Dual Income Couples and Interstate Migration

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Abstract

We quantify the contribution of women's labor force attachment to the declining trend in interstate migration. Using CPS and SIPP data, we first document that for families in which both spouses have similar incomes, the propensity to migrate is significantly lower than for families with unequal spousal earnings. We construct a labor search model in which households make location, marriage, and divorce decisions. We calibrate the model to match aggregate U.S. statistics on mobility, marriage and labor flows and use it to quantify the effect of a fall in the gender wage gap on interstate migration. Narrowing the gender wage gap increases women's contribution to total family income; it induces a higher share of families with both spouses working and more couples with similar incomes. Our model predicts that the observed change in the gender wage gap accounts for 35% of the drop in family migration since 1981.

1 Introduction

In recent decades US households have experienced a dramatic decline in their mobility patterns. It is well documented that geographic mobility by all measures has fallen substantially over the past 30 years.[1] The drop is sharper for longer distance moves (i.e. interstate migration), which are typically more related to the labor market,[2] and it does not follow cyclical changes in the economy, but rather follows a secular trend.[3] This observation is not just confined to frequency of moves. Lifetime migration (i.e. whether a person leaves their state of birth) has reversed course in the 2000s by declining for the first time since 1940.[4]

How much of this decline can be explained by the increase in women's job prospects? In this paper, we establish a novel relationship between the change in women's labor force

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[1] See Frey (2009) for a general discussion.
[2] The rate of annual gross interstate migration has fallen by about half since the early 90s.
[3] Molloy, Smith and Wozniak (2011), Kaplan and Schulhofer-Wohl (forthcoming).
[4] Molloy, Smith and Wozniak (2011).

attachment and family migration, and propose a simple mechanism through which the increase in women's labor force attachment can explain the decline in interstate migration. We follow Mincer (1978) and argue that as the intra household income difference between spouses gets smaller, the choice of relocation becomes a joint decision as both partners pursue their job opportunities.

Using household level data from 1996 to 2011 we show that families with similar income spouses have substantially lower migration rates than families where most of the income is earned by one spouse. Strikingly we obtain a U shaped relationship between the male's share of income and migration propensity, and this observation is robust to conditioning on a rich set of controls that include household level demographic, economic, marriage and migration related indicators. Next, we observe that from 1981 to 2012 families with both spouses working (i.e. dual earners) experience a sharper drop in migration than the families with one working spouse (i.e. single earners). We argue that shrinking gender wage gap leads to higher fraction of families with dual earner spouses and more similar income couples within dual earner families. We study the implications of this trend in gender wage gap on migration by developing a quantitative model of marriage and labor markets with multiple locations.

We present a framework where ex ante identical individuals (males and females) receive job offers from multiple locations and make decisions about marriage and divorce. Single individuals, employed or unemployed, search for jobs in both their city of current residence and in other cities. There is a gender gap in job offers, on average males receive higher wage offers. Upon accepting an offer from an outside location, individuals have to move to that location and pay a one time moving cost. For families there is also an indirect cost for outside jobs: in order for a family to accept an offer and move, the spouse who does not receive an offer has to quit their job and become unemployed in the other city. In the model family migration decreases as the gender earnings gap declines because wives have a higher opportunity cost to moving. It becomes less likely for a spouse to receive a job offer high enough to compensate for the job loss of the partner.

We calibrate our model to the economy of the 2000s and match aggregate U.S. statistics on mobility, marriage and labor flows. The calibrated model has consistent predictions for the migration rates of dual and single earner families. We then run the following counterfactual exercise to address the contribution of women's labor force attachment to interstate migration: Change the mean wage offer distribution for females to a value that reflects the gender gap of 1970s while keeping the rest of the parameters at the benchmark calibration.

When we compare family migration in the counterfactual economy with the benchmark specification we establish two distinct findings that contribute to the final result: First we have a higher share of single earner families and fewer dual earner families in the counterfactual economy. This is simply due to change in the gender wage gap, with women having

fewer job offers that are better than their home production values. Since single earner families have higher mobility overall, we have higher overall mobility due to this compositional change. We label this as the "*compositional effect*". Second, in the counterfactual economy, migration rates of both single and dual earner families are higher. The change in migration for dual earners is bigger in relative terms, consistent with the data. The higher migration for each type of family in the counterfactual economy is due to differential changes in the type of moves within a family: Although a lower gender wage gap increases the propensity of family migration due to wives' job prospects, it reduces the migration generated by job offers coming to husbands. Since the majority of family moves are generated by job offers received by husbands, the change in male generated moves dominates the change in female generated moves. We label this as the "*within group effect*".

In the baseline model we take the distribution of married and single agents as given by setting the marriage and divorce choice exogenously. We find that the model with exogenous marriage and divorce produces a 0.25 percentage point change in family migration which corresponds to 35% of the observed drop in family migration between 1981 to 2012. Compositional changes in the type of earners contribute 72% of the total change of family migration in the model and the rest of the change is due to changes in migration within dual and single earner families.

In an extended model we consider endogenous marriage and divorce decisions. Single individuals meet with partners from both locations with some exogenous rates and decide on marrying when both parties agree on the terms of the marriage. In addition to job acceptance and mobility decisions, couples also evaluate the value of their marriage at each point in time. Besides the possibility of exogenous separation, a marriage can be dissolved whenever one of the partners values being single more than the value of the current marriage. The shrinking gender wage gap changes not only the migration rates of households but also affects the dynamics of marriage and divorce. In the counterfactual economy where the gender wage gap is higher we have a higher share of households that are married, consistent with the data, and we observe a 0.30 percentage point change in family migration, which corresponds to 42% of the observed drop between 1981 to 2012. Compositional changes in the type of earners contribute 60% of the total change of family migration in the model.

Related Literature A few recent papers address the secular decline in interstate migration. Kaplan and Schulhofer-Wohl (2012) argue against a less efficient US economy. They claim that the occupational mix of jobs offered in different regions has become more uniform, and with rising information about nonlocal jobs/amenities allowing people to assess different markets without moving, it is less necessary to make long distance moves. Molloy, Smith and Wozniak (2012) point out that if this was the case we would see a difference between the migration propensity of individuals who change occupation/industry vs the migration

propensity of individuals who stay in the same occupation/industry. Furthermore, the fact that occupational mobility and the job-to-job transition rate have been declining over the same period (Moscarini and Thomsson (2007) Hyatt and McEntarfer (2012)) is at odds with the flattening world hypothesis. Molloy et al. (2012) indicate that changes in the labor market that lead to the current trends in labor mobility could also affect interstate mobility. They cite firm specific human capital accumulation as one potential candidate.

Over the past few decades earnings of women relative to men have increased significantly from 64 percent in 1980 to 81 percent in 2010.[5] Goldin (2006) concludes that the wage gap between men and women is falling even within cohorts and different groupings. Accordingly within the family, the contribution of wives' income to total family income has risen from 26 percent in 1980 to 37 percent in 2009.[6] This means that a larger share of US families is comprised of more equally dependent spouses. These families have often been referred to dual income families, or *marriages of equally dependent spouses* (MEDS) (Nock,2001 Raley, Mattingly and Bianchi 2006). This has broad implications for a variety of topics. To mention a few, Greenwood and Guner (2009) attribute the fall in marriage rates and the rise in divorce to labor-saving technological progress in the household sector. Rotz (2011) distinguishes between the share of divorced people and the rate of divorce and relates the rise in age at marriage with falling divorce rates. Greenwood, Guner, Kockarkov and Santos (2012) explore the changes in marriage and divorce rate via education and the increase in assortative matching. Baudin, de La Crox and Gobbi (2012) look at the new types of families in terms of children decisions and relate it with the change in gender wage gap. Dahl and Sorenson (2012) investigate the feedback effect of family migration on gender wage gap. Gemici and Laufer (2011) analyze the effects of assortative matching within cohabiting couples. In this paper, we mainly focus on the mobility aspect of these implications.

The idea of modeling migration as an investment in human capital has roots back to the early work of Sjaastad (1962). Mincer (1978) and Sandell (1977) extended this framework to family migration and study the cases of tied movers and tied stayers.[7] Tied movers are spouses who prefer to stay in the current location from an individual point of view but choose to move with her spouse due to higher gains from moving as a family. Tied stayers are the spouses who prefer to move to a different location as a single but choose to stay due to higher utility of staying for a family. This framework is analyzed in depth by Guler et al (2012) in a labor search model. Gemici (2011) structurally estimates the family migration problem and assesses the implications of joint search on labor market outcomes, and marital stability of men and women. Kennan and Walker (2011) apply a similar approach

[5] http://www.bls.gov/cps/wlf-table16-2011.pdf

[6] http://www.bls.gov/cps/wlf-table24-2011.pdf

[7] Greenwood (1997) provides a detailed overview of the migration literature, discussion of the determinants of migration, and review of the early models.

to individual migration decisions, they estimate a dynamic migration model and show that migration decisions are affected by the prospects of future income.

Our paper is also related to the growing labor mobility literature from the point of local market adjustments, regional inequality and convergence dynamics; Barro and Sala-i Martin (1991), Blanchard and Katz (1992), Notowidigdo (2011), Ganong and Shoag (2012), local housing markets; Saks (2008), Ferreira, Gyourko, and Tracy (2010), Schulhofer-Wohl (2010), Winkler (2011), education and family dynamics; Costa and Kahn (2000), Compton and Pollak (2006), Wozniak (2010).

The rest of the paper is organized as follows. Section 2 provides information about the data and documents the stylized facts regarding income and migration propensities. Section 3 presents the simple model with exogenous marriage and divorce. Section 4 and 5 provide the details of our calibration and main results of the model. Section 6 introduces the model with endogenous marriage and divorce choice and analyzes the results. Finally, Section 7 concludes.

2 Empirical Findings

In this section, we present two findings that complement each other: first we establish a cross-sectional relationship between income similarity of spouses and their migration propensities, and second we document recent trends in family migration by earner status (i.e. dual vs single earner) and observe the implications of the first set of findings. For the first step we use the the Survey of Income and Program Participation (SIPP). For the second step we use the March Supplement of Current Population Survey (CPS) and compare the migration figures from 1981 to 1989 with figures from 2005 to 2012.

SIPP The SIPP is a nationally representative panel data set that has monthly information about household characteristics related to mobility, earnings, marital status etc.. It follows individuals for up to 3-4 years. Moreover it enables us to condition on the factors prior to moving, allowing us to establish a relationship between income similarity of spouses and their migration propensities. For the results reported here we compile data from the 1996, 2001, 2004 and 2008 panels which cover roughly 15 years.

We focus our analysis on civilian working age males who are married with a spouse present at the beginning of the panel. Furthermore we apply the following restrictions: 1) we keep individuals who are older than 18 at the beginning of the panel and don't hold any college degree at the end of the panel, or older than 21 and have a college degree at the beginning of the panel, 2) we drop individuals who are older than 55 at the beginning of the panel, 3) we drop individuals residing in Maine, Vermont, South Dakota, North Dakota and Wyoming since the 1996 and 2001 panels do not differentiate them as separate states,

4) we drop individuals who are not in the initial wave, and 5) we focus on households who are still in the sample at the end of the 36th month.[8] These exclusions leave us with 29,776 families.

The main independent variable of interest is the male contribution of income to total family income. For reasons laid out in Pingle(2006) we only use earned income coming from wages or self employment. We first observe the average wage for each spouse using the first wave (i.e. first 4 months). We then construct the male wage share of the total family wage. Next we follow the individual for the following 32 months and analyze the propensity of migration conditional on the information constructed at the end of 4th month. Specifically we run the following regression:

$$M_i = f(s_i) + \beta X_i + \epsilon_i \tag{1}$$

Here M_i denotes the indicator of interstate migration, equals to 1 if the individual moves to a different state within the next 32 months, 0 otherwise. s_i is our main variable of interest (i.e husband's wage share).[9] In order to capture potential nonlinear relationship between income similarity and migration we use a polynomial expansion of 4th order. X_i includes demographic, economic and other related variables that could potentially affect the migration decision for a family. We control for factors including age, race, education, labor supply characteristics, information on marital and migration history and state effects.[10]

We report the estimates of the regression in Appendix and refer to Taşkın (2012) for a thorough empirical analysis and discussion of the covariates. For the sake of illustration we focus on the relationship between income similarity of spouses and migration. We recover the predicted probability of migration using the male wage share variables and normalize the effects coming from the rest of the controls to have mean zero. The coefficients of the variable male wage share and its polynomials are jointly significant. We then draw the relationship between male wage share and predicted 32 month interstate migration rate net of other factors. Figure 1 depicts the striking relationship: the more similar the income prospects of the spouses the lower the migration propensity, and this result holds even after controlling for variety of factors that are correlated with the main variable of interest. In particular families where the husband or the wife is the main provider of income have a migration probability more than 6%; on the other hand this measure is around 4% for the families with equal earning spouses. However, note that this observation has a weaker prediction power for the female provider families.

[8] We abstract from the incidence of attrition since it brings additional complications to the mobility decision. See Taşkın (2012) for a formal treatment of attrition

[9] equals to 1(0) if the male (female) is the only provider of income and takes values between 0 and 1 if both spouses have positive earned income. For the cases when there is no family income we define the share as zero.

[10] A complete description of the controls used in (1) is provided in Appendix.

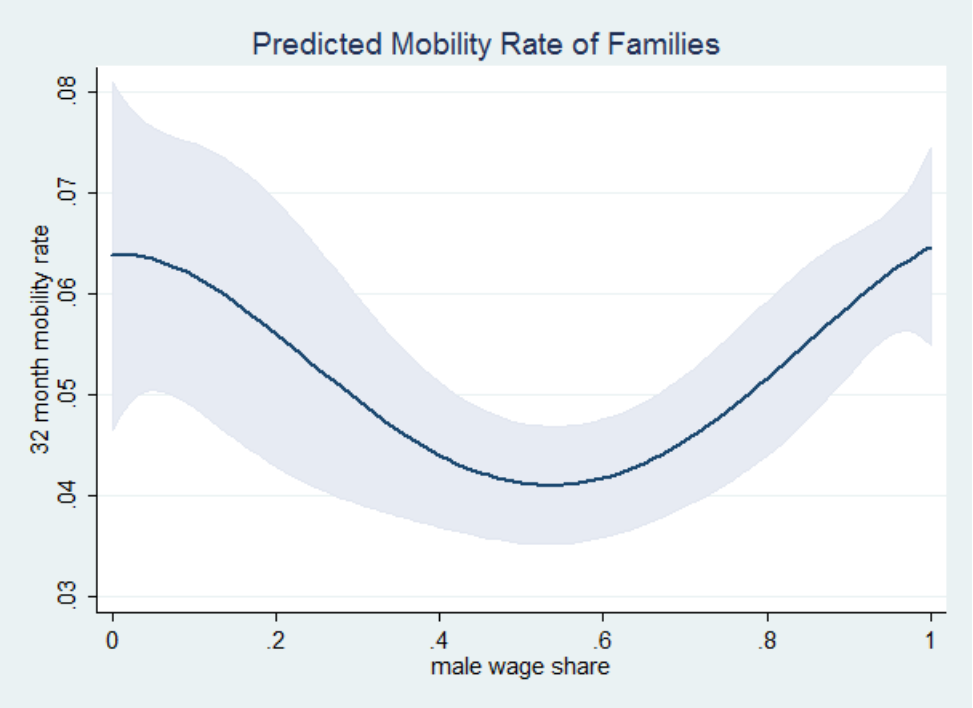


Figure 1: Interstate Migration by Male Wage Share

We have established a robust relationship between a couple's income similarity and their migration propensity. Our next step is to examine this relationship over time given the changes in women's earnings potential. We argue that women's increasing contribution to total family income would have differential effects on different types of families. In particular we claim that this change has a direct effect on the migration propensities of dual earner couples; more equal earnings prospects between spouses increases the opportunity cost of moving for a dual earner couple. Therefore we should observe a bigger change in migration for dual earner couples. Due to well known attrition problems in the SIPP we are not able to produce comparable migration figures over time. Therefore we turn the Current Population Survey for the task.

CPS The March CPS asks households whether they have changed residences in the last year, and collects information about mobility ranging from within county to between states. We focus on interstate migration for two reasons: first, for working age adults interstate mobility is associated with labor mobility, and second, we can directly compare mobility figures across time. In order to do such a comparison we compile data from 1981 to 1989 that represents the high gender wage gap period and from 2005 to 2012 for the low gender wage gap period. Our ideal universe is comprised of households with stable demographic

characteristics across time. For that reason we focus on primary families between ages 35 and 55. Moreover we would like to keep other demographics at the same level both for high and low gender wage gap periods. Among these characteristics education is one important factor that affects mobility. Therefore, we construct counterfactual mobility rates for the 2005-2012 period by keeping the education at the same level as in 1980s. Specifically, for each type of family by earner status (i.e. dual vs single) we keep the education composition at 1980 averages.

$$\widehat{M_i}^{t_1} = \sum_{j=1}^{4} E_{ij}^{t_0} M_{ij}^{t_1} \tag{2}$$

Here, i denotes the type of family with earner status, j represents 4 types of education levels based on college status for each spouse, and t_0 and t_1 denote the 1981-89 and 2005-12 periods respectively. $M_{ij}^{t_1}$ is the mobility rate of a family with earner type i and type j education level (eg. dual earner family with both spouses have college diploma) for the period of 2005-2012. $\widehat{M_i}^{t_1}$ then represents the counterfactual mobility rate of type i family if the education composition has remained constant at the level of the averages in the 1980s.[11]

We exclude subfamilies in the household since their mobility patterns might be affected by the primary families and their composition is not constant across time. Kaplan and Schulhofer-Wohl (forthcoming) note that the changes in imputation process for the mobility question has affected mobility patterns. In order to remove this mechanic effect of imputation we follow a methodology similar to Kaplan and Schulhofer-Wohl (forthcoming) and drop families if migration status of the household head (whether the respondent lived in the same home one year ago) was hot deck allocated. We also exclude couples where only one spouse reports making an interstate move. This increases the likelihood that a married couple was married in the previous year as well. Therefore, family migration is classified as either both spouses making an interstate move or neither of them.

We classify a couple as dual earners if both spouses are currently working, either full time or part time. Similarly we define a single earner couple when strictly one spouse is employed. Table 1 reports the average interstate migration rates of families for years 1981-1989 and 2005-2012 by earner status. We see a common declining trend, but this trend is not uniform with respect to earner status. We look at the change in mobility in relative terms since dual earner couples have substantially smaller mobility rates compared to single earners. From 1981 to 2012 we have a slight difference in mobility patterns that support our hypothesis: the dual earner migration rate has dropped by 50% whereas the drop in single earner migration is 39%. Overall family migration has dropped from 1.53 in 1981-1989 to

[11] For the overall family migration we obtain the counterfactual rate by having a weighted sum of the counterfactual migration rates for each earner type in 2005-2012 averages.

0.81, a relative fall of 47%.

Year	Dual Earner	Single Earner	Family Migration
1981-1989	1.03	2.15	1.53
2005-2012	0.51	1.31	0.81
drop(pct.)	0.52(50%)	0.83(39%)	0.72(47%)

Table 1: Interstate Migration Rate of Couples by Earner Status

Source: IPUMS CPS March Supplement 1991-2011

We conclude that families with both spouses working have a larger reduction in migration rate than single earner families do. If there are two independent sources that reduce migration propensities, one common source that affects every family in the same way and one specific source that differentially affects couples through spousal earnings, the residual fall of migration in dual earners could be attributed to the changes in women's earnings potential. The compositional change in the contribution of income via husband and wife has direct effects on dual earner families; as the income of the wife becomes closer to the income of the husband the expected gains from one spouse's moving needs to be bigger to compensate the loss of the other. Hence the migration propensity of a dual earner couple falls incrementally. However we should note that this does not exclude the possibility of a fall in migration in single earner families due to a change in women's earnings prospects.

Our next step is to put these pieces together and establish a formal relationship between the changes in the earnings difference via gender and overall family migration. For that we have a model of job search with location and marriage/divorce choice which is used to quantify the effect of the change in the gender wage gap on interstate migration.

3 Model of Labor and Marriage Markets with Migration

We first present a multiple location labor search model with exogenous marriage and divorce. We describe the basic mechanism of job search and migration decisions of single and married households. In the following section we relax the exogenous marriage and divorce assumption and investigate the family migration with divorce choice.

3.1 Environment

The model is similar to Guler et al (2012). Time is continuous. The economy is populated by a measure L of females and males distributed over L symmetric locations. Individuals only derive utility from consumption. Individuals can be either married or single. Marriage and divorce are exogenous choices. Single individuals meet with other singles only from their

local location and at the rate λ. Married couples receive exogenous divorce shocks at the rate φ. Individuals are either employed or unemployed. Unemployed individuals receive a benefit of z, which can be interpreted as home production and/or leisure. Both unemployed and employed individuals can receive job offers. The offer arrival rate from local market is α_l, and it is α_n from non-local markets. Offers are generated from an exogenous gender-specific distribution $F_i(w)$ where $i \in \{f, m\}$ denotes whether the individual is female ($i \equiv f$) or male ($i \equiv m$). Upon receiving an offer, singles have to decide whether to accept or reject the offer. Acceptance of an outside offer requires moving to the other location. Moving is entitled to a one-time cost of κ, which is the same for both singles and couples. Moreover, couples face an additional cost of moving. If a couple decides to move to another location as a consequence of a spouse receiving an offer, the other spouse has to quit her job if she is currently employed, i.e. we do not allow the couple to live separately. Lastly, type i individual becomes unemployed at an exogenous rate of δ^i.

3.2 Decision Rules

We denote the value of being single for a type i individual, where $i \in \{f, m\}$ is the gender of the individual, receiving an income of w_i, as $V_i^s(w_i)$. Similarly, the value of being a couple for a type i individual when spouse i is receiving an income of w_i and spouse j is receiving an income of w_j is $V_i^m\left(w_i, w_j\right)$.

Singles We first formulate the problem of a single earning wage w_i. A single meets with another single from her local location at the rate λ. Since upon marriage the change in the value potentially depends on the wage of the prospective spouse, it is crucial for the type i individual to know the distribution of singles for the other type, G_j. This distribution is an equilibrium object. The single receives job offers both from the local and non-local markets. Upon the arrival of the job offer, she decides whether to accept it or not. Acceptance of a job offer from non-local market requires paying a moving cost κ. Denote $I_i^{s,a_l}\left(w_i', w_i\right)$ as the indicator function for the accept/reject decision of individual i receiving a local offer w_i' when employed at the wage w_i. $I_i^{s,a_l}\left(w_i', w_i\right)$ is characterized as follows:

$$I_i^{s,a_l}\left(w_i', w_i\right) = \begin{Bmatrix} 1 & if & V_i^s\left(w_i'\right) > V_i^s(w_i) \\ 0 & o.w. & \end{Bmatrix}. \tag{3}$$

Similarly, we can characterize $I_i^{s,a_n}\left(w_i', w_i\right)$ as the indicator function for the accept/reject decision of individual i receiving a non-local offer w_i' when employed at the wage w_i as the

following:

$$I_i^{s,a_n}\left(w_i', w_i\right) = \begin{Bmatrix} 1 & if & V_i^s\left(w_i'\right) - \kappa > V_i^s\left(w_i\right) \\ 0 & o.w. & \end{Bmatrix}. \tag{4}$$

Then, we can formulate the flow value of being a single as the following:

$$\rho V_i^s\left(w_i; G_j^s\right) = \begin{array}{c} u\left(w_i\right) + \delta^i\left[V_i^s(z) - V_i^s\left(w_i\right)\right] + \lambda \int \left[V_i^m\left(w_i, w_j\right) - V_i^s\left(w_i\right)\right] dG_j^s\left(w_j\right) + \\ \alpha_l \int I_i^{s,a_l}\left(w_i', w_i\right)\left(V_i^s\left(w'\right) - V_i^s\left(w_i\right)\right) dF_i\left(w'\right) + \alpha_n \int I_i^{s,a_n}\left(w_i', w_i\right)\left(V_i^s\left(w'\right) - \kappa - V_i^s\left(w_i\right)\right) dF_i\left(w'\right) \end{array} \tag{5}$$

The first term is the instantaneous benefit of earning the wage w_i. The second term captures the change in value upon receiving the unemployment shock. The third term is the change in the value if the individual meets a partner with wage w_j. Notice that the distribution of the singles for the other type, G_j, which is an equilibrium object, determines the value of the meeting with a spouse. The fourth and the fifth terms capture the change in the value conditional on receiving a local and non-local job offer, respectively.

Couples We next formulate the value of being in a couple for a type i individual receiving w_i and married to a spouse receiving w_j. An important consideration in the problem of the couple is the intra-household allocation of resources. Two types of approaches arise in the literature regarding this issue: a unitary approach and a non-unitary approach. The unitary approach assumes that the couple behaves as a single unit and the resources are shared in a pre-determined way between the spouses. In the non-unitary approach, the decision and the sharing rule are determined through a cooperative or non-cooperative mechanism[12]. Since, in the exogenous model, we do not explicitly model marriage/divorce choice, we abstract from the determination of the sharing rule, and assume that the couple acts as in the unitary models, i.e. the couple maximizes the sum of the values for both spouses. The unitary framework ties the spouses to each other, and this effects their labor market decisions. Since we do not allow endogenous divorce and upon accepting a non-local offer the other spouse has to quit her job, married individuals face additional frictions in their labor market choices. More specifically, take a couple with current wages $\left(w_i, w_j\right)$. If spouse i receives a non-local offer w_i', she might have to reject this offer since spouse j might refuse to quit her job. Similarly, if spouse j receives an outside offer w_j' and accepts it, spouse i has to quit the job to move to the other location.

To better understand the decision rules for the couple, we first present the job accept/reject and move/stay decisions for the couple. First, consider a couple with current wages $\left(w_i, w_j\right)$. If spouse i receives a local offer w_i', then couple has three options: (1) spouse i accepts the offer and spouse j stays employed at the current wage, (2) spouse i

[12]See Browning, Chiappori and Weiss (2011), Chiappori and Donni (2011) for a detailed survey of these approaches.

accepts the offer and spouse j quits the job, and finally (3) spouse i rejects the offer. We denote $I_i^{m,a_l}\left(w_i', w_i, w_j\right)$ as the indicator function for the first option, i.e. $I_i^{m,a_l}\left(w_i', w_i, w_j\right) = 1$ if spouse i accepts the offer and spouse j stays employed at the current wage, and $I_i^{m,a_l}\left(w_i', w_i, w_j\right) = 0$ otherwise. Since the couple chooses the option which maximizes the total value of marriage, I_i^{m,a_l} is characterized as follows:

$$I_i^{m,a_l}\left(w_i', w_i, w_j\right) = \begin{Bmatrix} 1 & if & V_i^m\left(w_i', w_j\right) + V_j^m\left(w_j, w_i'\right) > \\ & & \max\left\{V_i^m\left(w_i', z\right) + V_j^m\left(z, w_i'\right), V_i^m\left(w_i, w_j\right) + V_j^m\left(w_j, w_i\right)\right\} \\ 0 & o.w. & \end{Bmatrix}. \quad (6)$$

Similarly, we denote $I_i^{m,q_l}\left(w_i', w_i, w_j\right)$ as the indicator function representing the second option, i.e. spouse i accepts the offer and spouse j quits the job. Lastly, $I_i^{m,r_l}\left(w_i', w_i, w_j\right)$ denotes the indicator function for the third option, i.e. spouse i rejects the offer and spouse j stays employed at the current wage. $I_i^{m,q_l}\left(w_i', w_i, w_j\right)$ is characterized as follows:

$$I_i^{m,q_l}\left(w_i', w_i, w_j\right) = \begin{Bmatrix} 1 & if & V_i^m\left(w_i', z\right) + V_j^m\left(z, w_i'\right) > \\ & & \max\left\{V_i^m\left(w_i', w_j\right) + V_j^m\left(w_j, w_i'\right), V_i^m\left(w_i, w_j\right) + V_j^m\left(w_j, w_i\right)\right\} \\ 0 & o.w. & \end{Bmatrix}. \quad (7)$$

For the last indicator function we need to have $I_i^{m,r_l}\left(w_i', w_i, w_j\right) = 1 - I_i^{m,a_l}\left(w_i', w_i, w_j\right) - I_i^{m,q_l}\left(w_i', w_i, w_j\right)$[13]. The indicator functions for spouse j are derived similarly.

If one of the spouses receives a non-local offer, the accept/reject decision is also tied to the location choice. Now, accepting an outside offer also involves relocation for both spouses, and that requires the other spouse to quit the job. Again, consider the case when spouse i receives a non-local offer, w_i' while the spouses are employed at the current wages $\left(w_i, w_j\right)$. The couple has two options in this case: (1) spouse i accepts the offer, spouse j quits the job and they relocate, and (2) spouse i rejects the offer. Denoting $I_i^{m,q_n}\left(w_i', w_i, w_j\right)$ as the indicator function for the first option, i.e. spouse i accepts, spouse j quits and the couple relocates, the equation characterizing this decision is as follows:

$$I_i^{m,q_n}\left(w_i', w_i, w_j\right) = \begin{Bmatrix} 1 & if & V_i^m\left(w_i', z\right) + V_j^m\left(z, w_i'\right) - \kappa > V_i^m\left(w_i, w_j\right) + V_j^m\left(w_j, w_i\right) \\ 0 & o.w. & \end{Bmatrix}. \quad (8)$$

Lastly, we denote $I_i^{m,r_n}\left(w_i', w_i, w_j\right)$ as the indicator function for the second option, i.e. spouse i rejects the offer. By construction, we need to have $I_i^{m,r_n}\left(w_i', w_i, w_j\right) = 1 - I_i^{m,q_n}\left(w_i', w_i, w_j\right)$.

[13] We conjecture that although it is possible for one spouse to quit the job while the other accepts a local offer, this will never happen in equilibrium. We conjecture this result due to the analysis of Guler et al (2012). They show that if there is on-the-job search, the "breadwinner cycle" disappears if offer arrival rates when employed and unemployed are the same.

Given these indicator functions, we can now formulate the problem of the couple as follows:

$$\rho V_i^m\left(w_i,w_j\right)=\left\{\begin{array}{c} u\left(w_i,w_j\right)+\delta^j\left[V_i^m\left(w_i,z\right)-V_i^m\left(w_i,w_j\right)\right]+\delta^i\left[V_i^m\left(z,w_j\right)-V_i^m\left(w_i,w_j\right)\right]+2\varphi\left[V_i^s\left(w_i\right)-V_i^m\left(w_i,w_j\right)\right] \\ +\alpha_l\int\left[I_i^{m,a_l}\left(w_i',w_i,w_j\right)\left(V_i^m\left(w_i',w_j\right)-V_i^m\left(w_i,w_j\right)\right)+I_i^{m,q_l}\left(w_i',w_i,w_j\right)\left(V_i^m\left(w_i',z\right)-V_i^m\left(w_i,w_j\right)\right)\right]dF_i\left(w_i'\right) \\ +\alpha_n\int I_i^{m,q_n}\left(w_i',w_i,w_j\right)\left(V_i^m\left(w_i',z\right)-\kappa-V_i^m\left(w_i,w_j\right)\right)dF_i\left(w_i'\right) \\ +\alpha_l\int\left[I_j^{m,a_l}\left(w_j',w_j,w_i\right)\left(V_i^m\left(w_i,w_j'\right)-V_i^m\left(w_i,w_j\right)\right)+I_j^{m,q_l}\left(w_j',w_j,w_i\right)\left(V_i^m\left(z,w_j'\right)-V_i^m\left(w_i,w_j\right)\right)\right]dF_j\left(w_j'\right) \\ +\alpha_n\int I_j^{m,q_n}\left(w_j',w_j,w_i\right)\left(V_i^m\left(z,w_j'\right)-\kappa-V_i^m\left(w_i,w_j\right)\right)dF_j\left(w_j'\right) \end{array}\right\} \tag{9}$$

Here the first line on the RHS is the instantaneous benefit plus the change in value if either of the spouses receive unemployment or divorce shocks. The second line represents the change in the value if spouse i receives a local offer. Here we have three possibilities. If spouse i accepts the offer and spouse remains employed, then the new value becomes $V_i^m\left(w_i',w_j\right)$. If spouse i accepts the offer and spouse j quits the job, the new value becomes $V_i^m\left(w_i',z\right)$. If spouse i rejects the offer, there is no change in the value. Similarly, the third line represents the change in the value if spouse i receives a non-local offer. Here the only difference is the change in the value if spouse i accepts the offer. In this case, the couple needs to move to the other location which requires a cost of κ, and spouse j has to quit her job. The fourth and fifth lines are analogous to spouse j.

There are two main differences between the married individual's problem and the single's problem, since spouses are tied to each other. A married individual might have to reject some offers that she would not reject if she were single (the ones coming from non-local markets) since her spouse might refuse to quit the job and move to the other location. Referring to the seminal work of Mincer (1976), these individuals are called as "tied-stayers". On the other hand, the married individual might have to quit her job since her spouse might accept a non-local offer, something she would not do if she were a single. Similarly, these individuals are called as "tied-movers"[14]. Notice that this observation should make it clear that a comparison of the mobilities of the single and the couple is not straightforward. The individual in a couple becomes less mobile due to lower probability of accepting non-local offers, but becomes more mobile due to the additional mobilities originated by the other spouse. In other words, compared to a single although the couple faces frictions for non-local offers which makes the couple less mobile, the total offer arrival probability for the couple is twice the single's, and this can make the couple more mobile. In sum, the net effect is ambiguous and it is theoretically possible to have the couple be more mobile than the single within the model.

[14]Guler et al (2012) analyzes how these cases might arrive in a similar framework we have here. We refer the reader to this paper to have a detailed analysis of these frictions.

3.3 Stationary Equilibrium

We are mainly interested in the steady-state of the economy. In the steady-state we have two types of distribution of households: (1) singles employed at wage w and (2) individuals employed at wage w_i and married to a spouse earning w_j. We denote $G_i^s(w)$ as the cumulative distribution of type i singles employed at wage w or smaller. Then, we can make the definition of the stationary equilibrium as follows:

Definition: A Stationary Equilibrium consists a set of value functions $\left\{V_i^s, V_i^m\right\}$, decision rules $\left\{I_i^{s,a_l}, I_i^{s,a_n}, I_i^{m,a_l}, I_i^{m,q_l}, I_i^{m,a_n}, I_i^{m,q_n}\right\}$ and a distribution of singles G_i^s such that

- Decision rules are defined as the solutions to equations (3)-(4) and (6)-(8).
- Given decisions rules and the distribution, value functions solve equations (9) and (5).
- Observed wage distribution of singles is in steady-state, i.e. the inflows and outflows are equal to each other.

4 Calibration

We proceed to calibration in two steps. First we set some values exogenously, taking some directly from previous studies, while for others we identify the moment from the data specified in the empirical section and exogenously set the model parameter to the target. We start with describing the household utility.

Preferences: Individuals are risk neutral and marital status does not alter utility formulation. Single individual of type i only derives utility from consumption of the current wage w_i:

$$u_i^s(w_i) = w_i \tag{10}$$

Similarly married individuals only derive utility from the consumption of the individual income:[15]

$$u_i^m(w_i, w_j) = w_i \tag{11}$$

Exogenous Calibration: The time period in the model is set to one month of calendar time. The monthly discount rate, ρ, is set to 0.004, which corresponds to an annual discount factor 0.953. Monthly job destruction rate, δ, is set to 0.034, as reported in Shimer (2005). The relative flow value of non-work, z, which includes home production and leisure, is

[15] It turns out that for the exogenous model income pooling does not matter. We have virtually the same results for the case when we set spouses pool their income and split it evenly. We change this specification when we allow for endogenous marriage and divorce decisions in the section 6.

taken from Hall and Milgrom (2008) as 0.71. Wage offers are drawn from a lognormal distribution for which we set the parameters such that the average wage offer for males, μ_m, is normalized to 1. For females we follow Greenwood, Guner, Kockarkov and Santos (2012) and set the average wage offer μ_f to 0.83 for the benchmark calibration and to 0.59 for the counterfactual exercise.

The exogenous divorce rate, φ, identifies the flow into divorce. We compile the SIPP 2004 and 2008 panels and follow individuals that are married with a spouse present at the beginning of the panel for 36 consecutive months. We use the same sample restriction except that we also include individuals who dropped out of sample during the time frame. Out of 15,379 families we have 433 of them either divorced or separated by the end of the third year. This makes an annual divorce rate of 0.94%. Hence we set φ to 0.00039 that corresponds to the annual rate. In the exogenous model, the share of married couples can be characterized by the following closed form: $\frac{\lambda}{\lambda+\varphi}$. Here we set λ as 0.00091 to have 70% of the households as married couples. We obtain the share of married households as following: According to March CPS for the 2005-2012 period within the universe of our restrictions we have 64% of the households as married, 16% of them as never married single, and the remaining part as cohabiting, separated or divorced individuals. We only have singles and married households in the model, hence we assume that the majority of the remaining part behaves like a single and set the share of married households as 70%. Table 2 summarizes the parameters that are calibrated outside the model.

Parameter	Value	Description
ρ	0.004	monthly discount rate
z	0.71	value of nonwork
δ	0.034	monthly job separation rate
φ	0.00039	monthly divorce rate
λ	0.00091	singles matching rate
μ_m	1.0	mean wage offer male
μ_f	0.83	mean wage offer female

Table 2: Parameters Calibrated Outside the Model

Calibration Within the Model: The rest of the parameters jointly determine the extent to which the equilibrium matches the remaining targets as a whole. We have the job arrival rate, $\alpha_l + \alpha_n$, and standard deviation of wage offers, σ, that identify the share of population that receives an offer above the current wage or non work value. Hence we use the share of dual earner couples and the share of single earner couples as targets. Using the March CPS 2005-2012 averages we find that 66% of the families are dual earner families, 31% of them are single earners. Our model has key predictions on mobility rates, using the March CPS

for the same time period we compute the single mobility rate as 1.29 and married mobility rate as 0.81, using the share of married as 70% yields an annual interstate migration rate as 0.93. We also target the married vs single mobility ratio which is 0.63 using the current figures. The share of offers coming from the outside location, $\frac{\alpha_n}{\alpha_l+\alpha_n}$, and moving cost parameter, κ, jointly identify these mobility targets. The former mainly maps to overall mobility and choosing the latter changes the relative mobility rate of single vs married households. We jointly choose values for these 4 parameters such that we match the corresponding targets. Table 3 summarizes the endogenous calibration with the corresponding descriptions.

Parameter	Value	Description
$\alpha_l + \alpha_n$	0.18	job offer rate
$\sigma_m = \sigma_f$	0.17	std. dev. of wage offers
$\frac{\alpha_n}{\alpha_l+\alpha_n}$	0.025	nonlocal job offer rate
κ	0.6	moving cost

Table 3: Parameters Calibrated Inside the Model

5 Quantitative Results

We now present the quantitative results of our model. We first present the results for the economy representing 2000s. Then, we present the results for our counterfactual, which represents the US economy in 1970s. The only difference between these two economies is the gender wage gap, i.e. the mean of the wage distribution for females is much smaller in the economy representing 1970s. We hope that by computing the model's predicted migration patterns changing only the gender wage gap, we can determine how much of the total change can be attributed to this effect.

Table 4 presents the results to the exogenous model representing 2000s. First, comparing the second and the third columns, we can see that the model fits the data quite well. It should not be surprising that the model matches the gender wage gap, share of married, share of dual earners, share of single earners, aggregate mobility rate and the ratio of married and single mobility rate quite well, since these moments are targeted in the calibration. However, the model also matches the data quite well in other dimensions we do not explicitly target. For instance, the level of single mobility in the data is 1.29%, whereas the model produces a mobility of 1.36%. Similarly, the mobility rate of the married couples is 0.81% in the data, and the model counterpart of the same moment is 0.77%. The model also captures the levels of the single earner and dual earner mobility rates quite well. Single earner mobility rate, which is defined as the mobility rate of single earners within married couples, is 1.31% in the data and 1.18% in the model. The model produces 0.31% mobility rate for dual earners, which is similar to the 0.51% rate in the data. Capturing these levels

and differences between the mobility rates of the single earners and dual earners plays an important role in explaining the sizable decrease in the mobility rate of the married couples.

Moment	Data	Model
gender gap	83%	83%
share of married	70%	70%
share of dual earners[1]	66%	65%
share of single earners[1]	31%	31%
mobility rate	0.93%	0.95%
married vs single mobility	63%	57%
single mobility	1.29%	1.36%
married mobility	0.81%	0.77%
single earner mobility	1.31%	1.18%
dual earner mobility	0.51%	0.31%

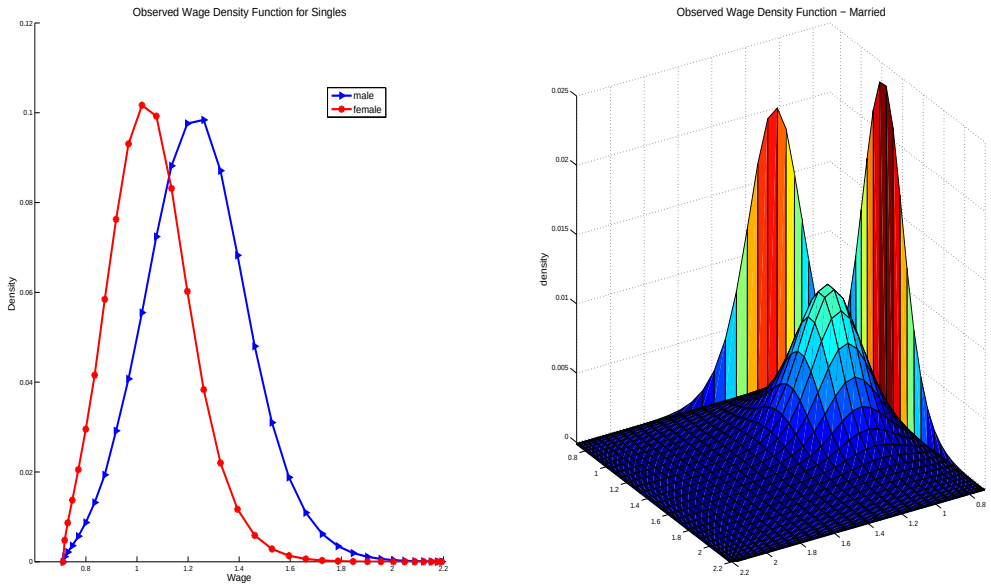
[1] Out of married couples

Table 4: Benchmark Results - Exogenous Model

Wage Distribution: Figure 2(a) shows the observed wage distribution of the singles generated by the model. Thanks to the gender wage gap, observed wage distribution of the male singles first-order stochastically dominates observed wage distribution of the female singles. Similarly, Figure 2(b) shows the observed joint wage distribution of the married households. The model generates a significant fraction of single-earner households and dual-earner households.

5.1 Workings of the Model

The model generates three major types of households regarding the number of working individuals ("breadwinners") in the household: single households, single-earner households and dual-earner households. The model successfully matches the measure of these three types of households very well. The main mechanism in the model works through the differential mobility rates across the three types of households. As in the data, the model predicts that the mobility rate for the singles is the highest, single earner mobility rate comes the second, and dual earner mobility rate is the lowest. Now, we explain the main mechanism driving these results. As we explained in Section 3, theoretically the comparison of the single mobility rate and married mobility rate is ambiguous. Married individuals, on the one hand, are less mobile due to the presence of a spouse and decisions are made jointly. This friction generates the tied-stayers. However, on the other hand, the presence of a spouse makes the married individual mobile, because now the married individual not only moves



(a) Singles (b) Married

Figure 2: Observed Wage Distribution

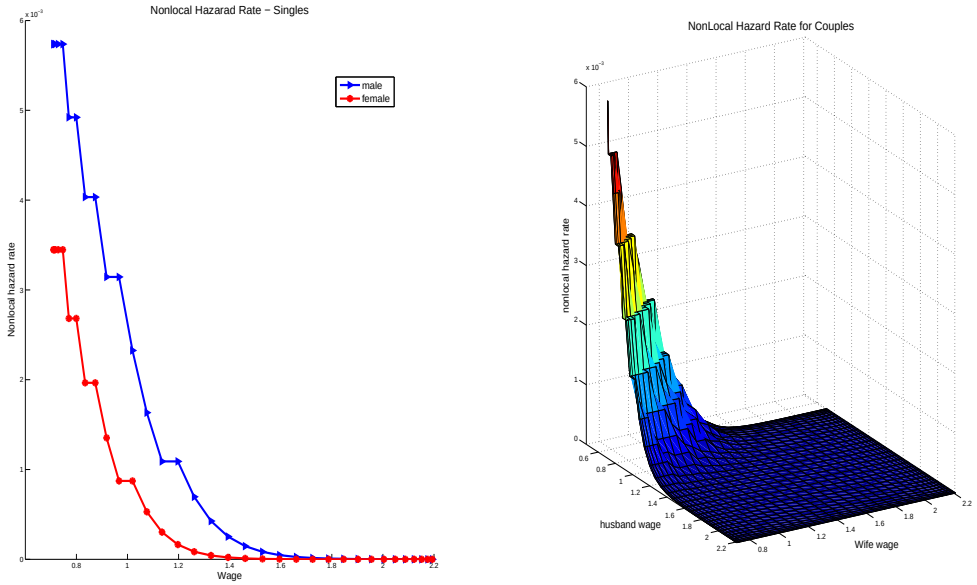
due to her labor market opportunities, but also due to the spouse's labor market opportunities. This mechanism generates the tied-movers in the model. Since both effects work in the opposite directions, it is not clear whether a married individual is less or more mobile compared to her single counterpart.

5.1.1 Hazard Rate for Non-Local Offers

To have a better understanding of these effects, we plot the hazard rates for non-local offers across different types of households.

Singles: First, we start with the singles. Figure 3(a) plots the hazard rate of singles for non-local offers. As expected, the hazard rate is a decreasing function of the current wage. As the current wage increases, the individual is less likely to receive a better offer from the non-local location. As a result, the hazard rate decreases. Moreover, if we compare the hazard rates of the female singles and the male singles, we observe that the hazard rate for the male singles is always significantly higher than the one for female singles. This is related to the gender wage gap. Since males have a wage offer distribution with a higher mean, at any wage, they are more likely to receive a better offer compared to the females. So, their hazard rate is significantly higher than the female hazard rate. This plays an important role

in the comparison of the mobility rates between the singles and married individuals. Since it is the males who are more likely to have better labor market prospects, within a married couple, it is generally the male who triggers the mobility. In other words, thanks to the gender wage gap, it is generally the females who are the tied-stayers or tied-movers in the model.



(a) Singles (b) Married

Figure 3: Hazard Rate for Non-local Offers

Married Individuals: We next analyze the hazard rate of the married individuals for the non-local offers. Figure 3(b) plots the total hazard rate of married individuals as a function of the spouse's wage. Notice that the total hazard rate of a married individual has two components. Moves to the other location can be generated by male accepting a non-local offer or female accepting a non-local offer. Figure 4 plots the composition of the total hazard rate as a function of both spouse's wage. As we can see in the figure, among the married couples, moves to the other location are generally generated by the male. The contribution of the male to the total hazard rate is significantly higher than the one for the female in every types of marriages.

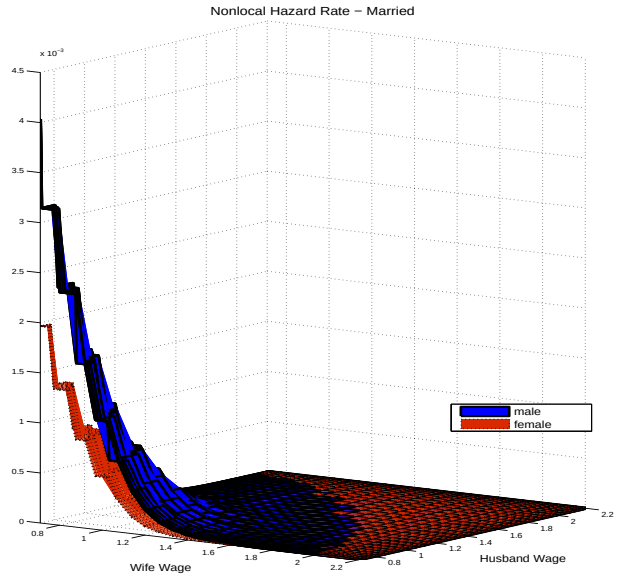
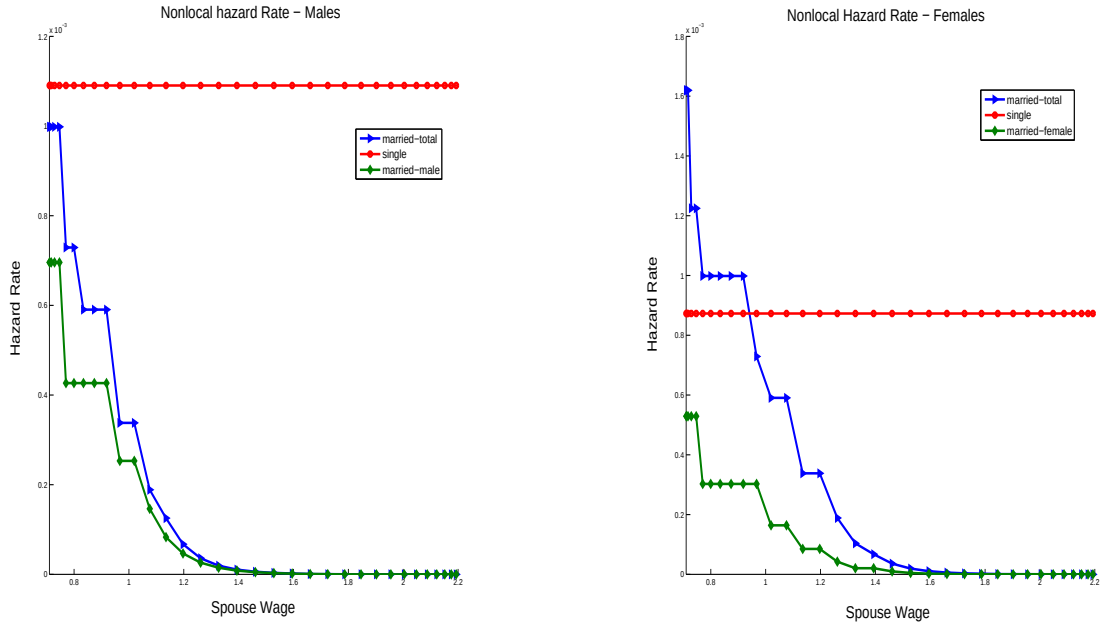


Figure 4: Hazard Rate Composition for Non-local Offers - Married

To better understand the dependance of the married individual's hazard rate for the non-local offers to the wage of the spouse, we present the hazard rate of the married individual for the non-local offers as a function of the spouse's wage by keeping the current wage of the married individual constant. Figure 5(a) plots hazard rate for non-local offers of a male currently earning the mean wage of the observed distribution as a function of the spouse wage. Similarly Figure 5(b) plots the same graph for the females. The first thing to notice is that the hazard rate for a married individual is a decreasing function of the spouse's wage. The line with the diamonds shows the hazard rate generated only by the moves of the male. This is clearly decreasing in the spouse's wage. As the wage of the spouse increases, it becomes less likely for the male to convince the wife to move as a result of a non-local offer to the male. Remember that the couple only moves if the total value after the move is greater than the total value with the current wages. As the male gets a better offer, it is true that he will realize an increase in his value by accepting the offer. However, accepting a non-local offer requires to move to the other location and female quitting the job. This means a loss to the value of the marriage for the female. As the wage of the female increases the loss in the value of the female upon moving increases, hence it requires a much higher wage offer to the male to compensate for such a loss. So, the hazard rate for nonlocal offers decreases as the wage of the spouse increases. The line with the arrows plots the total hazard rate for the male as a function of the spouse wage. This hazard rate includes not only the hazard rate generated by the male but also the hazard rate generated by the female. As the wage of the female increases, it becomes less likely for the female to receive a better nonlocal offer. So,

the hazard rate generated by the female also decreases as the wage of the female decreases. In total, the total hazard rate for a spouse is decreasing in the wage of the other spouse. This is the main reason why we observe a lower mobility rate for single earner households.



(a) Males

(b) Female

Figure 5: Hazard Rate for Non-local Offers - Married vs Single

Figure 5(a) and 5(b) also compare the total hazard rate of a single and married individual earning the same current wage. In Figure 5(a), we see this comparison for the male. A single male currently earning the mean wage has always a higher non-local hazard rate compared to his married counterpart regardless of the wage of his spouse. As expected the hazard rate of the married generated only by the moves of the male (line with diamonds) is always smaller than the hazard rate for the single. Compared to a single, married individual is tied to the spouse. As a result, the male has to reject some non-local offers that he would not reject if he were a single, i.e. becomes a tied-stayer. This decreases his hazard rate generated by his labor market opportunities. However, as we said earlier, the married individual can also move due to his wife's labor market opportunities. Since his wife can also potentially receive a non-local offer which might be acceptable to the couple, the total hazard rate of the male increases. As we see in Figure Figure 5(a), the total hazard rate for the male (line with arrows) is always greater than or equal to the hazard rate generated by his labor market

opportunities (line with diamonds). However, with the current calibration, the increase in the total hazard rate of the male generated by the female's labor market opportunities cannot compensate for the decrease in his hazard rate generate by his own labor market opportunities. Hence the total hazard rate of the married male is always smaller than the one for the single male. The main reason for this fact is the gender wage gap between the male and the female. Since the wage offer distribution of the male has first-order stochastic dominance over the wage offer distribution of the female, the increase in then total hazard rate of the male generated by the female's labor market opportunities is not big. So, this cannot compensate the decrease in the total hazard rate of the male (due to being a tied-stayer) generated by his own labor market opportunities.

However, the same comparison for the female reveals a different picture. As can be seen in Figure 5(b), although the hazard rate of the married female generated by her own labor market opportunities (line with diamonds) is smaller than her hazard rate as a single (line with circles), the total hazard rate of the married female is higher than the one for the single female, especially when the wage of the husband is sufficiently low. When the wage of the husband is really low, thanks to the wage offer distribution of the male, it is likely that the female can see an increase in her hazard rate when married due to the higher probability of male generated moves. Such an increase can easily offset the decrease in the married female hazard rate due to her own labor market opportunities.

5.2 Counterfactual: Increase in the Gender Wage Gap

Now, we turn to the main exercise of our paper. To understand the effect of the change in the gender wage gap on the mobility patterns of different types of households, we run the following counterfactual. We change the mean of the wage offer distribution of the male and female such that, the mean wage offer in the aggregate economy does not change and the gender wage gap between the female and male increases to the level we see in the data for 1970s. More specifically, we set the mean of the wage offer distribution for the male and female such that the gender wage gap at the mean wage offer is now 0.59 and the mean wage offer overall is the same as benchmark economy. Table 5 presents the results of this exercise.

Composition: As the gender wage gap increases from 83% to 59%, we observe the share of dual earners decrease from 65% to 52%. The main reason for this decrease is the decrease in the labor market attachment of the females. As the mean of the wage offer distribution for the female decreases, keeping the value of home production constant, the value of being employed decreases for the females. So, females exit the labor force and they become less attached to the labor market. Since the marriage rate is constant by construction (marriage and divorce probabilities are exogenous and constant), an immediate consequence of

Moment	Data	Benchmark	Counterfactual
gender gap	83%	83%	59%
share of married	70%	70%	70%
share of dual earners[1]	66%	65%	52%
share of single earners[1]	31%	31%	42%
mobility rate	0.93%	0.95%	1.07%
married vs single mobility	63%	57%	85%
single mobility	1.29%	1.36%	1.20%
married mobility	0.81%	0.77%	1.02%
single earner mobility	1.31%	1.18%	1.21%
dual earner mobility	0.51%	0.31%	0.37%

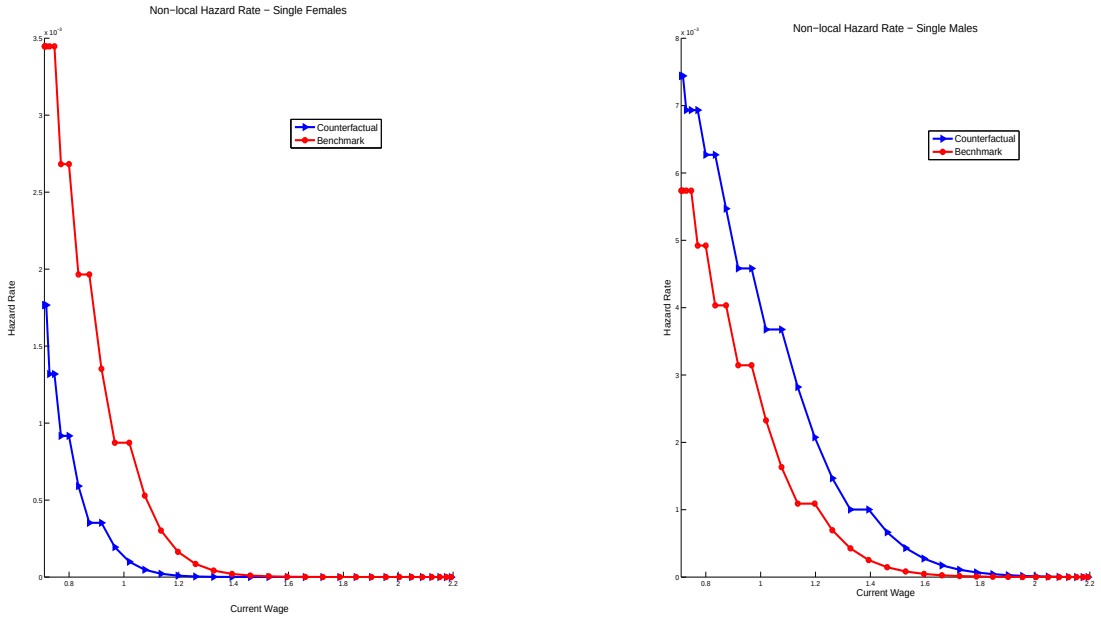
[1]Out of married couples

Table 5: Counterfactual: The Effect of an Increase in Gender Wage Gap

a decrease in the share of dual earners is the increase in the share of single earners. In the counterfactual, the share of the single earners increases from 31% to 42%.

Aggregate Mobility: The effect of the increase in the gender wage gap on the mobility patterns is the main focus of this paper. Table 5 shows that an increase in the gender wage gap increases the aggregate mobility from 0.95% to 1.07%. Decomposing the change in the aggregate mobility into single and married mobilities, we see that it is the change in the married mobility rate which generates this change. The counterfactual results suggest that the married mobility rate increases from 0.77% to 1.02% whereas the single mobility rate decreases from 1.36% to 1.20%. Notice that there is no compositional change in terms of married vs single in the population. So, the whole increase in the aggregate mobility comes from the relative change of the mobility rates of married and single. The relative mobility of married couples compared to singles increases from 57% to 85%. This is what generates the increase in the mobility rate.

Singles Mobility: The mobility rate of singles changes due to two mechanical reasons. Since the mean of the wage offer distribution for the single female decreases, the mobility of the single females should decrease. This can be seen in Figure 6(a) which plots the hazard rate of single females for non-local offers in both economies. Similarly, as Figure 6(b) shows, the hazard rate of single males for non-local offers increases since the mean of the wage offer distribution for the male increases. The hazard rate function is a convex function of the current wage. As a result, the change in the hazard rate of the single females dominates the change in the hazard rate of the single males, and we observe a decrease in the mobility rate of the singles.



(a) Females (b) Males

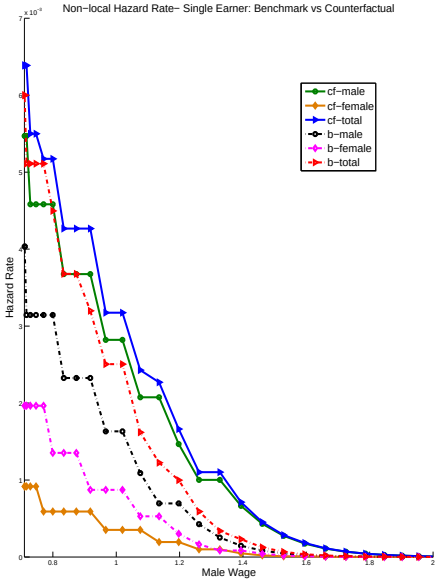
Figure 6: Hazard Rate of Singles for Non-local Offers - Benchmark vs Counterfactual

Married Mobility: As the gender wage gap increases, the mobility rate of the married individuals increases from 0.77% to 1.02%. This makes a change of 0.25% in levels and 25% drop in relative terms from counterfactual to benchmark economy. Recall that in the data the married mobility has fallen from 1.53% in 1981 to 0.81% in 2012. In level terms the exogenous model explains 35% (i.e. 0.25/0.72) of the overall drop in family migration. There are two reasons for this change. The first one is the compositional effect. As we documented earlier, the mobility rate of the single-earner households is significantly higher than the mobility rate of dual-earner households. As the gender wage gap increases, the share of single-earner households increases from 31% to 42%, and the share of dual-earner households decreases from 65% to 52%. As a result of this compositional change the aggregate mobility rate of married households increases. If we keep the mobility rate of single-earner and dual-earner households as in the benchmark economy, but use the share of these households in the counterfactual, we observe that the aggregate mobility rate of the married individuals increases from 0.77% to 0.95%, i.e. compositional changes can explain 72% of the change in the mobility rate of the married individuals. The rest, 28%, of the increase is due to the within-group changes in the mobility. As we can see from Table 5, the

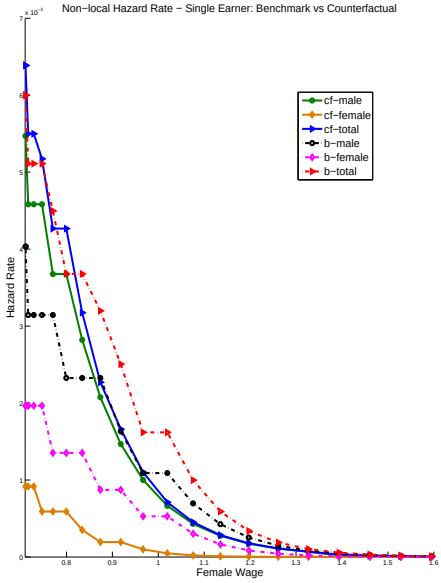
mobility rate of single-earner households increases from 1.18% to 1.21%, and the mobility rate of dual-earner households increases from 0.31% to 0.37%. To better understand the within-group changes in the mobility, we separately analyze the change in the mobility of single-earner and dual-earner households.

Single-Earner Households: Figure 7(a) plots the hazard rate of single-earner married household as a function of the current wage of the male for both economies. As expected, since females have a lower mean wage in the counterfactual, the hazard rate generated by female is lower in the counterfactual (solid line with diamonds) than in the benchmark (dashed line with diamonds). On the contrary, the hazard rate generated by males in the counterfactual (solid line with circles) is higher than the one in the benchmark (dashed line with circles). Again, the reason for this change is the higher mean offer in the counterfactual economy for the males. The change in the total hazard rate depends on which effect dominates. With the current calibration, we have the effect on the male dominating, and the counterfactual economy results a higher hazard rate for the single earner households (solid line with arrows) as a function of male wage compared to the benchmark economy (dashed line with arrows). Figure 7(b) plots the same picture as a function of female's wage. Here we can see that for lower wages of the female, we observe a higher hazard rate in the counterfactual whereas for higher wages of the female, the opposite is true. However, notice that these higher wages have very low probability of occurrence in the counterfactual economy considering the mean and standard deviation of the female wage offer distribution.

Dual-Earner Households: Figure 8(a) plots the hazard rate of a dual-earner household as a function of the wage of the male when the female is currently employed at the mean observed wage for the females in the benchmark, which is 1.02. Similarly, Figure 8(b) plots the hazard rate of a dual-earner household as a function of the female's wage when the male is employed at the mean observed wage for the males, which is 1.2. The common theme in both figures is the fact that the hazard generated by the female in the counterfactual (solid line with diamonds) is always smaller than the one in the benchmark (dashed line with diamonds), whereas the hazard rate generated by the male in the counterfactual (solid line with circles) is higher than the one in the benchmark (dashed line with circles). However, in both cases, the change generated by the male dominates, and the total hazard rate in the counterfactual (solid line with arrows) is higher than the one in the benchmark (dashed line with arrows).

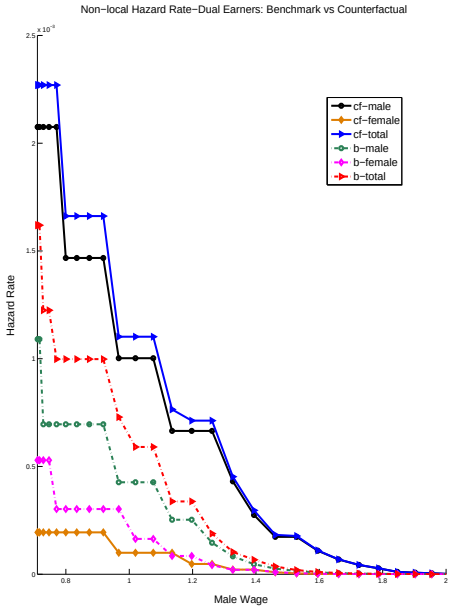


(a) Males

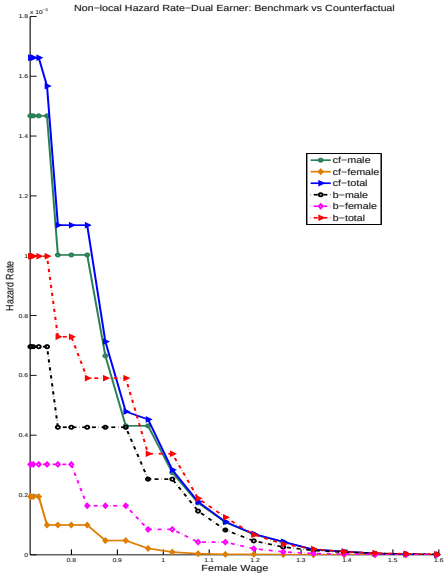


(b) Females

Figure 7: Hazard Rate of Single-Earners for Non-local Offers - Benchmark vs Counterfactual



(a) Males



(b) Females

Figure 8: Hazard Rate of Dual-Earners for Non-local Offers - Benchmark vs Counterfactual

Finally we decompose the mobility change in the single earner and dual earner families into type of moves (i.e. male generated vs female generated). Table 6 describes the mobility rates of families by different earner status and by type of moves. When we increase the gender wage gap single earner mobility increases from 1.18% to 1.21%. In relative terms this is a drop of 3% from counterfactual to benchmark economy. This slight drop is due to an increase in the male generated mobility that moves from 0.80% to 1.09%. Although female generated mobility moves from 0.39% to 0.12% in the counterfactual economy, the overall change is dominated by the change in the male generated moves. For dual earners the observation is the same. Overall dual earner mobility moved from 0.31% to 0.37% which is a relative change of 16%. Observe that we have a higher mobility change for dual earner families compared to single earners in relative terms. However the mechanism that makes the change in dual earner mobility is similar to to the single earner case: the male generated mobility increases from 0.21% to 35% and it dominates the drop of female earner mobility from 0.09% to 0.03%. In the counterfactual economy where the gender wage gap is wider, more than 90% of the family migration (both single and dual earner) are generated by the males, in the benchmark economy this share drops below 70%. Thus we conclude that although women's increasing labor force attachment gives them a higher role for generating family migration it induces a higher drop in the male generated moves. This creates some additional tied male movers in the benchmark economy however it also creates even greater number of tied male stayers.

Moment	Benchmark	Counterfactual
gender gap	83%	59%
single earner mobility	1.18%	1.21%
single earner mobility by male	0.80%	1.09%
single earner mobility by female	0.39%	0.12%
dual earner mobility	0.31%	0.37%
dual earner mobility by male	0.21%	0.35%
dual earner mobility by female	0.09%	0.03%

Table 6: Counterfactual: Single vs Dual Earner Mobility by Type of Move

6 Endogenous Marriage and Divorce

So far we have ignored the fact that singles can endogenously decide on getting married depending on characteristics of each other and couples can endogenously choose to divorce upon realization of a change in the characteristics of either one of the spouse. One might argue that using a model with exogenous marriage and divorce for the exercise of comparing two economies with different gender wage gaps is misleading since it abstracts from the fact

that the share of married couples in the population has been declining since the 1970s. In this section we introduce the decisions of marriage and divorce to remedy that problem.

Here we preserve the main structure of the exogenous model. Therefore we briefly describe the new features concerning the single and married households.

Preferences: Single individuals have the same preferences as in the previous section. Married households pool their income and receive non-monetary benefit/cost from marriage:

$$u_i^m(w_i, w_j) = \frac{w_i + w_j}{\theta} + \chi_i \tag{12}$$

Here w_i is the current wage of the individual i, and w_j is the current wage of his/her spouse. θ is specified to an extent that it reflects the economies of scale due to consumption of common goods within a family. One may think of this as the monetary benefit of being married. A married individual of type i also derives utility independent from the income and specific to the current marriage, χ_i. This match specific utility can be different between spouses, however it is constant during the course of the marriage. One may think of this as the love component of the marriage.

Marriage Choice: We allow single individuals to meet with other singles from both locations with rate λ_l from the local market and λ_n from the non-local market. Once they meet, each partner separately draws a random love shock χ_i, χ_j from the distributions P_i, P_j. A marriage occurs only if both individuals agree to marry. This happens if the value of marriage is higher than the value of staying as a single for each spouse.

First consider the singles matching from the local market. Denote $I_i^{s,m_l}\left(\chi, w_i, w_j\right)$ as the indicator function for the accept/reject decision of individual i with wage w_i meeting in the local market with individual j with wage w_j and each partner receives love shocks of $\chi_i, \chi_j \in \chi$ upon realization of the match. Then we have the decision of marriage for individual i as follows:

$$I_i^{s,m_l}\left(\chi, w_i, w_j\right) = \begin{Bmatrix} 1 & if & V_i^m\left(\chi, w_i, w_j\right) > V_i^s\left(w_i\right) \\ 0 & o.w. & \end{Bmatrix}. \tag{13}$$

Marriage decision from the non-local market is slightly more involved. If the other partner is in a non-local market, partners also need to decide which location to live conditional on marrying. In such a case the moving partner has to quit her job if she is currently employed. We construct that the marriage is realized at the location of individual type i if both spouses agree on the terms of marriage and the joint benefit of being married in location i is greater than the joint benefit of being married in location j. Specifically, denote $I_i^{s,m_n}\left(\chi, w_i, w_j\right)$ as the indicator function for the accept and move decision of individual i

with wage w_i meeting individual j with wage w_j and each partner receives love shock of $\chi_i, \chi_j \in \chi$. Then we have the decision of marriage and moving to the other location for individual i as follows:

$$I_i^{s,m_n}\left(\chi, w_i, w_j\right) = \begin{Bmatrix} 1 & if & V_i^m\left(\chi, z, w_j\right) + V_j^m\left(\chi, w_j, z\right) > V_i^m\left(\chi, w_i, z\right) + V_j^m\left(\chi, z, w_i\right) \\ & & and \\ & & I_i^{s,m_l}\left(\chi, z, w_j\right) I_j^{s,m_l}\left(\chi, w_j, z\right) = 1 \\ 0 & o.w. & \end{Bmatrix}. \quad (14)$$

The rest of the decisions directly follow from the previous section. We formulate the singles' problem with endogenous marriage decision in Appendix.

Couples: We first introduce the notion of endogenous divorce for a couple. Upon realization of any change we allow for unilateral divorce. Consider a couple with the following state variables: $\left(\chi, w_i, w_j\right)$. If spouse i receives an unemployment shock, both spouses evaluate the value of being married for the new state. The couple stays married only if both spouses still agree on the terms of marriage (i.e. if $I_i^{s,m_l}\left(\chi, z, w_j\right) I_j^{s,m_l}\left(\chi, w_j, z\right) = 1$).

We now present job accept/reject and move/stay decisions with endogenous divorce for the couples. We start with local job offer coming to individual i. Consider a couple with the following state variables: $\left(\chi, w_i, w_j\right)$. If spouse i receives a local offer w_i', then couple has three options: (1) spouse i accepts the offer and spouse j stays employed at the current wage, (2) spouse i accepts the offer and they get divorced, and finally (3) spouse i rejects the offer.[16] We denote $I_i^{m,a_l}\left(\chi, w_i', w_i, w_j\right)$ as the indicator function for the first option, i.e. $I_i^{m,a_l}\left(\chi, w_i', w_i, w_j\right) = 1$ if spouse i accepts the offer and spouse j stays employed at the current wage, and $I_i^{m,a_l}\left(w_i', w_i, w_j\right) = 0$ otherwise. Since the couple chooses the option which maximizes the total value of marriage, I_i^{m,a_l} is characterized as follows:

$$I_i^{m,a_l}\left(\chi, w_i', w_i, w_j\right) = \begin{Bmatrix} 1 & if & V_i^m\left(\chi, w_i', w_j\right) + V_j^m\left(\chi, w_j, w_i'\right) > \\ & & \max\left\{V_i^m\left(\chi, w_i', z\right) + V_j^m\left(\chi, z, w_i'\right), V_i^s\left(w_i'\right) + V_j^s\left(w_j\right)\right\} \\ & & and \\ & & I_i^{s,m_l}\left(\chi, w_i', w_j\right) I_j^{s,m_l}\left(\chi, w_j, w_i'\right) = 1 \\ 0 & o.w. & \end{Bmatrix}. \quad (15)$$

Note that in order this decision to take place, both spouses need to agree on the terms of marriage for the case where spouse i takes the new offer.

Similarly, we denote $I_i^{m,d_l}\left(\chi, w_i', w_i, w_j\right)$ as the indicator function representing the second option, i.e. spouse i accepts the offer and the couple gets divorced. Lastly, $I_i^{m,r_l}\left(\chi, w_i', w_i, w_j\right)$

[16] We drop the option of other spouse quitting from her job since it is overruled in the previous section.

denotes the indicator function for the third option, i.e. spouse i rejects the offer and spouse j stays employed at the current wage. $I_i^{m,d_l}\left(\chi, w_i', w_i, w_j\right)$ is characterized as follows:

$$I_i^{m,d_l}\left(\chi, w_i', w_i, w_j\right) = \begin{Bmatrix} 1 & if & V_i^s\left(w_i'\right) > V_i^m\left(\chi, w_i, w_j\right) \\ & & and \\ & & I_i^{m,a_l}\left(\chi, w_i', w_i, w_j\right) = 0 \\ 0 & o.w. & \end{Bmatrix}. \tag{16}$$

Note that since the couple maximizes the sum of the values for both spouses, we overrule certain cases of divorce when accepting the offer is strictly better for the couples as a sum (i.e. if $I_i^{m,a_l}\left(\chi, w_i', w_i, w_j\right) = 1$). The couple rejects the offer, $I_i^{m,r_l}\left(\chi, w_i', w_i, w_j\right) = 1$, if none of these decisions are taken.

Now, consider the case when spouse i receives a non-local offer w_i', with couple having the following state variables: $\left(\chi, w_i, w_j\right)$. Again, couple has three options: (1) spouse i accepts the offer, spouse j quits the job and they relocate, (2) spouse i accepts the offer but relocates as a single by divorcing spouse j, and (3) spouse i rejects the offer. Denoting $I_i^{m,q_n}\left(\chi, w_i', w_i, w_j\right)$ as the indicator function for the first option, i.e. spouse i accepts, spouse j quits and the couple relocates, the equation characterizing this decision is as follows:

$$I_i^{m,q_n}\left(\chi, w_i', w_i, w_j\right) = \begin{Bmatrix} 1 & if & V_i^m\left(\chi, w_i', 0\right) + V_j^m\left(\chi, 0, w_i'\right) - \kappa > \\ & & \max\left\{V_i^m\left(\chi, w_i', 0\right) + V_j^m\left(\chi, 0, w_i'\right), V_i^s\left(w_i'\right) + V_j^s\left(w_j\right) - \kappa\right\} \\ & & and \\ & & I_i^{s,m_l}\left(\chi, w_i', 0\right) I_j^{s,m_l}\left(\chi, 0, w_i'\right) = 1 \\ 0 & o.w. & \end{Bmatrix}. \tag{17}$$

Similar to the local job offer case we denote the second option, i.e. spouse i accepts the offer the couple gets divorced and individual i moves as a single, as $I_i^{m,d_n}\left(\chi, w_i', w_i, w_j\right)$ and characterize the decision problem as:

$$I_i^{m,d_n}\left(\chi, w_i', w_i, w_j\right) = \begin{Bmatrix} 1 & if & V_i^s\left(w_i'\right) - \kappa > V_i^m\left(\chi, w_i, w_j\right) \\ & & and \\ & & I_i^{m,q_n}\left(\chi, w_i', w_i, w_j\right) = 0 \\ 0 & o.w. & \end{Bmatrix}. \tag{18}$$

Lastly the couple rejects the offer, $I_i^{m,r_n}\left(\chi, w_i', w_i, w_j\right) = 1$, if none of these decisions are taken. Given the indicator functions, we formulate the problem of the couple in Appendix.

6.1 Calibration

We follow a similar calibration strategy as in the previous section with exogenous model, however we now have additional model parameters hence additional targets. We once again set the exogenous parameters at the values of the previous section, except for singles matching rate, λ, for reasons that we will describe below. We then proceed to the model parameters that are calibrated within the model.

We have two parameters coming from the utility function of married individuals: Consumption equivalence parameter, θ, is set to 1.6 to capture the economies of scale in a 2 person household.[17] We set two point distribution for the nonmonetary component of marriage, (i.e. $\chi_i \in \chi_l, \chi_h$). Before calibrating the values and the probability distribution it is useful to introduce the new features of the model.

Introduction of endogenous marriage and divorce brings two new aspects: first not every single would decide to marry upon matching with each other. We allow singles to meet for marriage purposes from both locations, therefore we have instances where singles from different locations meet with each other, decide to get married and one of them moves to the other's location. We label these instances as marriages with mobility. We use the CPS March Supplement from 2005 to 2012 to see whether just one family member makes an interstate move within previous year. For those who are in such condition we check whether this move is due to a change in marital status.[18] If only one spouse makes an interstate move and reports the change in marital status as the major factor, we assume that this is due to a match from different location as it happens in the model. From 2005 to 2012, 2.49% of the total family moves end up one partner having move to another state due to marital status change.

We then identify the model parameters that capture this new moment. The terms of marriage for inside matches is conditional on the wages of both individuals, (w_i, w_j), and independent love shocks of both individuals, (χ_i, χ_j). The terms of marriage for outside matches also depends on the cost of moving, κ. The share of matches depends on the overall matching rate, λ, and the probability distribution of love shock for males p_{mh}, p_{ml} and females p_{fh}, p_{fl}. We also have some share of matches from outside with rate $\frac{\lambda_n}{\lambda_l+\lambda_n}$.

The second new aspect of the current model is that the individuals may choose to divorce each other upon a change in the household. This endogenous divorce decision depends on the current wages of spouses, their love value and a received offer from either inside or outside. The rate of endogenous divorce depends on the rate of offers and employment separation shocks. We also have some divorces due to offers coming from outside. When a

[17] Fernandez-Villaverde and Krueger (2007) report estimates of consumption equivalance ranging between 1.06 and 1.7. OECD has an estimate of 1.7 in the early 1980s and 1.5 in the late 1990s. We pick the average of these two estimates.

[18] CPS March Supplement asks migrants to list their major reason for move since 1999.

Parameter	Value	Description
$\alpha_l + \alpha_n$	0.18	job offer rate
λ	0.0061	couples matching rate
$\sigma_m = \sigma_f$	0.17	std. dev. of wage offers
$\frac{\alpha_n}{\alpha_l+\alpha_n}$	0.05	nonlocal job offer rate
κ	0.7	moving cost
χ_h (χ_l)	0.275 (-0.275)	marriage benefit (cost)
pr_{fl}	0.75	probability of marriage cost (female)

Table 7: Calibration: Endogenous Model

couple decides to divorce due to an economic change in the family we label this as divorce due to financial reasons. National Fatherhood Initiative conducts a national marriage survey in the US in 2003 and asks detailed questions about marriage and divorce patterns. In that survey the couples who report to have a divorce are then asked to list reasons why their marriages fail. Out of 416 couples whom ever divorced 118 of them choose financial reasons as a major factor in that outcome. This makes the share of divorces due to financial reasons as 28%.

We pick the model parameters such that we match the moments from the previous section and the two additional moments, the share of single moves with marriage and the share of married moves with divorce. We set the share of singles matching from outside to the share of offers coming from outside (i.e. $\frac{\lambda_n}{\lambda_l+\lambda_n} = \frac{\alpha_n}{\alpha_l+\alpha_n}$). We pick the value of love shocks as symmetric, $\chi_h = -\chi_l$, and we normalize the mean value for the males, i.e. $pr_{mh} = pr_{ml} = 0.5$. After these normalizations we are left with 2 parameters. Table 7 summarizes the within model calibration of endogenous model. A quick snapshot of the calibration with endogenous model yields that the parameters in the endogenous model follows the parameters in the exogenous model with slight differences. The main difference is the singles matching rate, λ, being bigger in the endogenous marriage model since not every match turns out to be a successful marriage.

6.2 Results

Similar to the previous section we first start with the presentation of results for the benchmark economy representing early 2000s. Then, we will present the results for our counterfactual, which represents the US economy in 1970s.

As we can see from Table 8 the fit of the data with original moments follows directly from the previous section, hence our new parameters do not change the initial fit of the model. The model performs slightly worse in terms of explaining the two new targets. The model generates the share of moves with marriages out of total married moves as 4.62% against the actual target 2.49%. Similarly the share of divorces due to financial reasons is

58% in the model whereas it is 28% in the data. Main reason behind this is not having a more precise love shock distribution. This will be more clear when we explain the marriage decision.

Moment	Data	Model
gender gap	83%	83%
share of married	70%	66%
share of dual earners[1]	66%	65%
share of single earners[1]	31%	31%
mobility rate	0.93%	0.98%
married vs single mobility	53%	52%
share of moves with marriages	2.49%	4.62%
divorces due to econ.	28%	58%
single mobility	1.29%	1.34%
married mobility	0.81%	0.79%
single earner mobility	1.31%	1.24%
dual earner mobility	0.51%	0.32%

[1] Out of married couples

Table 8: Benchmark Results - Endogenous Model

Marriage Decision: When an individual of type i with wage w_i meets a partner j with wage w_j they decide on marrying or not based on the wages and their random love shocks separately drawn for each spouse. Hence we have an accept/reject decisions for 4 different cases of love distribution: (χ_l, χ_l),(χ_h, χ_l),(χ_l, χ_h),(χ_h, χ_h). Figure 9 characterizes the consensual decision of spouses with different wages and love shocks. Blue area represents the region where they both agree on the terms of marriage. For the case where both spouses have high marriage values, (χ_h, χ_h), they always choose to marry regardless of the wage of the spouse. When female has a low draw of marriage utility she rejects more often and prefers the potential husband to have high wage. The same is true for the case when the male has a low draw of love utility. Each individual prefers his/her spouse to have high wage. In the current parametrization the majority of the married couples are concentrated on high love shock case, i.e. (χ_h, χ_h). Out of 61% of the total married couples 58% lie in that case. Thus, it is not surprising that the model does not match the share of moves with divorces out of total married moves. For the couples that both have high love component, there is no endogenous divorce in the current parametrization. Hence the model at the moment simply does not have enough flexibility to generate this type of variation.

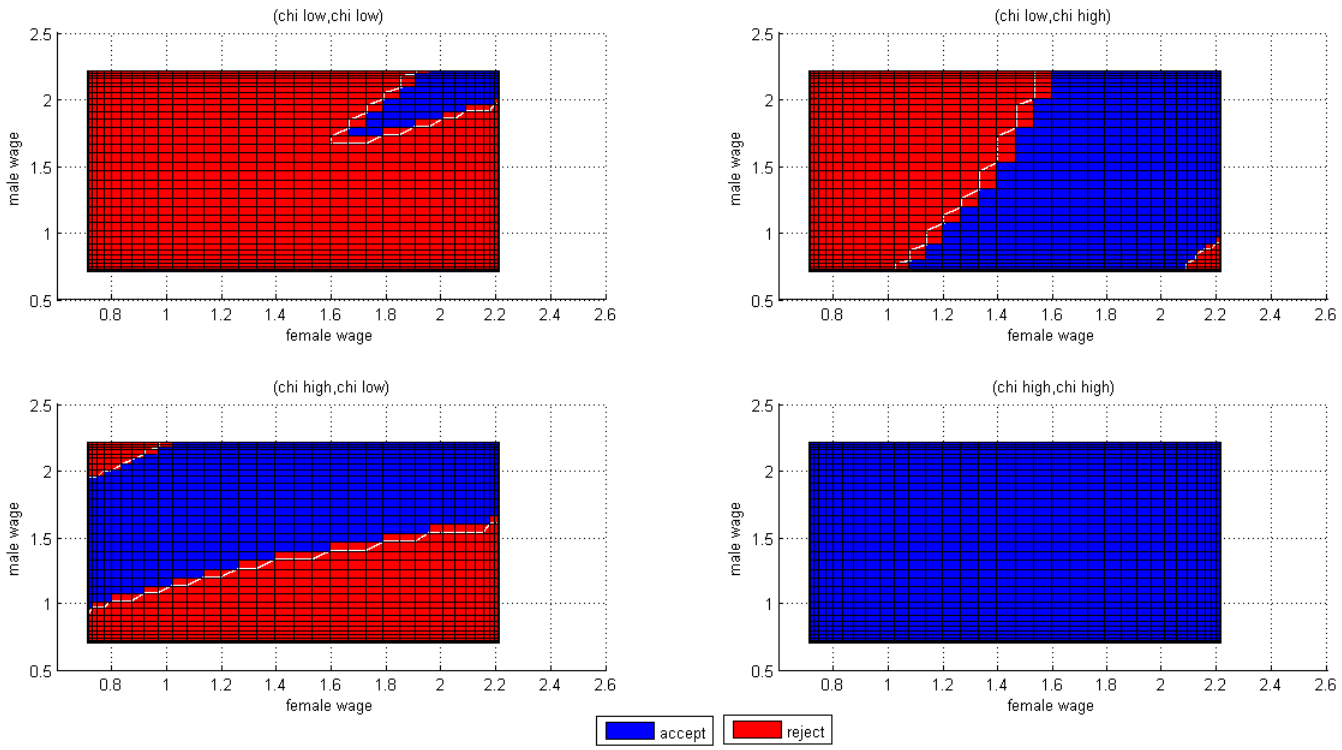


Figure 9: Regions of Marriage via Wages

6.2.1 Counterfactual: Increase in the Gender Wage Gap

We repeat the same counterfactual exercise as in the exogenous model, drop the mean wage offer for females to reflect the gender wage gap of 1970s. Table 9 presents the results of this exercise.

Share of Married: Since we allow individuals to have endogenous marriage and divorce choices, the share of married couples in the counterfactual economy changes from 66% to 73%. This is consistent with the trends in marriage. The relative composition of dual earner and single earner families within married households have virtually the same shares as in the counterfactual exercise with exogenous model. Therefore the workings of the model follow the exogenous specification to a great extent.

Aggregate Mobility: Table 9 shows that an increase in the gender wage gap increases aggregate mobility from 0.98% to 1.10%. Decomposing the change in aggregate mobility into single and married mobilities, we see that it is the change in the married mobility rate which generates this result. In the counterfactual economy the married mobility rate increases from 0.79% to 1.09% whereas the single mobility rate decreases from 1.34% to 1.14%. Notice that this result is obtained despite the fact there is also a compositional change in terms of married vs single share in the population. If we use the composition of married and single individuals as in the benchmark economy and have respective mobility rates from the counterfactual case we would have an aggregate mobility of 1.11%. Thus the compositional change from single households to married households has slightly decreased the aggregate mobility.

Moment	Data	Benchmark	Counterfactual
gender gap	83%	83%	59%
share of married	70%	66%	73%
share of dual earners[1]	66%	65%	52%
share of single earners[1]	31%	31%	41%
mobility rate	0.93%	0.98%	1.10%
married vs single mobility	63%	59%	96%
share of moves with marriages	2.49%	2.61%	3.92%
divorces due to econ.	28%	58%	64%
single mobility	1.29%	1.34%	1.14%
married mobility	0.81%	0.79%	1.09%
single earner mobility	1.31%	1.24%	1.31%
dual earner mobility	0.51%	0.32%	0.39%

[1] Out of married couples

Table 9: Counterfactual: The Effect of an Increase in Gender Wage Gap

Married Mobility: For the family migration we have similar results with the exogenous model: as the gender wage gap increases, the mobility rate of the married individuals increases from 0.79% to 1.09%. This reflects an increase of 0.30% in levels and 28% drop in relative terms from counterfactual to benchmark economy. Comparing to data, the level change in our model accounts for 42% of the overall change in the family migration. Again, there are two reasons for this change, compositional effect and within group effect. If we keep the mobility rate of single-earner and dual-earner households as in the benchmark economy, but use the share of these households in the counterfactual, we observe that the aggregate mobility rate of the married individuals increases from 0.79% to to 0.97%, i.e. compositional changes can explain 60% of the change in the mobility rate of the married individuals. Notice the contribution of within group changes has increased in the endogenous marriage model. In other words the difference between the counterfactual economies of the endogenous and exogenous marriage models is due to within group changes. Again we briefly decompose these within group changes into male and female generated moves.

Single vs Dual Earner Mobility: Table 10 describes the mobility rates of families by different earner status and by type of moves. When we increase the gender wage gap single earner mobility increases from 1.24% to 1.31%. In relative terms this is a drop of 5% from counterfactual to benchmark. As in the previous section this drop is due to an increase in the male generated mobility that moves from 0.82% to 1.22%. Since the majority of the moves for single earners are generated by males (66% in the benchmark economy) the overall change is dominated by the change in the male generated moves. For dual earners the observation is the same. Overall dual earner mobility moved from 0.32% to 0.39% which is a relative change of 21%. Similar to the single earner case this change is due to the change in the male generated mobility that increases from 0.22% to 37%. In the counterfactual economy where the gender wage gap is wider, more than 90% of family migration (both single and dual earner) is generated by the males, in the benchmark economy this share drops to 70%. Hence we conclude that the results from the exogenous marriage model still hold with even bigger magnitudes.

7 Conclusions and Future Work

We argue that changes in women's labor supply and changes in the economic role of wives within a family affect the mobility decisions of couples. We document that couples with similar incomes have lower migration propensities than otherwise identical couples do. Our theory is that a family with similar-income-spouses decline potentially many job offers coming from outside since the opportunity cost of moving is higher. Given that the share of dual income couples has increased substantially over the last 30 years we argue that this change

Moment	Benchmark	Counterfactual
gender gap	83%	59%
single earner mobility	1.24%	1.31%
single earner mobility by male	0.82%	1.22%
single earner mobility by female	0.41%	0.10%
dual earner mobility	0.32%	0.39%
dual earner mobility by male	0.22%	0.37%
dual earner mobility by female	0.10%	0.02%

Table 10: Counterfactual: Single vs Dual Earner Mobility by Type of Move

contributes to the decline in interstate migration that took place during the same time period. We use a labor search model with multiple locations and endogenous marriage and divorce decisions to quantify the effect of the change in women's labor force attachment on interstate migration. Our analysis suggests that without having any other amplifying source the change in the gender wage gap over the last 30 years explains 35% of the overall drop in family migration. Couples today increasingly face this relocation problem, and given the trends in the spousal earnings composition this problem will arguably become more common. Thus in aggregate terms the depressed migration due to this change is likely to be a permanent drop and we expect to see an even larger fall of migration in the future.

The fall in migration has strong implications for the both local and aggregate labor markets. The fact that people have to rely on local economic conditions more heavily with fewer opportunities available outside could result in lower job mobility for the employed, longer unemployment durations for the unemployed and in turn a less efficient economy in terms of matching jobs with the most suitable individuals. This sticky labor supply adjustment creates an aggregate friction which is often coined as mismatch in the literature.From the couples' point of view this means a slower recovery following an adverse shock. According to recent studies single men and women lost about 5 million jobs during the last recession, and have since gained back 90% of them. However couples only gained 22% of the 6 million jobs they lost during the same period.[19] We plan to investigate on these issues in future research.

[19]http://money.cnn.com/2012/08/15/news/economy/jobs-single-workers/index.html

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A Data Description & Results

The Complete list of variables used in the regression (1) in Section 2:

- husband's contribution of income to the total family income up to 4th order polynomial, log of the average family income for the first 4 months, indicator for no income families
- age, education indicators for both spouses (denoted as *_sp*), power couple indicator, race indicator, number of kids in the family, whether the family lives in a metropolitan area, indicator for housing tenure
- indicators for labor force participation, employment, self employment, joint labor supply and employment indicators (denoted as *_jnt*), whether the individual or the wife receives transfer payments, the share of earned income coming from self employment, 6 major industry dummies, couples working in the same industry indicator. The variables listed here are controlled for both spouses except the interaction terms.
- panel controls, number of years stayed in state, number of previous marriages, number of years into the current marriage, controls for the current state, previous state and the state of birth

Table 11: Mobility Regression : OLS

	32 month migration probability	
	coefficient	standard error
black	-0.00561	(0.00538)
hispanic	-0.00924	(0.00510)
owner	-0.0414***	(0.00347)
age 25-29	0.0362***	(0.00990)
age 30-39	0.0353***	(0.0104)
age 40-49	0.0409***	(0.0113)
age 50+	0.0535***	(0.0123)
age 25-29_sp	-0.0234**	(0.00773)
age 30-39_sp	-0.0235**	(0.00815)
age 40-49_sp	-0.0227*	(0.00895)
age 50+_sp	-0.0114	(0.0101)
basic school	-0.0263***	(0.00645)
high school	-0.0218***	(0.00496)
some college	-0.0210***	(0.00472)
basic school_sp	-0.0104	(0.00686)
high school_sp	-0.00480	(0.00515)
some college_sp	0.00628	(0.00485)
power	0.0100	(0.00656)
no. of kids	-0.00479***	(0.00116)
metro	-0.00150	(0.00318)
yrs. in state	-0.00500***	(0.000169)
labor	0.0383*	(0.0166)
labor_sp	0.0792***	(0.0199)
labor_jnt	-0.0684***	(0.0193)
employed	-0.0296	(0.0181)
employed_sp	-0.0697***	(0.0203)
employed_jnt	0.0373*	(0.0185)
self employed	0.00815	(0.0142)
self employed_sp	0.00762	(0.0114)
self share	-0.0197	(0.0111)
self share_sp	0.0174*	(0.00704)
transfer	-0.0134	(0.0129)
transfer_sp	0.00959	(0.00975)
same industry	0.00708	(0.00385)
no family wage	-0.000399	(0.0191)
log family wage	0.000402	(0.00210)
no. of marriages	0.0139***	(0.00291)
yrs. in marriage	0.000489*	(0.000229)
panel 01	-0.00146	(0.00344)
panel 04	0.0594***	(0.00400)
panel 08	-0.00630	(0.00351)
N	29776	

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

B Computational Algorithm

- Guess the observed distribution of singles (one for female, G_f^s and one for male, G_m^s). A natural starting guess is the wage offer distributions: F_f and F_m.
- Guess value functions: V_i^s and V_i^m (Again a natural guess is the value functions when individuals are independent. Can derive the value function analytically in this case)
- Solve for the policy functions and decision rules
- Update the value function until convergence for the value functions is achieved
- Simulate the economy for a sufficiently large number of individuals over a sufficiently longer period of time. Check whether steady state is achieved.
- Calculate the observed wage distribution of singles, and check for convergence. If convergence is not achieved update the guess.

C Value functions

Single's problem:

$$\rho V_i^s\left(w_i;G_j^s\right)=\begin{array}{c} u\left(w_i\right)+\alpha_l\int I_i^{s,a_l}\left(w_i',w_i\right)\left(V_i^s\left(w'\right)\right)dF_i\left(w'\right)+\alpha_n\int I_i^{s,a_n}\left(w_i',w_i\right)\left(V_i^s\left(w'\right)-\kappa\right)dF_i\left(w'\right)+\\ \lambda_l\int\sum_\chi\left[I_i^{s,m_l}(\chi,w_i,w_j)I_j^{s,m_l}(\chi,w_j,w_i)V_i^m\left(\chi,w_i,w_j\right)+(1-I_i^{s,m_l}I_j^{s,m_l})V_i^s\left(w_i\right)\right]dG_j^s\left(w_j\right)+\\ \lambda_n\int\sum_\chi\left[\begin{array}{c} I_i^{s,m_n}(\chi,w_i,w_j)(V_i^m\left(\chi,z,w_j\right)-\kappa)+I_j^{s,m_n}(\chi,w_j,w_i)V_i^m\left(\chi,w_i,z\right)+\\ (1-I_i^{s,m_n}-I_j^{s,m_n})V_i^s\left(w_i\right)\end{array}\right]dG_j^s\left(w_j\right)+\\ +\delta^i\left[V_i^s(z)\right]-\left(\delta^i+\lambda_l+\lambda_n+\alpha_l+\alpha_n\right)V_i^s\left(w_i\right)\end{array}$$

Couple's problem:

$$\rho V_i^m\left(\chi,w_i,w_j\right)=\left\{\begin{array}{c} u\left(w_i,w_j\right)+\chi_i+\\ \alpha_l\int\left[I_i^{m,a_l}(w_i',w_i,w_j)V_i^m\left(w_i',w_j\right)+I_i^{m,d_l}(w_i',w_i,w_j)V_i^s\left(w_i'\right)+I_i^{m,r_l}(w_i',w_i,w_j)V_i^m\left(w_i,w_j\right)\right]dF_i\left(w_i'\right)\\ +\alpha_n\int\left[\begin{array}{c} I_i^{m,q_n}(w_i',w_i,w_j)(V_i^m\left(w_i',z\right)-\kappa)+I_i^{m,d_n}(w_i',w_i,w_j)(V_i^s\left(w_i'\right)-\kappa)+\\ I_i^{m,r_n}(w_i',w_i,w_j)V_i^m\left(w_i,w_j\right)\end{array}\right]dF_i\left(w_i'\right)\\ \alpha_l\int\left[I_j^{m,a_l}(w_j',w_j,w_i)V_i^m\left(w_i,w_j'\right)+I_j^{m,d_l}(w_j',w_j,w_i)V_i^s\left(w_i\right)+I_j^{m,r_l}(w_j',w_j,w_i)V_i^m\left(w_i,w_j\right)\right]dF_i\left(w_j'\right)\\ +\alpha_n\int\left[\begin{array}{c} I_j^{m,q_n}(w_j',w_j,w_i)(V_i^m\left(z,w_j'\right)-\kappa)+I_j^{m,d_n}(w_j',w_j,w_i)(V_i^s\left(w_i\right)-\kappa)+\\ I_j^{m,r_n}(w_j',w_j,w_i)V_i^m\left(w_i,w_j\right)\end{array}\right]dF_i\left(w_j'\right)\\ +\delta^j\left[I_i^{s,m_l}\left(w_i,z\right)I_j^{s,m_l}\left(z,w_i\right)V_i^m\left(w_i,z\right)+\left(1-I_i^{s,m_l}\left(w_i,z\right)I_j^{s,m_l}\left(z,w_i\right)\right)V_i^s\left(w_i\right)\right]\\ +\delta^i\left[I_i^{s,m_l}\left(z,w_j\right)I_j^{s,m_l}\left(w_j,z\right)V_i^m\left(z,w_j,z\right)+\left(1-I_i^{s,m_l}\left(z,w_j\right)I_j^{s,m_l}\left(w_j,z\right)\right)V_i^s\left(z\right)\right]\\ +2\varphi V_i^s\left(w_i\right)-\left(2\alpha_l+2\alpha_n+\alpha_l+\delta^i+\delta^j+2\varphi\right)V_i^m\left(w_i,w_j\right)\end{array}\right\}$$