Family Migration and Labor Market Outcomes*

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Abstract

Spousal considerations are important determinants of male and female job search behavior and choice of location. The goal of this paper is to assess the implications of joint location constraints on the migration patterns, labor market outcomes, and marital stability of men and women. A model of household migration decisions in a dynamic framework with intra-household bargaining is developed and estimated using the PSID. Results show that family ties related to migration decisions hinder mobility and wage growth. Without family ties 25 percent of men and 23 percent of women move, whereas when married only 18 percent move. Without family ties men's and women's wages are 10 and 3 percent higher, respectively, compared to when they are married. Also, without location ties divorce rates fall from 24 to 16 percent.

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1 Introduction

Joint migration decisions have become increasingly relevant in the modern labor market with the rising labor force attachment of women. Spousal considerations are important determinants of male and female job search behavior and choice of location. Family ties deter job mobility between locations, thereby limiting the ability of spouses to simultaneously pursue their job opportunities. One or both partners usually end up compromising their career opportunities in other locations in order to be able to stay together. If married individuals move in response to their spouses' job opportunities as well as their own, then their labor market decisions can be considerably different than those of single individuals. In some circumstances, such location constraints may also have a negative impact on marital stability.

To what extent do such location ties matter for wage growth and family stability? Evidence from the Panel Study of Income Dynamics suggest that location ties may be strongly linked to migration patterns, labor market outcomes and divorce patterns. It is well documented that married people move much less frequently compared to singles. However, consequences of migration, such as employment and wage profiles, differ markedly by marital status also. Figure 1 shows that married men who move at least once during the course of their marriage have on average higher wages than those who never move, where a move is defined as a change of location between two consecutive years.[1] For married women, however, there is no significant difference by migrant status. As seen in Table 1, married women are also less likely to remain employed following a move. These gender differences are not observed for single men and women, for whom migration is associated with higher wages, and for whom the likelihood of remaining employed following a move is similar.[2] Also, divorce rates are higher in periods that involve a relocation for the family. In particular, approximately six percent of divorces are those that are accompanied by a relocation of at least one of the spouses.

As the above descriptive analysis suggests, marriage is a potential impediment to mobility and hence wage growth. However, the selective nature of marriage makes it difficult to attribute lower mobility and lower wage growth solely to family ties. The above analysis also suggests that location constraints are linked to higher marital instability. However, location and marital status are outcomes that are jointly determined. Therefore, it is hard to draw conclusions about the direct effect of migration ties on divorce rates from these observations alone. The strong link between marital status, migration trends, and labor market outcomes renders necessary an analysis that puts

[1] A location is defined as a Census Division in the United States. Census divisions are groupings of states that have been defined by the U.S. Census Bureau for the purpose of data presentation. There are nine census divisions in the United States. See Appendix for a list of the Census divisions.

[2] The empirical patterns observed for the wages and employment rates by migrant status also holds after controlling for the education for married people. This is presented in more detail in the data section.

emphasis on the family aspect of migration behavior. However, the large literature on migration in economics mostly disregards the family aspect of migration and treats the household as a single unit rather than a collection of agents. There has only been a few studies on the subject since the seminal work of Mincer (1978), which emphasized the erroneous inferences one can make about the determinants and consequences of migration if one disregards the family component to it.[3]

The purpose of this paper is to quantify the inhibiting effect of location ties on location mobility, wage growth and marital stability, by developing and estimating a dynamic model of married couples' decisions regarding geographic location and employment status in a framework with intra-household bargaining. It theoretically and empirically analyzes migration in a dynamic framework distinguishing between individual and family decisions, characterizing each household member with individual preferences.[4] This framework allows for a rich representation of the tradeoffs that a couple faces in making employment and migration decisions. It also permits conducting counterfactual experiments that help quantify the implications of location ties on migration rates, labor market outcomes and family stability.

The model incorporates household decision problem in a dynamic search framework with uncertainty, allowing for differences in wage offer distributions between locations as well as between men and women, with intra-household bargaining, endogenous experience accumulation and the possibility of divorce. Each year a married couple makes decisions about consumption, location, employment and divorce. The spouses' respective shares of the total household utility are determined in a Nash bargaining framework with the threat point specified as the value of divorce. Upon divorce, individuals continue to make consumption, employment and migration decisions alone. The household chooses among multiple locations that differ in terms of their wage offer distributions and non-pecuniary benefits. In addition to location, wage offer distributions differ by gender, education and labor market experience, which accumulates endogenously. Gains from marriage are determined by a marriage utility that evolves stochastically over time. Agents also face uncertainty regarding their wage offers, value of leisure and moving cost. Differences between spouses in their wage draws and value of search in other locations are two reasons why spouses might prefer to reside in different locations when taking only their private calculus of migration into account. Utility is transferable so that such conflicts are resolved through intra-household transfers as long as gains from marriage exceed the total location ties, defined as the measure of negative private externalities incurred due to family migration. When total ties exceed total gains from marriage, divorce occurs, which is an efficient outcome. The model is structurally estimated using data from the Panel Study of Income Dynamics, which has detailed information on employment, wage and location his-

[3]The literature on family migration is briefly summarized at the end of this section.

[4]Mazzocco (2007) shows that the solution to the standard unitary model is equivalent to a collective model of the household with full commitment only under certain conditions. He also shows that when there is no commitment, household intertemporal behavior cannot be represented using the unitary model.

tories of married couples between the years 1968 and 1997. It is estimated by simulated method of moments, which minimizes a weighted average distance between a set of sample moments and moments simulated from the model (McFadden (1989)).

The estimated model provides evidence on the structural differences between men and women in preferences and labor market environments they face within and between locations. Moreover, it shows it is these gender differentials that give rise to the fact that family ties hinder mobility and that migration has such different consequences for the labor market outcomes of men and women. This is due to two important features of the estimated model. First, correlation between spouses' wage offers within and between locations is low. Specifically, for each location, there are considerable differences in the wage offer distributions between men and women: Some locations that have the highest mean wage offers for men are those that have the lower mean wage offers for women. Hence partners do not always prefer the same location, and probability of relocation differs between families and individuals acting alone. Second, parameter estimates also show that men face larger geographic differentials in their wage offer distributions, have higher mean wage offers for each location, and have a lower utility of leisure. Hence men's gains (or losses) on average dominate women's gains (or losses) from relocation, household moves are generally initiated by men's opportunities, and women usually end up being the tied mover. Men are also tied stayers at times, albeit less frequently, as women's losses are sometimes large enough to make moving not optimal. In the framework employed in this paper, where utility is transferable and compensation for current and future private losses caused by family migration is possible, the adverse consequences of being the tied spouse on labor market outcomes are compensated via intra-household transfers. Partners make compromises on their location choice as a trade-off against the gains from marriage.

In order to quantify the deterrent effect of family ties on mobility, behavior is simulated under a counterfactual experiment where individuals act alone instead of making decisions jointly with their spouse. In other words, under the counterfactual, individuals make decisions taking into account only their private calculus of gains and losses. Simulations show that when acting alone, men and women move more frequently compared to when they are married. 18 percent of married couples move at least once, whereas 25 percent of men and 23 percent of women move when they are acting alone. Higher mobility translates into higher wages especially for men: When acting alone, average male wages increase by 10 percent, whereas female wages increase only by 3 percent compared to when they are married.

As the descriptive analysis suggests, location ties created through relocation opportunities may also increase marital instability. The estimated model is also used to quantify these effects by simulating behavior under a counterfactual experiment, where mobility cost is raised to a level which renders moving never optimal. Results show that location ties contribute to marital instability: The percentage of couples who divorce in the baseline case is 24 percent, and it is 16 percent with no

mobility. When mobility costs are very high, wage offer draws from other locations no longer lead to a disparity between the spouses' ranking of the current and alternative locations, as the alternative location is never optimal for either of them in the face of very high moving costs. Hence conflicts due to differing job opportunities across locations are not present, and divorces that arise due to such conflicts no longer occur.

The paper is organized as follows. Section 2 provides a review of the related literature. Section 3 describes the structure of the model. Section 4 presents the functional form assumptions used in the empirical application. Section 5 outlines the numerical solution algorithm and implementation. Section 6 presents the data. Section 7 gives the estimation method. Section 8 presents the parameter estimates and model fit. Section 9 outlines the results from the counterfactual experiments. Section 10 concludes.

2 Related Literature

Migration literature in economics can be classified into two groups of studies. The first group consists of studies that analyze migration at the individual level, where the main focus is on the determinants of moving decisions and the returns to migration in terms of lifetime wages and earnings. Most of these studies analyze migration with a perfect foresight setting without uncertainty about future employment and earnings. One paper that incorporates individual migration in a dynamic setting with uncertainty is Kennan and Walker (2011), which develops a dynamic migration model and estimates it using panel data from the NLSY. The focus of this paper is different in that it emphasizes family migration decisions, rather than individual decisions. Bishop (2008) also analyzes dynamic migration decisions and finds that location-specific amenity values can explain important trends in observed migration trends in the United States.

The second group of studies analyze migration at the household level. One of the earliest papers to emphasize the importance of studying migration as a family decision is Mincer (1978). Mincer (1978) presents a model where families make migration decisions based on a one time comparison of total gains and/or losses of the spouses' earnings. Mincer (1978) introduces the idea that family mobility decisions might play a reinforcing role in the observed differences between men and women in terms of their labor market outcomes. These ideas are also explored by Frank (1978), who develops a model of joint placement where families maximize total income by choosing a work location within a two-period setting. He uses this model to quantify the fraction of the unexplained wage gap that results from family migration. This paper extends these earlier ideas and analyses in the following ways. First, it incorporates household migration decisions between multiple locations in a dynamic setting with uncertainty and the possibility of making multiple moves. Second, the model distinguishes between accepted and offered wage distributions of men and women, which

is important for the purposes of understanding the sources of gender differences in migration and labor market outcomes.

This paper also contributes to a large literature on household economics that views the family as a collection of agents with different preferences, rather than a single unit. Due to its emphasis on the intertemporal aspects of household decision making, it is closest in approach to Mazzocco (2007) and Mazzocco, Yamaguchi, Ruiz (2007). Mazzocco (2007) generalizes the static collective framework introduced by Chiappori (1988) to a dynamic framework with no commitment and derives formal tests of commitment in the household. It is also shown in Mazzocco (2007) that the standard unitary model, where a unique utility function is assigned to the household, is a special case of the collective model with full efficiency. This paper employs a Nash bargaining framework instead of a collective one. Here, in addition to labor supply, the focus is also on the location decisions of families, although savings decisions are not included. In the model, couples do not have access to a commitment technology. However, unlike in the dynamic framework employed in Mazzocco (2007) and Mazzocco, Yamaguchi, Ruiz (2007), transferable utility together with agents' ability to make up-front transfers lead to efficient household equilibrium outcomes. This paper is also similar to a number of studies that have explored household search in the labor market. Dey and Flinn (2008) look at the relationship between health insurance coverage, wage and employment outcomes at the household level. This paper focuses on migration decisions in addition to labor market decisions of the household.

Family migration has also been explored by Costa and Kahn (2000) and Compton and Pollak (2004), with a focus on the impact of the changing migration patterns of married couples on the composition of educational attainment in large metropolitan areas in the US. These two papers explore the reasons behind the increased concentration of so-called power couples, couples in which both spouses have college degrees, in large metropolitan areas. This paper differs considerably in approach from these studies, in that it aims to provide evidence on structural differences that give rise to some of these patterns. For example, it estimates the underlying gender differences preferences and wage offer distributions between locations. These underlying structural differences turn out to be important in explaining family migration patterns and their different consequences on male and female labor market outcomes. It also uses counterfactual experiments to quantify the impact of ties on such patterns.

Family migration decisions within a intra-household bargaining framework has also been theoretically analyzed by Lundberg and Pollak (2001). They use a two-stage model of family location decisions to illustrate how inefficiencies may arise if current decisions have implications for future bargaining power of the family members. They show that under lack of commitment, family migration decisions give rise to inefficiencies. This paper extends their study by incorporating job search, endogenous experience accumulation, uncertainty in the intra-household bargaining frame-

work. Location decisions of families have been studied in the context of child outcomes as well. In Liu, Mroz, Van Der Klaauw (2004), locations differ in terms of their employment opportunities for the parents as well as schooling opportunities for the children. The focus of Liu, Mroz, Van Der Klaauw (2004) is the determinants of child outcomes, such as parental inputs and schooling inputs. On the other hand, this paper focuses on the labor market outcomes of married men and women, as well as their marital stability in relation to their migration patterns.

3 Model

The decision model starts at the time of marriage. Employment and migration problem of the couple is modeled in a joint search framework with multiple locations. There are N different locations, each representing a separate labor market environment for each gender. In the model, married couples jointly make decisions regarding consumption, leisure, location and divorce starting from the time of marriage. This section outlines the general model and properties of the household equilibrium. In Section 4, the functional forms used in the empirical implementation of the model are presented.

Agents get utility from consumption and leisure. They also derive utility from marriage, utility from residing in a particular location, and disutility from changing locations. Marriage utility, location-specific utility, and utility cost of relocation depend on the agent's state vector $\Omega_{i,t}$.[5] Agents face uncertainty in their preferences for leisure, location utility, marriage utility, and utility cost of moving. Current period utility of an individual i in period t ($i = h$ for husband, and $i = w$ for wife) is given by,

$$u_i(c_{i,t}, \ell_{i,t}, \vartheta_{i,t}; \Omega_{i,t}) \quad i = h, w$$

where $c_{i,t}$ denotes individual consumption of agent i, $\ell_{i,t}$ denotes leisure, and $\vartheta_{i,t}$ denotes marital status. Utility is linear in consumption.

Agents randomly draw wage offers from their current location and/or other locations each period. For each location/employment alternative, they determine their respective shares of the total household utility as the solution to a symmetric Nash bargaining problem. The threat point in their problem is specified as the value of divorce, which is the discounted sum of future utilities that the spouses would obtain as single agents. The symmetric Nash bargaining solution implies that conditional on each alternative j, each spouse gets their outside option (expected present discounted lifetime utility of being a single agent) plus half of the total marriage surplus, so that spouse i gets,

$$\bar{V}_{i,t}(\Omega_{i,t}) + \frac{1}{2}\left\{ \begin{array}{l} u_h(c_{h,t}, \ell_{h,t}, \vartheta_{h,t}; \Omega_{h,t} \mid j) + \beta E V_{h,t+1}(\Omega_{h,t+1} | j, \Omega_{h,t}) - \bar{V}_{h,t}(\Omega_{h,t}) + \\ u_w(c_{w,t}, \ell_{w,t}, \vartheta_{w,t}; \Omega_{w,t} \mid j) + \beta E V_{w,t+1}(\Omega_{w,t+1} | j, \Omega_{w,t}) - \bar{V}_{w,t}(\Omega_{w,t}) \end{array} \right\} \quad (1)$$

[5] The state space is discussed in detail in Section 4.3.

$\bar{V}_{i,t}(\Omega_{i,t})$ denotes the outside option of spouse i. It is the maximum over alternative-specific value functions associated with being a single agent. Then, $\bar{V}_{i,t}(\Omega_{i,t})$ is defined as follows:

$$\bar{V}_{i,t}(\Omega_{i,t}) = \max_{j \in \{1,..,\bar{J}\}} \{\bar{u}_i(c_{i,t}, \ell_{i,t}, \vartheta_{i,t}; \Omega_{i,t} \mid j) + \beta E \bar{V}_{i,t+1}(\Omega_{i,t+1} | j, \Omega_{i,t})\}$$

The couple chooses the alternative that maximizes their expected discounted present value of lifetime utility. The value function of spouse i can be written as follows,

$$V_{i,t}(\Omega_{i,t}) = \max_{j \in \{1,..,\bar{J}\}} \{u_i(c_{i,t}, \ell_{i,t}, \vartheta_{i,t}; \Omega_{i,t} \mid j) + \Gamma_{i,t}(j) + \beta E V_{i,t+1}(\Omega_{i,t+1} | j, \Omega_{i,t})\}$$

where $\Gamma_{i,t}(j)$ is the intra-household utility transfer that spouse i gets conditional on alternative j and is the transfer that implements the Nash bargaining solution specified in equation (1). Utility is linear in consumption, agents can borrow and save at a risk free interest rate, and conditional on each work and location alternative transfers occur through exchange of private consumption. Also, utility from leisure, marriage utility, non-pecuniary benefits and moving costs are measured in consumption units. Due to these assumptions, any distribution of total lifetime utilities between the partners is possible.

Couple's different location and employment options correspond to different utility possibility frontiers. The couple chooses the alternative that corresponds to the outermost utility possibility frontier. Figure 2 shows the case where moving and both working at their offered wages at location B is preferred to staying and both continuing to work at their current wages at location A. $\bar{V}_h$ and $\bar{V}_w$ are the best available outside options of the husband and wife. As long as there exists some agreement preferred by both parties to the disagreement outcome, the couple will stay married and choose the alternative with the highest surplus. Figure 3 shows the case where the household chooses to divorce. In this example, the alternative that is associated with the highest utility possibility frontier is $\{\text{Move}\}$, but the outside options of the husband and wife give higher utility.

In the model, household decisions lead to efficient migration and divorce outcomes. Due to the transferable utility framework employed, negative private externalities caused by family migration can be internalized within the household. As Lundberg and Pollak (2001) show, in a dynamic model with limited commitment where household members jointly make decisions (such as location) that affect their future outside options, outcomes are generally dynamically inefficient. In their framework, a decision that is good for the household as a whole might not be individually rational when total household gains or losses (current or future) from family migration cannot be fully shared. Despite limited commitment, such dynamic inefficiencies do not arise here due to assumptions that enable partners to make current as well as up-front utility transfers. This is discussed in more detail below.

The following example illustrates the kind of negative private externalities that arise due to

family migration. Suppose both spouses are working in their current location l and the husband receives a high wage offer from location k. Also assume that relocation is optimal for the household, so that the family surplus in location k is higher than that in l. In this scenario, relocation means that the wife has to leave her current job and search for a new one in location k. In other words, relocation entails foregone earnings for the wife, both because she has to give up her current wage, and because she experiences some periods of non-employment until she accepts a new job in the new location thereby accumulating fewer years of work experience. Both these factors manifest themselves as lower value of being single due to lower future wage offers, decreasing the value of her outside option and therefore future share of total household utility. Lower value of being single matters not just because it implies a lower share of total surplus (due to the Nash bargaining solution concept), but also because there is a possibility of separation in the future due to uncertainty in preferences and future wage offers. This is the measure of negative private externality imposed on her by family migration. Mincer (1979) coins the term 'location ties' for such externalities, albeit with a static framework in mind taking into account only current wage losses. Such externalities can be internalized only if the couple can rely on commitment to future compensations or on up-front utility transfers, both of which enable the husband to share his relocation gain with his wife, thereby making up for her current and future losses. In this case, husband foregoes part of his private gain and wife incurs a private loss as a trade-off against the gain from marriage. When such transfers are not possible, inefficiencies arise. If spouses cannot commit to a division of future household surplus that compensates the trailing spouse for foregone earnings power,[6] then the family chooses to not relocate or chooses to separate, which in this case is an inefficient outcome.[7] Such inefficiencies do not arise in this model, because even though commitment to future compensations is not possible, compensation is still feasible in the current period through up-front utility transfers.

The exclusion of the marriage decision from the model means that the impact of relaxing location constraints on the marriage decision will not be taken into account. Due to the forward-looking behavior of agents, joint location constraints agents expect to face within the marriage might have important implications for the timing of marriage as well as sorting patterns.[8] Conditioning on mar-

[6]This is either due to giving up their job in current location or due to lower labor market experience accumulation while searching for a new job at the destination location.

[7]This is analogous to a household specialization problem where full specialization requires spouses to compensate the partner that specializes in household production for his/her foregone labor market opportunities. When full specialization is the Pareto optimal allocation in the household, it can emerge as an equilibrium outcome only if spouses have access to a commitment technology which allows them to make such compensations.

[8]For example, due to potential future location conflicts, gains from marrying a partner who faces large geographic wage differentials is different from gains from marriage to a partner who does not stand to benefit from geographic mobility. For an individual who is more location constrained (for example, a lawyer), it might, under certain circumstances, be better to choose a partner who does not stand to lose a lot from being the tied spouse (for example, a teacher).

riage means that the total effects of location ties calculated using the estimated model in this paper will not incorporate the effects of location ties on the timing of marriage and sorting patterns. In this regard, the quantitative effects of family migration ties on labor market outcomes found in this paper can be seen as a first step towards understanding the full implications of location ties.

4 Empirical Implementation

This section outlines the functional form assumptions used in the empirical application.

4.1 Utility Function

In each period, utility of agent i whose location in the previous period and current period is l and k, respectively, is given by:

$$\begin{aligned} & u_{i,t}(c_{i,t}, \ell_{i,t}, \vartheta_{i,t}; \Omega_{i,t}) \\ = \; & c_{i,t} + \psi(.)\, 1\{l \neq k\} + b_i(.)\, 1\{\ell_{i,t} = 1\} + M(.) 1\{\vartheta_{i,t} = 1\} + \delta(.) \quad i = h, w \end{aligned}$$

where $c_{i,t}$ is individual consumption, $\ell_{i,t}$ is leisure which is 1 if the individual stays at home and 0 otherwise, $\vartheta_{i,t}$ is marital status and $\Omega_{i,t}$ is the state vector. $\psi(.)$ is the utility cost of relocation, $b_i(.)$ is the utility of leisure, $M(.)$ is marriage utility, $\delta(.)$ is the location specific utility. The specification of the utility function is partly determined by using model fit criteria. It is discussed in more detail below.

Psychic cost from relocation, $\psi(.)$, is given by:

$$\begin{aligned} \psi(n_t, e_{i,t-1}, d_{l,t}, \varepsilon^1_{i,t}) &= \gamma_1\, 1\{n_t = 1\} + \gamma_2\, e_{i,t-1} + \gamma_3\, d_{l,t} + \varepsilon^1_{i,t}, \;\; i = h, w \\ \varepsilon^1_{i,t} &\sim N(0, \sigma_1) \end{aligned}$$

where n_t denotes the presence of children, $e_{i,t-1}$ is agent's employment status in the previous period, $d_{l,t}$ is the number of periods couple has resided in location l. $\varepsilon^1_{i,t}$ is the random shock to utility of leisure that is independently and identically distributed across time periods and spouses.

Utility of leisure, $b_i(n_t, g_i, \varepsilon^2_{i,t})$, is given by:

$$\begin{aligned} b_i(n_t, g_i, \varepsilon^2_{i,t}) &= \gamma_{4,i}(g_i) + \gamma_{5,i}\, 1\{n_t = 1\} + \varepsilon^2_{i,t} \quad i = h, w \\ \varepsilon^2_{i,t} &\sim N(0, \sigma_{2,i}) \end{aligned}$$

where n_t denotes the number of children, g_i is education level, and $\varepsilon^2_{i,t}$ is iid across periods and spouses. For males, $\gamma_{4,i}$ is restricted to be zero.

Marriage utility $M(.)$ is given by:

$$\begin{aligned} M(d_{M,t}, \varepsilon^3_t) &= \gamma_6 + \gamma_7 \, d_{M,t} + \varepsilon^3_t \\ \varepsilon^3_t &\sim N(0, \sigma_3) \end{aligned}$$

where $d_{M,t}$ is the number of periods the couple has been married, and ε^3_t is a random shock that is iid across periods. Shocks to marriage utility are assumed to be couple specific.

Utility of residing in location k is given by:

$$\delta(k, H) = \eta_k + \gamma_8 1\{k = H\}$$

The total non-pecuniary component of the flow utility ($\eta_k + \gamma_8 1\{k = H\}$) from residing in a location differs between agents, as they all have different home locations (denoted by H) and as they derive an extra utility from residing at home (this extra utility is given by γ_8).[9]

4.2 Arrival Rates and Wage Offers

Households can choose between their current location and an alternative location. A location corresponds to one of the nine Census Divisions in the United States.[10] A period corresponds to a calendar year.

Each period, a household currently residing in location l, gets a draw from location k with a certain probability. This draw probability depends on whether location k is the home location of the household. If k is not their home location, then probability of drawing it is equal to the probability of drawing any of the $N-1$ locations, where N denotes the total number of locations.[11] Job offers

[9] In the general model, home is just a location that potentially has a higher probability of being drawn and that gives the couple a higher utility. In the empirical implementation of the model, this is defined as the location the head grew up in. It is defined in this way for the empirical implementation, because there is no data on the location the wife grew up in.

[10] A list of the Census Divisions can be found in Appendix. One consequence of this aggregation in the empirical implementation of the model is that moving rates are smaller than they would have been with a more a disaggregate definition of a location in the data. However, the proportion of moves that are disregarded due to this aggregation is not large. Specifically, about 72 percent of the moves that are between states are also between Census Divisions.

[11] An alternative specification would have the probability of drawing from a location depend on the distance between the two locations or be even less restrictive by allowing a different draw probability between each different location pair. The second case is hard to identify given the small migration rates in the data, which means that the number of moves between each location pair is quite small. The first approach has not been

of the husband and wife arrive from their current location l with a certain probability. Conditional on drawing location k, both spouses receive job offers from that alternative location. Arrival rate of offers from the current location is determined by the agents' gender, employment status and education. When employed, the agents continue to get offers on-the-job at a different frequency relative to when they are not working. Probability of receiving a job offer from location l while the agent is in location l is given by $\lambda_i(g_i, e_i)$, where g_i and e_i denote the education level and current employment status of spouse i, respectively. The education variable corresponds to whether the individual has a college degree or not.

The set of alternatives that are available to the agents are different depending on their job offers from current location l and alternative location k. For example, suppose a couple at period t, is currently working in location l at wages (ω_h, ω_w). Also, suppose that this couple gets offers from location l and location k, given by $(\tilde{\omega}_h^l, \tilde{\omega}_w^l)$ and $(\tilde{\omega}_h^k, \tilde{\omega}_w^k)$. The set of alternatives available to this couple are as follows: (1) Stay/Both continue to work at (ω_h, ω_w), (2) Stay/Both work at $(\tilde{\omega}_h^l, \omega_w^l)$, (3) Stay/Both work at $(\omega_h^l, \tilde{\omega}_w^l)$, (4) Stay/Both work at $(\tilde{\omega}_h^l, \tilde{\omega}_w^l)$, (5) Stay/Only Husband work at current wage or (6) his new wage, (7) Stay/Only Wife work at current wage or (8) her new wage, (9) Stay/Neither work, (10) Move/Both work at $(\tilde{\omega}_h^k, \tilde{\omega}_w^k)$, (11) Move/Only husband work at $\tilde{\omega}_h^k$, (12) Move/Only wife work at $\tilde{\omega}_w^k$, (13) Move/Neither work, and (14) Divorce and the spouses stay or move alone. Given the wage offers described above, the alternatives available to a single agent are: (1) Stay and continue to work at ω_i^l, (2) Stay and accept new offer $\tilde{\omega}_i^l$, (3) Stay and do not work, (4) Move and work at $\tilde{\omega}_i^k$, and (5) Move and do not work.

Wage offers are drawn from a distribution that depends on the characteristics of the individuals, and they are allowed to differ by gender and location. The wage offer of individual i ($i = h$ for husband, and $i = w$ for wife) from location k is given by,

$$ln\, \omega_{i,t,k} = \alpha_{i,k}^0 + \alpha_i^1\, g_i + \alpha_i^2\, x_{i,t} + \alpha_i^3\, x_{i,t}^2 + \nu_{i,t,k} \qquad i = h, w \qquad k = 1, 2, .., 9$$

where $x_{i,t}$ denotes the work experience of spouse i. The joint distribution of $\nu_{t,k} = (\nu_{h,t,k}, \nu_{w,t,k})$ is assumed to be normal so that $\nu_{t,k} \sim N(0, \Sigma)$ for each location k. $\nu_{t,k}$ is independently and identically distributed across locations. Once an agent accepts a wage draw $\nu_{i,t,k}$, he/she keeps that draw until he/she changes to another job, moves or quits into unemployment. Hence, $\nu_{i,t,k}$ is the only source of serial dependence in the unobservable component of the state space in the model. $\alpha_{i,k}^0$ is the mean wage offer in each location and is allowed to differ by gender and location so that men and women face different wage offer distributions within and between locations. The returns to education and experience, governed by the parameters α_i^1, α_i^2, α_i^3, differ by gender as well.

taken here given the fact that locations here correspond to large Census Divisions in the data. Any definition of distance between these large locations will be arbitrary. A specification with probabilities depending on distance would be more appropriate if locations in the model corresponded to smaller regions in the data.

4.3 State Space and Initial Conditions

Initial conditions of a married couple at the time of marriage ($t = 1$) are their starting location (l_0), their employment status in the previous period ($e_{h,0}, e_{w,0}$), their wages in location k if they were working in the previous period ($\nu_{h,0,k}, \nu_{w,0,k}$), total labor market experience ($x_{h,0}, x_{w,0}$), home location (H) and education (g_h, g_w). Duration at location is assumed to be 0 at the start of the marriage and is defined as the number of periods the couple has resided in a particular location since the start of the marriage. In the model, there is no serial dependence in unobservable characteristics, except for the serial dependence that arises due to the search framework employed here (i.e. serial dependence due to the fact that agents keep their $\nu_{i,t,k}$ until they quit into non-employment or accept a new wage draw). It is assumed that the search process is initiated at the time of marriage.[12]
The couple's state space at period $t > 1$ is:

$$\Omega_{i,t} = \left\{ \begin{array}{l} l_{t-1}, \mathrm{e}_{h,t-1}, e_{w,t-1}, \nu_{h,t-1}, \nu_{w,t-1}, \\ x_{h,t}, x_{w,t}, n_t, d_{l,t}, d_{M,t}, H, g_h, g_w, \\ \varepsilon^1_{h,t}, \varepsilon^1_{h,t}, \varepsilon^2_{h,t}, \varepsilon^2_{w,t}, \varepsilon^3_t, \nu_{h,t}, \nu_{h,t} \end{array} \right\}$$

Total labor market experience of the individual in $t+1$ is determined by his/her work experience, $x_i(t)$, and employment choice $e_i(t)$ in period t:

$$x_{i,t+1} = \left\{ \begin{array}{ll} x_{i,t} & \text{if} \quad e_{i,t} = 0 \\ x_{i,t} + 1 & \text{if} \quad e_{i,t} = 1 \end{array} \right.$$

Also, the number of periods the couple has resided in a location is determined by the past duration at that location and the couple's moving choice in period t. If the couple changed locations in the previous period, their duration at location is set to 0 so that the duration at location is given as follows:

$$d_{k,t+1} = \left\{ \begin{array}{ll} d_{k,t} + 1 & \text{if} \quad k = l_t \\ 0 & \text{if} \quad k \neq l_t \end{array} \right.$$

If the couple remains married, the duration of marriage, $d_{M,t+1}$, is determined as follows:

$$d_{M,t+1} = d_{M,t} + 1$$

[12] This is a strong assumption since the search process starts when the agents first enter the labor market after school. Even if this assumption is dropped, there is an initial conditions problem only for those agents who are observed to be working in the first period of their marriage. For those who are not working in the first period, all initial observable state variables are independent of ν_0.

Fertility is exogenous so that in each period the wife gives birth with a certain probability:

$$n_{t+1} = \begin{cases} n_t & \text{if} & n_t = 1 \\ 1 & \text{with probability } p_n \text{ if} & n_t = 0 \\ 0 & \text{with probability } 1-p_n \text{ if} & n_t = 0 \end{cases}$$

5 Solution Method

Household's problem can be solved recursively, starting from the last period T, which is taken to be 30. At period 30, the value functions are the current returns to choosing each alternative. It is possible to calculate these alternative-specific value functions for every element of the state space at period T, and then calculate the maximum for each element in the state space and each set of shocks, and finally integrate over the shocks. This procedure gives the expected value of the maximum alternative-specific value function for each element in the state space at period T,

$$E_T\left[max\{V_{i,T}(\Omega_{i,T}|j=1),....,V_{i,T}(\Omega_{i,T}|j=J)\}\right] \quad i=h,w$$

Given the above *Emax* functions, $V_{h,T-1}(\Omega_{h,T-1})$ and $V_{w,T-1}(\Omega_{w,T-1})$ can be calculated for all possible state space elements in period $T-1$ (all possible points in $\Omega_{i,T-1}$). The value functions of males and females can be calculated at each period using this backwards recursion method. Calculation of the *Emax* functions at each point in the state space creates a computational difficulty. The size of the state space is very large, especially given that there are multiple locations. The value function needs to be computed at each point in the state space that consists of the current location of the couple, their home location, as well as the employment status, location tenure, labor market experience, wages and education level of each spouse.[13] The large state space of the couple's decision problem renders the estimation of the model parameters computationally infeasible, since the dynamic programming problem needs to be solved for each evaluation of the estimation criterion. The problem is that the estimation procedure requires the repeated full solution of the dynamic model.

The following approach is taken to circumvent these problems. First, the locations are defined as Census Divisions in the United States, so that there are only 9 locations the couple can reside in and choose to move to. This reduces the size of the state space considerably. One consequence of this aggregation in the empirical implementation of the model is that moving rates are smaller than

[13] Current location is a state variable because it determines the wage offer the agents draw from and because the arrival rate of a wage offer from location l is different depending on whether the household is residing in location l or not. If an individual is employed, his wage draw from the previous period $\nu_{i,t-1,k}$ is a state variable because agents keep wage draws between periods until exiting into non-employment or changing jobs by accepting a new wage offer.

they would have been with a more a disaggregate definition of a location in the data. However, the proportion of moves that are disregarded due to this aggregation is not large. Specifically, about 72 percent of the moves that are between states are also between Census Divisions.[14]

Second, instead of evaluating the *Emax* at each point in the state space, it is computed only at a subset of the state space. The value of the *Emax* at the other state space points is obtained using the interpolation method proposed by Keane and Wolpin (1994).[15] This approximation method is used within each location and joint education level of the spouse. In other words, the *Emax* is approximated over the state variables work experience, location tenure, wages, and children. Locations and education levels of the spouses are not interpolated over. This is because each location and education level make a big difference in terms of both the labor market environments that the couple faces and their arrival rates of offers. Therefore, it would be difficult to get an accurate approximation of the *Emax* function by interpolating over these state variables.

Another complication that arises regarding the computation is that a multi-dimensional integration is required in order to compute the *Emax* function at the chosen points in the state space. This integration is with respect to the vector of shocks in the model. Monte Carlo integration method is used to perform this calculation.

6 Data

The core PSID sample consists of two independent samples: a cross-sectional national sample, known as the SRC (Survey Research Center) sample, and a national sample of low-income families, known as the SEO (Survey of Economic Opportunities) sample. This core sample originated in 1968 and the individuals from families in the core sample were interviewed from 1968 to 1996 every year. In 1990 and 1997, a supplemental sample of Latino households and Immigrant families were added to the core PSID sample. The estimation sample used in this paper includes only those individuals who are associated with families from the SRC.

The criteria used to construct the estimation sample are as follows. White male heads of households that are observed from the first year of marriage for at least three periods are selected. In order to obtain information about the first year of marriage, the Marriage History File is used, which has retrospective histories of marriages and is collected in the 1985-2005 waves of the PSID.[16] If the

[14] Kennan and Walker (2011) define locations as states, but they use a limited history approximation method in order to keep the size of the state space small. Even with fewer locations (9 Census Divisions) the state space in the model in this paper is large due to the fact that it includes the years of work experience, current wages, education of two individuals rather than one.

[15] Due to the interpolation method used for the solution of the problem, discretization over the wage distribution is not required.

[16] The PSID collects retrospective histories of marriages for those individuals who are of marriage-eligible age and who are living in a PSID family at the time of the interview in the 1985-2005 waves.

1985-2005 retrospective marriage history is not available, the marriage history is constructed by using the 1968 survey that contains information on the duration of the current marital status of the head. Males who are heads of households are followed from the time of their marriage through the time of their divorce, their last interview or until they are age 54, depending on which event occurs first. The estimation sample includes white male heads for whom the age of marriage is above 18 or below 50. 65 percent of the sample consists of males who got married before age 25. Those male heads and their wives who are observed for only less than three periods are excluded. Using these criteria, there are 1478 couples in the sample. Table 2 includes information about the proportion of couples in the sample by their first year of observation. The employment, wage and location histories of the male heads and their wives are followed during the course of their marriage. If at least one spouse in a couple has a college degree, the periods for which where they are younger than age 25 are dropped.

An individual is considered to be married if the marital status of the head at the time of interview is "Legally married". For the years 1968-1977, PSID does not make the distinction between marriage and cohabitation. However, after 1977, the variable for marital status distinguishes the married couples from those that are just cohabiting. Those couples who are listed as permanently cohabiting are not considered as married, so that cohabiting couples are not included in the sample.[17] Divorce is assumed to occur when the individual is observed to be married in period t, and not married in the next period. A period corresponds to a calendar year in the data.

A location is defined as a Census Division. Census divisions are groupings of states that have been defined by the U.S. Census Bureau. There are nine census divisions in the United States: New England, Middle Atlantic, East North Central, West North Central, South Atlantic, East South Central, West South Central, Mountain, Pacific. The list of states that are included in each division is included in the Appendix. A couple is considered to have relocated if their location in period t is different from their location in the next period.

PSID has detailed information on employment, earnings and total labor market experience of household heads and wives. The employment status of the individuals is obtained through the number of hours they work during the year. An individual is considered to be working if their hours of work exceeds 1000 hours for a given year. The annual earnings is computed by multiplying their hourly wages by 2000 (50 weeks X 40 hrs/wk) hours so that the variation in earnings only reflects variation in the hourly wages. The labor market experience variable of the household head and wife is constructed as follows. The PSID has information on the amount of time the household

[17] Cohabiting couples might behave differently in comparison to those who are legally married, and one of the reasons may be because there is more uncertainty in terms of the future of the relationship. The higher degree of uncertainty a cohabiting couple faces regarding future separation may lead to interesting implications on joint labor supply decisions of couples. This paper does not distinguish between legal marriage and cohabitation. Gemici and Laufer (2010) explore the implications of such a distinction.

head and wife have worked since the age of 18 until the time of interview. The work experience variable is self-reported, and the question is asked of only new heads or wives in the household. The question is asked to all heads and wives for only certain years. For each individual, the value of the work experience variable at the reported years is used together with the employment status for each preceding or subsequent year to compute the total labor market experience in a given year. The labor market experience of an individual is considered to be 0 at age 18.

Attrition is an important problem in the PSID. For example, as Fitzgerald, Gottschalk and Moffitt (1998) point out, by 1989 PSID had experienced about 50 percent sample loss from cumulative attrition from the original 1968 sample. In the sample that is used for the estimation in this paper, married couples are followed until they are divorced, until the head of the household is age 54 or until year 1997, depending on which event occurs first. Table 3 shows the information regarding the proportion of couples who remain in the sample, by their duration of marriage. The couples who leave the sample, are categorized into two groups: (1) Those who leave because they divorce, reach age 54 or reach year 1997, (2) Those who leave because they are non-response (attritors). Despite the fact that attrition is not negligible in this sample, for each period, the proportion of non-response couples is 0.9%, so that the attrition rates are small on average. One of the reasons for the small attrition rates is that individuals are followed only when they are married, and do not attempt to follow them after a change in marital status. As Lillard and Panis (1998) point out, in the PSID, married couples are more likely to continue in the panel compared to single individuals. Also, the likelihood of attrition decreases considerably as the duration of marriage increases.

6.1 Descriptive Statistics

Table 4 displays the basic descriptive statistics for the estimation sample. The average length of time that a couple is observed in the sample is 13.48 years. The average age of marriage for the males in the sample is 26.84 and it is 25.15 for the females. The proportion of those couples where both the husband and wife are college educated is 19.49 percent. 20.63 percent of couples are those with only one spouse college educated, and 59.88 percent are couples with no college education. Table 4 also shows the moving rates. Approximately 18.54 percent of the couples in the sample are observed to change locations at least once. Of all the moves that are observed for the people in the sample, approximately 32.83 percent are moves that are back to the home location of the head. The home location is defined as the place where the head grew up.

Table 4 also shows patterns related to divorce and migration behavior of the couples in the sample. The analysis distinguishes between two kinds of divorces: (1) Those divorces that involve a change of location by at least one of the spouses, (2) Those that do not involve a change of

location.[18] Approximately 23.68 percent of the married couples in the sample divorce eventually. 6.00 percent of these divorces are those that involve a change of location in the following period. Moreover, in contrast to periods where there is no change in location, the proportion of couples who divorce is higher in periods of migration. This can be seen in Table 5, which shows the per-period divorce rates. The divorce rate in periods that do not involve a change of location is 1.83 percent, and it is 4.54 percent in periods that involve a change of location.

The per-period (annual) moving rates by the characteristics of the couples in the sample are as follows. Table 6 shows that the migration rates decrease by the number of periods a couple has resided in a certain location. Table 7 shows migration rates by the joint education level, joint employment status of the couples as well as by whether they have any children. Couples are classified according to their joint education level as follows: (1) Both spouses are college educated, (2) Only husband is college educated, (3) Only wife is college educated, (4) Neither is college educated. Also, couples are classified according to their joint employment status as follows: (1) Both spouses are working, (2) Only husband is working, (3) Only wife is working, (4) Neither spouse is working. The couples are least likely to move when both spouses are working in their current location. Table 7 shows that 1.63 percent of couples with both spouses working migrate annually, whereas for couples with neither spouse working, the annual migration rate is 5.26 percent. Table 7 also shows that couples in which both spouses are college-educated are the ones most likely to move. For couples with children, the annual migration rate is 2.16 percent, whereas for couples with no children the migration rate is 3.50 percent. In short, in terms of the migration rates, the couples who are most likely to move are those with joint college degrees, as well as those who are not working, and who do not have any children.

The distribution of the couples by their location of residence in their first year of marriage is displayed in Table 8. A large number of couples live in the Middle Atlantic, East North Central and West North Central divisions. Table 9 shows the in-migration and out-migration rates for each Census division. In-migration is defined as migration into an area during a given period, and out-migration is defined as migration out of an area during a given period. These rates are given as the number of in-migrants and out-migrants as a proportion of the total number of couples in that location in a given year. An interesting aspect of the domestic migration patterns is that the location with the highest in-migration rate is also the location with the highest out-migration rate. The same holds for the location with the lowest in- and out-migration rate. The lowest levels of both in- and out-migration occurs in the Middle Atlantic (which consists of New York, New Jersey and

[18] For example, if in year t the couple is married and in location l, and in year $t+1$ they are divorced and at least one of the spouses is in a different location k, then this is consider as a 'divorce with a change of location'. A distinction is not made in terms of which precedes the other. For the moments used in the estimation, in particular those regarding divorces that involve a change of location, the same definition is used.

Pennsylvania), and the highest levels occur in the Mountain (which consists of Arizona, Colorado, Idaho, New Mexico, Montana, Utah, Nevada and Wyoming). Table 10 shows the mean annual log wages of males and females by each of the 9 Census Divisions. New England, Middle Atlantic and the Pacific are the locations with the highest mean accepted wages for the men and women in the sample. These are the divisions that include New York, Massachusetts, and California.

Table 11 and Figures 4-5 display the labor market outcomes of the couples by their migrant status and their education level. There are two different aspects of the data presented below: (1) Transition rates between employment status for men and women in periods of relocation and periods of no relocation, (2) Wages of men and women by whether they ever relocated during the course of their marriage.

Table 11 also shows the employment rates of men and women conditional on their employment status in the preceding period, making a distinction between whether they relocated or not. Conditional on not working in period t, males are three times more likely to become employed in period $t+1$ in periods where they do not move: The proportion of those who become employed is 50.15 percent for males and 17.33 percent for females. On the other hand if they move, males are approximately six times more likely to become employed relative to their wives: The proportion of those who become employed in a different location is 2.73 percent for males and 0.48 percent for the females. Also, females are more likely to remain unemployed when they move in comparison to when they stay. These transition rates show that the proportion of men who continue working (or start working) in their new location is higher than that of women. Relocation is associated with lower employment rates for women (in comparison to the periods where they remain in the same location). This is not the case for men.

Looking at the males and females in the sample by whether they ever moved during the course of their marriage reveals that there is a strong relationship between migration and the labor market outcomes of married people. Figure 4 shows the wages of men by their total labor market experience, education and moving status. For college educated married men, those who moved at least once have higher wages. For married men who do not have a college degree, those who moved at least once have similar wages to those who never move. Figure 5 shows the wages of working women by their total labor market experience, education and moving status. For college educated married women, migration is associated with lower wages. In other words, those college educated women who moved at least once have lower wages than those who never moved during the course of their marriage. On the other hand, for married women who are not college educated, the wages of those that have moved at least once and those that have never moved are similar.

7 Estimation

Estimation is carried by simulated method of moments where the model parameters are chosen to minimize a weighted average distance between a set of sample moments and moments simulated from the model. Moments related to the couples' labor market outcomes are employment rates by gender, experience, education level, location and presence of children; wages by gender, work experience, education level, location, children, spouse's characteristics, and family's migrant status. Moments related to the migration rates are migration rates by age of head, duration at location, joint employment status, joint education level and children; migration inflow and outflow rates for each location; divorce rates by migrant status; transition rates between each location; proportion of moves that are home moves.
The method of moments estimator used is defined as follows:

$$\min \; g(\theta)' W g(\theta)$$

The weights are the inverse of the estimated variances obtained from the micro-data, divided by the number of individuals that contribute to each moment. $g(\theta)$ is defined as follows:

$$g(\theta) = \frac{1}{N}\sum_{i=1}^{N} g_i(\theta) = \left[\bar{m}^1 - \mu^1(\theta), ..., \bar{m}^K - \mu^K(\theta)\right]$$

where $\{\bar{m}_1, .., \bar{m}_k, ..., \bar{m}_K\}$ correspond to each of the data moments defined above, and $\{\mu_1(\theta), .., \mu_k(\theta), ..., \mu_K(\theta)\}$ are the corresponding model moments. N denotes the number of individuals in the sample. Given the moment definitions listed above, it can be seen that the number of individuals that contribute to each moment is different. For the calculation of the standard errors of the simulated method of moments estimator, $g_i(\theta)$ is redefined so that all the statistics are defined over the whole sample instead. This is denoted as $\tilde{g}_i(\theta)$ and is defined as:

$$\tilde{g}_i(\theta) = \left[\frac{1}{N_1}(\bar{m}_i^1 - \mu^1(\theta))D_i^1, ..., \frac{1}{N_K}(\bar{m}_i^K - \mu^K(\theta))D_i^K\right]$$

where N_k is the number of individuals that contribute to moment k and D_i^1 is a dummy variable that indicates whether individual i contributes to moment 1. Note that,

$$g(\theta) = \frac{1}{N}\sum_{i=1}^{N} \tilde{g}_i(\theta)$$

The variance-covariance matrix of the parameter estimates can then be estimated by $(\tilde{G}'\hat{W}\tilde{G})\tilde{G}\hat{W}\hat{Q}\hat{W}\tilde{G}(\tilde{G}'\hat{W}\tilde{G})^{-1}$

where,

$$\tilde{G}(\hat{\theta}) = \frac{1}{N}\sum_{i=1}^{N}\frac{\partial \tilde{g}_i(\theta)}{\partial \theta}$$
$$\hat{Q} = \frac{1}{N}\sum_{i=1}^{N}\tilde{g}_i(\theta)\tilde{g}_i(\theta)'$$

The model moments in the estimation criterion are replaced with their simulated counterparts. In the above formula, the standard errors of the estimator are also corrected for this simulation bias.

8 Results

8.1 Parameter Estimates

Tables 12 through 14 report the parameter estimates. The standard errors are included in the parentheses together with the parameter estimates.

Table 12 displays the wage offer function parameter estimates for men and women. These parameter estimates have several important features. First, correlation between spouses' wage offer draws within a location is 0.57. More importantly, there are considerable differences in spouses' location ranking in terms of the wage offer distributions; for example, the locations that have the highest mean wage offer for men are those that have the lower mean wage offer for women. These features of the estimated model mean that correlation between private current and future gains of spouses from relocation is low, so that partners will not always prefer the same location and probability of relocation will differ between families and individuals acting alone. As Mincer (1978) shows, the extent to which probability of relocation differs between families and individuals acting alone is stronger for lower values of correlation between household members' private gains from relocation, and is zero if they are perfectly correlated.[19] This is because when location specific opportunities are perfectly and positively correlated between spouses, the location that is most preferred by one partner is also preferred by the other, even before any transfers. The aforementioned features of the wage offer parameter estimates informs about the level of such a correlation.[20]

[19]Mincer (1978) also shows that when one spouse's gain or loss is always negligible and therefore is always dominated by the other, family ties do not have a deterrent effect on mobility. Table 12 shows that women have lower mean wage offers compared to men. Nevertheless, women's wage opportunities are not negligible and not always dominated by husband's. Hence, while women are usually tied movers, men are also tied stayers at times when women's losses from relocation are too high.

[20]In general, the extent to which probability of relocation differs between families also depends on the extent to which private externalities imposed by family migration can be internalized. While the assumptions of the model regarding efficiency inducing utility transfers means that the extent to which family ties hinder mobility is reduced, the model estimation does not put restrictions on the joint distribution of spouses' wage

Second important feature of Table 12 is that the difference between locations in terms of mean wage offers is higher for men compared to women: The standard deviation of mean wage offers across locations for zero experience level and no college education is $1,857 for men and $1,146 for women. Men face higher geographic differentials in their wage offer distributions, and hence face higher gains from mobility compared to women.

A comparison of accepted mean wages by location and education in the data in Table 10 and offered wage parameters in Table 12 reveals the strong selection in women's wages. In the estimation, selection correction is achieved through a combination of functional form assumptions and exclusion restrictions. For example, for both men and women children enter the utility of leisure, which determines the probability of working, but they do not enter the wage offer equation. Once selection is taken into account, the ranking of locations in terms of wages gets reversed in the case of women. For example, New England is the location with the highest average accepted wages for women. It is also one of the locations with the lowest employment rates for women who are college educated as well as for those who are not college educated. Consequently, after correcting for positive selection into employment, parameter estimates show that New England is the location with the lowest mean wage offer for women. This example shows that it is important to take selection into account if one is interested in discerning gender differentials in wage opportunities within and between locations.

The estimates also show that college educated individuals face a wage offer distribution with a higher mean compared to individuals who do not have a college education. This is true for the wage offer functions of both genders, and can be seen in Table 12 which shows that for men education increases the log wage offers by $\alpha_{1m} = 0.44$ and for women by $\alpha_{1f} = 0.39$.

Table 13 reports the estimates for the parameters related to the probability of getting job offers. Identification of the gender specific wage offer distributions enables the identification of arrival rate of offers within a location, through using the hazard rates in the data. The parameter estimates show that the arrival rates of job offers differ considerably by gender, employment status and education level. For a male who is working, and college educated, the arrival rate of a job offer from his current location is 0.39 while it is 0.12 for the female. For a male who is not working, and not college educated, the arrival rate of a job offer from his current location is 0.80 while it is 0.34 for the female. For both education groups, both men and women receive job offers from current location at a lower rate if they are working compared to when they are not working. Finally, the parameter estimates show that men overall have higher arrival rates of offers compared to women. Table 13 also displays the parameter estimates for the non-pecuniary benefits for each location. This is the utility that the agents get from being in a certain location in each period. The value for the non-pecuniary benefits of one of the locations is normalized to 0.

offers other than its joint normality. Even with the ability to fully internalize gains or losses, the fact that optimality of relocation depends on the sum of gains of two partners rather than just one, decreases the probability of moving when partners' gains are not perfectly correlated.

Table 14 displays the utility function parameter estimates for males and females. It can be seen that the value attached to not working is considerably different between men and women. The estimated value of leisure for an individual with children is on average \$9,911 (=\$4,751+\$5,159) for women, and \$181 (=\$146+\$35) for men.[21]

Table 14 also shows the parameter estimates related to the individual moving costs. These are assumed to be the same for men and women. In the model, the moving costs differ by the current employment status, location tenure and whether the couple has any children. For example, the cost of moving for a person who is currently working, with children, and who has been in his current location for 5 years is estimated to be \$10,922. On the other hand, if he is not working, the estimated cost of moving is considerably lower at \$5,335 (in 1983 dollars). Moving costs are identified from the observed relationship between geographic wage differentials and migration probabilities in the data, as in Kennan and Walker (2011). The level of the moving costs are determined by the present value of the differences in the wage levels between locations, taking into account both partners' wage opportunities. For example, for higher levels of present value of the difference in the wage levels between locations, moving costs have to be higher to reconcile large geographic wage differentials in the data (after correcting for selection) with small migration rates. In a framework that treats migration as a family decision, the level of moving costs that are needed to reconcile observed low migration rates with large geographic wage differentials is relatively smaller, compared to a framework that looks at individual decisions. This is because, for a given level of geographic wage differential, relocation probability is smaller for families compared to individuals acting alone. For example, in this framework where migration is treated as a family decision, in addition to moving costs, another important feature that governs the relationship between migration rates and geographic wage differentials is the correlation between spouses' wage offers within and between locations.

In summary, most important features of the parameter estimates is that correlation between spouses' labor market opportunities across locations is low, women face smaller geographic differentials in their mean wage offers and have lower mean wage offers for each location overall. Women also have a higher utility of leisure, so that they expect to work less over their lifetime in the labor market, and any current wage gains or losses from relocation do not translate into high total lifetime utility gains or losses like they do for men. Hence men's gains on average dominate women's losses, household moves are generally initiated by men's opportunities, and women usually end up being the tied mover experiencing adverse employment and wage consequences after relocation. Results from counterfactual experiments discussed in Section 9 provide further evidence on the ways such structural differences give rise to the deterrent effect of family ties on migration and the different

[21]The utilities of not working can be expressed in monetary equivalent terms (in 1983 dollars) due to the linearity of the utility function.

consequences family migration has on the labor market outcomes of men and women.

8.2 Model Fit

Figures 6–8 and Tables 15-19 show the model fit for chosen moments of the estimation. The model predictions in general do well in comparison to the data moments.

Figure 6 and Table 15 show that the model is able to fit the wage and employment profiles of men and women by their location, education and years of work experience. The model captures the variation in male and female wages and employment rates between locations and between education groups. Figure 7 shows that the model also provides a good fit to the employment and wage profiles of men and women by their labor market experience. In particular, Figure 8 shows that the model captures the fact that migration is associated with higher wages for married men, but not for married women. Table 16 shows that the model captures the fact that in comparison to married women, married men are more likely to remain employed following a move. However, the model understates the extent to which women remain employed following a move. In the estimated model, the following two factors lead to these patterns: (1) Women have a higher value of leisure, so that relative to men, the women are expected to work less over the life-cycle. Therefore, household moves that result in lower future wage offers for the wife are less costly for the household, (2) Women face lower mean wage offers in each location and lower geographic wage offer differences compared to men. Since the husbands face a higher geographic differential in terms of their wages, the household gain is larger from pursuing his wage offers in other locations, rather than the wife's.

Table 17 shows the moments related to the moving rates and divorce rates for the data and simulations. In the data 18.54 percent of couples move at least once during the course of their marriage, and in the model 18.18 percent of couples move at least once. Also, in the data 23.68 percent of couples divorce, and in the model 24.43 percent divorce. The model simulations also capture the patterns of moving rates by age of head. Table 17 shows that the model captures the fact that moving rates decrease by age of head. This a feature of the finite horizon in the decision model.

The transition matrix by region, in the data and the model simulations is displayed in Table 18. This table presents the proportion of couples who move to region k, conditional on being in region l for all regions.[22] It can be seen that the model simulations provide a reasonable fit to the transition rates in the data, except for the fact that the model overstates the proportion of moves that are to the Northeast region. The model fit for the unconditional transition rates between employment status and location between two consecutive periods are presented in Table 19. As in the data, the model predicts that men are much more likely to become employed when they move, compared to women.

[22]The transition matrix aggregates divisions into regions. A list of which divisions are included in each region is provided in the Appendix. This aggregation is mainly due to the small number of moves in each cell when we look at the transition rates between each division.

9 Discussion

9.1 Family Ties, Mobility, and Labor Market Outcomes

In order to quantify the effect of family ties on mobility and wage growth, the estimated model is used to simulate behavior under a counterfactual experiment, Experiment I, where individuals act alone instead of making decisions jointly with their spouse. In other words, individuals make decisions taking into account only their private calculus of gains and losses. They have the same initial conditions and face the same environment as the baseline. In order to abstract from children in accounting for differences in behavior with and without family ties, individuals are simulated facing the same probability of having a child as in the baseline. [23]

In order to quantify the inhibiting effect of family ties on migration, we compare the migration rates under Experiment I to the baseline rates. The counterfactual results from Experiment I show that family ties considerably hinder mobility. This can be seen in Table 20 that displays the proportion of men and women who move at least once under the baseline and counterfactual scenarios. 18 percent of married couples move at least once, whereas 25 percent of men and 23 percent of women move when they are acting alone.[24]

In addition to migration rates, another outcome that is different when individuals are acting without family ties is the wage gain (or loss) they experience in periods of relocation. Table 20 shows that both men and women experience higher wage gains in periods of relocation in Experiment I compared to the baseline. For college educated women, log wage gain experienced in periods of relocation when married is -0.11, whereas it is 0.09 when acting alone. For college educated men, log wage gain experienced in periods of relocation is 0.23 when married, whereas it is 0.42 when acting alone. Both men and women experience lower wage gains in periods of relocation under the baseline, because their migration calculus also involves their spouse, whereas in Experiment I they move taking only their private gains into account. Unlike the data comparison where differences in the consequences of migration between single and married people can also arise due to selection (into family structure) on observable and unobservable characteristics, the difference between behavior

[23] It should be noted that a comparison of these counterfactual results to data on single individuals is not appropriate given the way estimation is carried out in this paper. This is because parameter estimates obtained here do not apply to singles, since only married individuals are used for the estimation and selectivity into marriage is not taken into account. Nevertheless, this experiment provides a valid comparison of behavior with family ties and behavior in the absence of family ties, since behavior is simulated with agents facing the same environment and constraints as in the baseline except for the presence of a spouse. More importantly, this comparison using the results of Experiment I circumvents the problem of selectivity into family structure, a problem encountered when comparing single and married individuals in the data.

[24] In the estimation, in order to compute the moments from the model, the behavior of the married people is simulated for only the number of periods they are observed in the data. In the simulation for this counterfactual, the same procedure is followed.

under the baseline and Experiment I can be attributed solely to family ties as the men and women have the same characteristics and face the same environment in both cases. As the 'tied mover' in the baseline, women incur private losses due to relocation (due to moving costs, lower wages or a non-employment spell following the move, foregone earnings, lost experience accumulation that lead to lower value of being single and lower share of total household utility), but these losses are shared and compensated for by her marriage utility and part of husband's private gains. Similarly, as the 'tied stayer' in the baseline, men's private losses are compensated by intra-household transfers and marriage utility. Transferable utility assumption in the model render such efficiency inducing transfers possible.

Table 20 also shows that for periods of no relocation, there is no difference in terms of average wage difference between two consecutive periods under the counterfactual scenario compared to the baseline. In general, the fact that search behavior between locations is strongly influenced by family ties also could influence search behavior within each location, since different prospects of being a tied mover or stayer changes the calculus of accepting or rejecting each wage offer. The counterfactual results show that this is not the case. This shows that family aspect of decision making matters mostly for job search behavior between locations and not as much for job search behavior within locations.[25]

How do the differences in migration rates and the magnitude of wage gains incurred with and without family ties manifest themselves in overall wage growth of men and women? Table 20 shows that the average wages of men in Experiment I is $25,920, in comparison to $23,662 in the baseline case. In other words, when acting alone, men's wages are about 10 percent higher compared to the baseline. Men's wages are higher when they are acting alone, because compared to the baseline they move more frequently and experience higher wage gains when they move, as is displayed in Table 20. Women's average wages also increase under Experiment I but at a much smaller rate compared to men: In Experiment I women's average wage is $16,510, in comparison to $16,082 under the baseline. In other words, when they are acting alone, women's wages are about 3 percent higher compared to the baseline. Increase in the wages for women is much smaller in comparison to men, because their gains from relocation are not as high as they are for men due to lower geographic wage offer differentials they face. Hence the increase in their mobility rates compared to the baseline as well as in their relocation wage gains are not as high as they are for men. This can also be seen in Table 20, which shows that women experience much lower wage gains in periods of relocation compared to men even under Experiment I, where they are acting alone.[26]

[25]This is due to the specification of the agents' utility functions. With a non-linear utility function, job search behavior of partners would be influenced more strongly by the current wage and job prospects of their spouse. Dey and Flinn (2008) present a detailed analysis of the joint job search behavior of couples within locations with more general preferences.

[26]However, women's wage gains in periods of relocation are still higher compared to the wage gains they

The contrast in men and women's wage increases compared to the baseline under Experiment I reveals an important feature of the estimated model. It shows that geographic mobility is a much more important source of wage growth for men than it is for women, when married but also when acting alone. With family ties, geographic mobility does not lead to wage growth for women, because household moves are generally initiated by the husband's wage opportunities. However, even without family ties, geographic mobility is not as important a source of wage growth for women compared to men, because they do not face large geographic wage differentials and their monetary gains from relocation are not as high as that of men.

One of the purposes of Experiment I is to quantify labor market costs that married individuals incur due to location ties. These costs take the form of reduced wage growth due to lower mobility as well as due to lower wage gains in periods of relocation, as explained above. It is important to note that the above estimates of such costs provide a lower bound of the true costs of location ties. This is because only the married individuals have been used for the estimation. Conditioning on marriage implies that the parameter estimates apply only to the population of married individuals and not to the population as a whole. Selection into marriage renders the population of married individuals different than that of single ones, especially in terms of cost of family ties related to migration decisions. Individuals who have chosen to be married have on average lower costs of family ties compared to the whole population. Hence, cost of location ties is potentially higher for the overall population and the results in this paper provide a lower bound to such costs.

9.2 Family Ties, Marital Instability and Wage Growth

Mincer defines location ties as the measure of the negative private externality imposed by family migration. He points out that location decisions lead to divorce when the couple's migration ties exceed the gains from marriage. One implication of this conjecture is that when location ties are large (when one or both partners stand to lose a lot from being the tied spouse), divorce is more likely. To what extent do such ties increase divorce rates? In order to quantify the impact of location ties on marital instability, the estimated model is used to conduct a counterfactual experiment, Experiment II, where mobility cost is raised to a level which renders moving never optimal.

Table 21 shows that 24 percent of couples divorce in the baseline case, whereas in Experiment II it is 16 percent. When moving costs are high, divorce rates fall due to two reasons in the estimated model: (1) Value of outside option is lower, especially for men, and the marital surplus therefore is higher for any given marriage utility level, (2) Wage offer draws from other locations no longer lead to a disparity between the spouses' ranking of the current and alternative locations, as the alternative location is never optimal for either of them in the face of very high moving costs. In

experience under the baseline, since they are no longer in the role of the tied spouse in Experiment I.

the model, divorce occurs in two occasions. First, partners divorce when marriage utility is low, so that divorce might be optimal in periods where the couple has a low or negative marriage utility shock. Second, partners divorce when one spouse draws a wage offer that leads to a high gain from relocation, whereas the other spouse faces a high loss, and marriage utility is not sufficient to make up for the loss that either incurs through being the tied mover or stayer. Divorce is an efficient outcome as there are no transfers that can be made within the household that will make them better off if they remain married. As men and women face conflicting incentives to move (or stay), divorce might be optimal when there is a large discrepancy between the gain of each spouse from a particular location so that there exist no feasible transfers that make both better off being married than divorce. With high moving costs, there are no such conflicting incentives, as neither partner ever wants to relocate.

In Experiment II, another outcome of interest is wage growth and employment without mobility. Table 21 reports the employment rates and average wages under the baseline and counterfactual scenarios. Agents are separated into two groups here according to whether they were movers in the baseline case (determined by whether he/she ever relocated during the course of his/her marriage). This is to see the mechanism underlying the changes observed under this counterfactual scenario. Those who relocated at least once in the baseline case are defined as 'Movers in Baseline' and those who have not, as 'Stayers in Baseline'. The distinction is made in order to see which group experiences the larger changes when there is no mobility. It can be seen in Table 21 that for men, employment rates do not change compared to the baseline, but wages go down considerably, especially for those who were movers in the baseline. For the agents that were movers in the baseline, wages go down by 15 percent, from \$25,142 to \$21,248, while there is almost no change in the stayer group. In the baseline, family mobility generally benefits the husband as it is initiated by his opportunities, and therefore is an important source of wage growth for the husband and not the wife. Therefore in Experiment II, where there is no mobility, it is the men's wages, and in particular the wages of those that were movers in the baseline, that go down and not the women's as discussed below. For women, the opposite occurs.

It can be seen in Table 21 that especially for women who were 'Movers' in the baseline, employment rates as well as wages are higher in Experiment II. Women are less likely to remain employed when they change locations with their husbands in the baseline case. Therefore with no possibility of moving, their employment rates are higher under the counterfactual scenario, especially for those women who were movers in the baseline case. For women who were movers in the baseline, employment rates increase from 48 percent to 53 percent, while wages increase by 4 percent, from \$14,775 to \$15,442.

An important feature of these results is that when there is no mobility, it is the men who experience the largest changes in their wages. For men, wages overall are lower in Experiment II mainly

because an important channel through which their wages can grow is shut off. This is because geographic mobility is a relatively more important channel for men's wage growth, as they are the main beneficiaries of household moves.

9.3 Family Ties and Changing Role of Women

The last 50 years in the United States have seen a dramatic increase in the employment rates and wages of women. How does the equalization of male and female employment opportunities impact the family migration experience? Under the third counterfactual experiment, Experiment III, the wage offer distribution parameters of females are set equal to those of males.[27] The goal of this experiment is to assess what implications migration has on the couples' wages once the labor market environments they face are equated.[28]

Figure 9 shows the wage profiles of women by their migrant status under the counterfactual scenario. It can be seen that when there is no gender difference in the labor market opportunities, migration is associated with higher wages for women: Women who moved at least once have considerably higher wages than those who never moved. This result indicates that the reason migration has different implications for married men and married women in the baseline is the different wage offer distributions they face. In the baseline, men face higher mean wage offers with larger wage differentials between locations, and therefore household moves that require men to make compromises are more costly. Men face larger geographic differentials in terms of their income, therefore the men's wage gains induce household migration rather than the women's. However, when they face equal wage offer distributions, household migration is initiated by the wife's opportunities as much as it is by the husband's. This result is especially important, since one of the findings from the estimated model is that the structural differences between men and women in terms of the labor market opportunities they face is what gives rise to the gender differences in the consequences of migration for married people. Experiment III provides further evidence on the validity of such an interpretation.

[27] This experiment does not take a stance on how such an equalization of wage offers arises. This can be either due to increase in the rental rates of skills that women face relative to men (decrease in discrimination) or because an increase in the skill endowments of women (due to higher educational attainment levels). A more comprehensive analysis would look into the fundamentals that give rise to such an equalization and assess the implications of the changes of these fundamentals on the economy, marriage market and household labor supply overall. Some examples to changes in such fundamentals are skill biased technological change or the rise in the service sector relative to the manufacturing sector, as in Lee and Wolpin (2006). Such an analysis is outside the scope of this paper. Moreover, other potential implications of the changes in attributes of males and females are the change in the sorting patterns as well as timing of marriage. These effects are also not taken into account here.

[28] Under this counterfactual, men and women still differ in terms of the arrival rates of their job offers.

10 Conclusion

In this paper, a dynamic model of married couples' decisions regarding geographic location and employment status in a framework with intra-household bargaining is developed and estimated. The model is shown to provide a reasonable fit to the data on migration and employment choices of married couples. Specifically, the model performs well in fitting the differences in the wage and employment profiles of men and women by their migrant status. The estimated model is used to assess to what extent joint location constraints affect the labor market outcomes, migration patterns and marital stability of men and women.

Parameter estimates provide evidence on the structural differences between men and women in preferences and labor market environments they face within and between locations. The estimated model shows that correlation between partners gains between and within locations is low. Therefore they do not always prefer the same location, and probability of relocation differs between families and individuals acting alone. Counterfactual experiments confirm this by showing that individuals move much more frequently when they are acting alone. Another important feature of the estimated model is that men face larger geographic differentials in their wage offer distributions, have higher mean wage offers for each location, and have a lower utility of leisure compared to women. Due to these differences, household moves are generally initiated by men's opportunities in other locations. Men are also tied stayers at times, albeit not as frequently, because women's losses are sometimes large enough to make moving not optimal. Counterfactual experiments show that, when they are acting alone, both men and women experience higher wage gains in periods of relocation. Results from the counterfactual experiments also help quantify the strong link between family location constraints and marital stability. Counterfactual experiments show that joint location constraints lead to higher divorce rates.

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Figure 1: **Wages by Age and Migrant Status (in 1983 dollars)**

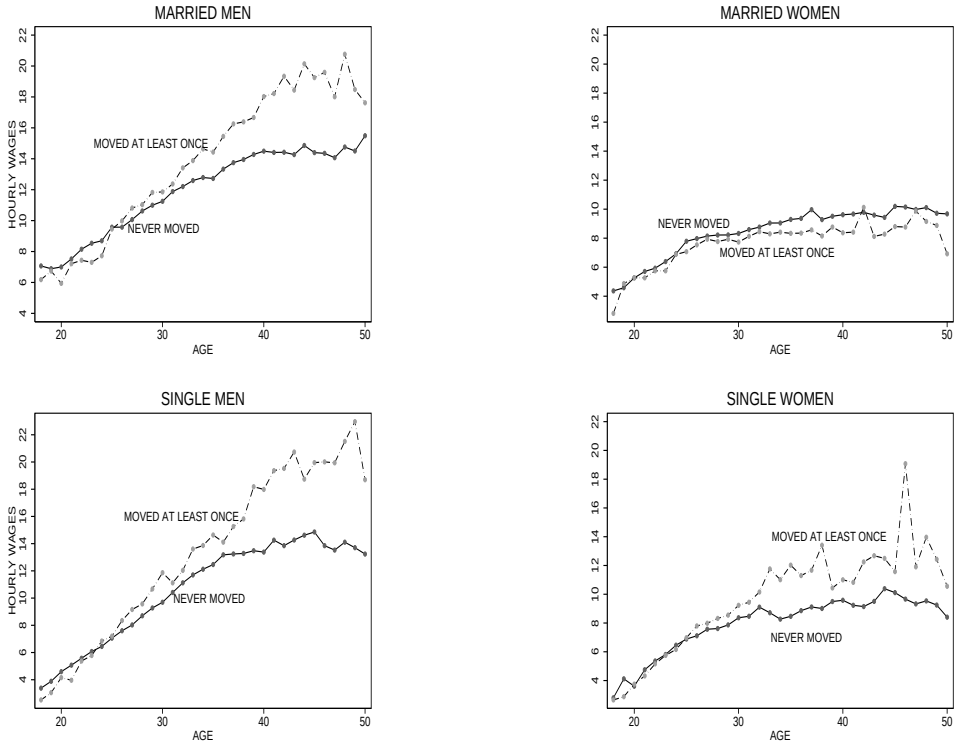


Table 1: **Employment Conditional on Being Employed in the Preceding Period**

		Employed at T+1	
		Stay	Move
	Married Men	97.85%	94.31%
	Married Women	86.53%	72.05%
Employed at T			
	Single Men	94.84%	89.87%
	Single Women	93.26%	87.36%

Figure 2: **Decision of the Household**

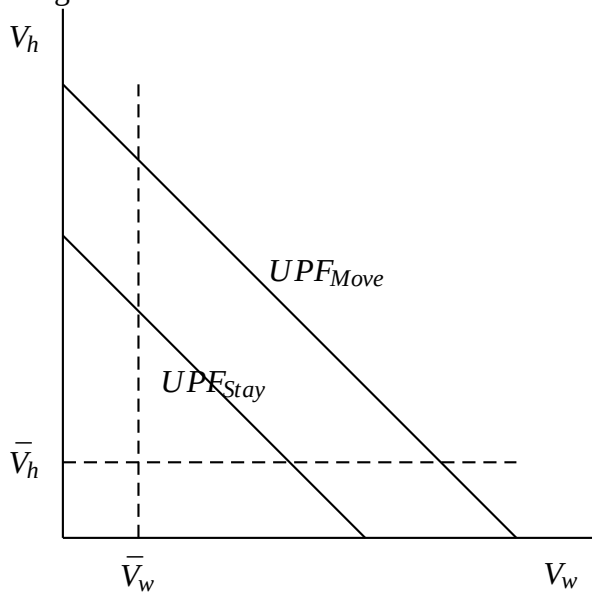


Figure 3: **Decision of the Household**

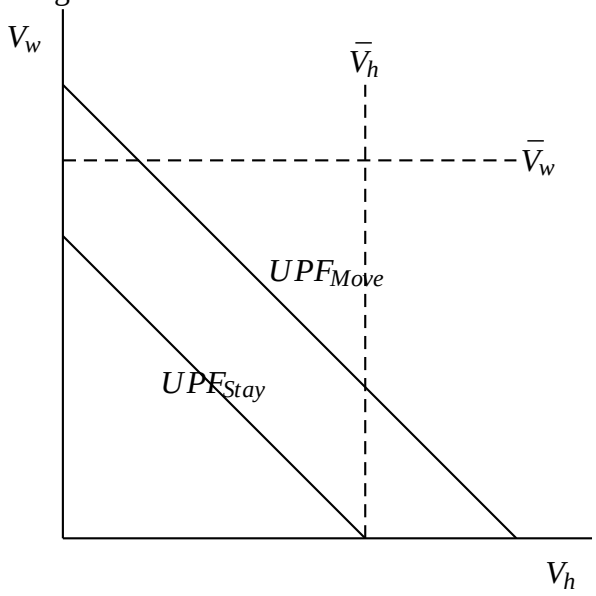


Table 2: **Proportion of Couples by the First Year of Observation**

First Year of Observation	Number	Percentage (Cumulative)
1968	11	0.74
1969	23	2.30
1970	41	5.07
1971	56	8.86
1972	65	13.26
1973	79	18.61
1974	60	22.67
1975	51	26.12
1976	65	30.51
1977	60	34.57
1978	50	37.96
1979	70	42.69
1980	68	47.29
1981	47	50.47
1982	71	55.28
1983	76	60.42
1984	59	64.41
1985	59	68.40
1986	57	72.26
1987	53	75.85
1988	47	79.03
1989	55	82.75
1990	55	86.47
1991	46	89.58
1992	41	92.35
1993	44	95.33
1994	40	98.04
1995	29	100.00
Total	1,478	

Table 3: **Number of Couples who Remain in the Sample by Reason for Leaving**

Marriage Duration	Leave due to Divorce/Age 54/Year 1997	Non-Response	Remain in Sample
0	0	0	1478
1	0	0	1478
2	54	9	1415
3	76	9	1,330
4	78	11	1,241
5	61	8	1,172
6	69	10	1,093
7	68	11	1,014
8	61	9	944
9	54	2	888
10	56	8	824
11	56	6	762
12	48	6	708
13	58	9	641
14	59	6	576
15	47	4	525
16	41	10	474
17	50	6	418
18	45	5	368
19	41	7	320
20	31	4	285
21	44	2	239
22	32	3	204
23	24	3	177
24	43	1	133
25	40	1	92
26	34	1	57
27	30	0	27
28	17	0	10
29	10	0	0

Table 4: **Descriptive Statistics**

Average # of years a couple is observed	13.48	(*7.25*)
Average # of years a couple stays in a division	7.56	(*6.34*)
Average age of head at marriage	26.84	(*6.88*)
Average age of wife at marriage	25.15	(*6.65*)
Average work experience of husband at time of marriage	6.78	(*6.68*)
Average work experience of wife at time of marriage	4.28	(*4.76*)
Average annual wages for husband (in 1983 dollars)	25,088	(*17,403*)
Average annual wages for wife (in 1983 dollars)	16,904	(*10,525*)
Percentage of Couples by Education		
Both Have College Degree	19.49%	
Only Husband Has College Degree	12.65%	
Only Wife Has College Degree	7.98%	
Neither Has College Degree	59.88%	
Percentage of Couples by Number of Moves		
Never Moved	81.46%	
Moved Once	10.49%	
Moved Twice	5.07%	
Moved Three Times or More	2.98%	
Proportion of Moves that are Back Home	32.83%	
Proportion of Couples who Divorce	23.68%	
Proportion of Divorces Followed by a Move	6.00%	

Table 5: **Per-Period Divorce Rates (Annual)**

Overall Divorce Rates	1.90%
Divorce Rates Conditional on Staying	1.83%
Divorce Rates Conditional on Moving	4.54%

Table 6: **Per-Period Moving Rates Between Census Divisions by Location Tenure (Annual)**

# of Years at Current Location	Moving Rate
0	6.05 %
1	4.73 %
2	3.25 %
3	2.38 %
4	1.86 %
5	1.58 %
6	1.39 %
7	1.20 %
8	0.95 %
9	0.89 %
10	0.83 %

Table 7: **Per-Period Moving Rates Between Census Divisions (Annual)**

By Joint Employment Status	
Both Working	1.63%
Only Husband Working	3.39%
Only Wife Working	2.76%
Neither Working	5.26%
By Joint Education Level	
Both Have College Degree	3.77%
Only Husband Has College Degree	2.91%
Only Wife Has College Degree	0.99%
Neither Has College Degree	2.14 %
By Whether the Couple Has Children	
No Children	3.50 %
Children	2.16 %

Table 8: **Percentage of Couples by Location of Residence in the First Period**

Census Division	Number	Percent
New England	90	6.09
Middle Atlantic	228	15.43
East North Central	281	19.01
West North Central	200	13.53
South Atlantic	185	12.52
East South Central	108	7.31
West South Central	134	9.07
Mountain	88	5.95
Pacific	164	11.10
Total	1,478	100.00

Table 9: **Per Period In- and Out-migration Rates by Census Divisions**

Census Division	In-migration	Out-migration
New England	1.67%	1.94%
Middle Atlantic	0.99%	1.52%
East North Central	2.36%	2.36%
West North Central	1.88%	1.89%
South Atlantic	3.67%	2.69%
East South Central	3.54%	2.68%
West South Central	2.89%	3.68%
Mountain	4.63%	3.86%
Pacific	2.44%	3.14%

Table 10: **Annual Log Wages by Location, Education and Gender (in 1983 dollars)**

	Males		Females	
Census Division	No College	College	No College	College
New England	10.01	10.29	9.58	9.98
	(0.0005)	(0.0004)	(0.0007)	(0.0009)
Middle Atlantic	9.87	10.36	9.49	10.12
	(0.0002)	(0.0003)	(0.0003)	(0.0007)
East North Central	9.89	10.32	9.42	10.02
	(0.0001)	(0.0003)	(0.0002)	(0.0005)
West North Central	9.73	10.03	9.27	9.83
	(0.0002)	(0.0005)	(0.0003)	(0.0005)
South Atlantic	9.78	10.24	9.46	9.90
	(0.0002)	(0.0005)	(0.0003)	(0.0006)
East South Central	9.69	10.16	9.34	9.93
	(0.0003)	(0.0011)	(0.0003)	(0.0011)
West South Central	9.72	10.12	9.36	9.89
	(0.0003)	(0.0005)	(0.0003)	(0.0006)
Mountain	9.77	10.11	9.39	9.84
	(0.0004)	(0.0009)	(0.0006)	(0.0011)
Pacific	9.93	10.26	9.54	9.97
	(0.0002)	(0.0005)	(0.0004)	(0.0011)

Table 11: **Transition Rates - Males**

	Employed-Stay	Unemployed-Stay	Employed-Move	Unemployed-Move
Males				
Employed	95.52%	2.09%	2.24%	0.14%
Unemployed	50.15%	46.06%	2.73%	1.06%
Females				
Employed	85.07%	13.24%	1.22%	0.47%
Unemployed	17.33%	79.26%	0.48%	2.92%

Figure 4: **Males - Hourly Wages by Experience, Migrant Status and Education (in 1983 dollars)**

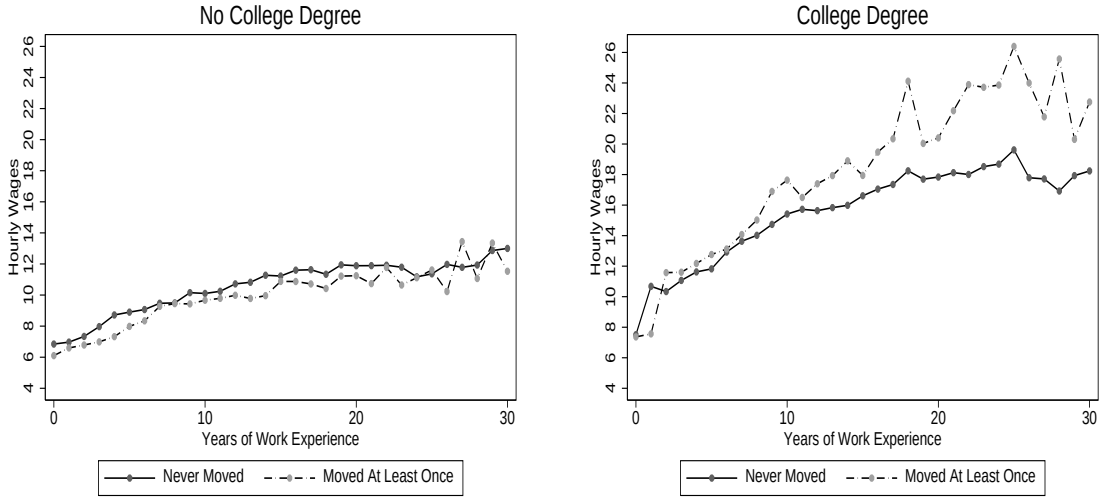


Figure 5: **Females - Hourly Wages by Experience, Migrant Status and Education(in 1983 dollars)**

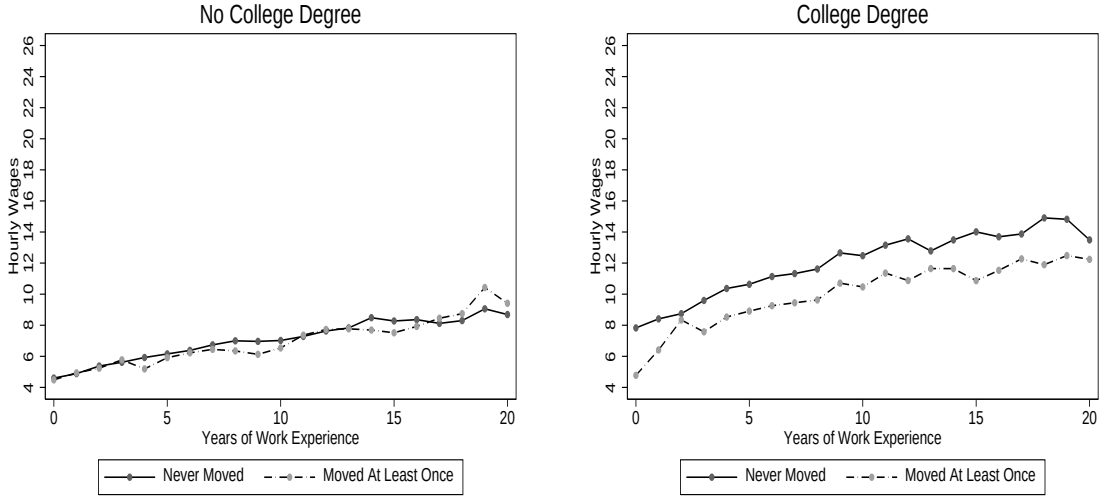


Table 12: **Parameter Estimates: Log Wage Offer Function**

	Male	Female
Constant (α_0)		
New England	9.23	8.12
	(0.0013)	(0.0042)
Middle Atlantic	9.26	8.39
	(0.0011)	(0.0008)
East North Central	9.30	8.50
	(0.0015)	(0.0021)
West North Central	8.53	8.71
	(0.0033)	(0.0027)
South Atlantic	8.98	8.76
	(0.0023)	(0.0028)
East South Central	9.07	8.77
	(0.0014)	(0.0016)
West South Central	8.92	8.76
	(0.0017)	(0.0022)
Mountain	8.89	8.78
	(0.0015)	(0.0012)
Pacific	9.03	8.44
	(0.0029)	(0.0059)
Education (α_i^1)	0.43731	0.39417
	(0.00046)	(0.00034)
Experience (α_i^2)	0.01669	0.01552
	(0.00002)	(0.00001)
Experience Sq. (α_i^3)	-0.00048	-0.00050
	(0.0000013)	(0.0000006)
Sd of shock to wage offers ($\sigma_{v,i}$)	0.49	0.42
	(0.00018)	(0.00025)
Correlation Between Spouse Wage Draws	0.57	
	(0.00074)	

Table 13: **Parameter Estimates: Arrival Rates of Offers and Non-pecuniary Benefits**

	Males	Females
Arrival Rate of Offers:		
Educated & Working	0.39	0.12
	(0.00026)	(0.00106)
Not Educated & Working	0.17	0.16
	(0.00032)	(0.00129)
Educated & Not Working	0.81	0.42
	(0.00113)	(0.00086)
Not Educated & Not Working	0.80	0.34
	(0.00157)	(0.00085)
Probability of Drawing Home	0.19	
	(0.00024)	
Probability of Drawing Location if not Home	0.15	
	(0.00012)	
Non-pecuniary benefits:		
New England	-4,986	
	(13.52)	
Middle Atlantic	0.00	
East North Central	3,099	
	(12.75)	
West North Central	3,662	
	(22.25)	
South Atlantic	4,001	
	(17.37)	
East South Central	-1,727	
	(16.51)	
West South Central	5,878	
	(27.97)	
Mountain	8,834	
	(18.52)	
Pacific	-10,645	
	(20.48)	

Table 14: **Parameter Estimates: Utility**

	Males	Females
Utility from Not Working:		
No College ($\gamma_{4,i}$)	146	4,751
	(3.69)	(3.54)
College ($\gamma_{4,i}$)	146	11,366
	(3.69)	(5.82)
Children ($\gamma_{5,i}$)	35	5,159
	(4.33)	(4.41)
Sd of shock to utility from not working ($\sigma_{2,i}$)	5,004	11,132
	(7.82)	(7.83)
Staying Home Utility (γ_8)	13,064	
	(6.55)	
Marriage Utility:		
Constant (γ_6)	139	
	(0.60)	
Duration of Marriage Coefficient (γ_7)	481	
	(0.23)	
Sd of shock to Marriage Utility (σ_3)	28,905	
	(35.20)	
Moving Cost:		
Children (γ_1)	263	
	(15.20)	
Working (γ_2)	7,034	
	(9.94)	
Not Working	1,447	
	(9.63)	
Location Duration Coefficient (γ_3)	725	
	(2.30)	
Cost of Moving at time of Divorce (Υ)	28,495	
	(95.75)	
Sd of shock to Moving Cost (σ_1)	118	
	(3.35)	

Table 15: **Model Fit: Employment Rates by Census Division**

	Model	Data
Males - No College		
New England	**95.91%**	93.76%
Middle Atlantic	**94.87%**	92.97%
East North Central	**95.81%**	94.93%
West North Central	**96.70%**	96.81%
South Atlantic	**96.57%**	97.15%
East South Central	**95.12%**	95.71%
West South Central	**95.30%**	96.57%
Mountain	**93.59%**	94.97%
Pacific	**97.53%**	94.94%
Males - College		
New England	**98.56%**	97.24%
Middle Atlantic	**97.96%**	97.47%
East North Central	**98.45%**	97.99%
West North Central	**98.56%**	94.81%
South Atlantic	**98.66%**	96.37%
East South Central	**97.12%**	96.52%
West South Central	**98.79%**	98.17%
Mountain	**97.51%**	97.52%
Pacific	**98.09%**	96.63%
Females - No College		
New England	**55.25%**	46.06%
Middle Atlantic	**53.20%**	51.89%
East North Central	**53.79%**	54.01%
West North Central	**59.77%**	61.64%
South Atlantic	**63.64%**	64.61%
East South Central	**58.99%**	63.78%
West South Central	**60.33%**	55.93%
Mountain	**59.04%**	61.37%
Pacific	**50.24%**	48.68%
Females - College		
New England	**42.44%**	50.47%
Middle Atlantic	**58.70%**	59.56%
East North Central	**57.76%**	56.68%
West North Central	**66.88%**	66.57%
South Atlantic	**64.97%**	63.96%
East South Central	**56.02%**	55.88%
West South Central	**54.91%**	59.34%
Mountain	**64.14%**	60.54%
Pacific	**60.76%**	67.61%

Figure 6: **Model Fit: Wages by Census Division and Education (in 1983 dollars)**

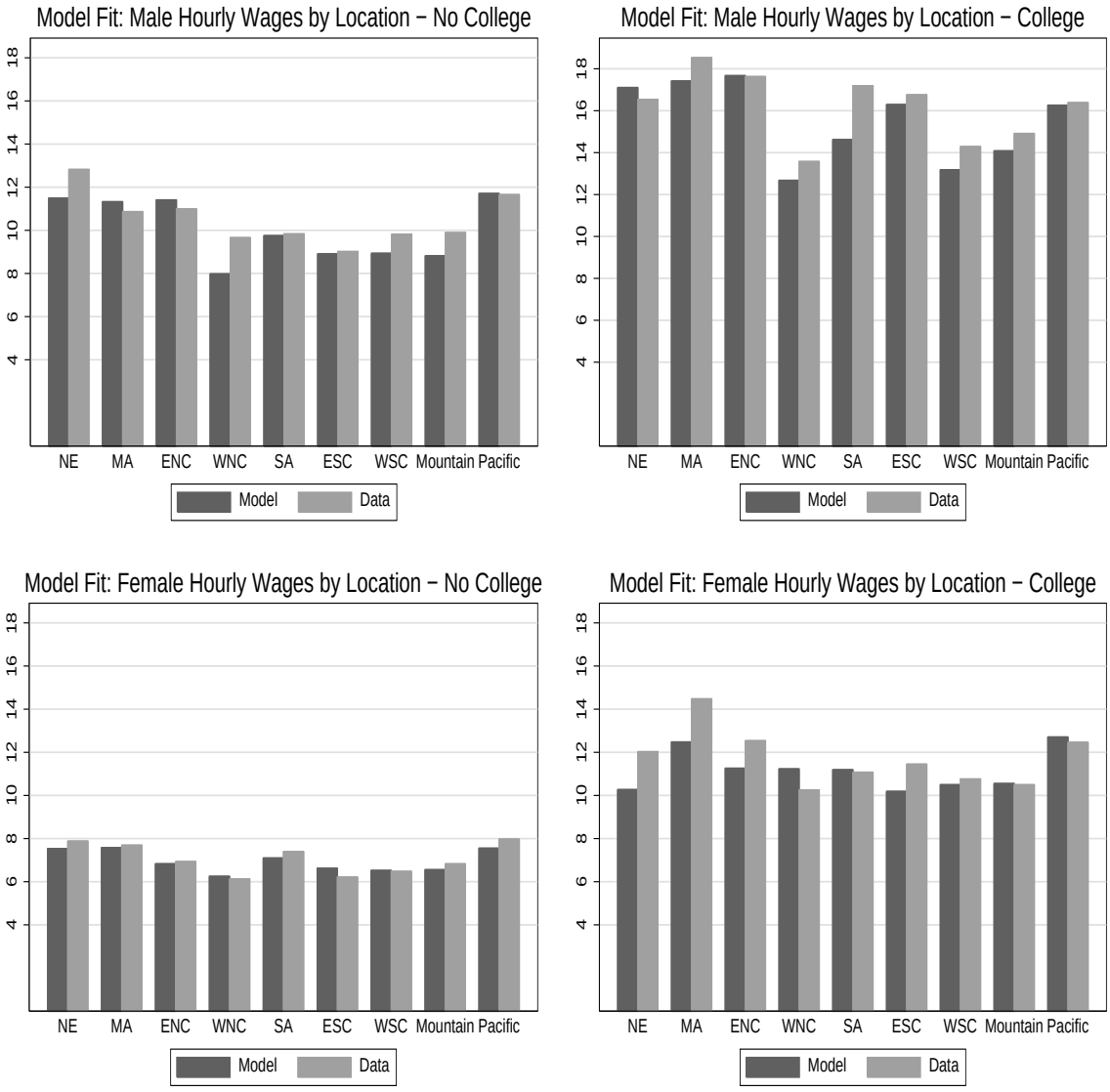


Table 16: **Model Fit: Transition Rates Between Employment Status**

		Employed at T+1			
		Stay		Move	
		Model	Data	**Model**	Data
Employed at T	Males	**98.74%**	97.85%	**88.86%**	94.31%
	Females	**86.38%**	86.53%	**59.37%**	72.05%

Figure 7: **Model Fit: Employment and Wages by Work Experience**

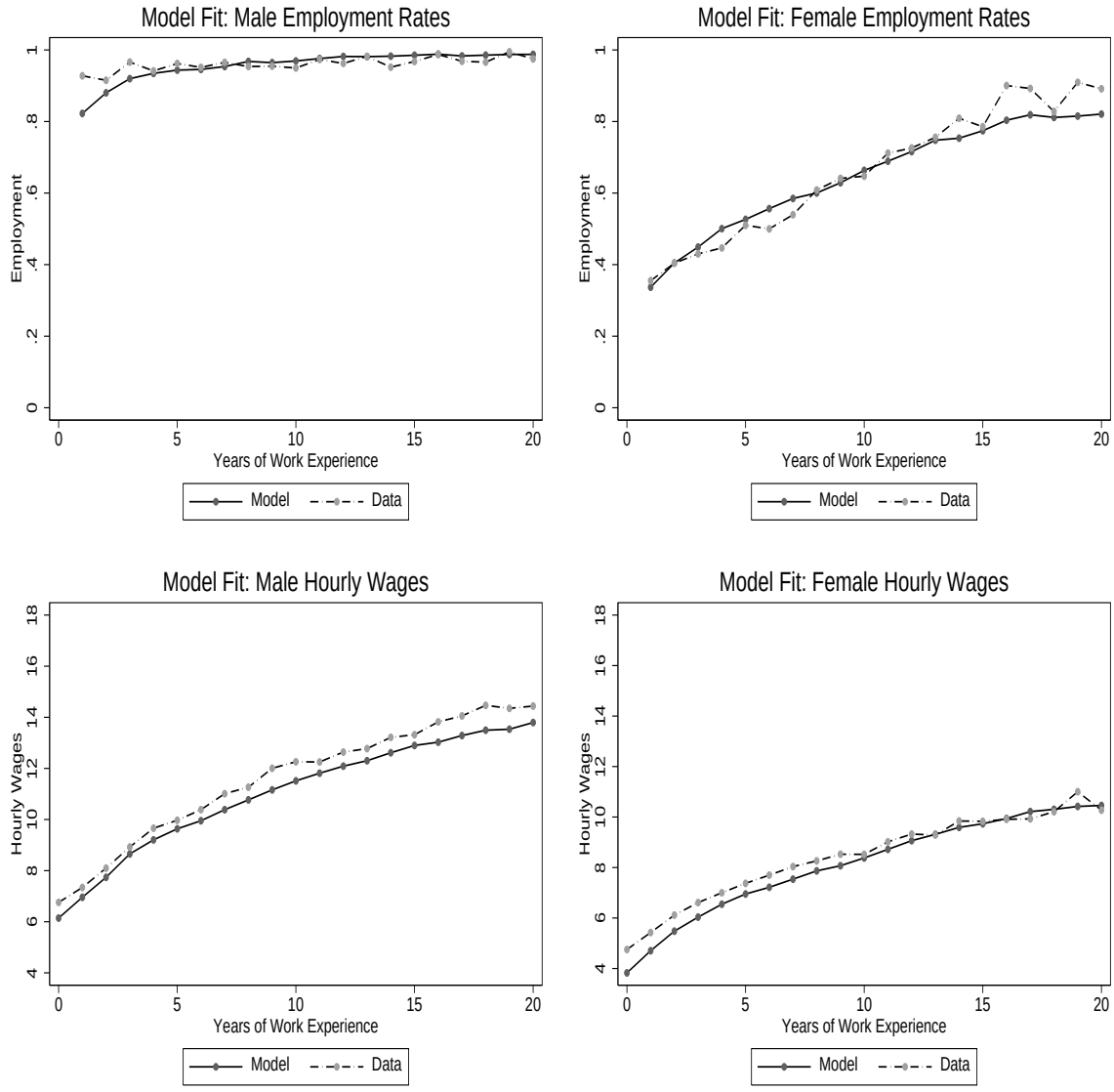


Figure 8: **Model Fit: Wages by Migrant Status**

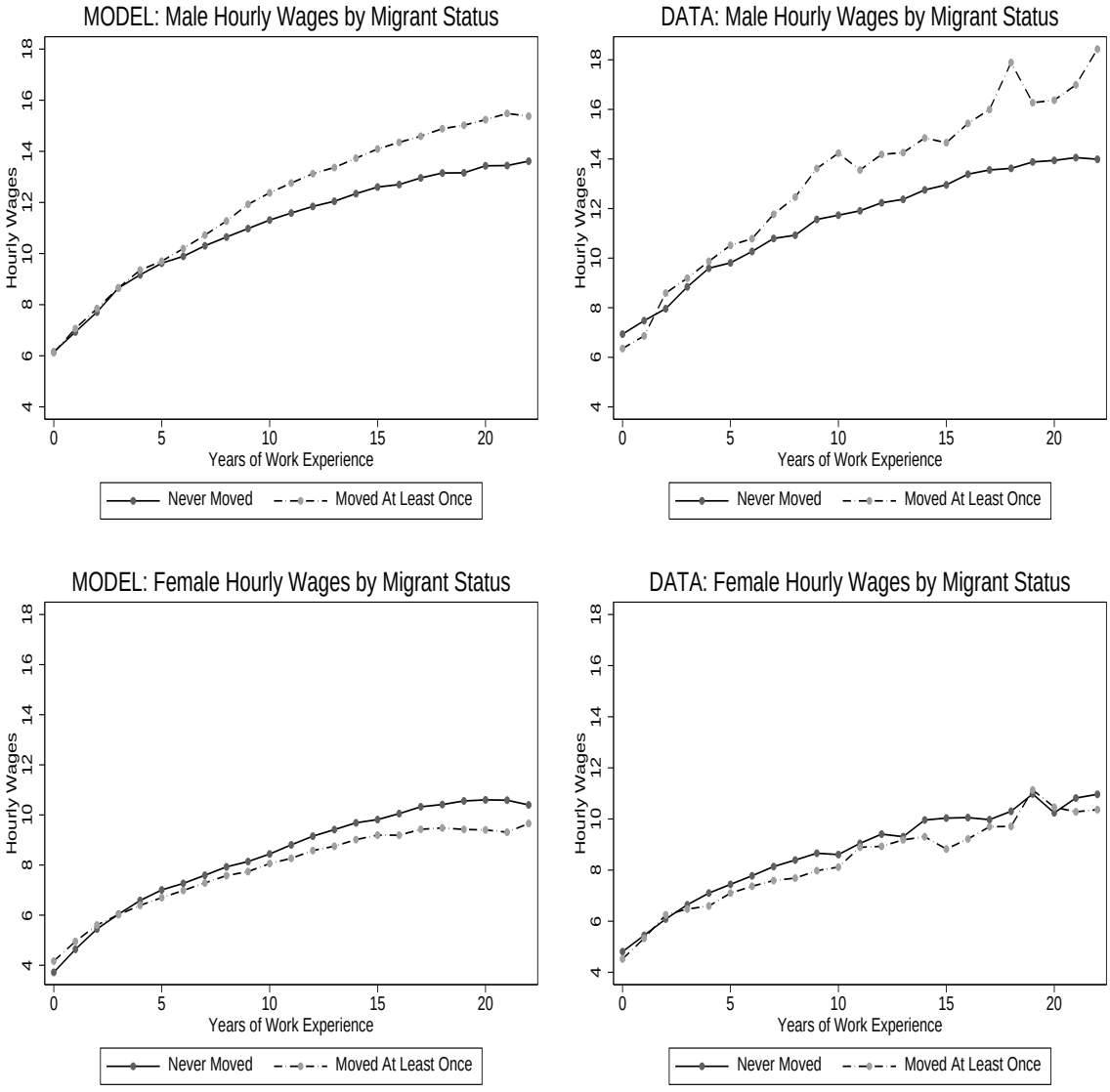


Table 17: **Model Fit: Moving Rates**

	Model	Data
Proportion of Couples who Moved at Least Once	**18.18%**	18.54%
Proportion of Moves that are Back Home	**33.38%**	32.83%
Proportion of Couples who Divorced	**24.43%**	23.68%
Proportion of Divorces that are Followed by a Move	**6.45%**	6.00%
Moving Rates by Age of Head		
18-25	**4.05%**	4.37%
26-30	**2.95%**	3.19%
31-35	**1.88%**	2.02%
36-40	**1.30%**	1.77%
41-50	**1.15%**	1.81%
Moving Rates by Joint Education Level		
Both College Educated	**2.79%**	3.77%
Only Husband College Educated	**2.86%**	2.91%
Only Wife College Educated	**1.92%**	1.00%
Neither College Educated	**2.01%**	2.14%
Moving Rates by Joint Employment Status		
Both Working	**1.55%**	1.64%
Only Husband Working	**2.95%**	3.39%
Only Wife Working	**4.26%**	2.77%
Neither Working	**6.57%**	5.26%

Table 18: **Model Fit: Transition Rates (%) - By Region**

		Northeast	Midwest	South	West
Northeast	**Model**	**12.03**	**31.61**	**31.16**	**25.20**
	Data	14.52	24.19	38.71	22.58
Midwest	**Model**	**19.37**	**17.11**	**36.48**	**27.04**
	Data	8.87	20.97	45.16	25.00
South	**Model**	**17.74**	**31.83**	**23.71**	**26.72**
	Data	8.00	31.33	43.33	17.33
West	**Model**	**15.23**	**28.47**	**32.79**	**23.52**
	Data	10.38	29.25	30.19	30.19

Table 19: **Model Fit: Transition Rates (%)**

		Work-Stay	Not Work-Stay	Work-Move	Not Work-Move
Males - No College					
Work	**Model**	**96.59**	**1.54**	**1.60**	**0.26**
	Data	95.70	2.47	1.73	0.11
Not Work	**Model**	**53.99**	**40.98**	**4.25**	**0.79**
	Data	49.59	48.17	1.42	0.81
Males - College					
Work	**Model**	**96.74**	**0.54**	**2.52**	**0.20**
	Data	95.22	1.43	3.18	0.19
Not Work	**Model**	**60.86**	**30.85**	**7.61**	**0.68**
	Data	51.79	39.88	6.54	1.79
Females - No College					
Work	**Model**	**84.53**	**13.97**	**0.95**	**0.55**
	Data	84.92	13.55	1.04	0.48
Not Work	**Model**	**16.37**	**80.61**	**1.93**	**1.10**
	Data	18.11	79.03	0.49	2.37
Females - College					
Work	**Model**	**86.20**	**11.84**	**1.01**	**0.95**
	Data	85.40	12.49	1.65	0.46
Not Work	**Model**	**13.77**	**82.81**	**1.77**	**1.65**
	Data	15.21	79.88	0.46	4.44

Experiment I: Migration and Labor Market Outcomes with no Family Ties

Table 20: **Experiment I: Baseline and Counterfactual Comparison**

	Baseline	No Family Ties
Proportion who Moves at Least Once:		
Males	**18%**	25%
Females	**18%**	23%
Log Wage Gain For Periods of Relocation:		
Males - No College	**0.17**	0.44
Males - College	**0.23**	0.42
Females - No College	**-0.02**	0.05
Females - College	**-0.11**	0.09
Log Wage Gain For Periods of No Relocation:		
Males - No College	**0.01**	0.01
Males - College	**0.02**	0.02
Females - No College	**0.01**	0.01
Females - College	**0.01**	0.01
Employment Rates:		
Males	**96%**	97%
Females	**58%**	60%
Female-to-Male Ratio	0.60	0.62
Wages:		
Males	**23,662**	25,920
Females	**16,082**	16,510

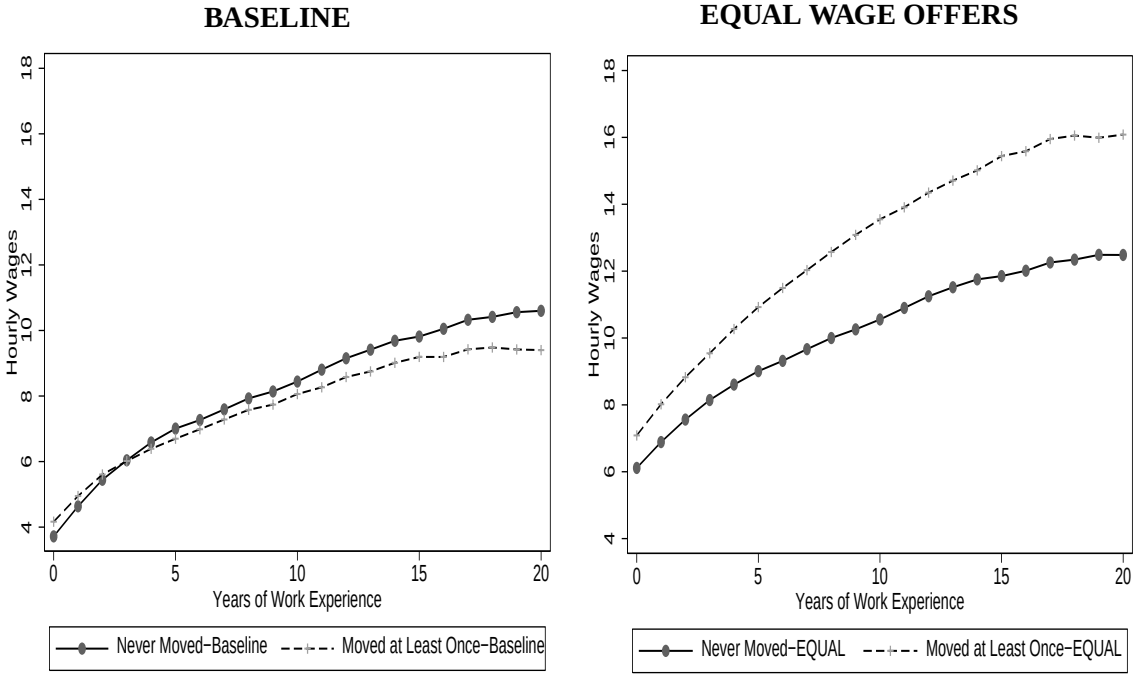
Experiment II: No Migration

Table 21: **Experiment II: Baseline and Counterfactual Comparison**

	Baseline	No Migration
Employment Rates:		
Males	**96%**	96%
Females	**58%**	59%
Female-to-Male Ratio	**0.60**	0.61
Employment Rates by Baseline Moving Status:		
Males who were 'Stayers' in Baseline	**97%**	96%
Males who were 'Movers' in Baseline	**95%**	95%
Females who were 'Stayers' in Baseline	**60%**	61%
Females who were 'Movers' in Baseline	**48%**	53%
Wages:		
Males	**23,662**	23,073
Females	**16,082**	16,506
Female-to-Male Ratio	**0.68**	0.72
Wages by Baseline Moving Status:		
Males who were 'Stayers' in Baseline	**23,307**	23,509
Males who were 'Movers' in Baseline	**25,142**	21,248
Females who were 'Stayers' in Baseline	**16,339**	16,729
Females who were 'Movers' in Baseline	**14,775**	15,442
Divorce Rates:		
Proportion of Couples who Divorce	**24%**	16%

Experiment III: Equal Wage Offer Distributions

Figure 9: **Female Wages by Work Experience and Moving Status**



APPENDIX

A Geographic Aggregations

A.1 List of Census Divisions

1. Division 1 (New England): Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont.
2. Division 2 (Middle Atlantic): New Jersey, New York, Pennsylvania.
3. Division 3 (East North Central): Indiana, Illinois, Michigan, Ohio, Wisconsin.
4. Division 4 (West North Central): Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota.
5. Division 5 (South Atlantic): Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia.
6. Division 6 (East South Central): Alabama, Kentucky, Mississippi, Tennessee.
7. Division 7 (West South Central): Arkansas, Louisiana, Oklahoma, Texas.
8. Division 8 (Mountain): Arizona, Colorado, Idaho, New Mexico, Montana, Utah, Nevada, Wyoming.
9. Division 9 (Pacific): Alaska, California, Hawaii, Oregon, Washington.

A.2 List of Regions

1. Region 1 (Northeast): New England, Middle Atlantic.
2. Region 2 (Midwest): East North Central, West North Central.
3. Region 3 (South): South Atlantic, East South Central, West South Central.
4. Region 4 (West): Mountain, Pacific.