

Family Migration and Labor Market Outcomes

Ahu Gemici *

Department of Economics, New York University

19 W.4th St.

New York, NY 10012

ahu.gemici@nyu.edu

FIRST DRAFT: JANUARY 2007

THIS DRAFT: JUNE 2008

*I am truly indebted to Kenneth Wolpin, Antonio Merlo and Petra Todd for their generous support and encouragement. I also benefited from conversations with Nicola Persico, John Knowles, Aureo De Paula, Phillip Kircher, Kurtulus Gemici, Manolis Galenianos, Melissa Tartari, Guido Menzio, Jorge R. Gallardo-Garcia, Limor Golan, Chris Flinn, Matt Wiswall and seminar participants at Duke University, Washington University, University of Minnesota, University of Iowa, New York University, Rochester University, and University of North Carolina at Chapel Hill. I am responsible for all errors.

Family Migration and Labor Market Outcomes

Abstract

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. The results show that marriage involves compromises for both spouses in terms of foregone job opportunities, and that tied migration has negative implications for the wages of married individuals. Family migration also has an impact on marital stability due to its effect on the gains to being married relative to being single.

JEL Classification Code: J12, J16, J31, J61

Keywords: Family Migration, Gender Wage Gap, Household Labor Supply, Divorce

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.¹ This paper theoretically and empirically analyzes the relation between marriage, migration and labor supply decisions.

Evidence from the Panel Study of Income Dynamics shows that the relationship between migration and wage/employment outcomes of men and women significantly differs by marital status. 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.² 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.³

In light of the migration patterns above, this paper addresses three main questions: (1) What accounts for the observed relationship between migration and labor market outcomes of married men and women? (2) What are the migration responses of married people to differences in their wage opportunities across locations? (3) To what extent do family migration decisions contribute to the observed gender wage gap? (4) To what extent do joint location constraints the married couples face contribute to their marital instability? In particular, if married individuals move in response to their spouses' job opportunities as well as their own, then their labor market decisions can be markedly different than that of single individuals. The implications of joint location constraints on the observed wage and employment outcomes of married couples can only be discerned after taking the selective nature of migration and joint job search behavior into account. To address the questions of interest, this paper develops and estimates a dynamic model of married couples' decisions regarding geographic location and employment status in a framework with intra-household bargaining.

In the model, each year a married couple makes decisions about whether (1) they will stay in their current location or move to a different location, (2) whether the husband will work, (3) whether the wife will work, (4)

¹The early literature on migration recognized the role of the family in location and labor supply decisions (Mincer (1978), Frank (1978)). This literature is briefly summarized at the end of this section.

²A 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.

³The 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.

whether they will remain married. 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 employment and migration decisions as single agents. The household chooses among multiple locations that differ in terms of their wage offer distributions and non-pecuniary benefits. In addition to location, the wage offer distributions differ by gender, education and labor market experience, which accumulates endogenously. Men and women are allowed to differ in their preferences for leisure. Divorce occurs as a result of changes in the marriage utility and different job opportunities that the couple faces in different locations. The model is structurally estimated using data from the Panel Study of Income Dynamics, which has detailed information on employment, wage and location histories of married couples between the years 1968 and 1997. The model 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)).

In this paper, it is shown that a unitary and static approach to the household's problem will fail to account for important aspects of the joint location and labor supply problem of married couples.⁴ The point of departure is the incorporation of the household's decision problem in a dynamic search environment with uncertainty, allowing for differences in wage offer distributions across locations as well as between men and women, with intra-household bargaining, endogenous experience accumulation and the possibility of divorce. This framework allows for a rich representation of the tradeoffs that a couple faces in making employment and migration decisions.

Such a representation can provide important insights into how the family members' joint location constraint affects their labor market decisions as well as their marital stability. First, this constraint leads to both spouses making compromises in terms of their labor market opportunities. Family members do not always accept the best offers they have from other locations, because the costs and gains from relocation are also influenced by the expected value of search of their partner in the new location. Household bargaining provides the mechanism by which such costs or gains from relocation (or no relocation) are shared. However, when the costs that one spouse incurs are too high relative to the gains from marriage or his/her partner's gains from relocation, it is optimal for the couple to divorce. In contrast, in cases where there are gains to remaining married, an individual might reject a high wage offer because his/her spouse does not face a favorable labor market environment in the new location. Therefore, in addition to current wage offers, the expected value of search of the partners across locations as well as the expected value of remaining married are important determinants of married couples'

⁴By static I refer to the type of models that do not incorporate uncertainty in future wage opportunities or in preferences.

location decisions. Second, family members' location problem has an impact on their marital stability due to its effect on both the current and future gains to being married relative to being single. The joint location problem faced within marriage might lead to smaller gains to remaining together, as individuals are less restricted in terms of their location choices when they are single.

The estimated model allows me to quantify the extent to which men and women differ in terms of their labor market opportunities across geographic locations,⁵ and more importantly, to what extent these differences contribute to their different migration experiences.⁶ In the model, men and women are allowed to differ in terms of the wage offer distributions they face in the labor market, the frequency with which they receive offers and their utility from not working. The importance of each of these factors in accounting for the gender differences in migration patterns is assessed. Using the estimated model, it is found that there are two reasons for the fact that married women do not experience wage growth through migration in contrast to married men: (1) Women have a higher value of leisure and furthermore the presence of children considerably increases their value of not working. 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 variance of offers across locations relative to men, and therefore compromises made by the husband in the form of rejected offers from other locations, are more costly than that of the wife's. One of the results in this paper is that the second factor, namely the difference in the wage offer distributions faced by men and women, is the most important determinant of the fact that married women do not experience wage growth through migration.

The estimated model is also used to perform counterfactual experiments to quantify the implications of joint location constraints on the migration patterns, marital stability and labor market outcomes of married men and women. The first examines the extent to which joint decision making within the household contributes to the observed location and employment decisions. Specifically, the behavior of all individuals is simulated were they single instead of married. The simulations show that as singles, men and women move more frequently compared to when they are married. This shows that both married men and women forego job opportunities in other locations due to the presence of their spouses. Also, the average male accepted wages increase by 9.54 percent and female accepted wages increase by 2.66 percent under the singles scenario. Male accepted wages

⁵By labor market opportunities, I specifically refer to the wage offer distributions faced by men and women, as well as the frequency with which they receive job offers from their current location and other geographic locations.

⁶Here, the 'migration experience' of an individual refers to how his/her wages and employment patterns change when he/she moves.

increase, mainly due to their higher mobility rates. When single, males are able to take full advantage of their different job opportunities across locations. Accepted wages of women as single agents are higher because, when single, women only move for their own employment opportunities, and therefore experience positive wage gains when they move. On the other hand, when married, the household moves are generally initiated by their husband's opportunities.

For the second counterfactual experiment, the moving costs are increased in order to examine how mobility concerns contribute to employment decisions and marital stability. With no migration, the gender wage gap decreases: The female-to-male accepted wage ratio is 0.68 for the baseline, in comparison with 0.72 with no possibility of moving. When there is no migration men's accepted wages fall and women's accepted wages increase. This shows that family migration concerns magnify differences in the observed wages of men and women. Another important result is that joint location constraints have considerable implications for marital stability. The empirical evidence suggests that there is a relationship between the mobility and divorce behavior of married couples. Approximately six percent of divorces observed in the PSID sample used for the estimation are those that are followed by a relocation of at least one of the spouses. The results from the estimated model show that marital stability increases considerably when migration costs are high. The percentage of couples who divorce in the baseline case is 24.43 percent, and it is 15.77 percent with no migration.

The 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 (2008), which develops a structural dynamic migration model and estimates it using panel data from the NLSY. Kennan and Walker (2008) find that individuals' migration decisions are significantly influenced by their income prospects in different locations. This paper is most closely related to Kennan and Walker (2008) in terms of general approach, but this paper extends their study to incorporate family migration decisions, rather than individual decisions.

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).⁷ Mincer (1978) presents a

⁷This 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 and wage and employment outcomes at the household level. This paper focuses on migration decisions in addition to labor market decisions of the household.

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. The sources of uncertainty are future job opportunities in different locations as well as the possibility of divorce. Moreover, family members accumulate experience while working so that current migration-induced interruptions to their employment spells translates into lower future wage offers and a lower total household utility.

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 wage differences. There is a large literature on the gender differences between the labor market outcomes of men and women. This paper contributes to this literature by quantifying how gender differences arise when we take into account the fact that the job decisions of married men and women are linked through the geographic location constraints that they face. Specifically, the estimated model helps to assess how tied migration has negative implications for the wage growth of married women as well as married men. The results show that tied migration (like child rearing) has a dampening influence on the wage growth of women. The comparative advantages of spouses in the labor market and at home are reinforced by family migration decisions. These results support Mincer's conjecture that family mobility concerns magnify gender wage gaps. Such an reinforcement mechanism arises, because family migration ties might be detrimental for the labor market experience accumulation of individuals as well as their ability to take advantage of job opportunities in other geographic locations.

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. In relation to these studies, this paper could be viewed as providing insight into the mechanism underlying joint migration decisions of educated couples.

Family migration decisions within a intra-household bargaining framework has also been studied 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 and uncertainty in the intra-household bargaining framework. 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.

The paper is organized as follows. Section 2 describes the structure of the model. Section 3 outlines the numerical solution algorithm and implementation. Section 4 presents the data. Section 5 gives the estimation method and estimation results. Section 6 outlines the results from the counterfactual experiments. Section 7 concludes.

2 Model

The model incorporates the decisions of married couples starting from the time of marriage. The time horizon is 30 periods. Each period, the individuals make decisions regarding their location, labor supply and marital status. In other words, each period, the couple makes decisions about whether they will stay in their current location or move to a different location, whether the husband will work, whether the wife will work, and whether they will remain married. A period corresponds to a calendar year. A location corresponds to one of the nine Census Divisions in the United States.⁸

The household can choose between their current location and one alternative location, drawn randomly. In what follows, the current location is labelled by A . The other eight possible locations are labelled as B . Each period, the couple can either stay in their current location A , or move to one other candidate location B . The candidate location B is chosen from the other eight possible locations at random. The probability of having the

⁸A list of the Census Divisions can be found in Appendix. The reasons for choosing divisions, rather than states, are listed in the section on the solution method and implementation.

opportunity to move to location B is assumed to be different if B is the home location of the couple. The home location of the family is defined as the place where the husband grew up.⁹ If the couple is already in their home location, the probability of having the opportunity to move to location B is simply $\frac{1}{8}$ for each of the 8 possible locations. On the other hand, if they are not in their home location (i.e., if home is one of the 8 other locations), the probability of having the opportunity to move to location B is given as follows,

$$pr(B) = \begin{cases} p^{home} & \text{if } B = \text{home} \\ \frac{1-p^{home}}{7} & \text{if } B \neq \text{home} \end{cases} \quad (1)$$

Job offers of the husband and wife arrive from their current location A with a certain probability. Conditional on drawing a location B , both spouses receive job offers from that alternative location with probability 1. The 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 potentially different frequency relative to when they are not working. The probability of receiving a job offer from location A while the agent is in location A 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 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,

$$\ln \omega_{i,k} = \alpha_{0,i,k} + \alpha_{1i} g_i + \alpha_{2i} x_i + \alpha_{3i} x_i^2 + v_{i,k} \quad i = h, w \quad k = 1, 2, \dots, 9 \quad (2)$$

where x_i denotes the work experience of spouse i . The joint distribution of $v_k = (v_{h,k}, v_{w,k})$ is assumed to be normal so that $v_k \sim N(0, \Sigma)$ for each location k . v_k is independently and identically distributed across locations. Once an agent accepts a wage draw $v_{i,k}$, he/she keeps that draw until he/she changes to another job, moves or quits into unemployment. Also, $\alpha_{0,i,k}$ 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 across locations. The returns to education and experience, governed by the parameters α_{1i} , α_{2i} , α_{3i} , differ by gender as well. The

⁹The home location of the wife is not taken into account, because this information is not available in the PSID.

log specification of the wage functions means that the variance of the wage offers also is also governed by the parameters $\alpha_{0,i,k}, \alpha_{1i}, \alpha_{2i}, \alpha_{3i}$.

2.1 Preferences

Individuals derive utility from marriage (M), from leisure if not working (b), and they derive utility from residing in a certain location k , given by $\eta_k + \gamma_8 1\{k = H\}$. The location specific utility, η_k , is allowed to differ by location, but is assumed to be the same for all individuals. However, 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).

The model involves a psychic cost (ψ) associated with changing locations. An interpretation of this moving cost is that it might be difficult for individuals to leave the environment they are familiar with. This utility cost is allowed to depend on the individual's employment status, whether there are any children in the household, on the number of periods the couple has resided in their current location, and a random component that is independently and identically distributed across periods. Moreover, if the spouses divorce and move in a given period, there is an additional cost of moving only for that period of separation (denoted as Y). In the remaining periods which they continue as single agents, the individuals face the same moving costs as they do when they are married. The cost of moving from location l to location k for spouse i is given as follows:

$$\psi(n, e_{i,-1}, d_l, \varepsilon_{1,i}) = \gamma_1 1\{n = 1\} + \gamma_2 e_{i,-1} + \gamma_3 d_l + \varepsilon_{1,i}, \quad i = h, w \quad (3)$$

where n indicates whether the couple has any children, $e_{i,-1}$ denotes the employment status of the individual i in the previous period, and d_l is the number of periods the couple has resided in location l .

Agents also get utility from not working. For females, this utility is allowed to differ by their education level. The utility from not working is a function of whether the couple has any children and the effect of children on

the value of leisure is allowed to differ by gender so that the utility from not working is given as:

$$b_h(n, \varepsilon_{2,h}) = \gamma_{4,h} + \gamma_{5,h} 1\{n = 1\} + \varepsilon_{2,h} \quad (4)$$

$$b_w(n, g_w, \varepsilon_{2,w}) = \gamma_{4,w}(g_w) + \gamma_{5,w} 1\{n = 1\} + \varepsilon_{2,w} \quad (5)$$

$$\varepsilon_{2,h} \sim N(0, \sigma_{2,h}) \quad (6)$$

$$\varepsilon_{2,w} \sim N(0, \sigma_{2,w}) \quad (7)$$

Each period, the couple gets a marriage bonus that depends on the duration of marriage (d_M) and a stochastic shock which is independently and identically distributed across periods. This marriage bonus is the same for the husband and the wife, and is given by:

$$M(d_M, \varepsilon_3) = \gamma_6 + \gamma_7 d_M + \varepsilon_3 \quad (8)$$

$$\varepsilon_3 \sim N(0, \sigma_3) \quad (9)$$

Last, the location utility of individual i whose home location is H and who is in location k is:

$$\pi(k, H) = \eta(k) + \gamma_8 * 1\{k = H\} \quad (10)$$

where $\eta(k)$ denotes the non-pecuniary benefits for each location.

Given the above, the utility of an agent at period t whose location in the previous period and current period is l and k , respectively, is given by:

$$u_h = \Psi(n, e_{h,-1}, d_l, \varepsilon_{1,h}) 1\{l \neq k\} + b_h(n, \varepsilon_{2,h}) + M(d_M, \varepsilon_3) + \eta(k) + \gamma_8 1\{k = H\} \quad (11)$$

$$u_w = \Psi(n, e_{w,-1}, d_l, \varepsilon_{1,w}) 1\{l \neq k\} + b_w(n, g_w, \varepsilon_{2,w}) + M(d_M, \varepsilon_3) + \eta(k) + \gamma_8 1\{k = H\} \quad (12)$$

2.2 State Space

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 ($v_{h,k}(0), v_{w,k}(0)$), 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.¹⁰

The couple's state space at period $t > 1$ is:

$$\Omega_i(t) = \left\{ \begin{array}{l} l(t-1), e_h(t-1), e_w(t-1), v_h(t-1), v_w(t-1), \\ x_h(t), x_w(t), n(t), d_l(t), d_M(t), H, g_h, g_w, \\ \varepsilon_{1,h}(t), \varepsilon_{1,h}(t), \varepsilon_{2,h}(t), \varepsilon_{2,w}(t), \varepsilon_3(t), v_h(t), v_w(t) \end{array} \right\}$$

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 :

$$x_i(t+1) = \begin{cases} x_i(t) & \text{if } e_i(t) = 0 \\ x_i(t) + 1 & \text{if } e_i(t) = 1 \end{cases}$$

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:

$$d_k(t+1) = \begin{cases} d_k(t) + 1 & \text{if } k = l(t-1) \\ 0 & \text{if } k \neq l(t-1) \end{cases}$$

If the couple remains married, the duration of marriage, $d_M(t+1)$, is determined as follows:

$$d_M(t+1) = d_M(t) + 1$$

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

$$n(t+1) = \begin{cases} n(t) & \text{if } n(t) = 1 \\ 1 & \text{with probability } p_n \text{ if } n(t) = 0 \\ 0 & \text{with probability } 1 - p_n \text{ if } n(t) = 0 \end{cases}$$

¹⁰Duration at location is defined as the number of periods the couple has resided in a particular location since the start of the marriage.

2.3 Household's Decision Problem

Each period, the couple makes decisions about whether they will stay in their current location or move to a different location, whether the husband will work, whether the wife will work and whether they will remain married. 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.¹¹

The set of alternatives that are available to the agents are different depending on their job offers from location A and location B . For example, suppose a couple at period t , is currently working in location A at wages (ω_h, ω_w) . Also, suppose that this couple gets offers from location A and location B , given by $(\tilde{\omega}_h^A, \tilde{\omega}_w^A)$ and $(\tilde{\omega}_h^B, \tilde{\omega}_w^B)$. 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 $(\tilde{\omega}_h^A, \omega_w^A)$, (3) Stay/Both work at $(\omega_h^A, \tilde{\omega}_w^A)$, (4) Stay/Both work at $(\tilde{\omega}_h^A, \tilde{\omega}_w^A)$, (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 $(\tilde{\omega}_h^B, \tilde{\omega}_w^B)$, (11) Move/Only husband work at $\tilde{\omega}_h^B$, (12) Move/Only wife work at $\tilde{\omega}_w^B$, (13) Move/Neither work, and (14) Divorce and the spouses stay or move alone.

The symmetric Nash bargaining solution implies that conditional on each alternative J (where $J=1, \dots, 14$), 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,

$$\bar{V}_i(\Omega(t)) + \frac{1}{2} \left\{ \begin{array}{l} \omega_h(t) + u_h(t|J) + \beta EV_h(\Omega(t+1)|J, \Omega(t)) - \bar{V}_h(\Omega(t)) + \\ \omega_w(t) + u_w(t|J) + \beta EV_w(\Omega(t+1)|J, \Omega(t)) - \bar{V}_w(\Omega(t)) \end{array} \right\} \quad (13)$$

$\bar{V}_i(\Omega(t))$ denotes the outside option of spouse i . It is the maximum over alternative-specific value functions associated with being a single agent. Given the wage offers described above, the alternatives available to a single agent are: (1) Stay and continue to work at ω_i^A , (2) Stay and accept new offer $\tilde{\omega}_i^A$, (3) Stay and do not

¹¹The possibility to remarry is not allowed in the model. Therefore, once they divorce from their current spouses, the individuals continue as single agents from then on. This is restrictive, as remarriage rates are high in the data. Remarriage decisions are not modelled in order to make the model tractable. Analyzing marriage and location decisions together is an extension, and this paper can be seen as a first step towards such a model.

work, (4) Move and work at $\tilde{\omega}_i^B$, and (5) Move and do not work. Then, $\bar{V}_i(t)$ is defined as follows:

$$\bar{V}_i(\Omega(t)) = \max_{J \in \{1, \dots, 5\}} \{ \bar{u}_i(t|J) + \beta E \bar{V}_i(\Omega(t+1)|J, \Omega(t)) \} \quad (14)$$

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

$$V_i(\Omega(t)) = \max_{J \in \{1, \dots, 14\}} \{ u_i(t|J) + \Gamma_i(t|J) + \beta E V_i(\Omega(t+1)|J, \Omega(t)) \} \quad (15)$$

where $\Gamma_i(t|J)$ is the intra-household utility transfer that spouse i gets conditional on alternative J .

It can be seen in Figure 2 that the 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 {Move}, but the outside options of the husband and wife give higher utility.

The household contemplates moving, because locations differ by their non-pecuniary benefits, they might receive a wage offer from the other location or the prospects in that location in terms of its wage offer distribution might be much higher than their current location. The factors that influence the household's employment and migration decisions will be explained in the following example. Consider a case where both spouses are working in their current location A . For simplicity, the offer situation of the couple is such that they both get job offers from location B , and neither gets a job offer from their current location. Furthermore, suppose that the wage offer that the wife gets from location B is very low, and that the husband's location B offer is relatively high.

In addition to the magnitude of the wage offer that the husband receives and the value of his on-the-job search at the destination location, there are several factors that play into the couple's decision to relocate. First, it is the value of non-pecuniary benefits in the new location relative to the current one as well as the fact that there is a cost associated with relocating. The second factor that plays into their decision is the value of search for the

wife in the new location. This is determined by her wage offer distribution in location B , as well as her value of leisure and her arrival rate of offers. For example, it is possible to observe a situation where the husband has a very high offer from the other location B , but it is not optimal to move because the wife's prospects (in terms of the wage offer distribution she will face there) at location B are so low that they decide to forego his good offer. The third factor that plays into their decision to relocate is that the household moving and the wife becoming unemployed at the destination location means lower accumulated labor market experience for her. This means lower future wage offers for the wife, and hence lower future total household utility. The household takes these factors into account to determine the expected costs and gains from relocation. Divorce is the efficient outcome when the value of staying is very high for one of the spouses, and value of moving is very high for the other, so that there are no gains to staying married and the optimal decision to make is for the husband is to move alone and the wife to stay. Divorce can also occur due to the fact that the value of marriage evolves stochastically over time.

3 Solution Method and Implementation

Given the above formulation, the problem can be solved recursively, starting from period $\bar{T} = 30$. 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 ,

$$E_T [\max\{V_h(\Omega(T)|d(T) = 1), \dots, V_h(\Omega(T)|d(T) = 9)\}|\Omega(T)]$$

$$E_T [\max\{V_w(\Omega(T)|d(T) = 1), \dots, V_w(\Omega(T)|d(T) = 9)\}|\Omega(T)]$$

Given the above E_{max} functions, $V^h(T - 1)$ and $V^w(T - 1)$ can be calculated for all possible state space elements in period $T - 1$ (all possible points in $\Omega(T - 1)$). The value functions of males and females can be calculated at each period using this backwards recursion method. Calculation of the E_{max} 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. The large state space of the couple's decision problem deems 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 they would have been with a more 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.¹²

Second, instead of evaluating the *E_{max}* at each point in the state space, it is computed only at a subset of the state space. The value of the *E_{max}* at the other state space points is obtained using the interpolation method proposed by Keane and Wolpin (1994).¹³ This approximation method is used within each location and joint education level of the spouse. In other words, the *E_{max}* 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 hard to get an accurate approximation of the *E_{max}* function by interpolating over these state variables.¹⁴

Another complication that arises regarding the computation is that a multi-dimensional integration is required in order to compute the *E_{max}* 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.

¹²Kennan and Walker (2008) define locations as states, but they use a limited history approximation method in order to keep the size of the state space small. The large size of the state space in their model is mainly due to the fact that one has to keep track of the agents' previous locations as they learn their location specific wages only if they have visited a location, and this match specific component is assumed to be constant. On the other hand, in this paper, the agents draw a new wage for an alternative location each time they are considering to move there.

¹³Due to the interpolation method use for the solution of the problem, discretization over the wage distribution is not required.

¹⁴Kennan and Walker (2008) also point out that this is the reason why they do not implement the interpolation method of Keane and Wolpin (1994). In other words, in the context of a migration problem, it is difficult to get an accurate approximation when interpolating over locations, as each location has its unique characteristics.

4 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 Economics 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 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.¹⁵ If the 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.¹⁶ 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.

¹⁵The 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.

¹⁶Cohabiting couples might behave differently in comparison to those who are legally married, and one of the reasons may be because there might be more uncertainty in terms of the future of the relationship.

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. During the course of the year, the couples are assumed to remain in the same location. As mentioned above in the solution method section, the main reason to implement this particular aggregation of states into divisions is to keep the size of the state space manageable so that there are 9 locations instead of 50. The state space consists of the couple's current location, total labor market experience of the spouses, their current employment status, location tenure, current wages, education level, home location and whether they have children. The size of the state space increases significantly as the number of locations gets larger.

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 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 (attriters). 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.

4.1 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 33.38 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. Two kinds of divorces are distinguished: (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.¹⁷ 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. This suggests that co-location conflicts might be related to marital instability.

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.

¹⁷For example, if in year t the couple is married and in location i , and in year $t + 1$ they are divorced and at least one of the spouses is in a different location j , then this is considered 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.

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 3.50 percent whereas for couples with no children the migration rate is 2.16 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 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: 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.

5 Estimation Results

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. The moments used in the estimation are listed below. Next to each definition, the total number of moments for that category is included.

Moments related to the couples' labor market outcomes are as follows:

- Proportion of husbands and wives who work by experience, education level and whether they have children. These variables are conditioned on jointly so that in this category there are $32 \times 2 \times 2$ moments for

each spouse.

- Proportion of husbands and wives who work by location and education level (9x2 for each spouse).
- Proportion of husbands and wives by the education level of their spouse (2x2).
- Accepted wages of husbands and wives who work by work experience, education level and whether they have children (32x2x2 for each spouse).
- Accepted wages of husbands and wives who work by location and education level (9x2 for each spouse).
- Accepted wages of husbands and wives by the education level of their spouse (2x2).
- Accepted wages of husbands and wives by work experience, education and moving status (32x2x2 for each spouse).¹⁸
- Proportion of husbands and wives who work in a given period by whether they were working in a preceding period and whether they changed their location between the two consecutive periods, by their education level (2x8 for each spouse).
- Log wage difference of the husbands and wives by whether they moved since the preceding period, by education level (4 for each spouse).
- Standard deviation of the accepted wages and the correlation between the wages of husbands and wives (1 for each spouse).

Moments related to the migration rates are given as follows:

- Proportion of couples who move by age of head, location tenure, joint employment status, joint education level and whether the couple has any children.
- In- and out-migration rates for each Census division (2x9).
- Divorce Rates by duration of marriage and moving status (29+2).
- Transition rates between Census regions (4x4).
- Proportion of moves that are back to home location (1).

¹⁸The moving status refers to whether the couple has ever changed location during the course of their marriage.

- Proportion of moves that are back to home location by the destination and origin locations (9+9).

The method of moments estimator used is defined as follows:

$$\min g(\theta)'Wg(\theta) \quad (16)$$

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:

$$g(\theta) = \frac{1}{N} \sum_{i=1}^N g_i(\theta) = [\bar{m}^1 - \mu^1(\theta), \dots, \bar{m}^K - \mu^K(\theta)] \quad (17)$$

where $\{\bar{m}_1, \dots, \bar{m}_k, \dots, \bar{m}_K\}$ correspond to each of the data moments defined above, and $\{\mu_1(\theta), \dots, \mu_k(\theta), \dots, \mu_K(\theta)\}$ 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, I redefine $g_i(\theta)$ so that all the statistics are defined over the whole sample instead. This is denoted as $\tilde{g}_i(\theta)$ and is defined as:

$$\tilde{g}_i(\theta) = \left[\frac{1}{N_1} (\bar{m}_i^1 - \mu^1(\theta)) D_i^1, \dots, \frac{1}{N_K} (\bar{m}_i^K - \mu^K(\theta)) D_i^K \right] \quad (18)$$

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

$$g(\theta) = \frac{1}{N} \sum_{i=1}^N \tilde{g}_i(\theta) \quad (19)$$

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,

$$\tilde{G}(\hat{\theta}) = \frac{1}{N} \sum_{i=1}^N \frac{\partial \tilde{g}_i(\theta)}{\partial \theta} \quad (20)$$

$$\hat{Q} = \frac{1}{N} \sum_{i=1}^N \tilde{g}_i(\theta) \tilde{g}_i(\theta)' \quad (21)$$

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.

5.1 Parameter Estimates

Tables 12 through 15 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. It can be seen in Table 12 that men and women's mean wage offers differ considerably between locations. The variation across 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. The estimates 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 $\alpha_{1f} = 0.39$. This means that college educated individuals face a higher variance in their mean wage offers between locations: The standard deviation of mean wage offers across locations for an individual with zero experience level and a college education is \$2,876 for men and \$1,700 for women. Therefore, college educated individuals have a higher gain from moving, as they face larger income differentials across locations. The implications of a college degree on the propensity to migrate is higher for men.

Table 13 reports the estimates for the parameters related to the probability of getting job offers. 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 14 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.

Table 15 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.¹⁹

¹⁹The utilities of not working can be expressed in monetary equivalent terms (in 1983 dollars) due to the linearity of the

Table 15 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). These results are in sharp contrast with the estimates of Kennan and Walker (2008), who find that the average moving cost of an individual is \$300,521 (in 2007 dollars).

The large difference between these estimates is due to the following reasons. Kennan and Walker (2008) stress the weak relationship between income levels at locations and migration probabilities in the data as the reason for their high moving cost estimates. The argument is that given the low in and out-migration probabilities, the moving costs must be large relative to the present value of the differences in the income levels across locations.²⁰ For example, they calculate the gain in the present value of a move from a low income to a high income state as \$301,574.²¹ Then given the migration rates in the data, the moving cost estimate must be large relative to income, since it has to exceed the differences in the present value from residing in different locations. In this paper, the estimated gains from moving in terms of present value are smaller, because the current and future utility gains from moving are determined by wage differentials across locations, moving costs, spouse's opportunities in the other location and differences in the non-pecuniary benefits for each location.

First, in this model, the wage differentials across locations do not necessarily reflect utility differences that might induce migration, as each location also differs by unobservable attributes that are denoted as non-pecuniary benefits.²² The difference in the moving cost estimates in this paper and Kennan and Walker (2008), therefore, is partially an accounting matter. In other words, in the data the small migration probabilities reflect small utility gains from moving. In Kennan and Walker (2008), high moving costs result in small gains from moving. In this paper, the moving costs together with differences in location specific utilities are what minimize the gains from moving (current and future). For example, consider a male, who has just gotten married, starting at West North Central, which has the wage offer distribution with the lowest mean. His present value of income at this location is \$50,967 in 1983 dollars (assuming 40 years of remaining working life and a discount factor

utility function.

²⁰This is abstracting from other factors as reasons for moving, and just looking at income gains.

²¹In their case, the individual's wage consists of both a location specific component, which is the same for everyone, and a location match component, which is different for individuals. The above number includes a move between a place with both a low location specific component and a low location match component to one where both components are higher.

²²Kennan and Walker (2008) also include amenity values. However, their amenity values are functions of observable attributes of the locations.

of 0.9). On the other hand, the present value of his income stream at the Middle Atlantic, which has the highest mean wage offer, is \$105,761. The geographic differential in the present value of his income stream is then roughly \$54,794. However, if we take into account the estimates for the unobservable attributes of these locations (which are \$0 for Middle Atlantic and \$3,662 for West North Central), the present value of the utility streams from residing in these locations is \$87,100 and \$105,761 respectively.²³ Therefore the geographic differential goes down to \$18,661.²⁴

The second reason for the smaller geographic differentials is that this paper incorporates the marital status of the individual when calculating the benefits of moving. In other words, the income gain from moving between two locations also includes the income gains of the individual's spouse. These two factors make the total utility gain from a potential move lower on average,²⁵ and therefore the moving cost estimate that is needed to account for the migration probabilities in the data is smaller.

5.2 Model Fit

Figures 6–8 and Tables 16–20 show the model fit for chosen moments of the estimation. The model predictions in general do well in comparison to the data moments. The chi-squared test statistics are also presented to determine whether or not the model provides a good fit to observed data for each moment.

Figure 6 and Table 16 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 accepted wages and employment rates across locations and across 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 17 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

²³Other factors that might induce migration, other than earnings and non-pecuniary benefits, are not taken into account in this example.

²⁴Both moving costs and location specific utilities are unobserved, and have similar implications in terms of the migration patterns. Therefore, it is difficult to distinguish one from the other in this model.

²⁵The effect of the income gain of the individual's spouse on the migration probability of the couple depends on the correlation between their wage offer draws.

future wage offers for the wife are less costly for the household, (2) Women face lower mean wage offers in each location and lower variance of offers across locations relative to men. Since the husbands face a higher geographic differential in terms of their income, the household gain is larger from pursuing his wage offers in other locations, rather than the wife's.

Table 18 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 the age of head. Table 18 shows that the model captures the fact that moving rates decrease by the age of head.

The transition matrix by region, in the data and the model simulations is displayed in Table 19. This table presents the proportion of couples who move to region j , conditional on being in region i for all regions.²⁶ 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 20. As in the data, the model predicts that men are much more likely to become employed when they move, compared to women.

6 Counterfactual Experiments

The goal of this paper is to determine to what extent location constraints that married couples face in the labor market affect their migration patterns, wage, employment outcomes and marital stability. To address this question, the model is simulated under a number of counterfactual scenarios. These counterfactuals are as follows: (1) Simulate behavior for single men and women by making the couples divorce in the first year of their marriage, (2) Increase moving costs, (3) Equate wage offer distributions of men and women.

6.1 Counterfactual 1: Divorce in Period 1

Under the first counterfactual scenario, the couples are made to divorce before the first year of their marriage. The outcomes of interest are the migration rates, wage and employment profiles of men and women as single

²⁶The 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.

agents. This counterfactual examines the extent to which joint decision making within the household contributes to the observed migration patterns and gender differences in wage and employment profiles. The divorce before the first year of marriage is assumed to come as a surprise to the agents, and therefore assume that their initial conditions at the age of marriage do not change. The men and women under the counterfactual scenario have the same characteristics, and face the same environment as the baseline.

Table 21 displays the proportion of men and women who changed locations at least once under the baseline and the counterfactual scenarios. 18.18 percent of married men move at least once, whereas 25.29 percent move when they are acting as single agents.²⁷ When a married male gets a job offer from another location, his gains from relocation are influenced by his wife's job offer as well as her value of search in the other location. As long as the utility he can achieve within marriage is larger than his best outside option as a single agent, the Nash bargaining solution implies that he will share any loss that his spouse incurs due to a relocation. This loss may include moving costs, foregone earnings, and lower accumulated work experience. The concern for the other spouse's losses leads to, on average, lower gains from relocation for married men and hence foregone job opportunities in other locations. This is consistent with Mincer (1978)'s suggestion that married men are 'tied stayers'. Table 21 also shows that 18.18 percent of married women move at least once, whereas 23.34 percent move when they are acting as single agents. Hence, marriage causes women to move less frequently and forego job opportunities as well, but to a slightly less extent compared to men.

The wage difference between the origin and the destination location allows us to learn the extent to which the individuals gain from moving, at the period relocation occurs. Table 22 shows that while women experience wage losses when they move if they are married, they experience wage gains when they move if single. This shows that in the baseline, the wife moves generally due to the job opportunities of her husband in the other location. When single, the woman only moves for her own job opportunities and for positive wage gains. Also, in the baseline when the couple moves, the woman's cost of relocation (due to moving costs, lower wages or a non-employment spell following the move) is offset by the gain in total household utility due to higher income of the husband. In other words, the cost of relocation incurred by the wife through foregone earnings or lost experience accumulation is shared by her husband due to the Nash bargaining solution concept. Since the single woman does not have such transfers associated with relocation, migration is only optimal when her wage offer from the other location is high enough. Hence, the overall wage gains of single women who move are higher

²⁷In 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 of the the behavior of the spouses as single agents, the same procedure is followed.

compared to the baseline case. Table 22 also shows that for men the wage gains following a move are positive both when married and when single, and moreover they are considerably higher when single. One feature of the data was that married men experience wage growth through migration and married women do not. Table 22 shows that this is not the case when they are acting as single agents. Table 22 also shows that for periods of no relocation, there is no difference in terms of the wage gains when men and women are single compared to when they are married.

Table 23 shows that the average accepted wages of men under the counterfactual scenario is \$25,920, in comparison to \$23,662 in the baseline case. Table 23 shows that the average accepted wages of women under the counterfactual scenario is \$16,510 in comparison to \$16,082 in the baseline case. The increase in the accepted wages of men is due to the increased mobility and the increased wage gains experienced by those who move (as was shown in Table 22).

6.2 Counterfactual 2: Increase Moving Costs

The second counterfactual experiment is increasing the moving costs so that moving is never optimal for the couple.²⁸ The outcomes of interest under this counterfactual scenario are the wage and employment profiles of the married men and women, as well as their marital stability when there is no migration.

Table 24 reports the employment rates and average wages under the baseline and counterfactual scenarios. The accepted wages of men are lower compared to the baseline case, whereas the accepted wages of women are higher compared to the baseline case. For men, their wages overall are lower mainly because a channel through which their wages can grow is closed. This is a relatively more important channel for men's wage growth, as the estimates show that men face a higher variance in their mean wage offers across locations compared to women.

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. This is evident in Table 25 which distinguishes between different groups of females according to whether the female was a mover in the baseline case (determined by whether she ever relocated during the course of her marriage). Those females who relocated at least once in the baseline case are defined as 'Movers' and those who have not, as 'Stayers'. The largest increase in the employment rates between the baseline and the counterfactual scenario occurs for females who

²⁸The increase in the moving costs can be thought of as due to any factors that might make it harder for the couple to move. One example is the housing market becoming more rigid.

were ‘Movers’ in the baseline.

Family members’ location problem has an impact on marital stability due to its effect on both the current and future gains to being married relative to being single. With reduced gains from migration, marital stability increases as well. It can be seen in Table 26 that 24.43 percent of couples divorce in the baseline case, whereas with no migration it is 15.77 percent. In the model, divorce occurs for two reasons: (1) Marriage utility is stochastic, so that divorce might be optimal in periods where the couple has a low or negative marriage utility draw, (2) Wage offers from other locations are different for the spouses, so that when their opportunities differ significantly between their current and the alternative location, there may be no more gains to staying married.²⁹ When moving costs are high, the divorce rates fall due to two reasons in the model: (1) The continuation value of being a single agent is lower, especially for men, and the marital surplus therefore increases 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 the model, the value of being married differs from being single due to the the marriage utility, and also due to the fact that when they are single, agents make different migration decisions. This is shown in the counterfactual experiment where the spouses are simulated as single agents. Both men and women are more able to take advantage of their job opportunities in other locations when they are single. The prospects of higher mobility when single increases the value of being a single agent significantly, especially for men. In other words, their total lifetime utility from being a single agent is much lower with no migration. Therefore, when mobility costs are high, it is a significant fall in the men’s outside option. This leads to a higher gain from being married for both agents, and therefore to lower divorce rates.

6.3 Counterfactual 3: Equate Labor Market Opportunities

Under the third counterfactual scenario, the wage offer distribution parameters of the females are set equal to that of the males. 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.³⁰

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

²⁹This kind of 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.

³⁰Under this counterfactual, the men and women still differ in terms of the arrival rates of their job offers.

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 a larger variance across 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 husband's opportunities as much as it is by the wife's.

7 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.

This paper makes three important contributions to the literature. First, it is the first study to structurally estimate a dynamic model of household decision making regarding employment and migration. This paper contributes to the migration literature by taking spousal considerations into account in the analysis of the determinants and consequences of mobility decisions, and individuals' responses to regional income differentials. One of the main findings is that both married men and women make compromises in terms of their job opportunities due to the geographic location constraints they face in the labor market. The accepted wages of both men and women increase when acting as single agents, mainly due to increased mobility and more ability to take advantage of job opportunities in other locations. An important finding is the extent to which men and women face different labor market environments across locations. Men face a higher variance in terms of their wage offers across locations, and therefore their migration decisions are motivated to a larger extent by the large geographic income differentials they face. On the other hand, women do not face large geographic income differentials relative to men. This leads to the household moves being initiated by the husband's job opportunities rather than the wife's. Moreover, the husbands also forego job opportunities as they do not respond to the

regional differentials as much as they would as single agents. In conclusion, migration patterns are influenced considerably by spousal concerns.

Second, this paper highlights the link between joint location constraints faced by married couples and observed gender wage differences. Specifically it quantifies how gender differences arise when we take into account the fact that the job decisions of men and women are linked through the geographic location constraints that they face. Such an reinforcement mechanism arises, because family migration ties might be detrimental for the labor market experience accumulation of individuals as well as their ability to take advantage of job opportunities in other geographic locations. The estimated model helps to understand to what extent tied migration has negative implications for the wage growth of married women as well as married men. It is shown in this paper that a part of the gender wage gap can be attributed to the joint decision making within the household regarding migration and employment. The female-to-male accepted wage ratio increases from 0.68 to 0.72 when there is no migration. Hence, an analysis that disregards the joint decision making within the household will tend to overstate the differences in wage opportunities faced by men and women.

Third, this paper shows that there is a strong link between joint migration concerns and marital stability. Family members' location problem has an impact on marital stability due to its effect on both the current and future gains to being married relative to being single. Joint location problem faced within marriage might lead to smaller gains to remaining together, as individuals are less restricted in terms of their location choice when they are single. Indeed, an important finding is that when there is no migration, the proportion of couples who divorce decreases considerably.

A limitation of the analysis in this paper is that marriage decisions are not taken into account. A direction for future research is looking at the migration decisions of individuals jointly with their marriage decisions. Due to the forward looking behavior of agents, joint location constraints faced within marriage might have important implications for the timing of marriage as well as the choice of a spouse.

References

- [1] Barro, R. and X. Sala-i-Martin (1991), "Convergence Across States and Regions," *Brookings Papers on Economic Activity*, 1, 1-37.
- [2] Bergstrom, T.C. (1997) A Survey of the Theories of the Family, in *Handbook of Population and Family Economics*, Vol.1A, Chapter 2, Rosenzweig M. and O. Stark (Eds.).
- [3] Bielby, W. and D. Bielby (1992) "I Will Follow Him: Family Ties, Gender Role Beliefs, and Reluctance to Relocate for A Better Job," *The American Journal of Sociology*, 97 (5), 1241-1267.
- [4] Bowlus, A. (1997) "A Search Interpretation of Male-Female Wage Differentials," *Journal of Labor Economics*, 15 (4), 625-657.
- [5] Browning, M. and P-A. Chiappori (1998) "Efficient Intra-Household Allocations: A General Characterization and Empirical Tests," *Econometrica* 66 (6), 1241-1278.
- [6] Chiappori, P-A. (1988). "Rational Household Labor Supply," *Econometrica*, 56, 63-89.
- [7] Chiappori, P-A. (1988). "Collective Labor Supply and Welfare," *Journal of Political Economy*, 100 (3), 437-464.
- [8] Compton, J. and R. Pollak (2004), "Why are Power Couples Increasingly Concentrated in Large Metropolitan Areas?," *NBER Working Paper #10918*.
- [9] Costa, D. and M. Kahn (2000), "Power Couples: Changes in the Locational Choice of the College Educated, 1940-1990," *The Quarterly Journal of Economics*, 115 (4), 1287-1315.
- [10] Dahl, G. (2002). "Mobility and the Return to Education: Testing a Roy Model with Multiple Markets," *Econometrica*, 70 (6), 2367-2420.
- [11] Del Boca, D. and C. Flinn (2006) "Household Time Allocation and Modes of Behavior: A Theory of Sorts," Manuscript, NYU.
- [12] Dey, M. and C. Flinn (2008) "Household Search and Health Insurance Coverage ," Manuscript, NYU.
- [13] Echevarria, C. and A. Merlo (1999) "Gender Differences in Education in a Dynamic Household Bargaining Model," *International Economic Review*, 40 (2), 265-286.

- [14] Frank, R. (1978) "Why Women Earn Less: The Theory and Estimation of Differential Overqualification," *American Economic Review*, 68 (3), 360-373.
- [15] Fitzgerald, J., P. Gottschalk and R. Moffitt (1998) "An Analysis of Sample Attrition in Panel Data: The Michigan Panel Study of Income Dynamics" *The Journal of Human Resources*, Vol. 33, No. 2, Special Issue: Attrition in Longitudinal Surveys, pp. 251-299.
- [16] McElroy, M. and M.J. Horney (1981) "Nash Bargained Household Decisions: Toward a Generalization of the Theory of Demand," *International Economic Review*, 22, 333-350.
- [17] Manser, M. and M. Brown (1980) "Marriage and Household Decision-Making: A Bargaining Analysis," *International Economic Review*, 21 (1), 31-44.
- [18] Keane, M. and K.I. Wolpin (1993) "Career Decisions of Young Men," *Journal of Political Economy*, 105, 473-522.
- [19] Keane, M. and K.I. Wolpin (1994) "The Solution and Estimation of Discrete Choice Dynamic Programming Models by Simulation and Interpolation: Monte Carlo Evidence," *Review of Economics and Statistics*, 76, 648-672.
- [20] Kennan, J. and J. Walker (2008) "The Effect of Expected Income on Individual Migration Decisions," Manuscript, University of Wisconsin-Madison.
- [21] Ligon, E. (2002) "Dynamic Bargaining in Households (With an Application to Bangladesh)," Manuscript, University of California, Berkeley.
- [22] Lillard, Lee A. and C.W.A. Panis (1998) "Panel Attrition from the Panel Study of Income Dynamics: Household Income, Marital Status, and Mortality," *Journal of Human Resources*, Vol. 33, No. 2, Special Issue: Attrition in Longitudinal Surveys, pp. 437-457.
- [23] Liu, H., Mroz, T.A. and W. Van Der Klaauw (2004) "Maternal Employment, Migration and Child Development," Manuscript.
- [24] Lundberg, S. and R.A. Pollak (2001) "Efficiency in Marriage," Manuscript.
- [25] Lundberg, S. and R.A. Pollak (1993) "Separate Spheres Bargaining and the Marriage Market," *Journal of Political Economy*, 10 (6), 988-1010.

- [26] Lundberg, S. and R.A. Pollak (1993) "Bargaining and Distribution in Marriage," *Journal of Economic Perspectives* 10 (4), 139-158.
- [27] McFadden, D. (1989) "A Method of Simulated Moments for Estimation of Discrete Response Models Without Numerical Integration," *Econometrica*, 57(5), 995-1026.
- [28] Mincer, J. (1978) "Family Migration Decisions." *Journal of Political Economy*, 86 (5), 749-773.
- [29] Morrison, D. and D. Lichter (1988) "Family Migration and Female Employment." *Journal of Marriage and the Family*, 50 (1), 161-172.
- [30] Shihadeh, E. (1991) "The Prevalence of Husband-Centered Migration: Employment Consequences for Married Mothers" *Journal of Marriage and the Family*, 53, 432-444.
- [31] Sandell, S. (1977) "Women and the Economics of Family Migration", *The Review of Economics and Statistics*, 59 (4), 406-14.
- [32] Sjaastad, L. (1962) "The Costs and Returns of Human Migration", *Journal of Political Economy*, 70, 80-93.
- [33] Tunali, I. (2000) "Rationality of Migration", *International Economic Review*, 41 (4), 893-920.

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

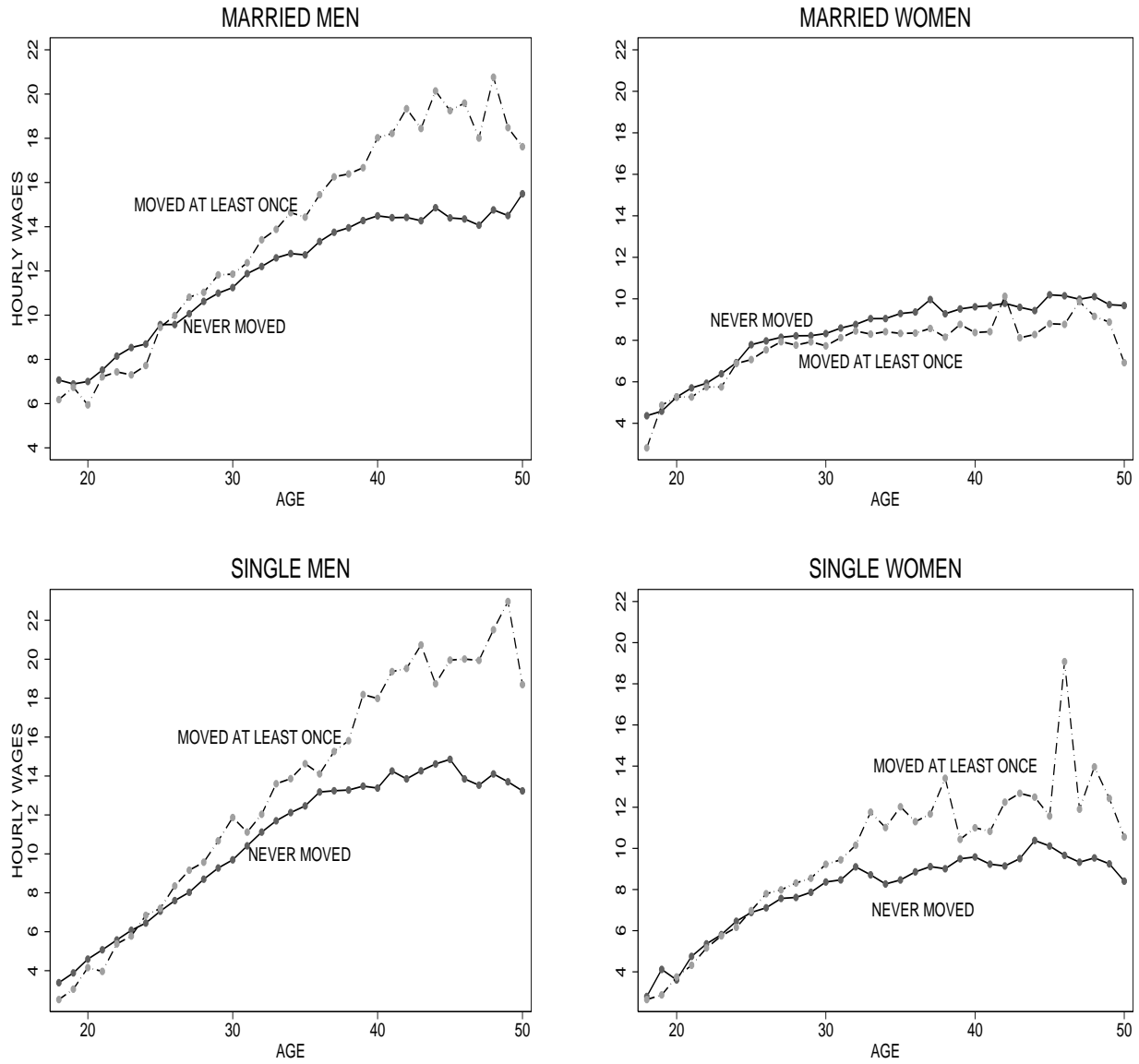


Table 1: **Employment Conditional on Being Employed in the Preceding Period**

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

Figure 2: **Decision of the Household**

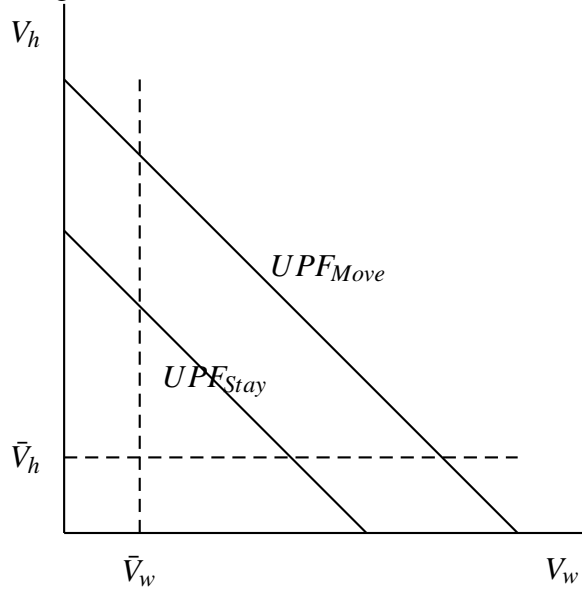


Figure 3: **Decision of the Household**

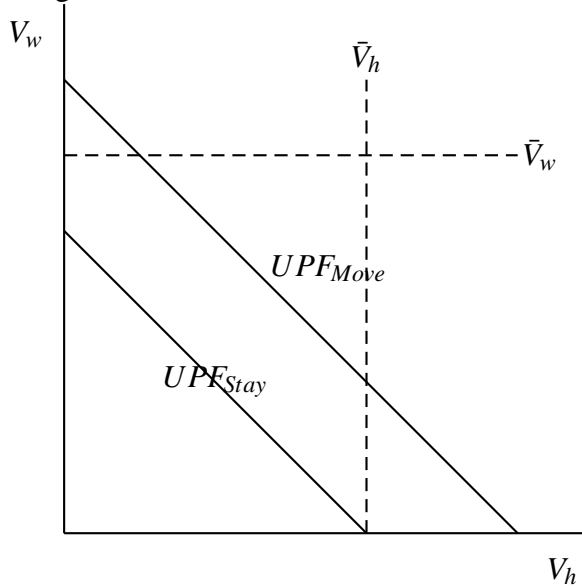


Table 2: Proportion of Couples by the First Year of Observation

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 accepted wages for husband (in 1983 dollars)	25,088	(17,403)
Average annual accepted 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 a Kid	
No Kid	3.50 %
Kid	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)**

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

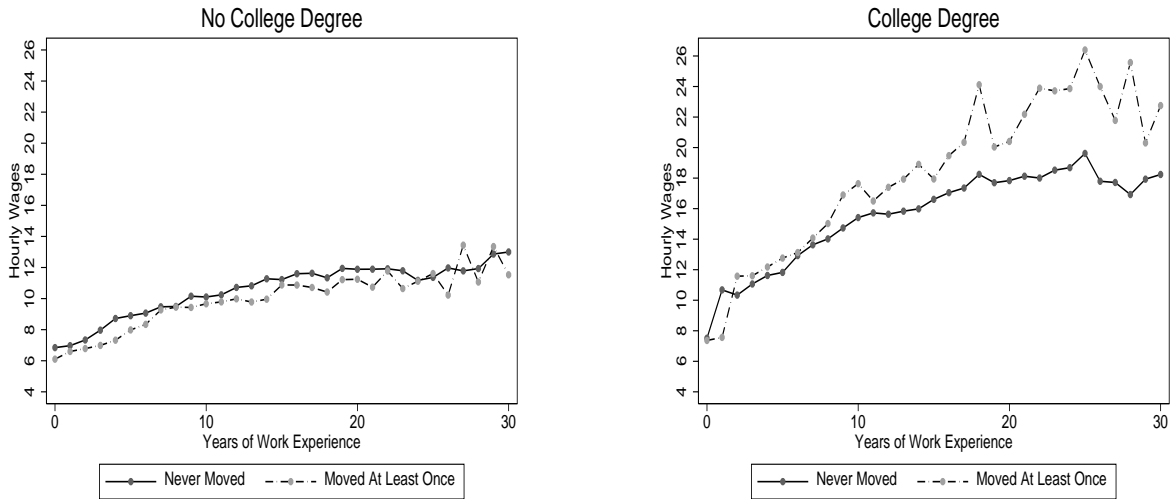


Figure 5: Females - Hourly Wages by Experience, Migrant Status and Education (in 1983 dollars)

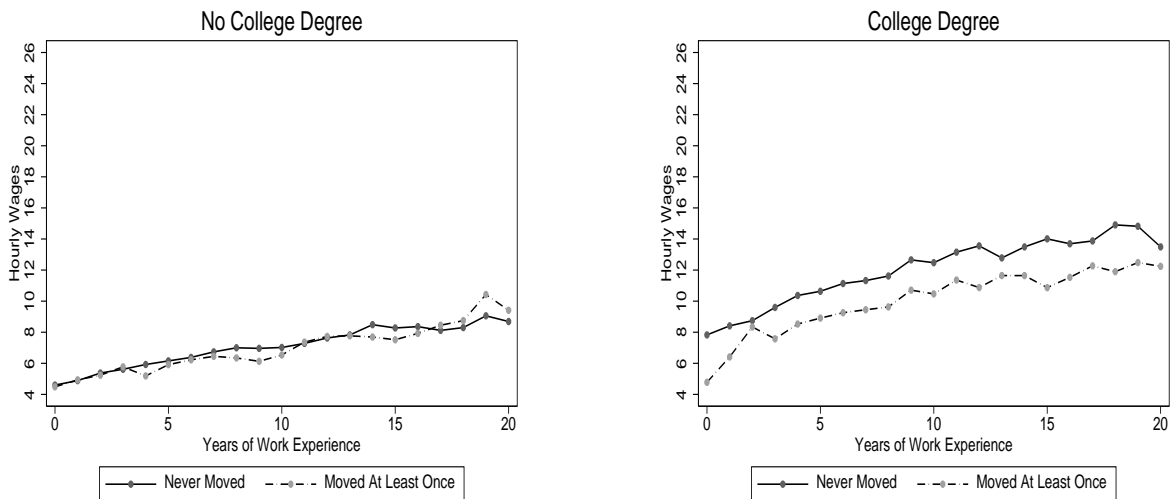


Table 12: Parameter Estimates: Log Wage Offer Function

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

Table 13: Parameter Estimates: Arrival Rates of Offers

	Males	Females
Educated & Working	0.39 (0.00026)	0.12 (0.00106)
Not Educated & Working	0.17 (0.00032)	0.16 (0.00129)
Educated & Not Working	0.81 (0.00113)	0.42 (0.00086)
Not Educated & Not Working	0.80 (0.00157)	0.34 (0.00085)
Probability of Drawing Home	0.19 (0.00024)	
Probability of Drawing Other	0.15 (0.00012)	

Table 14: Parameter Estimates: Non-pecuniary Benefits ($\eta(k)$)

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 15: Parameter Estimates: Utility

	Males	Females
Utility from Not Working:		
No College ($\gamma_{4,i}$)	146 (3.69)	4,751 (3.54)
College ($\gamma_{4,i}$)	146 (3.69)	11,366 (5.82)
Children ($\gamma_{5,i}$)	35 (4.33)	5,159 (4.41)
Sd of shock to utility from not working ($\sigma_{2,i}$)	5,004 (7.82)	11,132 (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 16: Model Fit: Employment Rates by Census Division

	Model	Data	Chi-Sq
Males - No College			
New England	95.91%	93.76%	0.23
Middle Atlantic	94.87%	92.97%	0.65
East North Central	95.81%	94.93%	0.19
West North Central	96.70%	96.81%	0.00
South Atlantic	96.57%	97.15%	0.04
East South Central	95.12%	95.71%	0.03
West South Central	95.30%	96.57%	0.17
Mountain	93.59%	94.97%	0.16
Pacific	97.53%	94.94%	0.92
Males - College			
New England	98.56%	97.24%	0.11
Middle Atlantic	97.96%	97.47%	0.02
East North Central	98.45%	97.99%	0.02
West North Central	98.56%	94.81%	1.12
South Atlantic	98.66%	96.37%	0.45
East South Central	97.12%	96.52%	0.01
West South Central	98.79%	98.17%	0.03
Mountain	97.51%	97.52%	0.00
Pacific	98.09%	96.63%	0.14
Females - No College			
New England	55.25%	46.06%	9.13
Middle Atlantic	53.20%	51.89%	0.57
East North Central	53.79%	54.01%	0.02
West North Central	59.77%	61.64%	1.17
South Atlantic	63.64%	64.61%	0.23
East South Central	58.99%	63.78%	4.09
West South Central	60.33%	55.93%	3.77
Mountain	59.04%	61.37%	0.75
Pacific	50.24%	48.68%	0.73
Females - College			
New England	42.44%	50.47%	8.01
Middle Atlantic	58.70%	59.56%	0.10
East North Central	57.76%	56.68%	0.17
West North Central	66.88%	66.57%	0.01
South Atlantic	64.97%	63.96%	0.09
East South Central	56.02%	55.88%	0.00
West South Central	54.91%	59.34%	1.93
Mountain	64.14%	60.54%	0.82
Pacific	60.76%	67.61%	3.26

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

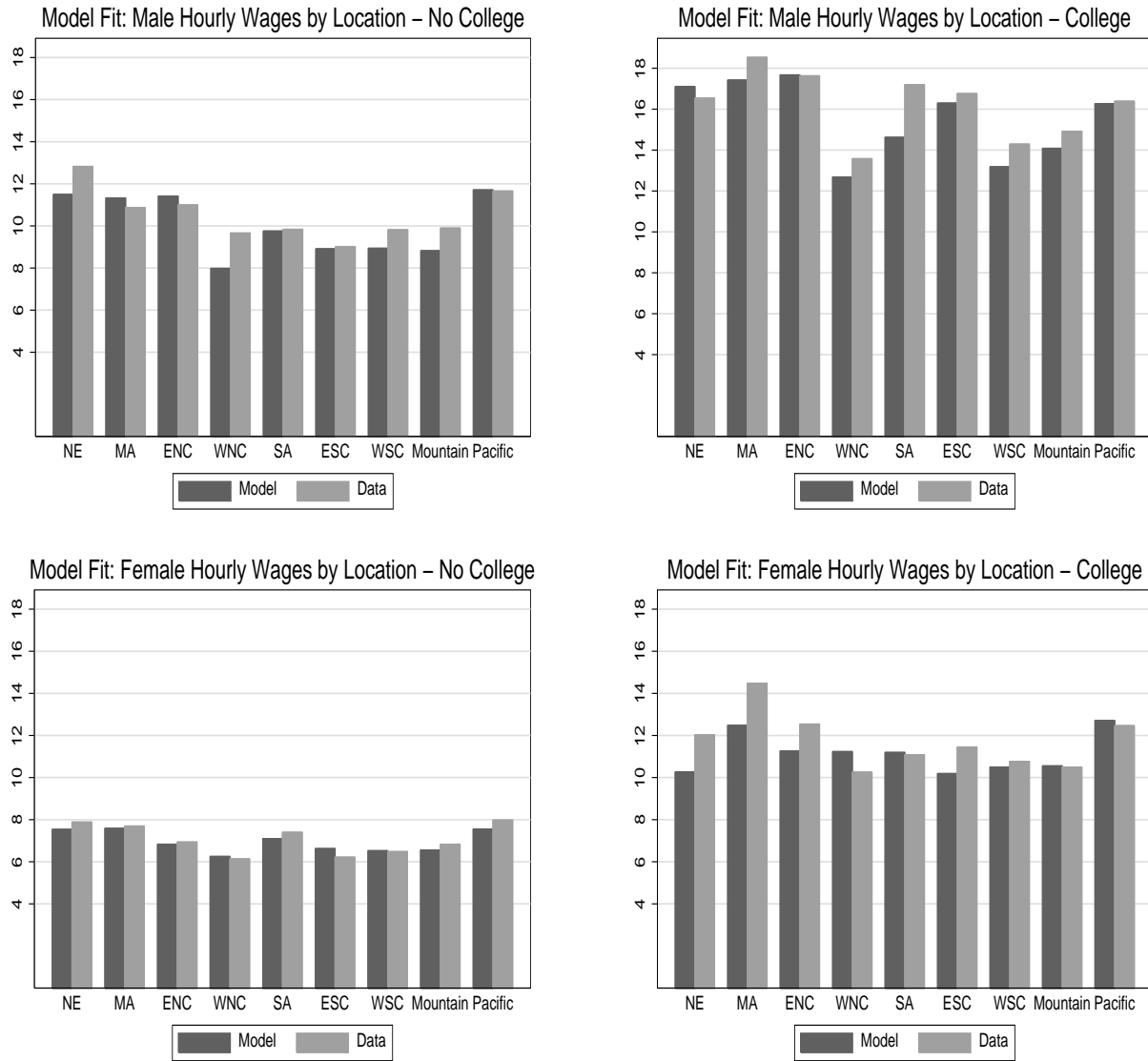


Figure 7: Model Fit: Employment and Wages by Work Experience

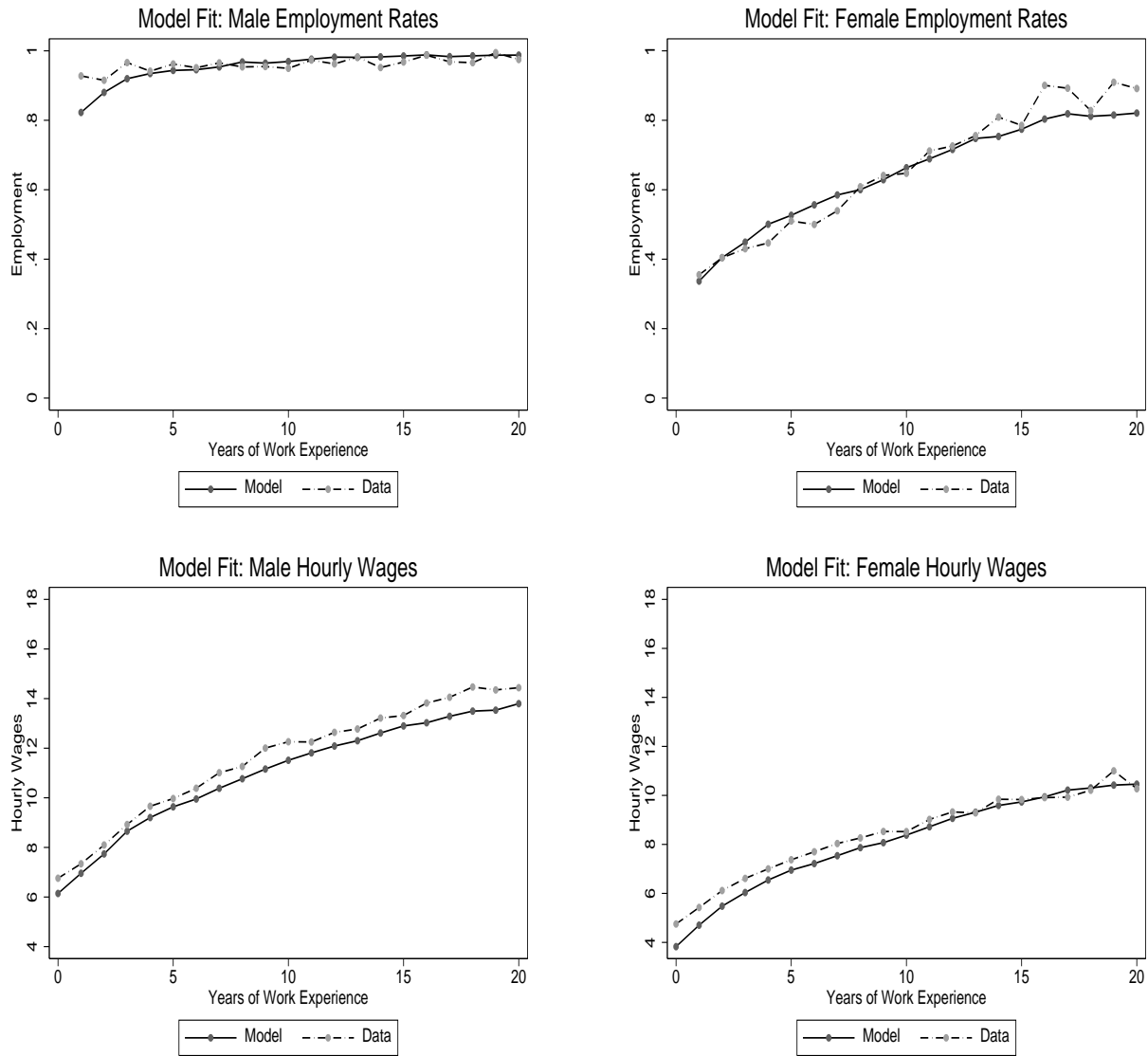


Table 17: Model Fit: Transition Rates Between Employment Status

		Employed at T+1					
		Stay			Move		
		Model	Data	Chi-Sq	Model	Data	Chi-Sq
Employed at T	Males	98.74%	97.85%	1.30	88.86%	94.31%	1.29
	Females	86.38%	86.53%	0.02	59.37%	72.05%	4.36

Figure 8: Model Fit: Wages by Migrant Status

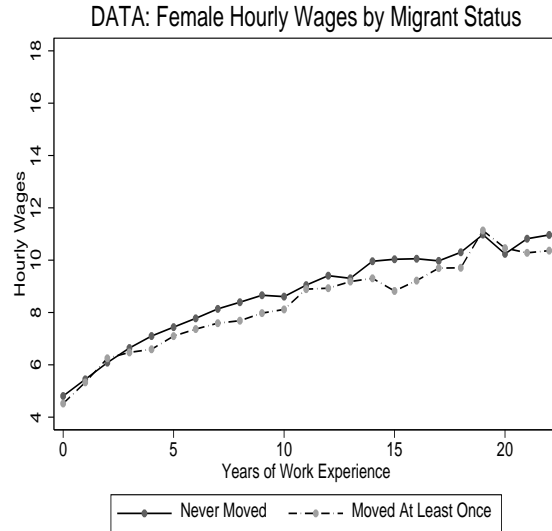
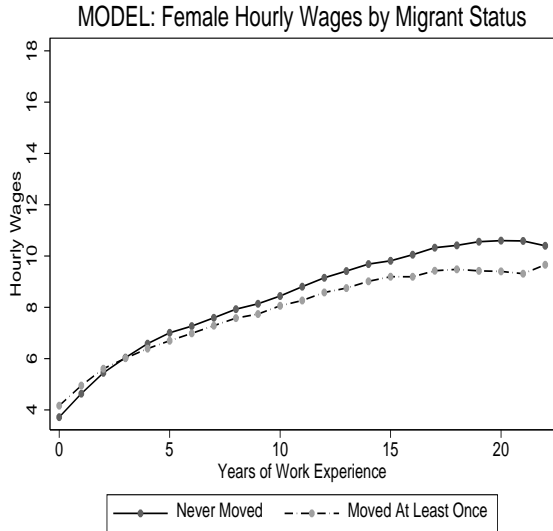
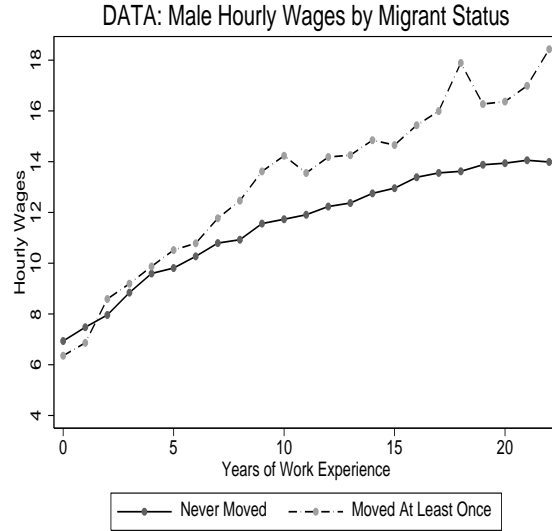
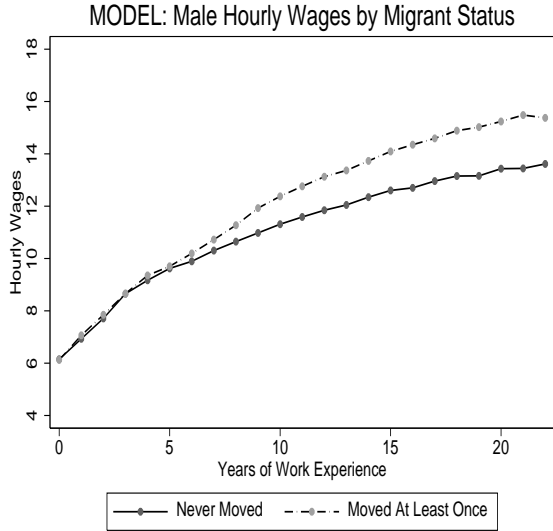


Table 18: Model Fit: Moving Rates

	Model	Data	Chi-Sq
Proportion of Couples who Moved at Least Once	18.18%	18.54%	0.10
Proportion of Moves that are Back Home	33.38%	32.83%	0.04
Proportion of Couples who Divorced	24.43%	23.68%	0.34
Proportion of Divorces that are Followed by a Move	6.45%	6.00%	0.11
Moving Rates by Age of Head			
18-25	4.05%	4.37%	0.61
26-30	2.95%	3.19%	0.77
31-35	1.88%	2.02%	0.41
36-40	1.30%	1.77%	5.94
41-50	1.15%	1.81%	13.37
Moving Rates by Joint Education Level			
Both College Educated	2.79%	3.77%	13.51
Only Husband College Educated	2.86%	2.91%	0.02
Only Wife College Educated	1.92%	1.00%	5.85
Neither College Educated	2.01%	2.14%	0.84
Moving Rates by Joint Employment Status			
Both Working	1.55%	1.64%	0.49
Only Husband Working	2.95%	3.39%	4.82
Only Wife Working	4.26%	2.77%	2.27
Neither Working	6.57%	5.26%	0.75

Table 19: 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
	Chi-Sq	0.32	1.08	1.13	0.17
Midwest	Model	19.37	17.11	36.48	27.04
	Data	8.87	20.97	45.16	25.00
	Chi-Sq	7.06	1.08	2.56	0.19
South	Model	17.74	31.83	23.71	26.72
	Data	8.00	31.33	43.33	17.33
	Chi-Sq	8.03	0.01	24.36	4.95
West	Model	15.23	28.47	32.79	23.52
	Data	10.38	29.25	30.19	30.19
	Chi-Sq	1.64	0.02	0.22	2.01

Table 20: **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
	Chi-Sq	0.88	58.31	0.97	9.29
Not Work	Model	53.99	40.98	4.25	0.79
	Data	49.59	48.17	1.42	0.81
	Chi-Sq	1.76	6.22	9.24	0.00
Males - College					
Work	Model	96.74	0.54	2.52	0.20
	Data	95.22	1.43	3.18	0.19
	Chi-Sq	1.41	83.44	9.94	0.02
Not Work	Model	60.86	30.85	7.61	0.68
	Data	51.79	39.88	6.54	1.79
	Chi-Sq	2.27	4.44	0.25	2.99
Females - No College					
Work	Model	84.53	13.97	0.95	0.55
	Data	84.92	13.55	1.04	0.48
	Chi-Sq	0.12	0.81	0.57	0.60
Not Work	Model	16.37	80.61	1.93	1.10
	Data	18.11	79.03	0.49	2.37
	Chi-Sq	9.79	1.63	56.33	77.74
Females - College					
Work	Model	86.20	11.84	1.01	0.95
	Data	85.40	12.49	1.65	0.46
	Chi-Sq	0.21	1.00	11.88	7.30
Not Work	Model	13.77	82.81	1.77	1.65
	Data	15.21	79.88	0.46	4.44
	Chi-Sq	2.96	2.00	18.74	91.26

Counterfactual 1: Singles

Table 21: **Proportion who Moved at Least Once: Baseline and Counterfactual**

Baseline	Single Males	Single Females
18.18%	25.29%	23.34%

Table 22: **Log Wage Difference Between Two Consecutive Periods**

	Baseline	Singles
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
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

Table 23: **Employment Rates and Accepted Wages**

	Baseline	Singles
Employment Rates		
Males	0.96	0.97
Females	0.58	0.60
Accepted Wages		
Males	23,662	25,920
Females	16,082	16,510

Counterfactual 2: No Migration

Table 24: **Employment Rates and Accepted Wages**

	Baseline	No Migration
Employment Rates		
Males	0.96	0.96
Females	0.58	0.59
Female-to-Male Ratio	0.60	0.61
Accepted Wages		
Males	23,662	23,073
Females	16,082	16,506
Female-to-Male Ratio	0.68	0.72

Table 25: **Employment Rates by the Female's Baseline Moving Status**

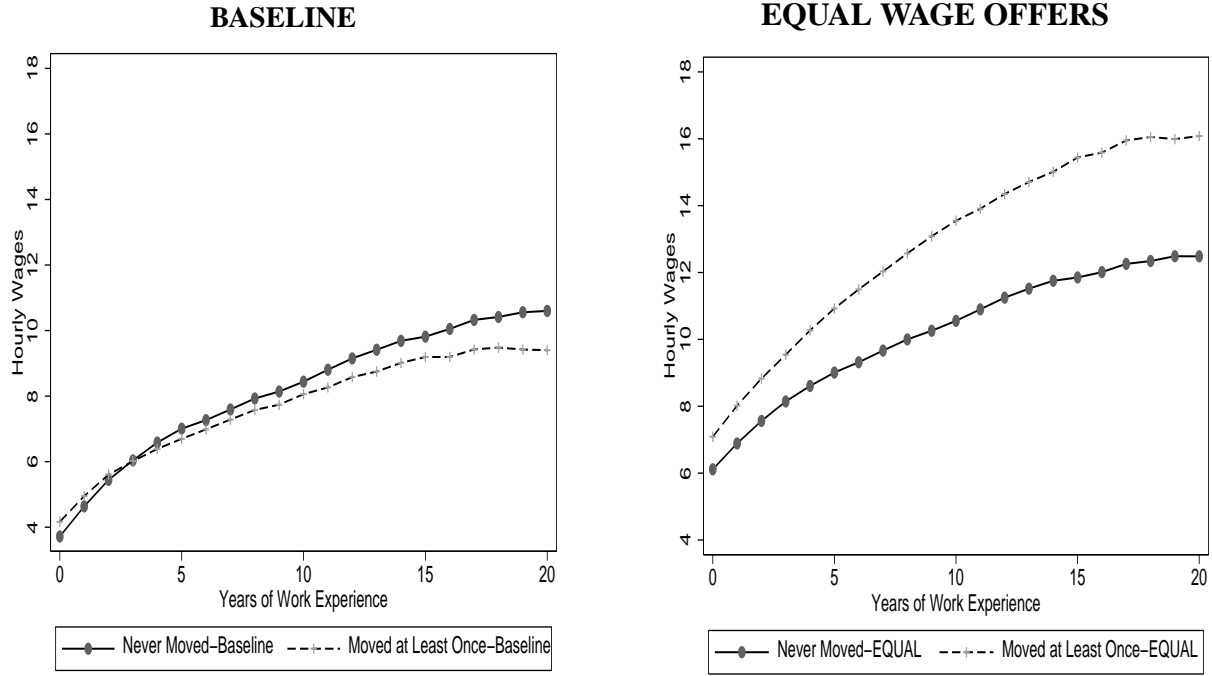
	Baseline	No Migration
Females who were 'Stayers' in Baseline	0.60	0.61
Females who were 'Movers' in Baseline	0.48	0.53

Table 26: **Divorce Rates**

	Baseline	No Migration
Proportion of Couples who Move	0.24	0.15

Counterfactual 3: Equal Wage Offer Distributions

Figure 9: Female Wages by Work Experience and Moving Status



APPENDIX

Table 27: CENSUS DIVISIONS

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

APPENDIX

Table 28: **CENSUS REGIONS**

Region 1: Northeast

New England
Middle Atlantic

Region 2: Midwest

East North Central
West North Central

Region 3: South

South Atlantic
East South Central
West South Central

Region 4: West

Mountain
Pacific
