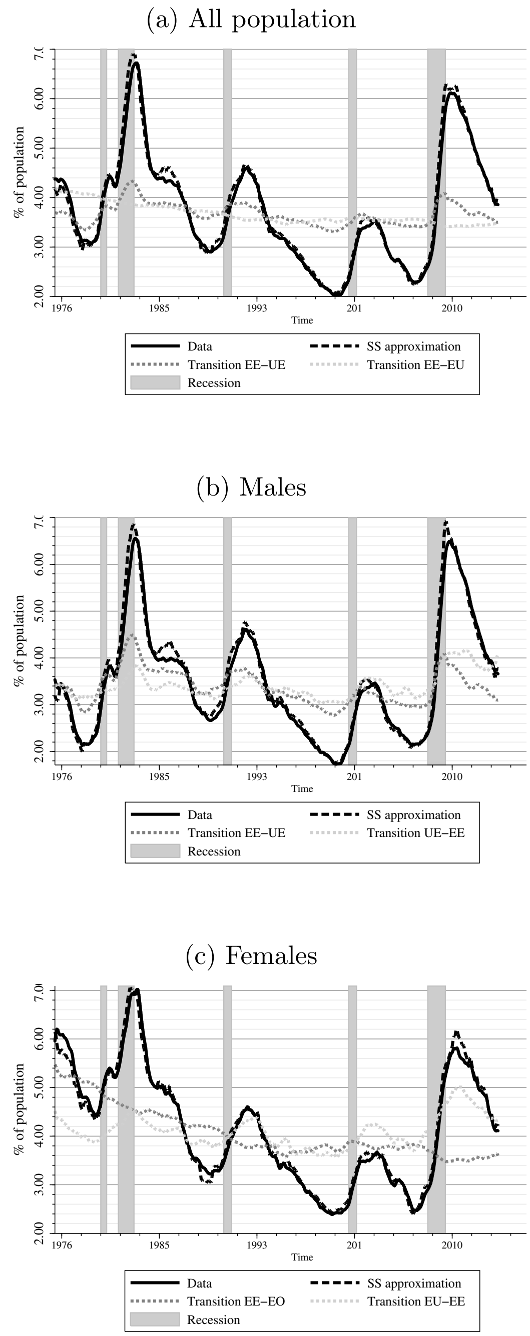
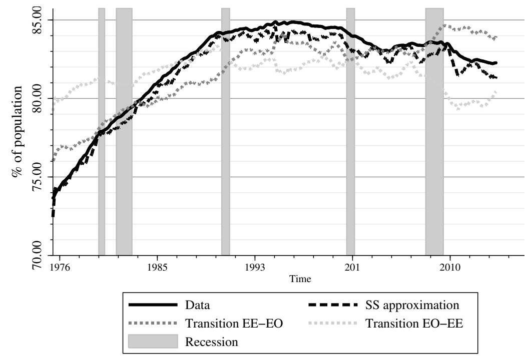
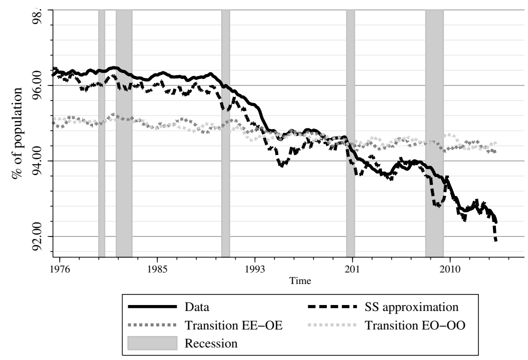



Figure 2.7: Decomposition exercise for unemployment rates, 1976:2 to 2013:12. The solid line represents the seasonally adjusted data. The dashed black line corresponds to the unemployment rate in the steady associated with the transition probabilities. The dashed dark and light gray lines correspond to the two most important transitions which contribute to the unemployment rate. The legend contains the description of these transitions. Grey areas represent NBER recession dates (taken from http://www.nber.org/cycles/cyclesmain.html).

(a) All population




(b) Males




(c) Females

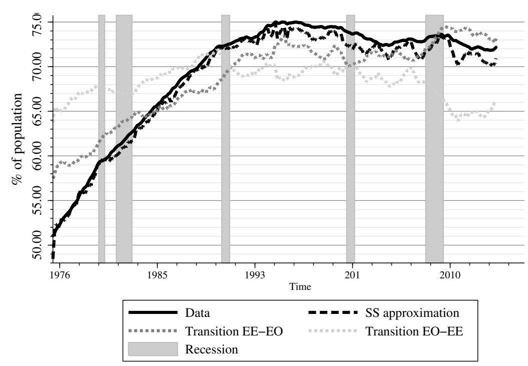



Figure 2.8: Decomposition exercise for participation rates, 1976:2 to 2013:12. The solid line represents the seasonally adjusted data. The dashed black line corresponds to the participation rate in the steady associated with the transition probabilities. The dashed dark and light gray lines correspond to the two most important transitions which contribute to the participation rate. The legend contains the description of these transitions. Grey areas represent NBER recession dates (taken from http://www.nber.org/cycles/cyclesmain.html).

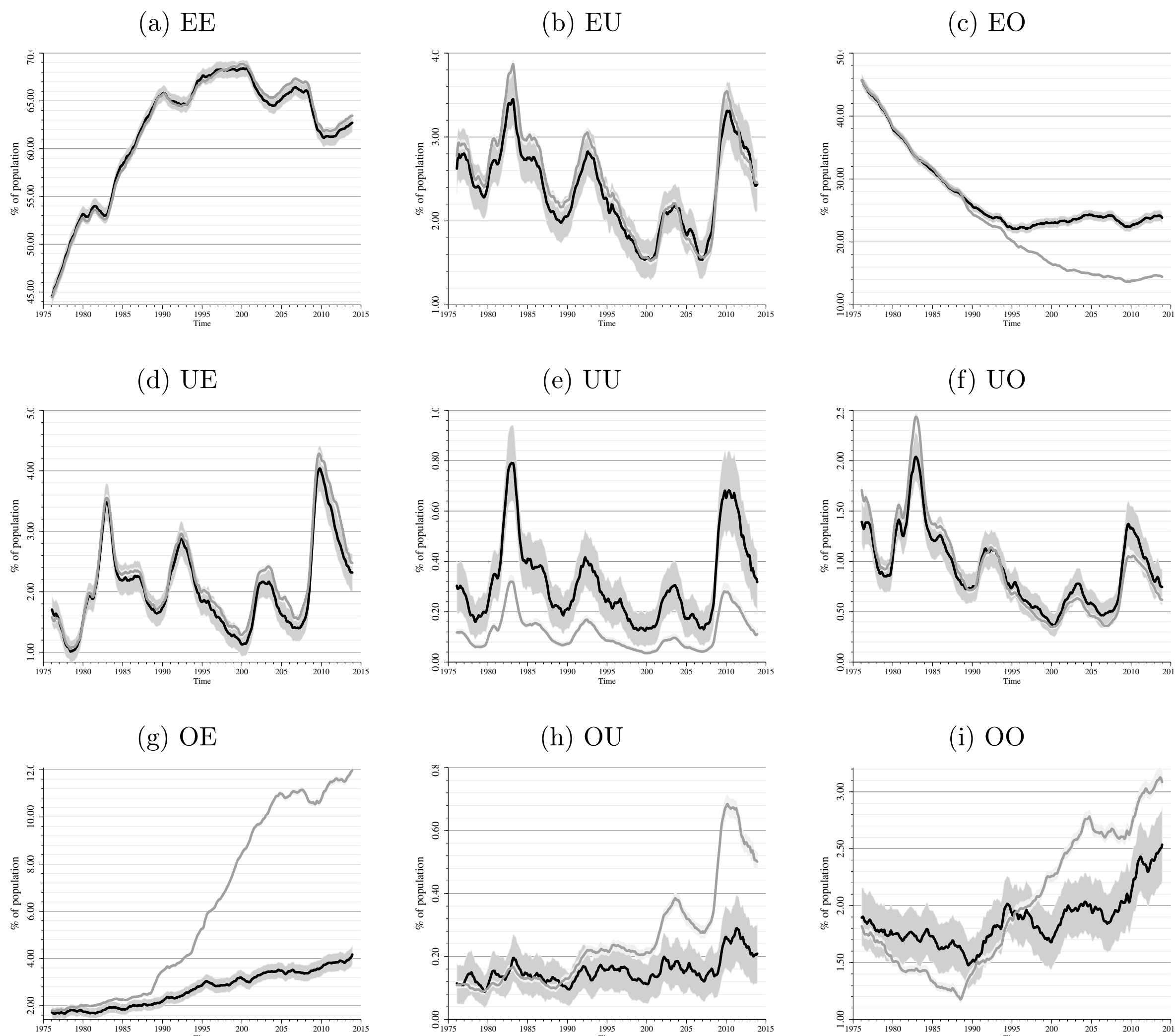



Figure 2.9: Labor market stocks for married couples, ages 25-54, 1976:2 to 2013:12. The solid black line represents the seasonally adjusted fraction of the population in state XY, where X refers to the male and Y to the female. X and Y can stand for: E - employed, U - unemployed, O - out of the labor force. The solid grey line represents the counterfactual data. Grey areas correspond to 95% confidence intervals.

# Chapter 3

# Unemployment Insurance in an Economy with Single and Married Households

## 3.1 Introduction

This chapter studies the effects, mainly in terms of welfare, of a publicly provided Unemployment Insurance (UI) program in an environment where the main source of heterogeneity among individuals is the type of household they live in, that is, some agents live alone while others live with their spouses as a family.

The standard framework used to study the effects of unemployment insurance programs focuses on single-agent models. However, there are two reasons why this framework might provide an incomplete picture of the effects of UI programs. First, as pointed out in Choi and Valladares-Esteban (2013), married and single individuals display striking differences in labor market dynamics and performance.[1] In particular, married individuals tend to have much lower unemployment rates than their single counterparts, which suggests that the two groups might have different needs with respect to UI. Second, the family can be an insurance provider, since when one family member is laid off, the other may start working to sustain consumption.

The framework used here, which extends the Aiyagari-Bewley-Huggett economy in Krusell et al. (2011), has five salient features.[2] First, households decide labor supply along the extensive margin. Second, agents are subject to non-insurable income and working opportunities shocks, cannot borrow, and the only saving technology available is a risk free asset which pays an exogenous interest rate. Third, agents are heterogeneous in gender and household type, that is, there are four types of agents: single females, single males, married females, and married males. Fourth, married agents take decisions within a unitary framework and pool income, consumption, and savings with their spouses. Finally, there is a government that, without having perfect information on the working opportunities of the agents, runs an unemployment insurance program which resembles the one in place in the US.

The model is able to account relatively well for different moments of the data, including the monthly transitions across labor market states; the labor market stocks associated to these transitions both for single and married households; as well as the duration of unemployment insurance spells and the fraction of unemployed workers who receive unemployment benefits in the US economy. To the best of my knowledge, this is the first model capable of reproducing the worker flows and labor market performance associated with the four types of individuals considered.

[1] Throughout this chapter the terms single and non-married are used interchangeably, referring to any person who is labeled as "never married", "separated", "divorced" or "widowed" in the Current Population Survey (CPS). I ignore cohabiting individuals, given the inability to distinguish them in a non-arbitrary way in the CPS.

[2] See Aiyagari (1994), Bewley (1980), and Huggett (1993).

The main finding is that for married households UI is not welfare improving. That is, the family is a better insurance device than the publicly provided unemployment insurance program. This result does not depend on the difference in the likelihood of being unemployed between married and single individuals nor on the distinct characteristics of their income shocks. On the contrary, it is a consequence of the joint decisions and the pooling of income, consumption, and savings implied by the family. For single individuals living with their clones as a family, UI would not be welfare improving, while for married individuals living apart as singles, UI would improve their welfare.

There are several papers which study the welfare implications and the effects of unemployment insurance programs. Abdulkadiroglu et al. (2002) point out how important hidden assets are in determining the optimal unemployment insurance scheme. Gomes et al. (2001) study the effects of unemployment insurance and business cycles in an incomplete markets framework in which the decision to accept or reject jobs is modeled explicitly. Hansen and Imrohoroglu (1992) find that the inability of the government to distinguish between voluntary and involuntary non-employment may reduce the welfare gains of unemployment insurance. Hopenhayn and Nicolini (1997) show how to design an unemployment insurance program in an environment where search effort is not observable by the insurance provider. Rendon (2006) analyzes the interactions between wealth accumulation and job search dynamics. Shimer and Werning (2008) highlight the role of unemployment insurance as a liquidity provision device.

Similarly to Abdulkadiroglu et al. (2002), Gomes et al. (2001), Hansen and Imrohoroglu (1992), Rendon (2006), and Shimer and Werning (2008), I allow households to save against employment risk. That is, agents accumulate assets to be able to sustain consumption when hit by a non-employment shock. Differently from these studies, I introduce the family as another source of insurance for some of the agents in the economy and I allow for heterogeneity in the amount of non-employment risk across types of agents. As is the case in Hansen and Imrohoroglu (1992) and Hopenhayn and Nicolini (1997), I assume that the government is not able to perfectly distinguish between workers who reject job offers and those that cannot find one. Hence unemployment insurance distorts the labor supply decision of households.

Much less work has been done on the effects of unemployment insurance in frameworks where the family plays an important role, although there are some exceptions. The closest study to mine is Ortigueira and Siassi (2013), who use an Aiyagari-Huggett economy to analyze the amount of insurance provided by married households against non-employment risks. The current analysis differs from theirs in three dimensions. First, the model presented here accounts for the labor stocks and transitions across employment, unemployment and non-participation associated with the four types of individuals considered (single females, single males, married females, and married males). Second, I do not assume that the government has perfect information about agents' opportunities to work. This feature generates a distortionary effect of UI over participation decisions. Finally, the UI considered here incorporates a past-employment requirement resembling one of the eligibility conditions existing in the US system. This element plays an important role in the employment decisions of the agents.

Some other authors have also analyzed unemployment insurance in multi-agent environments. Ek and Holmlund (2010) study optimal unemployment insurance of couples in a Diamond-Mortensen-Pissarides framework. I depart from their work in two dimensions. First, I do not consider unemployment benefits as the outside option of a worker in a bargaining process and, second, the model used here is able to account for multiple moments of the data associated with the difference in labor market dynamics between singles and married individuals in the US economy. Di Tella and MacCulloch (2002) study the provision of unemployment insurance in a context where agents form networks to share risk (these networks are what they consider families). Differently, I consider the family as the union generated by the contract of marriage and I abstract from commitment issues between spouses. Moreover, instead of a theoretical approach, I propose a quantitative exercise to test the effect of public intervention.

Although single-agent environments are predominant in quantitative macroeconomic and public policy analysis, there is a growing literature which is moving towards two-agent frameworks. The following is a list of some notable examples. Guner et al. (2012a) study the welfare implications of changes in the US tax code in a model where decisions are taken by two-earner households. Heathcote et al. (2010) explore the quantitative and welfare implications of the rise in college premium, the narrowing of the gender wage gap, and the increase of wage volatility using a model in which the decision unit is a two-agent household. Hong and Ríos-Rull (2007) analyze social security with two-member households. Kleven et al. (2009) study optimal taxation modeling explicitly second-earner decisions. I follow this stream of the literature by analyzing the implications of an unemployment insurance program in a model with single and married households.

This chapter is also related to the literature that studies household interactions and frictions in the labor market. Mankart and Oikonomou (2012) show that a household search model can account for some regularities of the US data that can not be replicated by single-agent search models. Guler et al. (2012) theoretically assess the problem of a two-member household who has to accept or reject job offers. Dey and Flinn (2008) study the implications of health insurance coverage in a search model where the decision unit is the household. Flabbi and Mabli (2012) analyze the bias in structurally estimated parameters in search models where the misspecification is related to joint-search.

The chapter is organized as follows. In Section 3.2, I describe the main differences between single and married individuals with respect to labor market dynamics that are found in the data. Section 3.3 presents a model which is able to account for the facts described in Section 3.2. In Section 3.4, I explain the calibration strategy followed to fit the model to the data. Then, in Section 3.5, the calibrated model is used to investigate the welfare responses of households to changes in UI benefits. In Section 3.6, I assess the effect on labor market stocks generated by changes in unemployment benefits. Section 3.7 reports different robustness checks. Finally, Section 3.8 concludes.

## 3.2 Labor market differences between single and married individuals

In the US labor market, single and married individuals display very different labor market dynamics. The most striking of these differences is the systematically lower unemployment rate exhibited by married individuals as compared to their non-married counterparts. As documented in Choi and Valladares-Esteban (2013), differences in observable characteristics between the two groups can only partially account for this unemployment gap. Moreover, it does not seem plausible that a mechanism of selection into marriage is behind the differences, either. While the proportion of married individuals in the labor force has been steadily decreasing over the past four decades, the unemployment gap between married and single individuals, when controlling for observable characteristics, has increased slightly. If the different unemployment rates between singles and married people could be explained by selection into marriage, the fact that less individuals are getting married, that is, there is more selection, would imply that the conditional gap should have been increasing. However, the opposite effect is found in the data.

In this section, I describe the main differences between married and single individuals, both for females and males, in terms of labor market stocks and transitions. I focus on the period from 2000 to 2005 based on three considerations. First, the dramatic increase in female labor force participation experienced in the last century might be behind the difference in dynamics between singles and married people. During the period from 2000 to 2005, not only was female labor force participation stable but also the differences between the participation rates of single and married females were *small*. Second, I want to abstract from the effects generated by the Great Recession in the labor market. Finally, the unemployment gap is a phenomenon that can be documented, at least, over the last four decades.

In order to compare the two groups, I employ monthly data from the Current Population Survey (CPS) to compute transitions over three labor market states, Employment ($E$), Unemployment ($U$), and Non-participation ($N$).[3] Each transition measures the probability of being in one state conditional on the state in the previous period. Hence, conditional on the state in the previous month, the transitions must sum up to one. The participation, employment, and unemployment rates associated to the transitions are also reported.

The general picture is that for both men and women, the unemployment rate of married people is lower than that of singles. Married males, in Table 3.1, exhibit an unemployment rate of 3.09% versus 7.88% for singles. In the case of women, in Table 3.2, married individuals have an unemployment rate of 3.38% versus 6.53% for singles. However, while married males display higher employment and participation rates than singles (89.70% vs. 80.67%), the situation for females is the opposite. Married women exhibit lower participation rates than their non-married counterparts (69.17% vs. 75.78%).

| **Singles** | | | | **Married** | | | |
|---|---|---|---|---|---|---|---|
| From / To | $E$ | $U$ | $N$ | From / To | $E$ | $U$ | $N$ |
| $E$ | 94.79 | 2.15 | 3.06 | $E$ | 98.00 | 0.90 | 1.10 |
| $U$ | 28.02 | 51.72 | 20.25 | $U$ | 30.19 | 56.87 | 12.95 |
| $N$ | 9.74 | 5.96 | 84.30 | $N$ | 6.89 | 2.82 | 90.29 |
| Participation Rate | | | 80.67 | Participation Rate | | | 89.70 |
| Employment Rate | | | 74.32 | Employment Rate | | | 86.93 |
| Unemployment Rate | | | 7.88 | Unemployment Rate | | | 3.09 |

Table 3.1: Labor market stocks and transitions for single and married males (%). CPS 2000-2005.

The main channel behind the lower unemployment rate of married males with respect to their single counterparts seems to be their higher attachment to employment (Table 3.1). Conditional on being employed in the previous period, married males are more likely to continue being employed (98.00% vs. 94.79%). At the same time, the probability of a married individual transitioning from employment to unemployment is more than two times smaller than for a single person (0.90% vs 2.15%). Concerning transitions out of unemployment, although married males are more likely to continue unemployed (56.87% vs. 51.72%), they also present a higher probability of entering employment (30.19% vs. 28.02%). Finally, married males are less likely than singles to be unemployed after a period of non-participation (2.82% vs 5.96%).

[3]See Shimer (2012) and Krusell et al. (2011) for a description of the methodology.

| **Single** | | | | **Married** | | | |
|---|---|---|---|---|---|---|---|
| From / To | $E$ | $U$ | $N$ | From / To | $E$ | $U$ | $N$ |
| $E$ | 95.39 | 1.49 | 3.13 | $E$ | 96.36 | 0.76 | 2.88 |
| $U$ | 25.88 | 49.84 | 24.28 | $U$ | 28.81 | 47.09 | 26.10 |
| $N$ | 7.88 | 4.57 | 87.55 | $N$ | 5.72 | 1.94 | 92.35 |
| Participation Rate | | | 75.78 | Participation Rate | | | 69.17 |
| Employment Rate | | | 70.83 | Employment Rate | | | 66.83 |
| Unemployment Rate | | | 6.53 | Unemployment Rate | | | 3.38 |

Table 3.2: Labor market stocks and transitions for single and married females (%). CPS 2000-2005.

In the case of females (Table 3.2), the lower unemployment rate of married compared to singles appears to be linked not only with employment attachment but also to the participation margin. As is the case for men, married females exhibit a higher probability of continued employment (96.36% vs. 95.39%), and are less likely to transition from employment to unemployment (0.76% vs. 1.49%). Conditional on being unemployed in the previous month, married women are more likely to be employed in the following period (28.81% vs. 25.88%). Moreover, they display a higher probability of *escaping* unemployment through non-participation (26.10% vs. 24.28%). Finally, married females exhibit a higher probability of remaining non-participants than their single counterparts (92.35% vs 87.55%).

The difference in the likelihood of being unemployed between singles and married individuals (and the labor market dynamics that induce this situation) may indicate that the two groups have different needs with respect to unemployment insurance. In other words, simply because married individuals are less likely to fall into unemployment it might be that their response to unemployment insurance is very different from that of singles. One of the purposes of this chapter is to explore if that is effectively the case. In particular, I explore how a married household reacts to unemployment insurance in contrast to a household formed by two singles, in which the effect of the difference in labor market dynamics is neutralized, allowing me to identify how important the difference in labor market dynamics is in explaining the response to unemployment insurance. Finally, it should be noted that assessing the potential sources of the differences in labor market dynamics between married and single individuals is outside the scope of this chapter.

## 3.3 The economic environment

Time is discrete and the time horizon is infinite. The economy is populated by a continuum of infinitely lived households with total mass equal to one. There are agents of two genders, females ($f$), and males ($m$). Agents may live in two types households, single households ($\mathcal{S}$) and married households ($\mathcal{M}$).

Single households can be composed by one female or one male, while married households consist of two members, one of each gender. Hence, there are single females ($\mathcal{S}$, $f$), single males ($\mathcal{S}$, $m$), married females ($\mathcal{M}$, $f$), and married males ($\mathcal{M}$, $m$). A fraction $\Phi_{\mathcal{S},f}$ of the households corresponds to single females, a fraction $\Phi_{\mathcal{S},m}$ to single males, and the rest ($1 - \Phi_f - \Phi_m = \Phi_{\mathcal{M}}$) are married households. Household type, $\mathcal{H} \in\{\mathcal{S} ,\mathcal{M}\}$, and gender, g$\in \{f, m\}$, are exogenous.

Households discount the future at rate $0 < \beta < 1$, derive utility from consumption streams over time and pay a utility cost when working. Preferences for single households are given by

$$\log(c) - \alpha_{\mathcal{S},g} e_g, \quad g \in \{f, m\}, \tag{3.1}$$

while for married households, they are:

$$\log\left(\frac{c}{1+\chi}\right) - \alpha_{\mathcal{M},f} e_f - \alpha_{\mathcal{M},m} e_m - \alpha_{\mathcal{M}} e_f e_m. \tag{3.2}$$

In both cases, $c \geq 0$ stands for consumption in the current period, $e_g \in \{0, 1\}$ is a discrete variable describing the work decision (1 means work) and $\{\alpha_{\mathcal{S},g}, \alpha_{\mathcal{M},g}, \alpha_{\mathcal{M}}\}$ are the parameters that quantify the disutility of work for each gender $g \in \{f, m\}$. The restriction that $e_g$ is either zero or one implies that all labor supply adjustments are done through the extensive margin.

Note that, for married households, it is assumed a unitary framework in which consumption is a public good adjusted by an adult equivalence scale ($\chi$). Within married households, the *individual* disutility of working ($\alpha_{\mathcal{M},g}$) is suffered by the household as a whole. Moreover, if both spouses work at the same time, the household suffers a utility cost associated to joint employment ($\alpha_{\mathcal{M}}$). The idea behind this cost is that, for married couples, second earners forgo a valuable contribution to the household when employed (childbearing, home production, etc.).

Individual labor income of any agent in the economy, irrespective of gender or household type, is given by

$$(1 - \tau)\, ze, \tag{3.3}$$

where $\tau$ is a linear labor income tax, $e$ is the binary decision to work and $z$ is a labor income shock.[4] The idiosyncratic shock $z$ differs across genders and household types.

For single households, $z$ follows an AR(1) stochastic process in logs. Given by

$$\log z'_{\mathcal{S},g} = \rho_{\mathcal{S},g} \log z_{\mathcal{S},g} + \varepsilon'_{\mathcal{S},g} \quad g \in \{f, m\}, \tag{3.4}$$

where $\rho_{\mathcal{S},g}$ represents the persistence parameter of the process, and $\varepsilon_{\mathcal{S},g} \sim N(0, \sigma_{\mathcal{S},g})$ is the innovation in the current period.

For agents living in married households, labor income shocks evolve jointly following a VAR(1) stochastic process in logs, given by

$$\log \begin{bmatrix} z'_{\mathcal{M},f} \\ z'_{\mathcal{M},m} \end{bmatrix} = \rho_{\mathcal{M}} \log \begin{bmatrix} z_{\mathcal{M},f} \\ z_{\mathcal{M},m} \end{bmatrix} + \begin{bmatrix} \varepsilon'_{\mathcal{M},f} \\ \varepsilon'_{\mathcal{M},m} \end{bmatrix}, \tag{3.5}$$

where $\rho_{\mathcal{M}}$ stands for the persistence of the process. The vector $\begin{bmatrix} \varepsilon'_{\mathcal{M},f} \\ \varepsilon'_{\mathcal{M},m} \end{bmatrix}$ is distributed according to

$$\begin{bmatrix} \varepsilon'_{\mathcal{M},f} \\ \varepsilon'_{\mathcal{M},m} \end{bmatrix} \sim N\left( \begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \sigma_f & \sigma_{fm} \\ \sigma_{fm} & \sigma_m \end{bmatrix} \right), \tag{3.6}$$

where $\sigma_f$ is the standard deviation of female's innovation shock, $\sigma_m$ is the standard deviation of male's income shock, and $\sigma_{fm}$ is the covariance between the two innovation shocks. It is assumed that the standard deviation of the two innovation shocks is the same and it is denoted by $\sigma_{\mathcal{M}} = \sigma_f = \sigma_m$. Notice that the correlation between the two innovation shocks is given by $\phi = \frac{\sigma_{fm}}{\sigma^2_{\mathcal{M}}}$.

Besides the discrete labor supply choice, households decide how much to consume and how much to save for the future. The only technology available for saving is a risk-free asset which pays an exogenous real interest rate $r$. Households are not allowed to borrow against future income.

### 3.3.1 The labor market

Labor income shocks are not the only source of uncertainty in this economy. To capture frictions in the labor market, agents are subject to working opportunities shocks that determine whether the agent has the possibility to work or not in a given period.

It is assumed that the probability of having a work opportunity in the current period depends on whether the agent was employed or not in the previous period, and on the

[4] Notice that the wage is exogenous and normalized to 1. The labor income shock can also be interpreted as the amount of efficiency units of labor per wage unit.

household type and gender. Those agents who were not employed in the previous period, receive an opportunity to work with probability $\lambda_{\mathcal{H},g}$. Employed agents last period do not have an opportunity to work in the current period with probability $\delta_{\mathcal{H},g}$.

The assumption that the probability of having an opportunity to work in a given period depends on the employment status in the previous period is based on the structure of the labor market transitions observed in the data (Section 3.2). In the data, those individuals that are employed in the previous month present a much higher likelihood of employment in the next period than those non-employed in the previous period. In the model, this idea is captured simply setting $1 - \delta_{\mathcal{H},g} > \lambda_{\mathcal{H},g}$, that is, the probability of having a work opportunity for an agent employed in the previous period $(1 - \delta_{\mathcal{H},g})$ is higher than the probability of having a working opportunity for a non-employed agent in the previous period.

The fact that both the arrival $(\lambda_{\mathcal{H},g})$ and the destruction probability $(\delta_{\mathcal{H},g})$ depend on gender and household type captures two potential differences among single females, single males, married females, and married males. First, the different composition of characteristics, both observable and unobservable, that these groups might present in the data. As an example, part of the labor market differences between single and married individuals can be accounted for by observables. This composition effect is partly captured in the model by the differences in the arrival and destruction probabilities. Secondly, in the model, conditional on the decision of employment versus non-employment, the probability of receiving/losing an opportunity to work is exogenous to the actions of the agents. For example, agents cannot exert more effort searching for a work opportunity in order to increase the likelihood of finding one. However, there might exist systematic differences between singles and married, males and females, in this dimension. These differences are partially reflected in the model through differences among the arrival and destruction probabilities.

In contrast to standard search models, here agents have to decide whether to work or not each period, independently of their employment status in the previous period. Agents might *quit* their job, if after being employed last period, they receive again an opportunity to work but decide not to work. The decision to work or not, in the case of single households, is mainly determined by the amount of assets, productivity, and the unemployment insurance status of the agent. For married, the labor market situation of the spouse plays also a very important role along with the factors listed for singles. This property generates two groups of non-employed agents. On the one hand, there are agents that decide not to work even-though they have the opportunity to do so. On the other hand, there are agents that would like to work but, due to the frictions in the market, do not have the opportunity to do it. I use this distinction to connect the model to the data as described in Section 3.3.6.

### 3.3.2 The government and the unemployment insurance

In this economy there is a government that taxes labor income, balances the budget every period, and finances an Unemployment Insurance (UI) program. The objective of the UI is to pay a compensation to those workers who lost their opportunity to work and did not find a new one. In other words, all agents that are hit by the destruction probability ($\delta_{\mathcal{H},g}$) and do not find a new working opportunity ($1-\lambda_{\mathcal{H},g}$) are compensated with a transfer $b > 0$ from the government.

Although the government can perfectly observe whether an agent is employed or not, that is not the case for working opportunities. Hence, the government cannot perfectly distinguish between workers who do not have opportunities and agents who refuse them. This implies that agents have the possibility to cheat, and receive unemployment benefits even-though they have an opportunity to work.

Each period, a fraction $\pi$ of the agents who have an opportunity to work are endowed with the ability to hide their situation from the government. Knowing their ability to cheat, agents choose between work and receiving unemployment benefits.[5] Notice that this is a non-trivial decision given that the probability of having an opportunity to work next period depends on the employment decision this period. If an agent decides to refuse an opportunity to work in order to enjoy benefits, she/he is not only forgoing the income associated to work, but also risking the possibility of not having an opportunity to work in the following period.

The inability of the government to perfectly identify those with work opportunities distorts agents' decisions. First, agents that were enjoying benefits last period and receive an opportunity might be able to extend their UI spell. That is, the UI distorts the willingness to accept offers for non-employed agents. Second, for those agents employed in the previous period, their decision to work again in the current period might be affected by the possibility to receive benefits, inducing endogenous *quits*.[6]

The UI considered in this model is fairly similar to the one in place in the US. Since the unemployment insurance practices differ across US states, it is difficult to summarize its characteristics. However, the program can be outlined along three dimensions: eligibility, amount of benefits, and duration.[7] In terms of eligibility, the program demands workers to stay in their job for a certain period of time, provide an acceptable reason for job separation, and not to have other job options. In the model, workers must be employed at least one period

[5] This feature is a simplification of the moral hazard problem in Hansen and Imrohoroglu (1992).

[6] A quit is understood as the situation where the agent worked last period and, having an opportunity to work in the current period, decides not to do so.

[7] Nicholson and Needels (2006) provide a general description of the main features of the program in the US.

before being able to collect benefits.[8] Also, those agents that have a working opportunity are not able to receive benefits unless they are endowed with the ability to hide opportunities. Finally, an acceptable reason for job separation is understood in the model as being hit by the destruction probability shock ($\delta_{\mathcal{H},g}$).

Regarding the amount of benefits, the model is calibrated to match the unemployment benefits received by workers in the data. Finally, while in US the unemployment insurance specifies a maximum spell for receiving benefits, the model does not explicitly impose any limitation.[9] However, as detailed in Section 3.4.2.1, the model does a reasonable job replicating the duration of UI spells and the fraction of unemployed agents who receive benefits. In the model, agents do not receive benefits for a long period mainly because they start working, or because they receive an opportunity to work and cannot hide it from the government.

In what follows, I describe the value functions which define the optimization problem of each type of household in the economy. Single household can be in two situations, employed or non-employed. In the case of married, since there are two individuals in the household the set of possibilities expands up to four scenarios: both work, the female works, the male works, or none is working.

### 3.3.3 Single households

Four factors define the situation of a single household. First, whether the agent in the household is working or not. Second, the level of assets held by the agent ($a$). Third, her/his labor income shock ($z_{\mathcal{S},g}$), which evolves according to the process described in Equation (3.4). And, finally, when the agent is not working, whether the agent receives unemployment benefits or not ($i_g$). If the agent receives unemployment benefits the indicator variable $i$ takes value 1, while it takes value 0 in the opposite case. Remember that an agent can receive benefits for two reasons: because she/he is eligible for benefits (do not have an opportunity to work) or because she/he manages to cheat to the government.

Let $W(a, z_{\mathcal{S},g})$ represent the value function for a single household where the agent is employed and $N(a, z_{\mathcal{S},g}, i)$ be the value function of a single non-employed household. For, $g \in \{f, m\}$, $N(a, z_{\mathcal{S},g}, i)$ is defined as:

$$
\begin{aligned}
N(a, z_{\mathcal{S},g}, i) = \max_{c,a' \geq 0} \{\log(c) + \\
+\beta E_{z'_{\mathcal{S},g}} \left[ \begin{array}{r} \lambda_{\mathcal{S},g} \max E_{i'} \left\{ W\left(a', z'_{\mathcal{S},g}\right), N\left(a', z'_{\mathcal{S},g}, i'\right) \right\} + \\ + (1-\lambda_{\mathcal{S},g}) N\left(a', z'_{\mathcal{S},g}, i' = i\right) \end{array} \right]
\end{aligned}
\tag{3.7}
$$

[8]The simplification of one period of employment is mainly done for computational reasons. Adding any employment requirement higher than one period implies a new state variable.

[9]The standard limit is 26 weeks.

subject to

$$c + a' = (1 + r)\, a + bi, \tag{3.8}$$

and where

$$i' = \begin{cases} 1, & \text{with probability } \pi \text{ and if } i = 1 \\ 0, & \text{otherwise.} \end{cases} \tag{3.9}$$

A non-employed agent might have two sources of income. If she/he is entitled to benefits ($i = 1$), the income of the agent consists of assets income and unemployment benefits. In the case of not being eligible for benefits the agent has to live out of income assets. If the agent end-ups without an opportunity to work next period ($1 - \lambda_{\mathcal{S},g}$), her/his unemployment insurance status is unchanged, that is, continues to receive benefits if she/he was receiving benefits in the previous period and vice versa. If the agent receives a job offer ($\lambda_{\mathcal{S},g}$), two situations are possible. First, if she/he was not receiving unemployment benefits last period, the agent chooses between work and continuing non-employed without benefits. Second, if she/he was receiving benefits in the previous period, with probability $\pi$, the agent is able to hide the opportunity of work from the government. In this case her/his decision is between working and not working while receiving benefits. With probability $1 - \pi$, the government knows that the agent got an opportunity, and the decision is between work and non-employment without benefits.

Similarly, the value function for single employed household, $W(a, z_{\mathcal{S},g})$, is defined by:

$$\begin{gathered} W(a, z_{\mathcal{S},g}) = \max_{c,a' \geq 0} \{\log(c) - \alpha_{\mathcal{S},g} + \\ + \beta E_{z'_{\mathcal{S},g}} \left[ \begin{array}{r} (1 - \delta_{\mathcal{S},g})\, E_{i'} \max\left\{W\left(a', z'_{\mathcal{S},g}\right), N\left(a', z'_{\mathcal{S},g}, i'\right)\right\} + \\ + \delta_{\mathcal{S},g} N\left(a', z'_{\mathcal{S},g}, 1\right) \end{array} \right] \end{gathered} \tag{3.10}$$

subject to

$$c + a' = (1 + r)\, a + (1 - \tau)\, z_{\mathcal{S},g}, \tag{3.11}$$

and where

$$i' = \begin{cases} 1, & \text{with probability } \pi \\ 0, & \text{otherwise.} \end{cases} \tag{3.12}$$

If the agent works, she/he receives labor income defined by her/his productivity after taxes ($(1 - \tau)\, z_{\mathcal{S},g}$). However, the household suffers also a utility cost from working given by $\alpha_{\mathcal{S},g}$. If an employed agent starts the following period without a working opportunity ($\delta_{\mathcal{S},g}$), she/he is non-employed with benefits. If, next period, an opportunity to work appears ($1 - \delta_{\mathcal{S},g}$) the agent might be able to hide it from the government. With probability $\pi$, she/he decides between work and non-employment with benefits, while with probability $\pi$ the agent chooses between work an non-employment without benefits.

For each optimization problem, policy functions for the optimal level of asset holdings, $a^{\star}_{W,g}(a, z_{\mathcal{S},g}, i_g)$ and $a^{\star}_{N,g}(a, z_{\mathcal{S},g}, i_g)$, can be obtained. The maximization decision that households may face at the beginning of each period, $\max\{W(a, z_{\mathcal{S},g}), N(a, z_{\mathcal{S},g}, i)\}$, defines the labor supply policy function $e^{\star}_{\mathcal{S},g}(a, z_{\mathcal{S},g}, i_g)$. Notice that the policy function for labor supply is well defined for all households irrespective of whether they actually face the opportunity to work or not. In other words, it is possible to know for all non-employed agents if they would accept a job or not. This fact is used to reconcile the model with the data as described in Section 3.3.6. The main idea is that among all non-employed workers, those that if offered to work would decline, are considered non-participants, while those that if they could, they would work, are categorized as unemployed. That is, unemployment is defined as agents that would like to work but cannot do it because of labor market frictions.

### 3.3.4 Married households

The optimization problem of a married household is defined by four factors. First, the amount of asset holdings ($a$). Second, the labor income shock of each member of the household ($z_{\mathcal{M},f}$ and $z_{\mathcal{M},m}$) which evolves according to the process described in Equation (3.5). Third, which agents in the household, if any, are employed. And, finally, if there is any member of the household who does not have a job, whether she/he is receiving unemployment benefits or not ($i_f$ and/or $i_m$). Notice that, on top of the assumption of a unitary framework for married households, it is assumed that married households hold their assets jointly.

Let $\mathcal{W}(a, z_{\mathcal{M},f}, z_{\mathcal{M},m})$ denote the value function for a married household where both agents are working. Let $\Omega_f(a, z_{\mathcal{M},f}, z_{\mathcal{M},m}, i_m)$ represent the value function of a married household where only its female member works, while $\Omega_m(a, z_{\mathcal{M},f}, z_{\mathcal{M},m}, i_f)$ stands for the opposite case, that is, the male works and the female does not. Finally, let $\mathcal{N}(a, z_{\mathcal{M},f}, z_{\mathcal{M},m}, i_f, i_m)$ denote the value function for a married household where none of the agents are working.

$\mathcal{N}(a, z_{\mathcal{M},f}, z_{\mathcal{M},m}, i_f, i_m)$ is defined by:

$$\mathcal{N}(a, z_{\mathcal{M},f}, z_{\mathcal{M},m}, i_f, i_m) = \max_{c,a'\geq 0}\{\log\left(\frac{c}{1+\chi}\right) + \\ +\beta E_{z'_{\mathcal{M},f}, z'_{\mathcal{M},m}, i'_f, i'_m}\left[\begin{array}{r} \lambda_{\mathcal{M},f}\lambda_{\mathcal{M},m}E_{i'_f,i'_m}\max\{\mathcal{W}('), \Omega_f('), \Omega_m('), \mathcal{N}(')\} + \\ +\lambda_{\mathcal{M},f}(1-\lambda_{\mathcal{M},m})E_{i'_f}\max\left\{\Omega_f(', i'_m = i_m), \mathcal{N}(', i'_f, i'_m = i_m)\right\} + \\ +(1-\lambda_{\mathcal{M},f})\lambda_{\mathcal{M},m}E_{i'_m}\max\left\{\Omega_m, (', i'_f = i_f), \mathcal{N}(', i'_f = i_f, i'_m)\right\} + \\ +(1-\lambda_{\mathcal{M},f})(1-\lambda_{\mathcal{M},m})\mathcal{N}(', i'_f = i_f, i'_m = i_m) \end{array}\right] \tag{3.13}$$

subject to

$$c + a' = (1+r)a + b(i_f + i_m), \tag{3.14}$$

and where

$$i'_g = \begin{cases} 1, & \text{with probability } \pi \text{ and if } i_g = 1 \\ 0, & \text{otherwise.} \end{cases} \qquad g \in \{f, m\} \tag{3.15}$$

Any married household can face up to four different situations each period: both members have an opportunity to work, only the female has an opportunity, only the male, or none of them have a working opportunity. As it is the case for singles, if an agent of a married household, who is not employed in the current period, does not receive an opportunity to work in the following period, her/his status with respect to unemployment benefits is not changed. In the case that she/he was not receiving benefits last period, she/he does not receive benefits in the current period and vice versa (in general, $i'_g = i_g$ for $g \in \{f, m\}$).

Also, as for singles, married agents might be able to hide their working opportunities from the government. Notice that, in the case that both members of the household have a working opportunity, four different scenarios can occur: both members of the household can hide their opportunity, only the female can do it, only the male, or none of them is able to cheat to the government. Of course, the possibility to hide an offer and continue to receive benefits is conditional on being already receiving benefits.

The value function for a married household where only the female is employed, $\Omega_f\left(a, z_{\mathcal{M},f}, z_{\mathcal{M},m}, i_m\right)$, is defined by:

$$\Omega_f\left(a, z_{\mathcal{M},f}, z_{\mathcal{M},m}, i_m\right) = \max_{c,a'\geq 0}\{\log\left(\tfrac{c}{1+\chi}\right) - \alpha_{\mathcal{M},f} +$$
$$+\beta E_{z'_{\mathcal{M},f}, z'_{\mathcal{M},m}} \left[ \begin{array}{r} \left(1-\delta_{\mathcal{M},f}\right)\lambda_{\mathcal{M},m} E_{i'_f, i'_m} \max\left\{\mathcal{W}\left(^{\prime}\right), \Omega_f\left(^{\prime}\right), \Omega_m\left(^{\prime}\right), \mathcal{N}\left(^{\prime}\right)\right\} + \\ +\left(1-\delta_{\mathcal{M},f}\right)\left(1-\lambda_{\mathcal{M},m}\right) E_{i'_f} \max\left\{\Omega_f\left(^{\prime}, i'_m = i_m\right), \mathcal{N}\left(^{\prime}, i'_f, i'_m = i_m\right)\right\} + \\ +\delta_{\mathcal{M},f}\lambda_{\mathcal{M},m} E_{i'_m} \max\left\{\Omega_m\left(^{\prime}, i'_f = 1\right), \mathcal{N}\left(^{\prime}, i'_f = 1, i'_m\right)\right\} + \\ +\delta_{\mathcal{M},f}\left(1-\lambda_{\mathcal{M},m}\right)\mathcal{N}\left(^{\prime}, i'_f = 1, i'_m = i_m\right) \end{array} \right] \tag{3.16}$$

subject to

$$c + a' = (1+r)\,a + (1-\tau)\,z_{\mathcal{M},f} + b i_m, \tag{3.17}$$

where

$$i'_f = \begin{cases} 1, & \text{with probability } \pi \\ 0, & \text{otherwise,} \end{cases} \tag{3.18}$$

and

$$i'_m = \begin{cases} 1, & \text{with probability } \pi \text{ and if } i_m = 1 \\ 0, & \text{otherwise.} \end{cases} \tag{3.19}$$

Symmetrically, the value function for a married household where the male is employed while the female is non-employed, $\Omega_m(a, z_{\mathcal{M},f}, z_{\mathcal{M},m}, i_f)$, is given by:

$$\Omega_m(a, z_{\mathcal{M},f}, z_{\mathcal{M},m}, i_f) = \max_{c,a'\geq 0}\{\log\left(\frac{c}{1+\chi}\right) - \alpha_{\mathcal{M},m} + \\ +\beta E_{z'_{\mathcal{M},f}, z'_{\mathcal{M},m}}\left[\begin{array}{r} \lambda_{\mathcal{M},f}(1-\delta_{\mathcal{M},m}) E_{i'_f,i'_m}\max\{\mathcal{W}('), \Omega_f('), \Omega_m('), \mathcal{N}(')\} + \\ +\lambda_{\mathcal{M},f}\delta_{\mathcal{M},m} E_{i'_f}\max\left\{\Omega_f(', i'_m = 1), \mathcal{N}\left(', i'_f, i'_m = 1\right)\right\} + \\ +(1-\lambda_{\mathcal{M},f})(1-\delta_{\mathcal{M},m}) E_{i'_m}\max\left\{\Omega_m, \left(', i'_f = i_f\right), \mathcal{N}\left(', i'_f = i_f, i'_m\right)\right\} + \\ +(1-\lambda_{\mathcal{M},f})\delta_{\mathcal{M},m}\mathcal{N}\left(', i'_f = i_f, i'_m = 1\right) \end{array}\right] \tag{3.20}$$

subject to

$$c + a' = (1+r)a + bi_f + (1-\tau) z_{\mathcal{M},m}, \tag{3.21}$$

where

$$i'_m = \begin{cases} 1, & \text{with probability } \pi \\ 0, & \text{otherwise,} \end{cases} \tag{3.22}$$

and

$$i'_f = \begin{cases} 1, & \text{with probability } \pi \text{ and if } i_f = 1 \\ 0, & \text{otherwise.} \end{cases} \tag{3.23}$$

A couple of remarks are important regarding the two value functions describing the cases were only the female or the male are working in a married household (Equation 3.16 and Equation 3.20, respectively). First, although only one member of the household works, the utility cost of working ($\alpha_{\mathcal{M},f}$ or $\alpha_{\mathcal{M},m}$) is suffered by the household as a whole. Second, as it is the case for single agents, if the employed member of the household does not have an opportunity to work next period, she/he will receive unemployment benefits.

Finally, the value function for a household in which both members are employed, $\mathcal{W}(a, z_{\mathcal{M},f}, z_{\mathcal{M},m})$, is defined by:

$$\mathcal{W}(a, z_{\mathcal{M},f}, z_{\mathcal{M},m}) = \max_{c,a'\geq 0}\{\log\left(\frac{c}{1+\chi}\right) - \alpha_{\mathcal{M},f} - \alpha_{\mathcal{M},m} - \alpha_{\mathcal{M}} + \\ +\beta E_{z'_{\mathcal{M},f}, z'_{\mathcal{M},m}}\left[\begin{array}{r} (1-\delta_{\mathcal{M},f})(1-\delta_{\mathcal{M},m}) E_{i'_f,i'_m}\max\{\mathcal{W}('), \Omega_f('), \Omega_m('), \mathcal{N}(')\} + \\ +(1-\delta_{\mathcal{M},f})\delta_{\mathcal{M},m} E_{i'_f}\max\left\{\Omega_f(', i'_m = 1), \mathcal{N}\left(', i'_f, i'_m = 1\right)\right\} + \\ +\delta_{\mathcal{M},f}(1-\delta_{\mathcal{M},m}) E_{i'_m}\max\left\{\Omega_m\left(', i'_f = 1\right), \mathcal{N}\left(', i'_f = 1, i'_m\right)\right\} + \\ +\delta_{\mathcal{M},f}\delta_{\mathcal{M},m}\mathcal{N}\left(', i'_f = 1, i'_m = 1\right) \end{array}\right] \tag{3.24}$$

subject to

$$c + a' = (1+r)a + (1-\tau)(z_{\mathcal{M},f} + z_{\mathcal{M},m}), \tag{3.25}$$

and where

$$i'_g = \begin{cases} 1, & \text{with probability } \pi \\ 0, & \text{otherwise.} \end{cases} \qquad g \in \{f, m\} \tag{3.26}$$

When both agents are employed, the household not only suffers the individual utility cost of each working member ($\alpha_{\mathcal{M},f}$ and $\alpha_{\mathcal{M},m}$) but also an extra utility cost associated with joint employment ($\alpha_{\mathcal{M}}$). In this case, if any of the two agents (or both of them) starts the following period without an opportunity to work, she/he will automatically receive benefits.

Like in the case of non-married households, each maximization problem characterizes a policy function for optimal asset accumulation: $a^{\star}_{\mathcal{W}}(a, z_{\mathcal{M},f}, z_{\mathcal{M},m}, i_f, i_m)$, $a^{\star}_{\Omega_f}(a, z_{\mathcal{M},f}, z_{\mathcal{M},m}, i_f, i_m)$, $a^{\star}_{\Omega_m}(a, z_{\mathcal{M},f}, z_{\mathcal{M},m}, i_f, i_m)$ and $a^{\star}_{\mathcal{N}}(a, z_{\mathcal{M},f}, z_{\mathcal{M},m}, i_f, i_m)$. At the same time, given any state for a married household a policy function for labor supply can be defined $(e_{\mathcal{M},f}, e_{\mathcal{M},f}) = e^{\star}_{\mathcal{M}}(a, z_{\mathcal{M},f}, z_{\mathcal{M},m}, i_f, i_m)$. This policy function is used to link the model with the data as described in Section 3.3.6.

### 3.3.5 Equilibrium

In this economy, the interest rate ($r$) is taken as exogenous. Labor income ($z_{\mathcal{H},g}$ for $\mathcal{H} \in \{\mathcal{S}, \mathcal{M}\}$ and $g \in \{f, m\}$) is only defined as deviations from the mean of the process, which is one. In other words, the price of labor is exogenous and normalized to one. One equilibrium object is the proportional tax ($\tau$) that, given the labor income in the economy, is needed to finance the UI. The others are the stationary distribution of agents across states.

Let $X^g_{\mathcal{S}}(a, z_{\mathcal{S},g}, i_g)$ be the measure across states of single households of gender $g \in \{f, m\}$ who have an opportunity to work in a given period. Analogously, let $X_{\mathcal{M}}(a, z_{\mathcal{M},f}, z_{\mathcal{M},m}, i_f, i_m)$ be the distribution of married households where both agents have an opportunity to work, $X^f_{\mathcal{M}}(a, z_{\mathcal{M},f}, z_{\mathcal{M},m}, i_f, i_m)$ corresponds to households where only the female has an opportunity, and $X^m_{\mathcal{M}}(a, z_{\mathcal{M},f}, z_{\mathcal{M},m}, i_f, i_m)$ represents those households where only the male has a working opportunity. Also, define $B^g_{\mathcal{S}}(a, z_{\mathcal{S},g}, i_g)$ as the measure of single households that receive unemployment benefits in a given period. For married households, $B_{\mathcal{M}}(a, z_{\mathcal{M},f}, z_{\mathcal{M},m}, i_f, i_m)$ is the distribution of households where both members receive benefits, $B^f_{\mathcal{M}}(a, z_{\mathcal{M},f}, z_{\mathcal{M},m}, i_f, i_m)$ represents those households where only the female receives benefits, and $B^m_{\mathcal{M}}(a, z_{\mathcal{M},f}, z_{\mathcal{M},m}, i_f, i_m)$ stands for the cases where only the male receives benefits.

The budget of the government each period is given by:

$$
\begin{aligned}
(1-\tau)\,[\sum_{g=f,m} \int z_{\mathcal{S},g} e^{\star}_{\mathcal{S},g} dX^{g}_{\mathcal{S}}\left(a, z_{\mathcal{S},g}, i_g\right) + \int \left(z_{\mathcal{M},f} e^{\star}_{\mathcal{M},f} + z_{\mathcal{M},m} e^{\star}_{\mathcal{M},m}\right) dX_{\mathcal{M}}\left(a, z_{\mathcal{M},f}, z_{\mathcal{M},m}, i_f, i_m\right) + \\
+ \sum_{g=f,m} \int \left(z_{\mathcal{M},g} e^{\star}_{\mathcal{M},g}\right) dX^{g}_{\mathcal{M}}\left(a, z_{\mathcal{M},f}, z_{\mathcal{M},m}, i_f, i_m\right)] = \sum_{g=f,m} \int dB^{g}_{\mathcal{S}}\left(a, z_{\mathcal{S},g}, i_g\right) + \\
+ \int dB_{\mathcal{M}}\left(a, z_{\mathcal{M},f}, z_{\mathcal{M},m}, i_f, i_m\right) + \sum_{g=f,m} \int dB^{g}_{\mathcal{M}}\left(a, z_{\mathcal{M},f}, z_{\mathcal{M},m}, i_f, i_m\right).
\end{aligned}
\tag{3.27}
$$

The revenue of the government, the left hand side of equation 3.27, is determined by how many single agents work and which is their productivity plus how many married agents are employed and their productivity. The expenditure of the government, in the right hand side, it basically the sum of agents that receive unemployment benefits. How many agents are entitled to benefits is mainly determined by the employment opportunity shocks. Hence, labor market frictions pin down the size of government spending. Then, taxes are crucially affected by labor market frictions and by how many agents are working, that is by the labor supply of the economy.

### 3.3.6 Employment, unemployment and non-participation

To connect the model with the moments of the data one needs a strategy to group agents in three categories: Employment ($E$), Unemployment ($U$) and Non-participation ($N$). To do this, I follow the strategy of Krusell et al. (2011) .

According to the value functions described in the previous sections the division between employed and non-employed agents is straightforward: those agents that work, are categorized as Employed. Among those who do not work, the ones that would like to work but cannot do it because they do not have an opportunity are categorized as Unemployed. The rest of the non-employed agents would not accept a job offer even if they had one, then, they are categorized as Non-participants.[10]

In the case of single households, if an agent is not employed but her/his policy function for labor supply, $e^{\star}_{\mathcal{S},g}$, equals 1 she/he will be categorized as unemployed agent. On the contrary, if the policy function equals 0, she/he will be categorized as non-participant. Basically, the strategy to establish the difference between Unemployment and Non-participation is based on the willingness to accept a job opportunity.

An analogous strategy is followed for married households. For each household, irrespectively of who actually has an opportunity to work, it is possible to know which agents in the household would like work. This information is contained in the policy function $e^{\star}_{\mathcal{M}}$. So, as an example, if in a married household both agents have the opportunity to work but only the

[10] For a deeper discussion about this strategy see Section 3.1 in Krusell et al. (2011).

female actually works, then the male agent in this household is considered non-participant. Similarly, if it is only the female the one who has an opportunity to work, but both would like to work, the male agent in this household is labeled as unemployed.

## 3.4 Calibration

In this section, I describe the procedure followed to fit the model to the data. Given that the analysis is focused on the labor market, the objective of the calibration exercise is that the model generates a good representation of the different labor market dynamics discussed in Section 3.2. In other words, the model is calibrated to replicate the labor market transitions of single females, single males, married females, and married males. Moreover, this implies that the model is also consistent with the labor market stocks, that is, the participation, employment, and unemployment rates associated to each type of individual.

The transitions among labor market states of the four types of individuals constitute twenty-four targets, six targets for each type. Although the transitions consist of three by three matrices, in each row probabilities must sum up to one, which implies six effective targets.

The model has twenty-seven parameters that need to be chosen. Seven of these parameters (discount factor $\beta$, interest rate $r$, unemployment benefits $b$, fraction of single females $\Phi_{\mathcal{S},f}$, fraction of single males $\Phi_{\mathcal{S},m}$, adult equivalence scale $\chi$ and cheating probability $\pi$) are common across households while the remaining twenty parameters (disutilities of work, arrival and destruction probabilities, and income shocks) are household and/or gender specific.

Among the twenty-seven parameters of the model, six are selected using a priori information, that is, calculated directly from the data or borrowed from the literature while the rest are calibrated to match different moments of the data.

| Symbol | Description | Value |
|---|---|---|
| $\beta$ | Discount factor | 0.9967 |
| $r$ | Monthly interest rate | 0.00374 |
| $b$ | Unemployment benefits | 0.45 |
| $\Phi_{\mathcal{S},f}$ | Fraction single females | 0.25 |
| $\Phi_{\mathcal{S},m}$ | Fraction single males | 0.25 |
| $\chi$ | Adult equivalence scale | 0.7 |
| $\pi$ | Cheating probability | 0.02 |
| Single Female Households | | |
| $\alpha_{\mathcal{S},f}$ | Disutility of work | 0.6014 |
| $\delta_{\mathcal{S},f}$ | Destruction probability | 0.0250 |
| $\lambda_{\mathcal{S},f}$ | Arrival probability | 0.3571 |
| $\rho_{\mathcal{S},f}$ | Persistence income process | 0.9793 |
| $\sigma_{\varepsilon_{\mathcal{S},f}}$ | Standard deviation income process | 0.2174 |
| Single Male Households | | |
| $\alpha_{\mathcal{S},m}$ | Disutility of work | 0.5747 |
| $\delta_{\mathcal{S},m}$ | Destruction probability | 0.0350 |
| $\lambda_{\mathcal{S},m}$ | Arrival probability | 0.3237 |
| $\rho_{\mathcal{S},m}$ | Persistence income process | 0.9810 |
| $\sigma_{\varepsilon_{\mathcal{S},m}}$ | Standard deviation income process | 0.2002 |
| Married Households | | |
| $\alpha_{\mathcal{M},f}$ | Disutility of work female | 0.1784 |
| $\alpha_{\mathcal{M},m}$ | Disutility of work male | 0.0109 |
| $\alpha_{\mathcal{M}}$ | Disutility of joint work | 0.1891 |
| $\delta_{\mathcal{M},f}$ | Destruction probability female | 0.0071 |
| $\delta_{\mathcal{M},m}$ | Destruction probability male | 0.0120 |
| $\lambda_{\mathcal{M},f}$ | Arrival probability female | 0.5735 |
| $\lambda_{\mathcal{M},m}$ | Arrival probability male | 0.5110 |
| $\rho_{\mathcal{M}}$ | Persistence income process | 0.9912 |
| $\sigma_{\varepsilon_{\mathcal{M}}}$ | Standard deviation income process | 0.1186 |
| $\phi$ | Correlation innovation shocks | 0.2883 |

Table 3.3: Benchmark parameter values.

### 3.4.1 Parameters assigned using a priori information

The first six parameters that appear in Table 3.3 are assigned using a priori information. The discount factor ($\beta$) is selected to be the monthly equivalent of the usual discount factor used in the neoclassical growth model, that is, 0.9967. The monthly interest rate ($r$) is selected to reflect a 4% annual interest rate. The unemployment insurance payment ($b$) is set to 0.45 which is a standard value in the search literature (see Gomes et al. (2001) or Hansen and Imrohoroglu (1992)). Both the proportion of single females and the proportion of single males in the economy are computed using the CPS for the years 2000 to 2005. Finally, the adult equivalence scale ($\chi$) is set to 0.7, the OECD scale.

### 3.4.2 Calibrated parameters

The remaining twenty-one parameters in Table 3.3 are calibrated to minimize the distance between twenty-four moments of the data and the moments generated by the simulated model. Among the twenty-one parameters that are calibrated, one is common across households (cheating probability $\pi$) while the rest are household specific. Five parameters correspond to single female households, an other set of five represent single male households, and the remaining ten parameters correspond to married households.

#### 3.4.2.1 Cheating probability

The probability of being able to hide work opportunities from the government ($\pi$) is jointly calibrated with all household-specific parameters to replicate the labor market moments described in Section 3.2. The probability to cheat affects, mainly, the transitions into non-participation. Those agents that have an opportunity to work but decide to receive unemployment benefits are, given the definition used in this chapter, non-participants. Hence, the bigger the probability of cheating is, the higher the amount of agents that decide not to work when having an opportunity to do so. Because of this effect, the probability to cheat has a big impact on the duration of UI spells, a non-targeted moment. If agents are more likely to be able to hide opportunities from the government, they are also more likely to receive unemployment benefits for a longer period of time. As a accuracy check, I compare the performance of the model with the data in terms of duration of UI spells.

| | Data | Model |
|---|---|---|
| Unemployment Insurance Spell (weeks) | 15.30 | 11.56 |

Table 3.4: Data versus Model. Unemployment Insurance Spell. US Department of Labor.

Table 3.4 displays the model-generated duration of unemployment spells in comparison with the data. While in the data, on average, individuals receive unemployment payments for 15.30 consecutive weeks, the model generates an unemployment insurance spell of 11.56 weeks.

Another non-targeted moment that is affected by the probability to cheat is the proportion of unemployed agents who receive unemployment benefits. If all the agents that receive benefits would do it only because of cheating, this measure would take the value zero. All agents receiving benefits would be considered non-participants because they already would have rejected an opportunity to work.

| | Data | Model |
|---|---|---|
| Agents receiving UI and being $U$ over total $U$ | 0.36 | 0.39 |

Table 3.5: Data versus Model. Proportion of agents receiving UI and being unemployed over total unemployed. Nicholson and Needels (2006) for the year 2004.

Table 3.5 reports the proportion of unemployed agents who receive benefits both in the data and in the model. In the data, 36% of the unemployed are receiving benefits, while in the model the number is 39%. Naturally, in practical terms this statistic is determined by a wide range of factors that are not included in the model (eligibility requirements, suspensions, exhaustions, etc.). However, the model provides a reasonable picture describing the fact that only a portion of those that are unemployed are receiving unemployment benefits.

#### 3.4.2.2 Single Households

The parameters related only with single households (disutility of work $\alpha_{\mathcal{S},g}$, destruction probability $\delta_{\mathcal{S},g}$, arrival probability $\lambda_{\mathcal{S},g}$, persistence of income process $\rho_{\mathcal{S},g}$ and standard deviation of the income process $\sigma_{\mathcal{S},g}$), both for females ($f$) and males ($m$), are calibrated to match the transitions across labor market states associated to each group. Table 3.6 compares the performance of the simulated model with the data for single females while Table 3.7 does it for single males.

| **Data** | | | | **Model** | | | |
|---|---|---|---|---|---|---|---|
| From / To | $E$ | $U$ | $N$ | From / To | $E$ | $U$ | $N$ |
| $E$ | 95.39 | 1.49 | 3.13 | $E$ | 95.22 | 1.38 | 3.40 |
| $U$ | 25.88 | 49.84 | 24.28 | $U$ | 34.82 | 61.14 | 4.04 |
| $N$ | 7.88 | 4.57 | 87.55 | $N$ | 7.88 | 4.40 | 87.72 |
| Participation Rate | | | 75.78 | Participation Rate | | | 77.86 |
| Employment Rate | | | 70.83 | Employment Rate | | | 72.77 |
| Unemployment Rate | | | 6.53 | Unemployment Rate | | | 6.54 |

Table 3.6: Data versus Model (%). Single Females. CPS 2000-2005.

Both for the case of single females and single males, the employment rate is mainly determined by the disutility of work ($\alpha_{\mathcal{S},g}$) and the standard deviation of the income process ($\sigma_{\mathcal{S},g}$). For females the disutility of work ($\alpha_{\mathcal{S},f}$) represents 1.82 units of equivalent consumption while for males is 1.78. The destruction probability ($\delta_{\mathcal{S},g}$) and the arrival probability ($\lambda_{\mathcal{S},g}$) are the principal parameters responsible for the transitions from $E$ to $U$, from $U$ to $E$, from $N$ to $E$ and for the unemployment rate. Finally, the main parameter affecting the transitions within the same state, that is, from $E$ to $E$, from $U$ to $U$ and from $N$ to $N$ is the persistence parameter of the income process ($\rho_{\mathcal{S},g}$).

| **Data** | | | | **Model** | | | |
|---|---|---|---|---|---|---|---|
| From / To | $E$ | $U$ | $N$ | From / To | $E$ | $U$ | $N$ |
| $E$ | 94.79 | 2.15 | 3.06 | $E$ | 94.88 | 1.86 | 3.27 |
| $U$ | 28.02 | 51.72 | 20.25 | $U$ | 31.80 | 64.86 | 3.34 |
| $N$ | 9.74 | 5.96 | 84.30 | $N$ | 9.74 | 4.57 | 85.69 |
| Participation Rate | | | 80.67 | Participation Rate | | | 81.16 |
| Employment Rate | | | 74.32 | Employment Rate | | | 74.76 |
| Unemployment Rate | | | 7.88 | Unemployment Rate | | | 7.88 |

Table 3.7: Data versus Model. Single Males. CPS 2000-2005.

The model does a good job replicating all the moments of the data except for the three transitions out of unemployment. Basically, the model is not able to account for the transition from $U$ to $N$ which implies that the other two transitions from unemployment are not properly matched (transitions out of each state must sum up to one). Given the structure of the model this is not a surprising outcome. The only reason why an agent might transit from unemployment to non-participation is because, given a sufficient amount of assets, changes in the income process induce her/him to prefer not to work. In practice other factors, that are not included in the model might be playing an important role (welfare subsidies, human capital depreciation, individuals going back to school, etc.). In the next section, I show that the model is able to generate this margin for married households.

#### 3.4.2.3 Married Households

In the case of married households, ten parameters are calibrated to simulate twelve targets. Table 3.8 compares the performance of the model with the data for married females and Table 3.9 does it for married males.

| **Data** | | | | **Model** | | | |
|---|---|---|---|---|---|---|---|
| From / To | $E$ | $U$ | $N$ | From / To | $E$ | $U$ | $N$ |
| $E$ | 96.36 | 0.76 | 2.88 | $E$ | 96.64 | 0.59 | 2.58 |
| $U$ | 28.81 | 47.09 | 26.10 | $U$ | 36.46 | 39.00 | 24.55 |
| $N$ | 5.72 | 1.94 | 92.35 | $N$ | 3.01 | 2.37 | 94.62 |
| Participation Rate | | | 69.17 | Participation Rate | | | 61.47 |
| Employment Rate | | | 66.83 | Employment Rate | | | 59.40 |
| Unemployment Rate | | | 3.38 | Unemployment Rate | | | 3.36 |

Table 3.8: Data versus Model. Married Females. CPS 2000-2005.

Analogously to single households, the employment rates are mainly affected by the three parameters related with the disutility of work in a married household ($\alpha_{\mathcal{M},f}$, $\alpha_{\mathcal{M},m}$ and $\alpha_{\mathcal{M}}$). In a household in which the male is considered the first earner and the female second, the consumption equivalence of the disutilities to work are 1.71 units for the man and 2.45 for the woman. The destruction probabilities ($\delta_{\mathcal{M},g}$) and the arrival probabilities ($\lambda_{\mathcal{M},g}$) are the parameters mainly responsible for the transitions from $E$ to $U$, from $U$ to $E$, from $N$ to $E$ and for the unemployment rate. The principal parameter determining the transitions within the same state (from $E$ to $E$, from $U$ to $U$ and from $N$ to $N$), both for females and males, is the persistence parameter of the income process ($\rho_{\mathcal{M}}$). Finally, the correlation between spouses' income shocks ($\phi$) mainly affects the transition $U$ to $E$.

| Data | | | | Model | | | |
|---|---|---|---|---|---|---|---|
| From / To | $E$ | $U$ | $N$ | From / To | $E$ | $U$ | $N$ |
| $E$ | 98.00 | 0.90 | 1.10 | $E$ | 97.96 | 0.90 | 1.13 |
| $U$ | 30.19 | 56.87 | 12.95 | $U$ | 37.75 | 46.92 | 15.33 |
| $N$ | 6.89 | 2.82 | 90.29 | $N$ | 6.69 | 4.51 | 88.80 |
| Participation Rate | | | 89.70 | Participation Rate | | | 87.58 |
| Employment Rate | | | 86.93 | Employment Rate | | | 85.08 |
| Unemployment Rate | | | 3.09 | Unemployment Rate | | | 2.86 |

Table 3.9: Data versus Model. Married Males. CPS 2000-2005.

As in the case of single households, the model is not completely accurate replicating the transitions out of unemployment. However, now the transition from $U$ to $N$ is much better captured than in the case of single households. This is due to the responses to spouses employment status. As an example, take the case of a household in which both agents are unemployed. If, let's say, the male finds a job opportunity and his productivity is high enough, the female might decide that she does not want a job anymore, hence, she becomes a non-participant. That is, the structure of the married household provides reasons to transit from unemployment to non-participation while the framework for singles does not. Finally, the model slightly underestimates the employment rate of both females and males.

#### 3.4.2.4 Comments on the calibrated labor income processes

There is a large literature that estimates income processes directly from the data. Here, instead of using the values from the literature, I estimate the labor income processes that provide a better match to the labor market dynamics I am interested in. The main reason for choosing this option is that, conceptually, the income processes present in the model are not only related with labor income per se but also capture other shocks that affect the payoffs of working: shocks to home production, family shocks, preference shocks, etc.[11]

Nonetheless, the estimated parameters for the labor income shocks do not differ much from other computations in the literature. Regarding the magnitude of the estimates, the values obtained are in a similar range of the estimates of idiosyncratic wage shocks in French (2005) or Floden and Lindé (2001). Concerning the differences between married and singles, Santos and Weiss (2012) use PSID data to compute income processes for males of the two

[11] See discussion in Krusell et al. (2011).

groups. As it is the case for my estimates, they find that the process for married is more persistent than for singles, and that the standard deviation of the process for married is lower than for singles. Finally, my estimate of correlation between income shocks of married agents it is not very different from the estimation in Hyslop (2001).

## 3.5 Welfare analysis

The main purpose of this chapter is to understand whether the unemployment insurance program described in Section 3.3.2 has different welfare implications for single and married households. In order to achieve this goal, the first counterfactual experiment I conduct is to change the amount of unemployment benefits in the economy, find the correspondent tax that is able to finance it, and compute welfare levels for each type of household.

As explained in Section 3.3.5, the properties of the income shocks and the labor market frictions allow the definition of a steady state distribution of agents across states. Using these distributions, welfare is computed as the weighted sum of the value of being in a particular state for each type of household in the steady state.

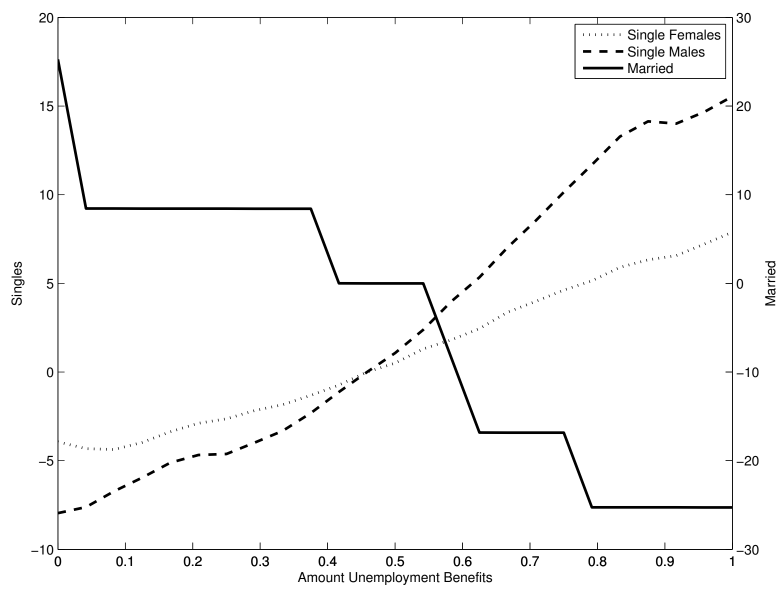



Figure 3.1: Changes in welfare levels for different amounts of unemployment benefits. Benchmark calibration.

Figure 3.1 displays the welfare levels, with respect to the benchmark calibration, that different amounts of unemployment benefits generate for each of the three groups of households: single males, single females and married. Each point represents the percentage change with respect to the amount of welfare that each household obtains in the benchmark economy. Remember that each amount of unemployment benefits is associated to a tax rate that balances the budget of the government.

While for single households higher amounts of unemployment benefits are associated with higher welfare, for married households the relationship is of the opposite sign. Single households are willing to accept higher income tax rates in exchange of receiving higher benefits when not having opportunities to work. However, married households dislike the increase in taxes that higher benefits imply. In fact, for married households the best situation possible is no benefits (and no taxes) at all.

The fact that the UI is not able to improve the welfare of married households can be explained as follows. In this economy, taxes can be understood as the *premium* that a household pays in order to receive a compensation whenever an agent looses the opportunity to work. Given an amount of unemployment benefits, the premium of the insurance is mainly pinned down by the labor market frictions in the economy, due to the fact that the government runs a balanced budget. In other words, the price of the insurance is determined by how many agents loose their opportunity to work. Most importantly, the premium (the tax) and the compensation (the unemployment benefits) of the unemployment insurance are the same for all the agents in the economy. However, married agents are less likely to be unemployed than their single counterparts. Moreover, the family is already providing insurance against employment loss. Hence, the insurance policy offered by the UI program is not adjusted to their needs. Loosely speaking, the unemployment insurance scheme is biased towards the singles, who need *more* insurance.

Single females and single males have also different needs regarding unemployment insurance. The line which represents the welfare of single males (dashed line) presents a bigger slope than the line representing the welfare for single females (dotted line). That is, when unemployment benefits increase, the relative gains for single males are higher than for single females. This occurs mainly because single males are more likely to loose their opportunity to work compared to single females. Hence, the welfare of single males, compared to single females, increases faster with higher levels of compensation.

The policy experiment conducted in this section shows that the UI program is not welfare improving for married households. There are three factors that can account for the different response to UI between singles and married. First, the likelihood of loosing/finding a working opportunity, that is, the differences regarding labor market frictions between the two groups.

Second, the different income processes that determine the evolution of labor productivity. Married households have an income process which is more persistent and presents a lower standard deviation than the one of single males or single females. In this economy, agents save mainly to protect themselves against labor income shocks and labor market frictions. If the income process is more persistent and presents lower variance, then the need to accumulate savings because of the uncertainty generated by the income volatility is lower. Hence, for married households, it is less costly to allocate savings to insure against labor market frictions. Finally, the different household environment in which agents live, i.e., the fact that married couples insure each other may also explain the different responses to UI. The following sections assess the importance of each of these factors in explaining why the UI is unable to improve the welfare of married households.

### 3.5.1 The importance of working opportunity shocks

As previously discussed, one of the candidates to explain why married households dislike the UI, while singles exhibit the opposite reaction, is the different likelihood of having no opportunity to work between the two groups. To assess the importance of this factor, I construct an economy where married households face the same likelihood of loosing and finding opportunities to work as single males. Table 3.10 reports the parameters that define married households in this experiment. While the disutilities of work and the income process are unchanged with respect to the benchmark economy, the destruction and arrival probabilities of married households are those of single males for both members of the household.

| Symbol | Description | Value |
|---|---|---|
| $\alpha_{\mathcal{M},f}$ | Disutility of work female | 0.1784 |
| $\alpha_{\mathcal{M},m}$ | Disutility of work male | 0.0109 |
| $\alpha_{\mathcal{M}}$ | Disutility of joint work | 0.1891 |
| $\delta_{\mathcal{M},f}$ | Destruction probability female | *0.0350* |
| $\delta_{\mathcal{M},m}$ | Destruction probability male | *0.0350* |
| $\lambda_{\mathcal{M},f}$ | Arrival probability female | *0.3237* |
| $\lambda_{\mathcal{M},m}$ | Arrival probability male | *0.3237* |
| $\rho_{\mathcal{M}}$ | Persistence income process | 0.9912 |
| $\sigma_{\varepsilon_{\mathcal{M}}}$ | Standard deviation income process | 0.1186 |
| $\phi$ | Correlation innovation shocks | 0.2883 |

Table 3.10: Parameters for *married* households with single males' working opportunities shocks.

Figure 3.2 shows welfare levels for different amounts of unemployment benefits in this economy. As in the benchmark economy, the unemployment insurance program is not welfare improving for *married* households either. That is, although married households are as likely as single males to loose and receive employment opportunities, their welfare is not improved by the unemployment insurance. This result implies that the response of married households in the benchmark economy can not be attributed to the differences in labor market frictions alone. Married households still have better sources of insurance than single households, the more persistent and less volatile income process and the insurance provided by the family.

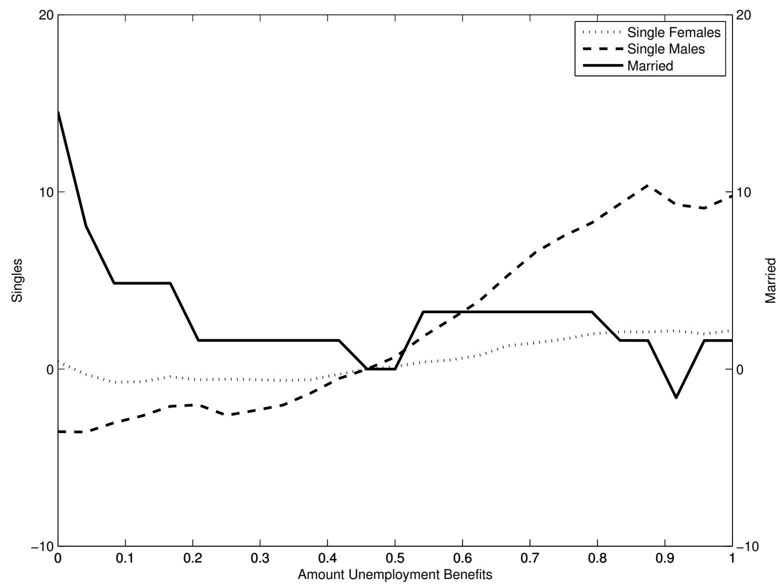



Figure 3.2: Single males' working opportunities shocks for married households.

### 3.5.2 The importance of income shocks

As explained before, one of the factors behind the different response to UI between single and married agents might be related to the differences in the labor income processes. Married households have an income process which is more persistent and with less dispersion than singles. That is, the amount of savings that married households need to build protection against the uncertainty generated by the income process is lower than for singles. Hence, for married households is less costly to save in order to insure the uncertainty derived from labor market frictions, the one relevant for the success of the unemployment insurance program.

| Symbol | Description | Value |
|---|---|---|
| $\alpha_{\mathcal{M},f}$ | Disutility of work female | 0.1784 |
| $\alpha_{\mathcal{M},m}$ | Disutility of work male | 0.0109 |
| $\alpha_{\mathcal{M}}$ | Disutility of joint work | 0.1891 |
| $\delta_{\mathcal{M},f}$ | Destruction probability female | 0.0071 |
| $\delta_{\mathcal{M},m}$ | Destruction probability male | 0.0120 |
| $\lambda_{\mathcal{M},f}$ | Arrival probability female | 0.5735 |
| $\lambda_{\mathcal{M},m}$ | Arrival probability male | 0.5110 |
| $\rho_{\mathcal{M}}$ | Persistence income process | *0.9810* |
| $\sigma_{\varepsilon_{\mathcal{M}}}$ | Standard deviation income process | *0.2002* |
| $\phi$ | Correlation innovation shocks | *0.0000* |

Table 3.11: Parameters for *married* households with single males' income shocks.

In order to understand whether the characteristics of the income shocks are behind the different welfare response of single and married households, I simulate an economy where married households possess the income shocks' characteristics of single male households. As Table 3.11 shows, not only the persistence and the standard deviation of married households are set to be the same as for single males but also the correlation between the income shocks of the spouses is set to 0. That is, in this experiment, a married household consists of two members which possess identical income shocks and these shocks present the characteristics of single males' income shocks.

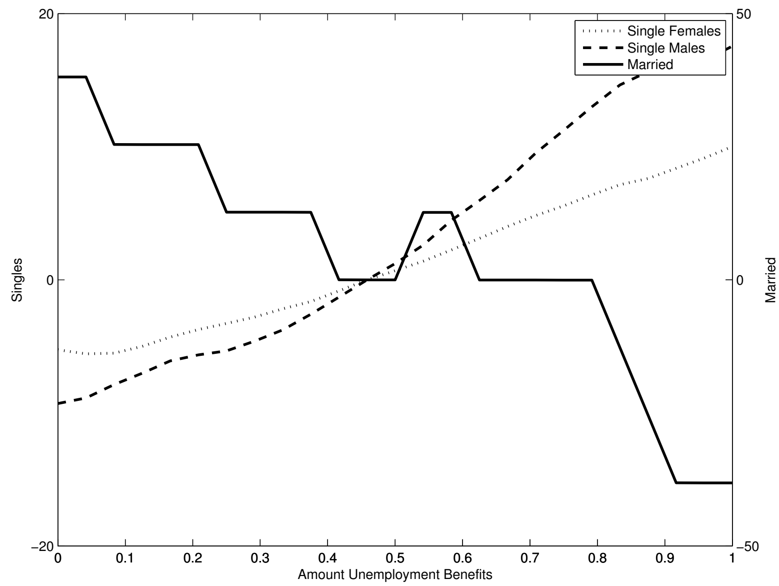



Figure 3.3: Single males' income shocks for married households.

As displayed in Figure 3.3, in this economy it is also the case that the best possible situation for *married* households is not to be protected by the unemployment insurance. This result implies that married households do not present a different response to the UI program because their income process allow them to build a less costly insurance against labor market frictions alone. Given that and the result of the previous section, the only candidate that remains to explain the different responses between married and singles is family insurance.

### 3.5.3 The family insurance

| Symbol | Description | Value |
|---|---|---|
| $\alpha_{\mathcal{M},f}$ | Disutility of work female | 0.1784 |
| $\alpha_{\mathcal{M},m}$ | Disutility of work male | 0.0109 |
| $\alpha_{\mathcal{M}}$ | Disutility of joint work | 0.1891 |
| $\delta_{\mathcal{M},f}$ | Destruction probability female | *0.0350* |
| $\delta_{\mathcal{M},m}$ | Destruction probability male | *0.0350* |
| $\lambda_{\mathcal{M},f}$ | Arrival probability female | *0.3237* |
| $\lambda_{\mathcal{M},m}$ | Arrival probability male | *0.3237* |
| $\rho_{\mathcal{M}}$ | Persistence income process | *0.9810* |
| $\sigma_{\varepsilon_{\mathcal{M}}}$ | Standard deviation income process | *0.2002* |
| $\phi$ | Correlation innovation shocks | *0.0000* |

Table 3.12: Parameters for *married* households with single males' working opportunities and income shocks.

In order to test if the insurance provided by the family is the determinant factor shaping the different reactions to UI between single and married households, I simulate an economy where married households are composed by two single male clones, and another economy in which married agents live apart as singles. As reported in Table 3.12, in the first experiment, married households are endowed with the income process of single males, and their arrival and destruction probabilities.

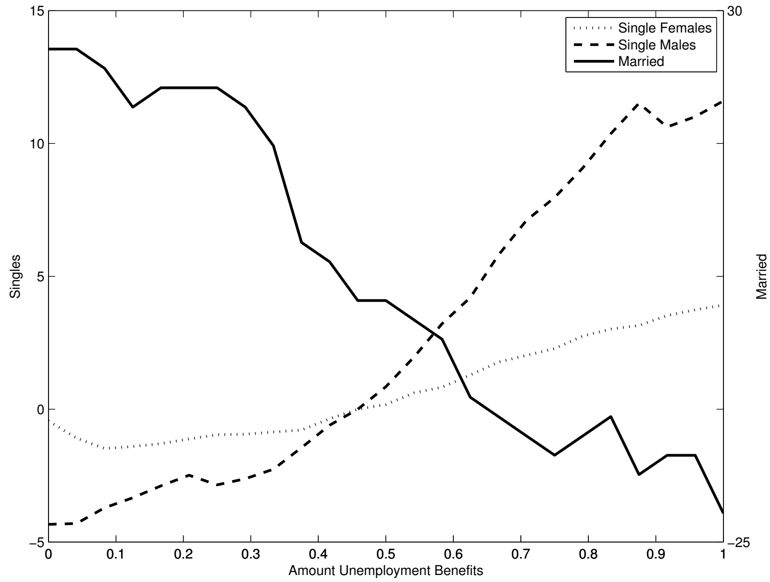



Figure 3.4: Single male clones living as married households.

Figure 3.4 shows that not even when *married* households consist of two single male clones, the unemployment insurance program is welfare improving for them. This result indicates that the family insurance plays a key role explaining the different responses to UI between single and married. That is, the fact that agents are already protected by the family implies that the publicly provided unemployment insurance fails to provide the right amount of protection for those agents.

| Single Female Households | | |
|---|---|---|
| $\alpha_{\mathcal{S},f}$ | Disutility of work | 0.6014 |
| $\delta_{\mathcal{S},f}$ | Destruction probability | *0.0071* |
| $\lambda_{\mathcal{S},f}$ | Arrival probability | *0.5735* |
| $\rho_{\mathcal{S},f}$ | Persistence income process | *0.9912* |
| $\sigma_{\varepsilon_{\mathcal{S},f}}$ | Standard deviation income process | *0.1186* |

| Single Male Households | | |
|---|---|---|
| $\alpha_{\mathcal{S},m}$ | Disutility of work | 0.5747 |
| $\delta_{\mathcal{S},m}$ | Destruction probability | *0.0120* |
| $\lambda_{\mathcal{S},m}$ | Arrival probability | *0.5110* |
| $\rho_{\mathcal{S},m}$ | Persistence income process | *0.9912* |
| $\sigma_{\varepsilon_{\mathcal{S},m}}$ | Standard deviation income process | *0.1186* |

Table 3.13: Parameters for *single* households with the married's working opportunities and income shocks.

In order to determine, if the distinct characteristics between single and married, i.e., the different income and working opportunities shocks also contribute to make the UI unattractive to married, I simulate an economy where single households are inhabited by married agents. As shown in Table 3.13, single households are endowed with the income shocks, the arrival, and the destruction probabilities of the married.

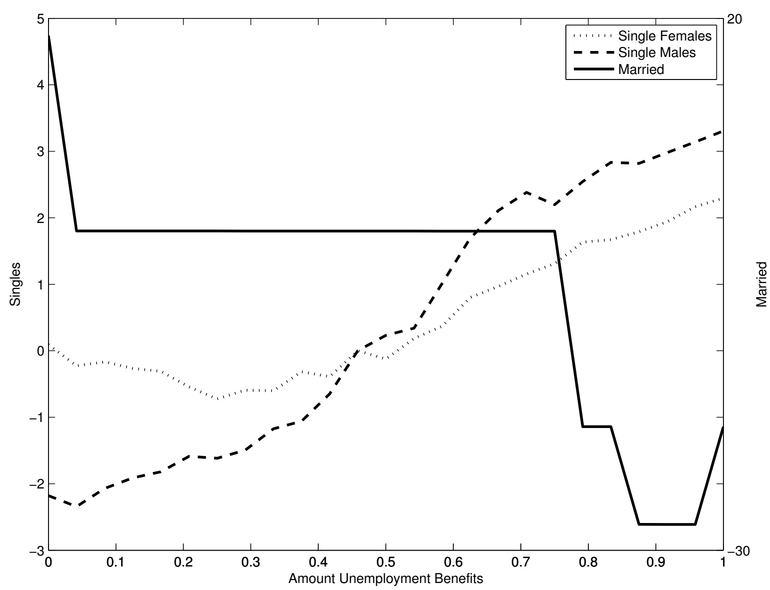



Figure 3.5: Married agents living as singles.

Figure 3.5 shows that when married agents live apart as singles, the unemployment insurance does improve their welfare. In conclusion, the main force behind the fact that married households would be better of with no unemployment insurance at all is the protection already provided by the family.

In this setup, the family insurance consist mainly of four components. First, because of the assumption of unitary framework, the two members of the households perfectly coordinate *their* decisions to smooth consumption. For example, if only one of them is employed and loses her/his opportunity the other can respond starting to work (if the opportunity to work arises). Second, simply because married households are composed by two agents, the needs towards insurance are different compared with singles. As an illustration, consider the case of a single and a married household in which all agents are employed. The probability to lose all the income in the household is higher for singles than for the married, simply because married households have two sources of working opportunities. Third, because married households pool resources, it is less costly for them to save against any given uncertainty than for singles. Take the case in which both a single and a married household face the same exact risk, i.e, both households need the same amount of savings to be protected against that risk. The married household have two sources of income to consume and save, while the single have only one. Given that consumption is a public good inside married households, this implies that saving is less costly for married. Finally, because married agents may be second earners, the insurance provided by the UI program might be not adequate for them. Consider a married household where the wife is the first earner and the husband is the second. The premium of the unemployment insurance is determined by the labor market frictions in the economy. However, in the married household, the welfare loss generated by the second earner losing his opportunity to work is very different than the welfare loss in a single household in which the agent loses her/his opportunity to work. Mainly, the concavity of the utility function and the consumption scaling generate a lower welfare loss for the married households when the second earner loses the opportunity to work compared with a single household.

## 3.6 Changes in participation, employment and unemployment rates

The model in this chapter has the three labor market states: employment, unemployment and non-participation. However, most of the frameworks commonly employed to analyze the effects of changes in unemployment insurance only take into account two states: employment, non-employment[12]. As a result it is interesting to study the responses of employment and unemployment (and, hence, participation) to policy changes.

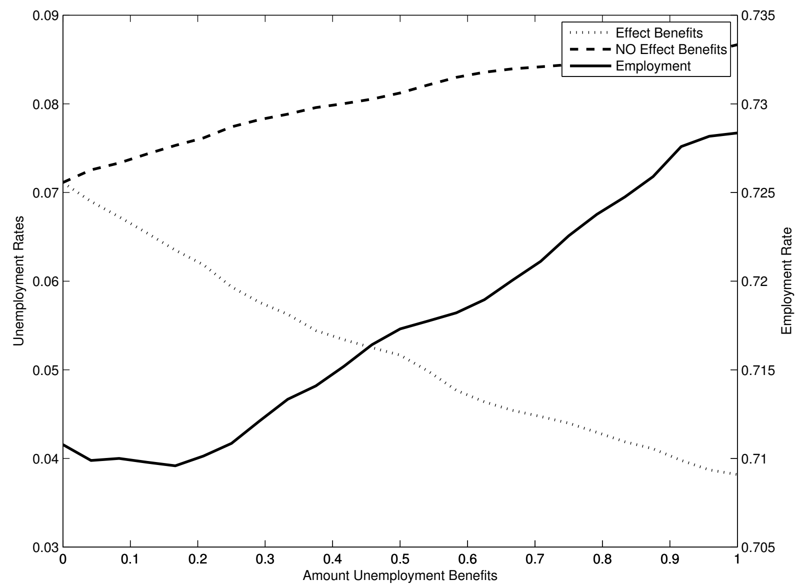



Figure 3.6: Changes in Employment and Unemployment rates for different amounts of unemployment benefits.

As displayed in Figure 3.6, the employment rate (solid line) increases with the amount of unemployment benefits while the unemployment rate (dotted line) decreases. The reason why the employment rate increases with the amount of benefits is related to the eligibility conditions of the unemployment insurance program. To receive benefits an agent should have been employed before. In that situation, from the point of view of a worker who has to decide whether to work or not (and is not already receiving benefits), the unemployment benefits are like a *reward* after the opportunity to work expires. Hence, the bigger is the *reward*, the more agents are willing to pay the utility cost which working involves.

The response of the unemployment rate is related to different forces. First, because employment is increasing, ceteris paribus, the unemployment rate should decrease. Second, due to the fact that in this model unemployment is measured using the willingness to work of the agents and the unemployment benefits have a discouraging effect over participation, the unemployment rate should also decrease.

[12] Of course, there are exceptions like Krusell et al. (2008) or Garibaldi and Wasmer (2005)

The dashed line in Figure 3.6 displays the unemployment rate of the economy if benefits would not affect participation. In other words, the difference between the dashed and the dotted line represents the fraction of workers that decide not to accept an opportunity to work (and hence are labeled as non-participants) because they are receiving unemployment benefits. The difference between the dotted and the dashed line captures the discouraging effect of benefits over participation, that is, how many agents decide that would not accept a job because they are better off staying at home and receiving benefits.

Moreover, the fact that higher benefits lead to more employment and discourage some non-employed workers to accept job offers illustrates that, overall, unemployment benefits generate two opposing effects. On one side, higher benefits increase the willingness to work of some agents (those that do not receive benefits), while discourages the willingness to accept working opportunities of others (those that are receiving benefits).

## 3.7 Robustness checks

In this section, I study if some of the assumptions imposed on the model affect the main result. First, related with the preferences of the agents, the assumption of a logarithmic utility is changed using instead a Constant Relative Risk Aversion (CRRA) functional form. This allows to perform the exercise in a context in which households are more risk averse. Second, because of its implications in terms of welfare, I explore the effects of changing the parameter that determines the congestion of consumption as a public good within married households. Finally, due to the crucial effect on savings and the relationship between private savings and public unemployment insurance, the interest rate is changed and set to 0%.

### 3.7.1 Risk aversion

In order to test if the assumption of logarithmic utility is crucial for the results obtained, I repeat the welfare analysis in Section 3.5 employing a CRRA utility form. In particular, the function used is given by:

$$u(c) = \frac{c^{1-\eta}}{1-\eta}, \tag{3.28}$$

where $\eta$ is the parameter capturing the degree of risk aversion. The parameter value used for $\eta$ is 2, which is a standard value for macroeconomic calibration exercises. Now households are more risk averse than in the benchmark.

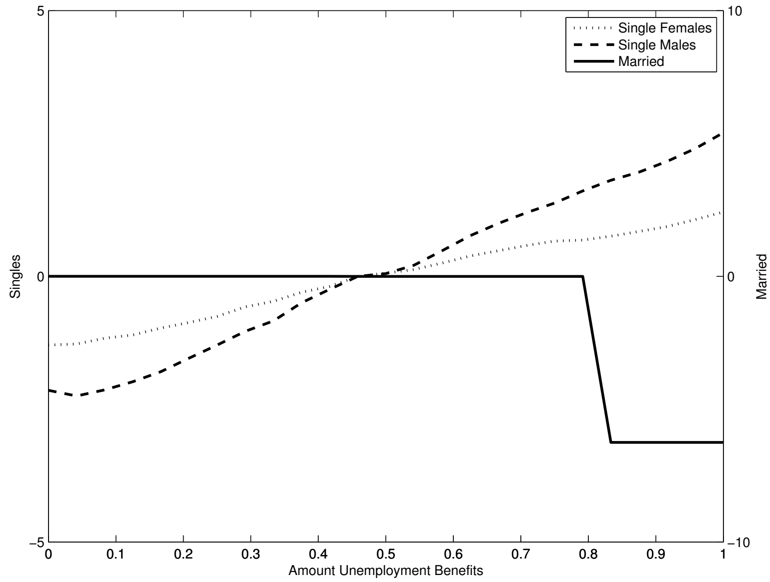



Figure 3.7: Welfare levels with CRRA utility.

As displayed in Figure 3.7, and comparing with the benchmark calibration in Figure 3.1, the qualitative implications of changing the amount of unemployment benefits are unchanged. For single households, the UI is equally welfare improving. Higher levels of benefits are associated with higher welfare. In the case of married households, as with logarithmic preferences, the UI does not improve welfare in any case. In fact, although not clear in the figure, a closer look to the results indicates that the optimal situation for married households is, still, no unemployment benefits. Hence, the results obtained with the benchmark calibration appear to be robust to increasing the risk aversion of households.

### 3.7.2 Adult equivalence scale

In the benchmark framework, the consumption of married households is a public good subject to congestion. The parameter measuring the congestion, the adult equivalence scale ($\chi$), that is used in the benchmark is smaller than one. This implies that there are some economies of scale in the consumption of married households. It is possible that, at least partially, this economies of scale for consumption are associated with insurance within the household. The idea is that, if one member of the household is unemployed, she/he benefits from the consumption obtained form the spouse's income more than proportionally.

To see if the economies of scale in consumption have a significant importance in the results, the adult equivalence scale is set to 1. Then, the experiment in Section 3.5 is repeated. Setting the adult equivalence scale is 1, can be understood as dividing all the consumption that occurs within the married household between the two spouses.

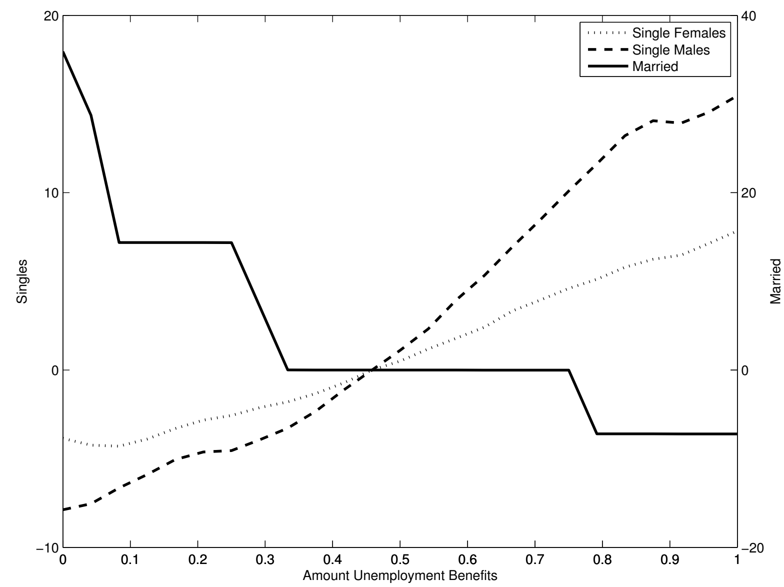



Figure 3.8: Welfare levels with adult equivalence scale ($\chi$) equal 1.

Figure 3.8 revels that the congestion of the public good within married households does not change significantly the results obtained with the benchmark economy. The UI is still welfare improving for singles households, while married households would prefer to have no unemployment insurance at all. Hence, the adult equivalence scale seems not to affect the results previously obtained.

### 3.7.3 Interest rate

The interest rate is a crucial parameter determining the payoffs of saving versus consumption. Since the environment studied here is an incomplete markets economy, savings is the only tool that agents can use to insure against uncertainty. The welfare implications of the UI crucially depend on its capacity to reduce the uncertainty that agents face.

In order to test the importance of the interest rate used in the benchmark economy (4% annual), I reproduce the main experiment of the chapter in an economy where the interest rate is set to 0%. Since the interest rate is an exogenous object and there is no borrowing, increasing the interest rate would only *benefit* agents. In other words, saving would be more profitable and agents would have to forgo less consumption to achieve the same amount of protection against the same risks. The interesting exercise is to study what happens when the return to savings disappears.

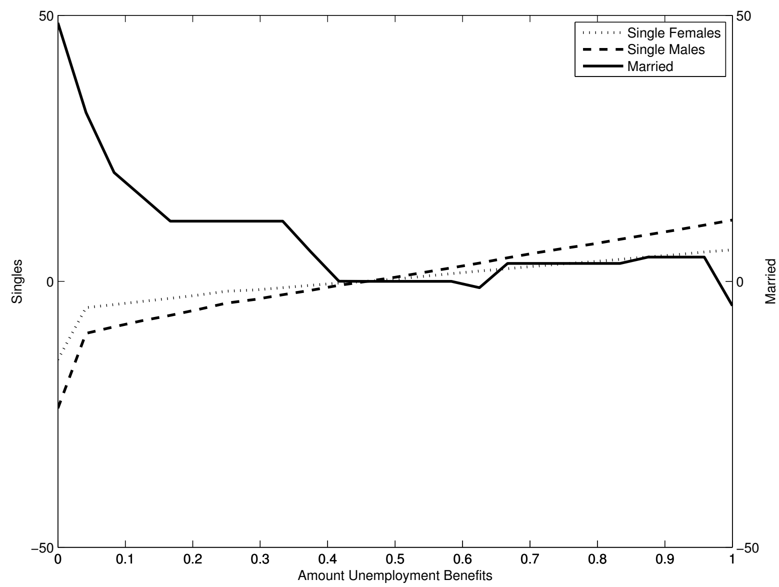



Figure 3.9: Welfare levels with interest rate ($r$) equal 0.

As can be seen in Figure 3.9, qualitatively the results do not change with respect to the benchmark case. When the interest rate is set to 0%, singles are better-off with higher unemployment benefits and married prefer not to have to finance any unemployment insurance at all. Thus, the interest rate does not play a significant role explaining the different responses, in terms of welfare, of married and singles regarding the UI.

## 3.8 Conclusions

This chapter studies the implications, mainly in terms of welfare, of an unemployment insurance program in a framework where some agents live as singles, while others live with their spouses as a family. The heterogeneity in household structure is a crucial element to consider when studying the implications of unemployment insurance mainly for two main reasons. First, in the US labor market, single and married individuals display very different labor market dynamics. In particular, singles are more likely to be unemployed than their married counterparts. Second, arrangements within the family are a major potential source of insurance against labor market uncertainty.

The main result of this analysis is that the unemployment insurance program, although beneficial for singles, is not able to improve the welfare of married households. The mechanism that explains this result is not related to the smaller likelihood of married people to be unemployed, not to the different income processes that characterize the two groups. On the contrary, it is a consequence of the private insurance provided by the family. When two single agents live in the same household as a family, the household dislikes unemployment insurance as well.

These results indicate that, in a household where both members can participate in the labor market and pool resources, an unemployment insurance program focused on individuals rather than on households is not welfare-improving. In other words, the insurance that each member of a married household provides to the other is a better protection against uncertainty than the solution that the government is offering.

The results of this chapter might be relevant to the design of optimal unemployment insurance under modern-day condition. Many features of the unemployment insurance program present in the US today have not changed since they were established by the original New Deal legislation of 1930s. At that time married households were not composed by two individuals capable of participating simultaneously in the labor market and thus providing insurance to each other.

# References


Abdulkadiroglu, A., Kuruscu, B., and Sahin, A. (2002). Unemployment Insurance and the Role of Self-Insurance. *Review of Economic Dynamics*, 5(3):681–703.

Aiyagari, S. (1994). Uninsured idiosyncratic risk and aggregate saving. *The Quarterly Journal of Economics*, 109(3):659–684.

Alvarez, F. and Veracierto, M. (2000). Labor-market policies in an equilibrium search model. *NBER Macroeconomics Annual 1999*, 14:265–316.

Bewley, T. (1980). Interest bearing money and the equilibrium stock of capital. *Mimeo.*

Blanchard, O. J., Diamond, P., Hall, R. E., and Murphy, K. (1990). IThe Cyclical Behavior of the Gross Flows of U.S. Workers. *Brookings Papers on Economic Activity*, 1990(2):85–155.

Chang, Y. and Kim, S.-B. (2007). Heterogeneity and Aggregation: Implications for Labor-Market Fluctuations. *American Economic Review*, 97(5):1939–1956.

Choi, S. and Valladares-Esteban, A. (2013). Unemployment Heterogeneity Across Households and Time. *Mimeo.*

Dey, M. and Flinn, C. (2008). Household search and health insurance coverage. *Journal of Econometrics*, 145(1):43–63.

Di Tella, R. and MacCulloch, R. (2002). Informal family insurance and the design of the welfare state. *The Economic Journal*, 112:481–503.

Ek, S. and Holmlund, B. (2010). Family Job Search, Wage Bargaining, and Optimal Unemployment Insurance. *The B.E. Journal of Economic Analysis & Policy*, 10(1).

Elsby, M., Hobijn, B., and Sahin, A. (2013). On the Importance of the Participation Margin for Labor Market Fluctuations. *University of Edinburgh, mimeo.*

Elsby, M., Michaels, R., and Solon, G. (2009). The Ins and Outs of Cyclical Unemployment. *American Economic Journal: Macroeconomics*, 1(1):84–110.

Flabbi, L. and Mabli, J. (2012). Household Search or Individual Search: Does it Matter? Evidence from Lifetime Inequality Estimates. *IZA Discussion Paper No. 6908.*

Floden, M. and Lindé, J. (2001). Idiosyncratic risk in the united states and sweden: Is there a role for government insurance? *Review of Economic Dynamics*, 4(2):406–437.

French, E. (2005). The effects of health, wealth, and wages on labour supply and retirement behavior. *The Review of Economic Studies*, 72(2):395–427.

Fujita, S. and Ramey, G. (2009). The cyclicality of separation and job finding rates. *International Economic Review*, 50(2):415–430.

Garibaldi, P. and Wasmer, E. (2005). Equilibrium search unemployment, endogenous participation and labor market flows. *Journal of the European Economic Association*, 3(June):851–882.

Gemici, A. and Laufer, S. (2011). Marriage and cohabitation. *New York University, mimeo.*

Gomes, J., Greenwood, J., and Rebelo, S. (2001). Equilibrium unemployment. *Journal of Monetary Economics*, 48(1):109–152.

Gottschalk, P., Moffitt, R., Katz, L. F., and Dickens, W. T. (1994). The Growth of Earnings Instability in the U.S. Labor Market. *Brookings Papers on Economic Activity*, 2:217–272.

Greenwood, J. and Guner, N. (2008). Marriage and Divorce since World War II: Analyzing the Role of Technological Progress on the Formation of Households. *NBER Macroeconomics Annual*, 23:231–276.

Greenwood, J., Guner, N., Kocharkov, G., and Santos, C. (2011). Technology and the Changing Family. *2011 Meeting Papers (No. 1420). Society for Economic Dynamics.*

Guler, B., Guvenen, F., and Violante, G. (2012). Joint-Search Theory: New Opportunities and New Frictions. *Journal of Monetary Economics*, 54(4):352–369.

Guner, N., Kaygusuz, R., and Ventura, G. (2012a). Taxation and Household Labour Supply. *The Review of Economic Studies*, 79(3):1113–1149.

Guner, N., Kaygusuz, R., and Ventura, G. (2012b). Taxing women: A macroeconomic analysis. *Journal of Monetary Economics*, 59(1):111–128.

Hansen, G. and Imrohoroglu, A. (1992). The Role of Unemployment Insurance in an Economy with Liquidity Constraints and Moral Hazard. *Journal of Political Economy*, 100(1):118–142.

Heathcote, J., Storesletten, K., and Violante, G. L. (2010). The Macroeconomic Implications of Rising Wage Inequality in the United States. *Journal of Political Economy*, 118(4):681–722.

Hong, J. and Ríos-Rull, J.-V. (2007). Social security, life insurance and annuities for families. *Journal of Monetary Economics*, 54(1):118–140.

Hopenhayn, H. and Nicolini, J. P. (1997). Optimal Unemployment Insurance. *Journal of Political Economy*, 105(2):412–438.

Huggett, M. (1993). The risk-free rate in heterogeneous-agent incomplete-insurance economies. *Journal of Economic Dynamics and Control*, 17(5-6):953–969.

Hyslop, D. R. (2001). Rising U.S. Earnings Inequality and Family Labor Supply: The Covariance Structure of Intrafamily Earnings. *American Economic Review*, 91(4):755–777.

Jaimovich, N. and Siu, H. (2009). The Young, the Old, and the Restless: Demographics and Business Cycle Volatility. *American Economic Review*, 99(3):804–826.

Kleven, H. J., Kreiner, C. T., and Saez, E. (2009). The Optimal Income Taxation of Couples. *Econometrica*, 77(2):537–560.

Knowles, J. A. (2013). Why are Married Men Working So Much? An Aggregate Analysis of Intra-Household Bargaining and Labour Supply. *The Review of Economic Studies*, 80(3):1055–1085.

Krusell, P., Mukoyama, T., Rogerson, R., and Sahin, A. (2008). Aggregate implications of indivisible labor, incomplete markets, and labor market frictions. *Journal of Monetary Economics*, 55(5):961–979.

Krusell, P., Mukoyama, T., Rogerson, R., and Sahin, A. (2010a). Aggregate labor market outcomes: The roles of choice and chance. *Quantitative Economics*, 1:97–127.

Krusell, P., Mukoyama, T., Rogerson, R., and Sahin, A. (2011). A three state model of worker flows in general equilibrium. *Journal of Economic Theory*, 146(3):1107–1133.

Krusell, P., Mukoyama, T., and Sahin, A. (2010b). Labor-Market Matching with Precautionary Savings and Aggregate Fluctuations. *The Review of Economic Studies*, 77(4):1477–1507.

Mankart, J. and Oikonomou, R. (2012). Household Search and the Aggregate Labor Market. *Department of Economics, University of St. Gallen.*

McCall, J. (1970). Economics of Information and Job Search. *The Quarterly Journal of Economics*, 84(1):113–126.

Nicholson, W. and Needels, K. (2006). Unemployment Insurance: Theory and Policy. *Journal of Economic Perspectives*, 20(3):47–70.

Ortigueira, S. and Siassi, N. (2013). How important is intra-household risk sharing for savings and labor supply? *Journal of Monetary Economics*, 60(6):650–666.

Pries, M. and Rogerson, R. (2009). Search frictions and labor market participation. *European Economic Review*, 53(5):568–587.

Regalia, F. and Ríos-Rull, J.-V. (2010). What Accounts for the Increase in the Number of Single Households? *2010 Meeting Papers (No. 995). Society for Economic Dynamics*.

Rendon, S. (2006). Job Search and Asset Accumulation Under Borrowing Constraints. *International Economic Review*, 47(1):233–263.

Santos, C. and Weiss, D. (2012). Risky Income, Risky Families: Marriage and Divorce in a Volatile Labor Market. *Mimeo*.

Shimer, R. (2005). The Cyclical Behavior of Equilibrium Unemployment and Vacancies. *The American Economic Review*, 95(1):25–49.

Shimer, R. (2012). Reassessing the ins and outs of unemployment. *Review of Economic Dynamics*, 15(2):127–148.

Shimer, R. and Werning, I. (2008). Liquidity and Insurance for the Unemployed. *American Economic Review*, 98(5):1922–1942.

Valladares-Esteban, A. (2013). Unemployment Insurance in an Economy with Single and Married Households. *Mimeo*.

Veracierto, M. (2008). On the cyclical behavior of employment, unemployment and labor force participation. *Journal of Monetary Economics*, 55(6):1143–1157.

# Appendix A

# Appendix for Labor Market Dynamics of Married Couples

| | EE | EU | EO | UE | UU | UO | OE | OU | OO |
|---|---|---|---|---|---|---|---|---|---|
| EE | 93.85 | 0.91 | 3.61 | 1.07 | 0.05 | 0.05 | 0.40 | 0.01 | 0.06 |
| EU | 24.20 | 46.13 | 26.19 | 0.63 | 1.49 | 0.68 | 0.13 | 0.31 | 0.23 |
| EO | 6.45 | 2.34 | 89.50 | 0.07 | 0.10 | 1.03 | 0.05 | 0.01 | 0.45 |
| UE | 28.31 | 0.66 | 1.33 | 59.99 | 1.44 | 1.38 | 6.54 | 0.08 | 0.27 |
| UU | 8.15 | 11.76 | 7.35 | 10.86 | 42.10 | 12.95 | 1.18 | 2.28 | 3.36 |
| UO | 2.34 | 1.48 | 25.48 | 2.79 | 5.02 | 54.30 | 0.34 | 0.25 | 7.99 |
| OE | 10.48 | 0.15 | 0.77 | 7.39 | 0.23 | 0.18 | 77.09 | 1.11 | 2.59 |
| OU | 3.07 | 4.24 | 3.00 | 2.02 | 5.67 | 2.10 | 16.38 | 40.99 | 22.54 |
| OO | 1.78 | 0.42 | 7.53 | 0.35 | 0.76 | 5.41 | 2.66 | 1.86 | 79.23 |

Table A.1: Joint average labor market transitions for married couples, ages 25-54, 1980:1 to 1989:12. E - employed, U - unemployed, O - out of the labor force. First letter corresponds to male and second to female.

| | EE | EU | EO | UE | UU | UO | OE | OU | OO |
|---|---|---|---|---|---|---|---|---|---|
| EE | 95.30 | 0.74 | 2.53 | 0.82 | 0.03 | 0.04 | 0.47 | 0.01 | 0.06 |
| EU | 27.32 | 44.47 | 25.14 | 0.46 | 1.16 | 0.53 | 0.25 | 0.30 | 0.36 |
| EO | 6.67 | 2.44 | 89.17 | 0.08 | 0.09 | 0.84 | 0.10 | 0.02 | 0.59 |
| UE | 30.11 | 0.55 | 1.00 | 56.07 | 1.14 | 1.05 | 9.50 | 0.15 | 0.43 |
| UU | 11.50 | 11.69 | 7.42 | 11.18 | 38.73 | 10.83 | 1.75 | 2.37 | 4.48 |
| UO | 2.61 | 1.71 | 28.28 | 2.68 | 4.32 | 48.53 | 0.63 | 0.46 | 10.79 |
| OE | 9.72 | 0.13 | 0.83 | 5.85 | 0.14 | 0.13 | 80.24 | 0.89 | 2.08 |
| OU | 2.47 | 4.17 | 1.87 | 1.49 | 5.07 | 1.59 | 17.80 | 40.26 | 25.27 |
| OO | 2.02 | 0.37 | 6.79 | 0.31 | 0.55 | 4.10 | 2.77 | 1.96 | 81.14 |

Table A.2: Joint average labor market transitions for married couples, ages 25-54, 1990:1 to 1999:12. E - employed, U - unemployed, O - out of the labor force. First letter corresponds to male and second to female.

| | EE | EU | EO | UE | UU | UO | OE | OU | OO |
|---|---|---|---|---|---|---|---|---|---|
| EE | 95.29 | 0.69 | 2.44 | 0.82 | 0.04 | 0.03 | 0.56 | 0.01 | 0.12 |
| EU | 24.25 | 46.88 | 25.67 | 0.55 | 1.18 | 0.49 | 0.29 | 0.29 | 0.38 |
| EO | 6.06 | 2.31 | 89.76 | 0.09 | 0.09 | 0.85 | 0.15 | 0.02 | 0.66 |
| UE | 27.68 | 0.55 | 0.91 | 56.99 | 0.92 | 1.01 | 11.32 | 0.12 | 0.49 |
| UU | 11.54 | 11.33 | 7.27 | 10.01 | 40.26 | 10.34 | 1.45 | 3.55 | 4.26 |
| UO | 2.99 | 1.72 | 28.49 | 2.44 | 4.96 | 47.71 | 0.97 | 0.60 | 10.10 |
| OE | 9.22 | 0.14 | 1.05 | 6.11 | 0.13 | 0.12 | 80.49 | 0.80 | 1.93 |
| OU | 3.23 | 3.12 | 2.66 | 1.20 | 5.34 | 2.49 | 15.18 | 46.10 | 20.68 |
| OO | 3.40 | 0.32 | 6.86 | 0.38 | 0.57 | 3.22 | 2.95 | 1.62 | 80.67 |

Table A.3: Joint average labor market transitions for married couples, ages 25-54, 2000:1 to 2009:12. E - employed, U - unemployed, O - out of the labor force. First letter corresponds to male and second to female.

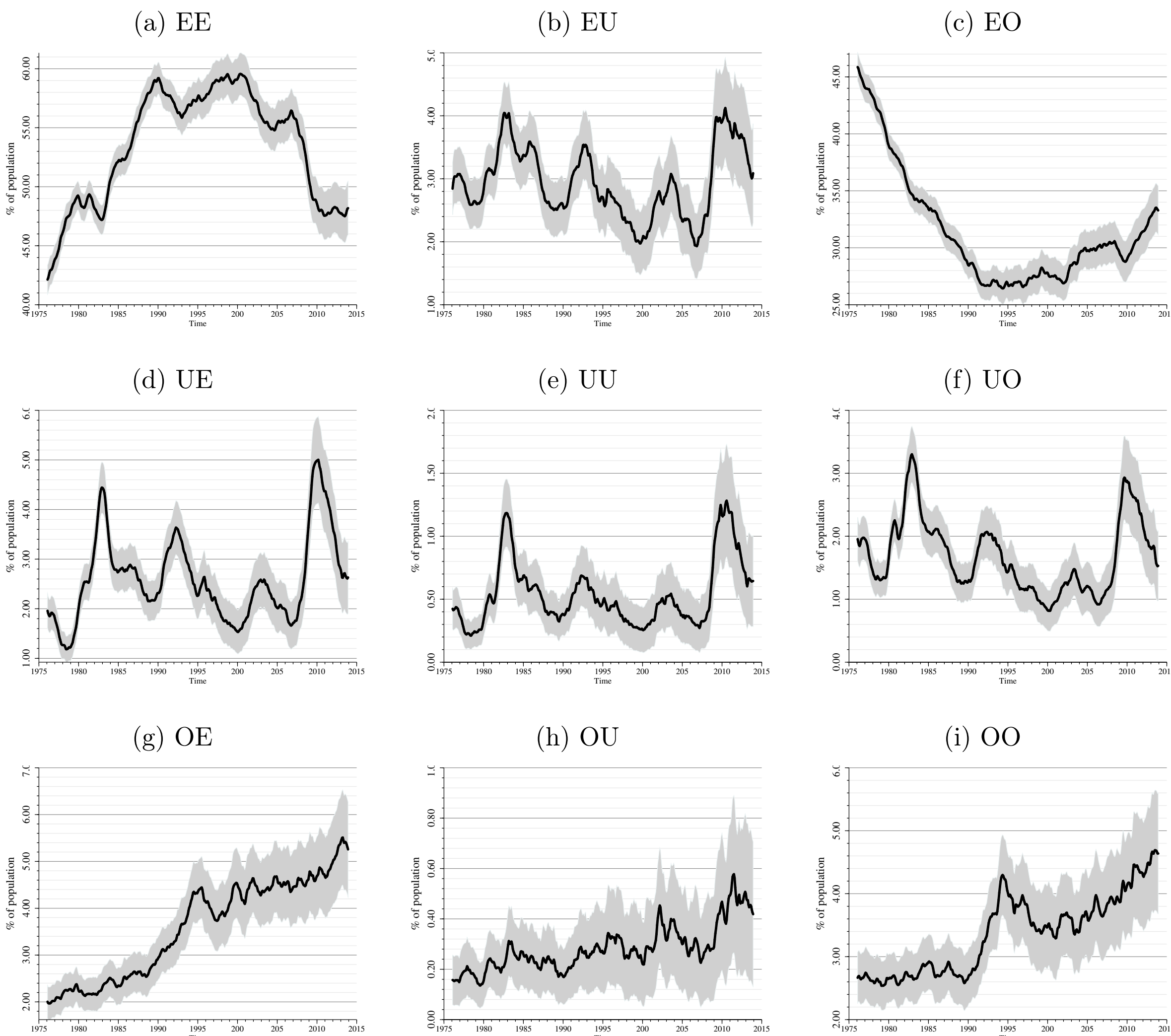



Figure A.1: Labor market stocks for married couples in which both members do not have college education, ages 25-54, 1976:2 to 2013:12. The solid line represents the seasonally adjusted fraction of the population in state XY, where X refers to the male and Y to the female. X and Y can stand for: E - employed, U - unemployed, O - out of the labor force. Grey areas represent NBER recession dates (taken from http://www.nber.org/cycles/cyclesmain.html).

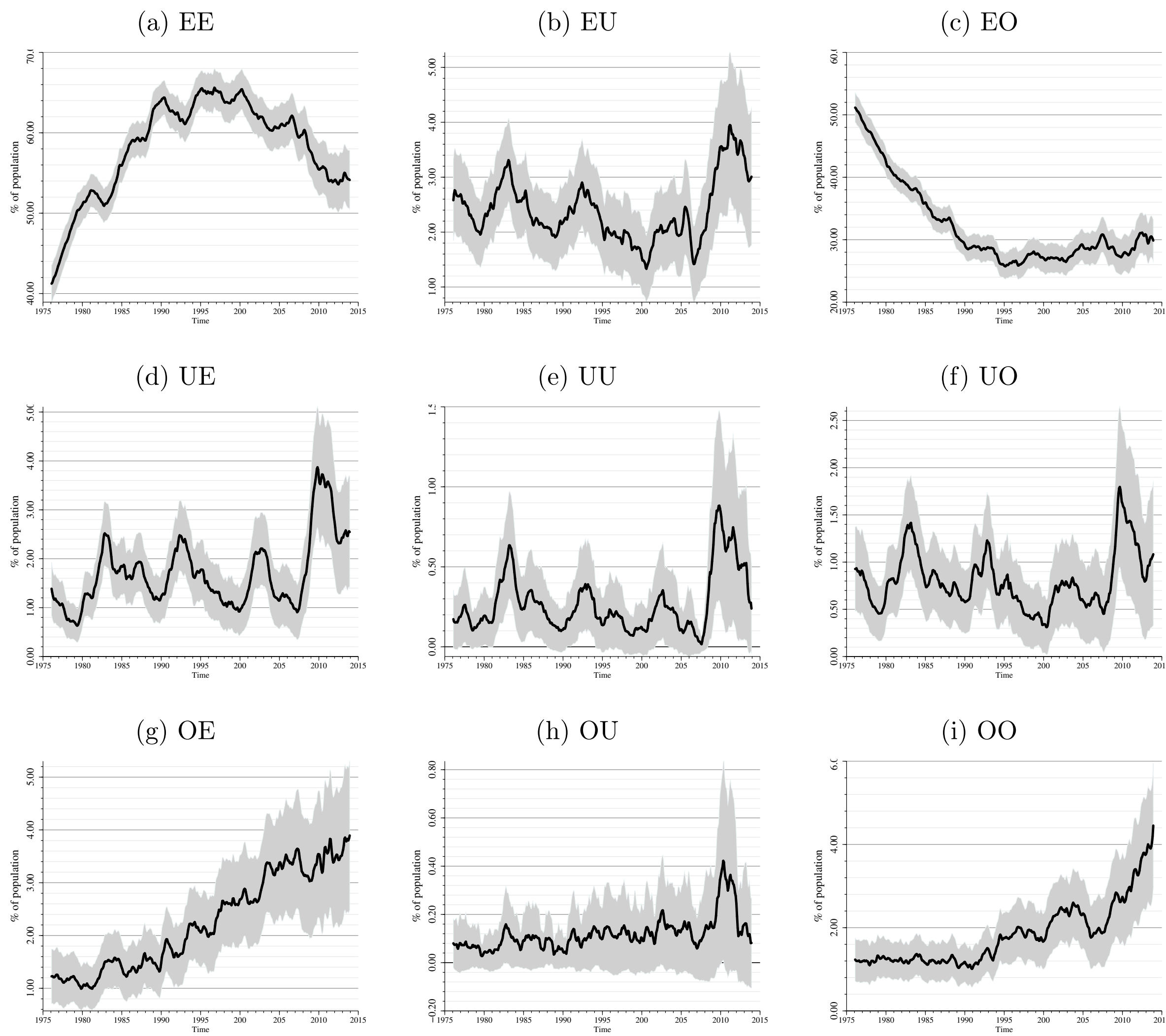



Figure A.2: Labor market stocks for married couples in which the husband possess college education and the wife does not, ages 25-54, 1976:2 to 2013:12. The solid line represents the seasonally adjusted fraction of the population in state XY, where X refers to the male and Y to the female. X and Y can stand for: E - employed, U - unemployed, O - out of the labor force. Grey areas represent NBER recession dates (taken from http://www.nber.org/cycles/cyclesmain.html).

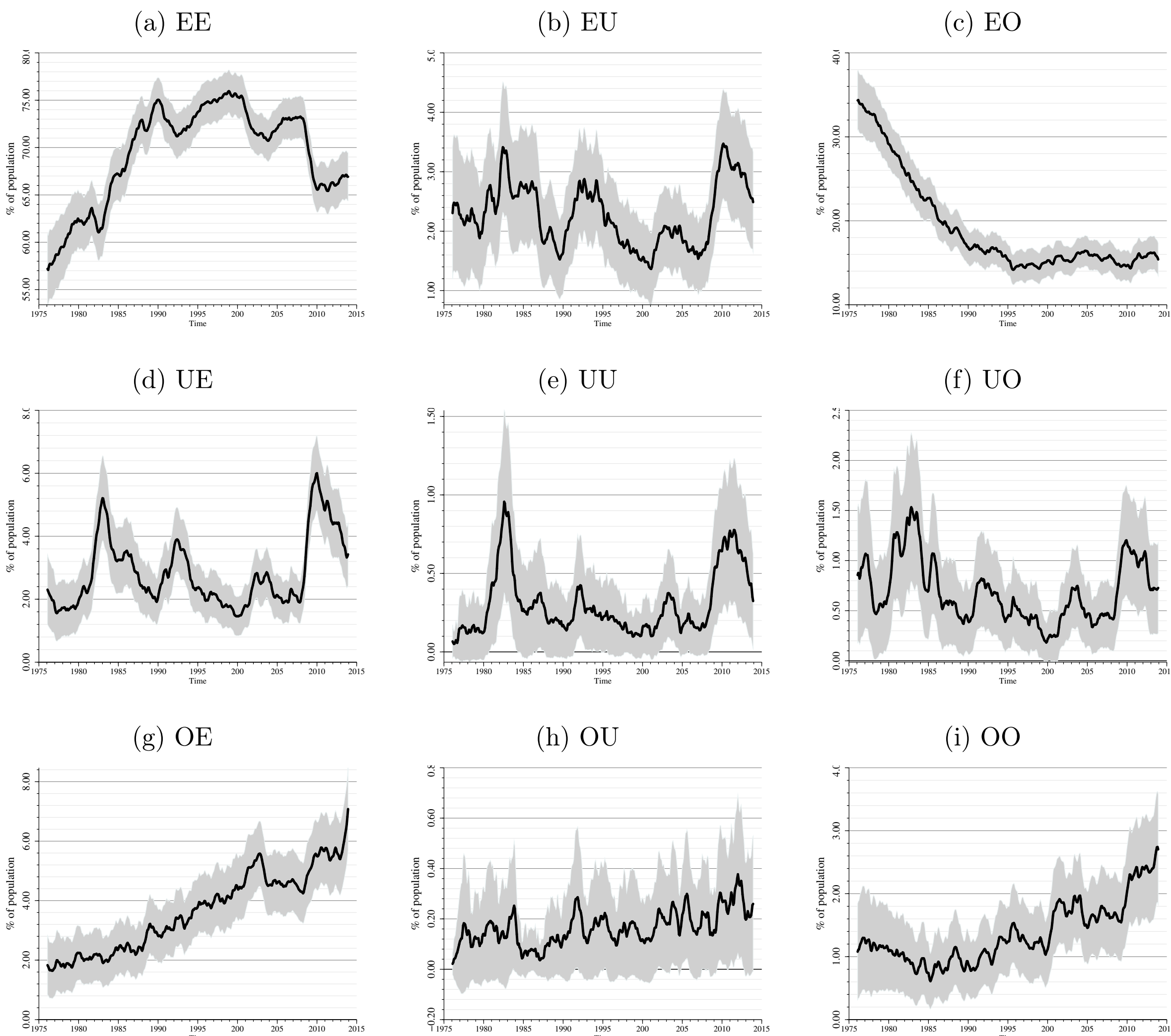



Figure A.3: Labor market stocks for married couples in which the wife possess college education and the husband does not, ages 25-54, 1976:2 to 2013:12. The solid line represents the seasonally adjusted fraction of the population in state XY, where X refers to the male and Y to the female. X and Y can stand for: E - employed, U - unemployed, O - out of the labor force. Grey areas represent NBER recession dates (taken from http://www.nber.org/cycles/cyclesmain.html).

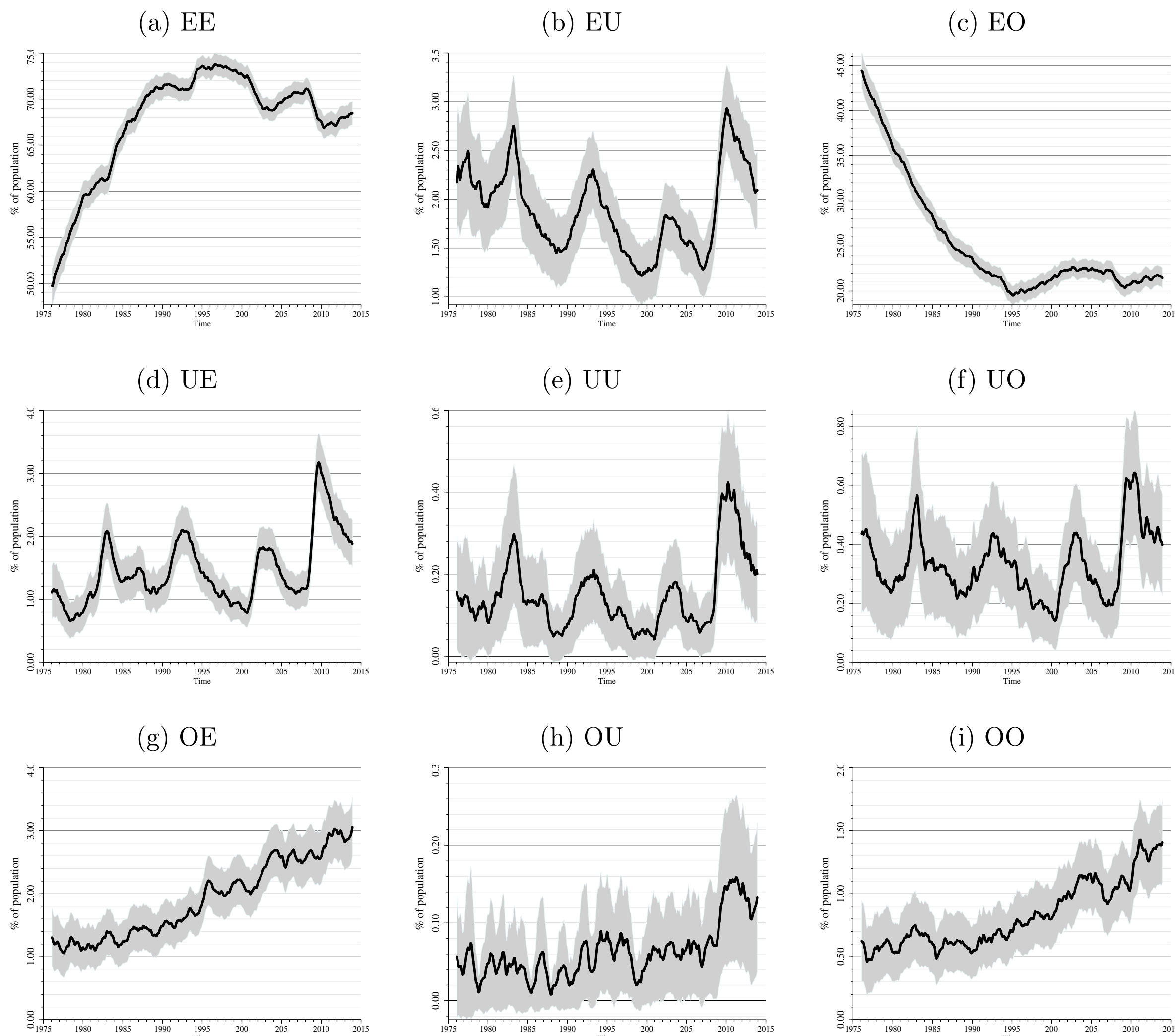



Figure A.4: Labor market stocks for married couples in which both members do possess college education, ages 25-54, 1976:2 to 2013:12. The solid line represents the seasonally adjusted fraction of the population in state XY, where X refers to the male and Y to the female. X and Y can stand for: E - employed, U - unemployed, O - out of the labor force. Grey areas represent NBER recession dates (taken from http://www.nber.org/cycles/cyclesmain.html).

| | | Male employed | | | Male unemployed | | | Male OLF | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Female transitions | | E | U | O | E | U | O | E | U | O |
| | E | 95.41 | 0.92 | 3.67 | 91.71 | 4.08 | 4.21 | 86.30 | 1.33 | 12.37 |
| Male employed | U | 25.07 | 47.81 | 27.12 | 21.62 | 52.25 | 26.12 | 16.72 | 45.90 | 37.38 |
| | O | 6.56 | 2.38 | 91.06 | 6.11 | 8.03 | 85.86 | 10.50 | 2.55 | 86.95 |
| | E | 93.46 | 2.19 | 4.36 | 95.52 | 2.28 | 2.19 | 95.08 | 1.29 | 3.63 |
| Male unemployed | U | 29.79 | 43.90 | 26.32 | 16.57 | 63.70 | 19.72 | 19.28 | 33.56 | 47.16 |
| | O | 7.77 | 5.08 | 87.15 | 4.59 | 8.01 | 87.40 | 4.00 | 2.88 | 93.13 |
| | E | 91.87 | 1.35 | 6.78 | 94.69 | 3.02 | 2.29 | 95.41 | 1.38 | 3.20 |
| Male OLF | U | 30.84 | 40.96 | 28.20 | 19.21 | 61.41 | 19.38 | 19.95 | 51.91 | 28.14 |
| | O | 18.17 | 4.36 | 77.47 | 5.57 | 11.01 | 83.42 | 3.19 | 2.23 | 94.58 |

| | | Female employed | | | Female unemployed | | | Female OLF | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Male Transitions | | E | U | O | E | U | O | E | U | O |
| | E | 98.46 | 1.12 | 0.42 | 94.46 | 4.91 | 0.63 | 97.08 | 1.35 | 1.57 |
| Female employed | U | 29.85 | 63.25 | 6.90 | 31.55 | 64.97 | 3.47 | 43.26 | 48.15 | 8.59 |
| | O | 11.04 | 7.78 | 81.17 | 10.82 | 15.25 | 73.93 | 21.35 | 4.79 | 73.86 |
| | E | 96.94 | 2.53 | 0.53 | 96.24 | 3.11 | 0.66 | 96.57 | 2.58 | 0.85 |
| Female unemployed | U | 40.34 | 54.01 | 5.65 | 21.14 | 74.58 | 4.27 | 31.09 | 54.30 | 14.61 |
| | O | 14.43 | 10.78 | 74.80 | 8.12 | 10.66 | 81.23 | 9.67 | 7.49 | 82.84 |
| | E | 98.06 | 1.11 | 0.83 | 95.53 | 3.94 | 0.53 | 98.37 | 1.13 | 0.49 |
| Female OLF | U | 41.78 | 51.95 | 6.27 | 21.58 | 75.15 | 3.27 | 29.03 | 61.84 | 9.12 |
| | O | 37.97 | 7.43 | 54.60 | 14.61 | 23.30 | 62.09 | 8.18 | 5.87 | 85.95 |

Table A.4: Conditional average labor market transitions for married couples, ages 25-54, 1980:1 to 1989:12. E - employed, U - unemployed, O - out of the labor force.

| | | Male employed | | | Male unemployed | | | Male OLF | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Female transitions | | E | U | O | E | U | O | E | U | O |
| Male employed | E | 96.67 | 0.75 | 2.57 | 92.33 | 3.71 | 3.96 | 86.89 | 1.37 | 11.73 |
| | U | 28.18 | 45.87 | 25.95 | 21.01 | 53.69 | 25.30 | 24.76 | 37.49 | 37.75 |
| | O | 6.78 | 2.49 | 90.73 | 8.03 | 8.61 | 83.36 | 13.76 | 2.51 | 83.73 |
| Male unemployed | E | 95.10 | 1.76 | 3.14 | 96.26 | 1.95 | 1.78 | 94.09 | 1.55 | 4.36 |
| | U | 35.91 | 38.53 | 25.56 | 18.52 | 63.77 | 17.71 | 20.71 | 26.48 | 52.81 |
| | O | 7.54 | 5.49 | 86.97 | 4.87 | 7.76 | 87.36 | 5.64 | 3.99 | 90.37 |
| Male OLF | E | 91.12 | 1.17 | 7.71 | 95.52 | 2.26 | 2.22 | 96.43 | 1.07 | 2.51 |
| | U | 29.22 | 48.40 | 22.39 | 19.26 | 59.72 | 21.02 | 21.42 | 48.33 | 30.25 |
| | O | 22.22 | 4.08 | 73.69 | 6.34 | 10.37 | 83.30 | 3.24 | 2.27 | 94.48 |

| | | Female employed | | | Female unemployed | | | Female OLF | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Male Transitions | | E | U | O | E | U | O | E | U | O |
| Female employed | E | 98.67 | 0.85 | 0.48 | 94.92 | 4.14 | 0.94 | 96.15 | 1.37 | 2.47 |
| | U | 31.47 | 58.61 | 9.92 | 29.08 | 61.24 | 9.68 | 39.78 | 42.53 | 17.69 |
| | O | 10.15 | 6.10 | 83.75 | 9.53 | 11.34 | 79.13 | 26.70 | 4.55 | 68.75 |
| Female unemployed | E | 97.43 | 1.70 | 0.87 | 96.82 | 2.51 | 0.67 | 96.63 | 2.04 | 1.33 |
| | U | 45.08 | 48.10 | 6.82 | 21.74 | 73.70 | 4.56 | 33.69 | 46.97 | 19.35 |
| | O | 13.72 | 6.69 | 79.60 | 8.33 | 10.24 | 81.43 | 5.99 | 5.47 | 88.54 |
| Female OLF | E | 97.41 | 1.17 | 1.42 | 95.83 | 3.40 | 0.77 | 98.42 | 0.92 | 0.66 |
| | U | 40.72 | 49.04 | 10.24 | 26.70 | 67.52 | 5.78 | 32.36 | 55.38 | 12.27 |
| | O | 39.08 | 6.39 | 54.52 | 13.42 | 18.23 | 68.35 | 7.39 | 4.45 | 88.16 |

Table A.5: Conditional average labor market transitions for married couples, ages 25-54, 1990:1 to 1999:12. E - employed, U - unemployed, O - out of the labor force.

| | | Male employed | | | Male unemployed | | | Male OLF | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Female transitions | | E | U | O | E | U | O | E | U | O |
| Male employed | E | 96.82 | 0.70 | 2.47 | 91.53 | 4.98 | 3.49 | 81.65 | 1.26 | 17.09 |
| | U | 25.03 | 48.45 | 26.51 | 25.06 | 52.84 | 22.10 | 32.65 | 30.97 | 36.38 |
| | O | 6.17 | 2.36 | 91.47 | 8.76 | 8.60 | 82.64 | 18.05 | 2.75 | 79.19 |
| Male unemployed | E | 94.84 | 2.02 | 3.14 | 96.69 | 1.56 | 1.75 | 94.75 | 1.15 | 4.10 |
| | U | 36.23 | 37.76 | 26.02 | 17.09 | 65.90 | 17.00 | 19.70 | 35.75 | 44.55 |
| | O | 8.75 | 5.21 | 86.03 | 4.50 | 8.94 | 86.56 | 8.73 | 5.14 | 86.12 |
| Male OLF | E | 88.62 | 1.42 | 9.96 | 96.19 | 1.99 | 1.82 | 96.72 | 0.96 | 2.32 |
| | U | 35.19 | 35.73 | 29.08 | 15.17 | 60.68 | 24.15 | 18.33 | 56.25 | 25.42 |
| | O | 32.02 | 3.13 | 64.85 | 9.42 | 12.73 | 77.85 | 3.46 | 1.89 | 94.65 |

| | | Female employed | | | Female unemployed | | | Female OLF | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Male Transitions | | E | U | O | E | U | O | E | U | O |
| Female employed | E | 98.58 | 0.84 | 0.58 | 92.93 | 5.92 | 1.15 | 94.15 | 1.26 | 4.58 |
| | U | 28.85 | 59.36 | 11.80 | 35.47 | 57.48 | 7.05 | 38.43 | 40.64 | 20.94 |
| | O | 9.62 | 6.38 | 84.01 | 12.54 | 11.36 | 76.10 | 32.81 | 4.19 | 63.00 |
| Female unemployed | E | 96.48 | 2.37 | 1.15 | 96.97 | 2.42 | 0.61 | 96.66 | 1.90 | 1.44 |
| | U | 48.06 | 45.27 | 6.67 | 21.29 | 72.19 | 6.52 | 32.38 | 48.47 | 19.15 |
| | O | 16.08 | 7.24 | 76.68 | 5.97 | 9.37 | 84.66 | 9.69 | 9.78 | 80.53 |
| Female OLF | E | 96.03 | 1.42 | 2.54 | 95.35 | 3.69 | 0.96 | 98.34 | 0.93 | 0.73 |
| | U | 42.65 | 42.93 | 14.42 | 23.81 | 68.43 | 7.76 | 33.05 | 55.26 | 11.69 |
| | O | 50.23 | 5.65 | 44.11 | 12.86 | 23.12 | 64.02 | 7.56 | 3.54 | 88.90 |

Table A.6: Conditional average labor market transitions for married couples, ages 25-54, 2000:1 to 2009:12. E - employed, U - unemployed, O - out of the labor force.