Dynamic Wage and Employment Effects of Elder Parent Care

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Abstract

This paper formulates and estimates a dynamic discrete choice model of elder parent care and work to analyze how caregiving affects a woman's current and future labor force participation and wages. I model caregiving and work decisions in an intertemporal framework which incorporates parental health changes, human capital accumulation, and job offer availability. The model is estimated on a sample of women from the *Health and Retirement Study* by efficient method of moments. The estimates indicate that women face low probabilities of returning to work or increasing work hours after a caregiving spell. I use the estimated model to simulate the caregiving, employment, and welfare effects of several elder care policy experiments including a longer unpaid leave than currently available under the Family and Medical Leave Act, a paid leave, and a caregiver allowance. The leaves encourage more work among caregivers by overcoming the labor market frictions many women face.

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1 Introduction

How does caregiving for an elderly parent affect a woman's current and future labor force participation and wages? Working less to provide care clearly affects a woman's current income, but it is also clear that her future labor market opportunities can be affected. Women who spend time away from work to provide care may later struggle to find a job or return to their previous wage. In addition, caregiving often involves a significant time commitment. On average, caregivers provide 10 to 20 hours of care per week for four years (MetLife, 2009a; National Alliance for Caregiving and AARP, 2009). Thus, the decision to provide care may mean a substantial loss of current and future earning capacity. These considerations make clear the potential long-term labor market effects of caregiving and underscore the inherent forward-looking nature of caregiving and work decisions.

Understanding the short and long-term effects of caregiving on work and wages is an important policy issue given the large and growing population of disabled elderly and the prevalence of informal care provided by adult daughters, most of whom have a history of working. Currently in the United States there are 9 million men and women over the age of 65 who need help with basic personal activities, household chores, or errands. By 2020, 12 million older Americans are projected to need long-term care.[1] About 70 percent of the elderly rely solely on informal care from family or friends, and about two-thirds of elder parent caregivers are women, a group which has experienced increasing labor force participation rates. In light of these trends and the fact that a typical caregiver is in her fifties or early sixties (Johnson and Wiener, 2006), still in her working years, providing care may involve a considerable loss of current and future human capital and job opportunities.

Despite the intertemporal nature of caregiving and work, the existing literature has overlooked the dynamics of these decisions. Most models are static and focus only on current foregone wages, which could underestimate the costs of caregiving. In contrast to most earlier studies, I model caregiving and work decisions in an explicitly intertemporal framework. I build and estimate a dynamic discrete choice model of caregiving and work that incorporates dynamic elements such as health changes of elderly parents, human capital accumulation, and labor market frictions. These features allow for long-term labor market effects of informal care that may arise due

[1]US Department of Health and Human Services' National Clearinghouse for Long-Term Care: http://www.longtermcare.gov/LTC.

to foregone or lower wages and decreased job opportunities during and after a caregiving spell. By incorporating these elements in a dynamic framework, I can identify various channels through which caregiving affects a woman's labor market outcomes over the short and long-term.

I estimate the structural parameters of the model using eight waves of data from the *Health and Retirement Study* by efficient method of moments. The results highlight various static and dynamic labor market tradeoffs faced by caregivers. Women who begin care provision are likely to continue to do so, especially if their parent is in poor health. Thus, when a woman makes caregiving and work decisions, she not only considers the tradeoff between caregiving and work today, but also the potential long-term tradeoffs generated by the persistence in caregiving. In addition, women are more likely to provide large amounts of care when their parents are in poor health, and these intensive care providers are less likely to be working, especially full-time.

The estimates also underscore the importance of labor market frictions. Women who do not work face low probabilities of receiving job offers in the future. For example, the probability a non-working woman younger than 62 will receive a part-time (full-time) offer next period is 7 to 9 (9 to 12) percent. Thus, those who leave work to provide care may find it difficult to return. The estimates also reveal that women cannot move frictionlessly between full and part-time work. As a result, a woman may not always have the option to decrease her work hours while providing care. If she does work part-time while caregiving, she is not guaranteed to be able to move to full-time work in the future. The wage estimates show that there is a wage penalty for not working in the prior period and that part-time jobs are associated with lower wage offers. Thus, women who leave work to provide care forgo experience and the associated wage returns, and face a lower expected wage if they return to work. In addition, caregivers are more likely to work part-time than non-caregivers, and earn a lower wage than had they worked full-time.

I use the estimated model to calculate the value of elder parent care, which reflects both the static and dynamic value of care provision. The median value of initiating care provision is $66,370 over a two-year period, about half the cost of two years of nursing home care. This estimate is two to three times larger than the values found in the previous literature, which are calculated using the replacement wage approach or current foregone wages due to caregiving. Thus, calculations that ignore forward-looking behavior and the intertemporal nature of caregiving and work decisions underestimate the value of elder parent care.

The estimated structural parameters are then used to analyze how various government sponsored programs for elder parent care affect a woman's caregiving and work decisions. I analyze three counterfactual policy experiments: (1) A two-year unpaid work leave to provide care for a parent; (2) A two-year paid work leave; and (3) A caregiver allowance where those who provide care receive a payment that is not linked to their employment status and can be received indefinitely. The first policy experiment is a lengthier version of the Family and Medical Leave Act (FMLA) of 1993 which allows workers to take up to a 12-week unpaid leave to care for an ill family member and guarantees the worker will return to his/her job at the same wage. The second policy experiment is of particular interest as paid leaves have recently received much attention both at the national and state-level.[2] The caregiver allowance experiment may inform about the labor market effects of policies similar to that of the recently suspended CLASS Act.

The results of the policy experiments show that both the unpaid and paid leaves generate modest increases in intensive care provision, and encourage more work, especially full-time, among women who ever provide intensive care to a parent. On the other hand, the caregiver allowance generates substantial increases in intensive care provision, but leads to an increase in non-work among women who ever provide intensive care. A comparison of the welfare gains generated by the policies shows that about half the value of the paid leave can be achieved with the unpaid leave, and the caregiver allowance and the unpaid leave generate comparable welfare gains. The gains generated by the leaves emphasize the value of guaranteeing a caregiver can return to work, and underscore the importance of taking an intertemporal approach to modeling caregiving and work decisions.

The paper proceeds as follows. Section 2 discusses the literature. The model is presented in Section 3. Identification is discussed in Section 4. Section 5 describes the data, discusses empirical implementation, and provides descriptive statistics. Estimation is discussed in Section 6. Section 7 presents the main results, model fit, and the value of elder parent care calculation. Section 8 discusses the counterfactual

[2]For example, H.R. 1723 The Family Leave Insurance Act of 2009 was introduced in the 111^{th} Congress to provide for a paid family and medical leave insurance program. Also, the federal budget for fiscal year 2011 established a $50 million State Paid Leave Fund within the Department of Labor to provide competitive grants to help states launch paid family leave programs similar to those already established in California and New Jersey.

policy experiments and results. Section 9 discusses an extended model, and a brief conclusion is presented in Section 10.

2 Related Literature

This paper contributes to two strands of the literature. The first examines the relationship between elder parent care and labor market outcomes such as labor force participation, work hours, and wages. Most US and European studies find a negative relationship between female labor force participation and caregiving (Ettner, 1995; Pavalko and Artis, 1997; Heitmueller, 2007; Bolin et al., 2008; Crespo and Mira, 2010).[3] However, the magnitude of this negative correlation varies across studies, ranging from an almost negligible effect to a 30 percentage point decrease in the probability of working. In addition, this negative correlation is stronger among intensive caregivers, or those with a greater commitment of caregiving time (Ettner, 1995; Carmichael and Charles, 1998; Heitmueller, 2007; Casado-Marín et al., 2011).

There is less consensus concerning whether caregivers who remain in the labor force reduce their work hours. Wolf and Soldo (1994), Bolin et al. (2008), and Casado-Marín et al. (2011) find little evidence of caregiving reducing work hours, while Ettner (1996), Johnson and LoSasso (2000), and Van Houtven, Coe, and Skira (2010) find female caregivers in the US reduce their work hours. In terms of wage effects, Carmichael and Charles (2003) find caregiving for more than 10 hours per week reduces current wages by 9 percent for women in the UK, and Heitmueller and Inglis (2007) find caregivers in the UK earn 3 percent less than non-caregivers with similar characteristics. Van Houtven, Coe, and Skira (2010) find caregiving leads to a 3 percent reduction in a woman's hourly wage in the US. While this literature examines several tradeoffs between caregiving and female labor supply, the tradeoffs are analyzed in isolation. In addition, these studies evaluate the effect of caregiving today on a woman's current labor market outcomes.[4] This is the first paper to examine the effects of caregiving on current and future labor force participation, at the intensive and extensive margins, as well as wages in one comprehensive framework.

This paper also contributes to the literature that formulates theoretical models

[3] Wolf and Soldo (1994) is a notable exception which finds no evidence of informal care reducing the propensity of married women to be employed.

[4] Heitmueller et al. (2010) and Moscarola (2010) allow last year's caregiving decision to affect current labor force participation but do not allow for direct contemporaneous effects of caregiving on employment. Spiess and Schneider (2003) find recently terminating care provision is insignificantly related to changes in work hours in Europe.

of caregiving and work. Almost all of the models are static time allocation models where the adult child makes caregiving and work decisions at a single point in time and the only cost of caregiving is current foregone wages (see for example, Börsch-Supan et al., 1992; Johnson and LoSasso, 2000; Crespo and Mira, 2010; Knoef and Kooreman, 2011). There is no forward-looking behavior, no parental health dynamics, and no long-term costs of caregiving. Fevang et al. (2009) is the only study which provides a theoretical model of caregiving and work with multiple periods. In that model, however, perfect foresight is assumed. In addition, the adult child can freely adjust her work hours over the three periods, and the wage is assumed to be constant over all periods.

I expand upon the literature by modeling caregiving and work decisions in an intertemporal framework which includes a forward-looking adult daughter, parental health uncertainty, human capital accumulation, and labor market frictions. The model allows informal care to have long-term labor market effects through several channels, such as foregone or lower wages over time and decreased job offers. With the exception of Knoef and Kooreman (2011), the structural parameters of the theoretical models are not estimated in the above-mentioned studies.[5] By estimating the structural parameters of the model, I can simulate counterfactual policy experiments such as the work leave and caregiver allowance programs described above. No studies have attempted to analyze the impact of government sponsored elder parent care programs on the caregiving and labor supply decisions of adult children in the US or the welfare gains generated by such policies.

3 Model

To answer the questions posed above, I propose a one-child one-parent dynamic discrete choice model in which an adult daughter makes joint decisions about caregiving and work.[6] The optimization problem, consistent with the data available for esti-

[5] Knoef and Kooreman (2011) estimate the structural parameters of their static model using only children, and then use those estimates to assess the nature of interactions between siblings. Börsch-Supan et al. (1992) jointly model employment and "time spent with parents," and estimate equations based on the underlying structural model.

[6] I abstract from the other parent since less than 7 percent of female caregivers care for both parents simultaneously. If both parents are alive, spousal caregiving is the most prevalent form of informal care (Spillman and Pezzin, 2000). I abstract from other adult children since among families with at least one informal care provider and at least two adult children, only 14 percent include multiple caregiving adult children (Byrne et al., 2009). Modeling a dynamic sibling bargaining game is beyond the scope of this paper but is a promising avenue for future research.

mation, begins at a point in the middle of the daughter's lifecycle.[7] At any period t, the daughter has up to two choices to make. She makes an employment decision $E = \{0, PT, FT\}$ for non-employment, part-time work, and full-time work, respectively, and a caregiving decision (given a parent is alive) $CG = \{0, 1, 2\}$ for no caregiving, light caregiving, and intensive caregiving, respectively.

3.1 Preferences

The woman is forward-looking and at any time t, her objective is to maximize her expected lifetime utility, U_t, given the choice set she faces. A woman's period utility, u_t, is determined by her consumption, C_t, leisure time, L_t, and caregiving decision, CG_t. The daughter receives direct utility from light and intensive caregiving which varies with the health of her parent, H_t^p.[8] This captures the idea that when a parent is very sick, a child may derive relatively more utility from caregiving than when the parent is healthy. In addition, there is a utility cost to initiating care which varies with the health of the parent. This captures the idea that beginning care provision may involve substantial adjustments (in the daughter's schedule, for example) and start costs. Utility from caregiving also varies with whether the woman has a sister, sis_t, since she may derive relatively less utility from caregiving when there are other adult daughters who could potentially provide care.[9,10] I allow for permanent unobserved heterogeneity in preferences through differences in the utility from leisure.[11] The period utility function is assumed to be linear in its arguments and is given by:

$$u_t = u\left(\ln(C_t), \ln(L_t), CG_t; H_t^p, sis_t, CG_{t-1}, \ell, \nu_{t,E,CG}\right), \tag{1}$$

where ℓ denotes the woman's unobserved type and $\nu_{t,E,CG}$ denotes time-varying unobserved utility from each choice in the model. The unobserved utility arguments,

[7] Initial conditions are those that prevail at that lifecycle point, and are addressed in Section 5.3.

[8] Parental health is discussed in detail in Section 3.5.

[9] Utility from caregiving does not vary with whether the woman has a brother since the literature finds that all else equal, daughters are significantly more likely than sons to provide care (Engers and Stern, 2002; Checkovich and Stern, 2002; Byrne et al., 2009).

[10] I assume the utility from care provision does not vary with the parent's financial needs. McGarry (1998) finds no significant difference between more and less wealthy parents in the probability of receiving informal care from children. Brown (2007) finds no evidence that children provide care in response to their parents' financial need, but rather to their parents' care needs in a dynamic structural model of parents' retirement asset choices and family care arrangements.

[11] I allow for two types, $\ell \in \{1, 2\}$, who differ in permanent features unobserved to the econometrician. In addition to having different leisure preferences, the types have different wage offer intercepts as discussed in Section 3.4.

$\nu_{t,E,CG}$, are assumed to be additively separable, serially uncorrelated, and normally distributed with mean zero and covariance matrix Σ_ν to be estimated.[12] The exact utility function specification is provided in Appendix A.

3.2 Time and Budget Constraints

The daughter's leisure, L_t, is constrained to equal the time that remains in a period given her work and caregiving choices. Caregiving is a use of time that is valued differently than leisure since a woman gets direct utility from caregiving, but the time constraint makes it clear that the direct opportunity cost of caregiving is foregone leisure time. The time constraint is given by:

$$L_t = \overline{T} - h_t^E - h_t^{CG}, \tag{2}$$

where $\overline{T}$ is the total time available per period, h_t^E denotes the hours associated with the woman's employment choice, and h_t^{CG} denotes the hours associated with her caregiving choice.

The daughter's consumption, C_t, is constrained by the sum of her hourly wage, w_t, times hours worked, h_t^E, and non-labor income, y_t.[13] Non-labor income varies with the woman's education, age, and marital status, and is included because the woman may receive income from other sources such as her spouse or retirement benefits.[14]

[12] More precisely, two covariance matrices are estimated. A 9×9 covariance matrix governs the unobserved utility from each joint caregiving and work choice for those with a parent alive. A 3×3 covariance matrix governs the unobserved utility from each work choice for women without a parent alive (since they no longer make a caregiving choice).

[13] I abstract from including a savings choice directly in the model. This may be a concern if those with more savings substitute away from informal care and purchase care for their parents. However, in the data, there is no descriptive evidence of a lower probability of informal care provision for those with more liquid wealth. In addition, Byrne et al. (2009) find among families where elderly parents receive formal health care, only 9 percent of these parents receive financial contributions for this care from their children. There could be a concern that those with more wealth can afford to provide care by consuming their savings; however, there is no descriptive evidence that caregivers experience significantly different changes in assets or savings than non-caregivers. Savings is currently incorporated in the model in that the woman's initial liquid assets enter the unobserved type probabilities, which is discussed in more detail in Section 5.3. This allows for persistent differences in behavior based on wealth that operate through the permanent unobserved heterogeneity.

[14] In the model, caregiving decisions are not motivated by inheritances or inter-vivos transfers. Most recent studies do not support the bequest motive (Checkovich and Stern, 2002; Norton and Van Houtven, 2006; Brown, 2007). The evidence on inter-vivos transfers is mixed. McGarry and Schoeni (1997) and Brown (2006) find parents do not transfer significantly more to their caregiving children than their non-caregiving children on average, while Norton and Van Houtven (2006) find caregiving children are 11 to 16 percentage points more likely to receive an inter-vivos transfer. If

Thus, non-labor income captures the influences of spousal labor supply. Appendix B describes how non-labor income is formulated. The budget constraint is given by:

$$C_t = w_t h_t^E + y_t. \tag{3}$$

3.3 Job Dynamics

If a woman worked part-time in period $t-1$, she is assumed to receive a part-time offer with certainty in period t, and if she worked full-time in period $t-1$, she is assumed to receive a full-time offer with certainty in period t.[15] If the woman was not working part-time in period $t-1$, either because she was not working or was working full-time, she receives a part-time offer in period t with probability $\lambda^{PT}(\mathbf{Z}_t)$, where $\mathbf{Z}_t$ is a vector of the woman's characteristics. If she was not working full-time in period $t-1$, either because she was not working or was working part-time, she receives a full-time offer in period t with probability $\lambda^{FT}(\mathbf{Z}_t)$. The offer probabilities reflect both search by the woman and contact made by the firm.[16] The offer probabilities are given by:

$$\lambda^E(\mathbf{Z}_t) = \frac{\exp[\lambda^E \mathbf{Z}_t]}{1+\exp[\lambda^E \mathbf{Z}_t]} \quad E \in \{PT, FT\}, \tag{4}$$

where

$$\lambda^E \mathbf{Z}_t = \lambda_0^E + \lambda_1^E I(E_{t-1}=0) + \lambda_2^E I(age_t \geq 62) + \lambda_3^E I(educ_t = 2) + \lambda_4^E I(educ_t = 3).$$

The vector $\mathbf{Z}_t$ includes whether the woman did not work last period, $I(E_{t-1}=0)$, whether she has reached the age of 62, $I(age_t \geq 62)$, and her education.[17] The offer probabilities depend on whether the woman has reached age 62 since Social Security retirement benefits can be claimed at this age and could consequently affect search intensity. Job offer arrival rates are constant over calendar time; thus, they do not

such financial considerations motivate caregiving decisions for some women, this will be reflected in the utility from caregiving parameters.

[15]Since transitions from full-time to part-time work, and vice versa, are infrequent in the data, job holding is assumed. About 17 percent of those working part-time in period t transition to full-time work the next period, and 11 percent of those working full-time in period t transition to part-time work the next period.

[16]The model assumes women who are identical in terms of observables, $\mathbf{Z}_t$, face the same offer probabilities. If there are differences in search intensity that are not captured in $\mathbf{Z}_t$, this can be introduced by including a search decision with a cost attached. Section 9 discusses such a model.

[17]Education is discretized into three categories: (1) Less than a high school degree; (2) High school degree/GED; and (3) At least some college.

account for business cycle effects.

3.4 Wage Offers

If a woman receives a job offer, she also receives an hourly wage offer given by:

$$\begin{aligned}\ln w_t =&\beta_{0,\ell} + \beta_1 age_t + \beta_2 age_t^2 + \beta_3 exper_t + \beta_4 exper_t^2 + \beta_5 I(educ_t = 2) + \\ &\beta_6 I(educ_t = 3) + \beta_7 I(E_t = PT) + \beta_8 I(E_{t-1} = 0) + \epsilon_t,\end{aligned} \tag{5}$$

where $exper_t$ is actual years of work experience, $I(educ_t = 2)$ and $I(educ_t = 3)$ are education indicators for having completed high school and at least some college, respectively, and ϵ_t is an i.i.d. wage unobservable which is distributed normal with mean zero and variance σ_w^2 to be estimated. Thus, wages grow if there are substantial returns to work experience and fall if there are penalties for being out of the workforce in the previous period or for working at a part-time job. Permanent unobserved heterogeneity in wages is incorporated by allowing the offer intercept to differ by unobserved type ℓ.

3.5 Parental Health Transitions

Parental health is a crucial element in the model as it provides an important channel for dynamics and helps to generate persistence in caregiving. The parent's health is assumed to be unaffected by informal care provided by the daughter.[18] Thus, a woman does not provide care to change the health trajectory of her parent, but because she derives direct utility from caregiving which varies with the parent's health (i.e. caregiving is a consumption good). The health of the parent takes on four discrete states: (1) Healthy; (2) Has any activities of daily living (ADL) limitations or has a memory or cognition problem; (3) Cannot be left alone for an hour or more; and (4) Death.[19] Parental health is modeled as a Markov process, which helps capture the fact that a parent's need for care may be sporadic, sustained, or intensified over the course of a caregiving episode. The health transition probabilities are estimated with

[18] In the data, informal care provision is positively correlated with poor parental health. Health transition estimates with informal care as an input imply that caregiving has no significant effect on parental health or leads to worsening parental health. Byrne et al. (2009) estimate elderly health-quality production functions and find informal care provided by children is relatively ineffective. Thus, I abstract from allowing informal care to affect parental health.

[19] Activities of daily living include bathing, dressing, and eating. The choice of health states is motivated by the parental health information available in the HRS data.

a multinomial logit specification such that

$$Pr(H_t^p = k) = \frac{\exp\left[\gamma_0^k + \gamma_1^k I(H_{t-1}^p = adl) + \gamma_2^k I(H_{t-1}^p = alone)\right]}{1 + \sum_{m=adl}^{death} \exp\left[\gamma_0^m + \gamma_1^m I(H_{t-1}^p = adl) + \gamma_2^m I(H_{t-1}^p = alone)\right]} \quad (6)$$
$$\text{for } k = healthy, ADL, alone, death.$$

Coefficients indexed by $k = healthy$ are normalized to zero.[20] I allow recovery from all health states except death.[21]

3.6 Dynamic Programming Problem

A woman's objective in any period t is to maximize her expected lifetime utility given by:

$$\max_{d_t \in D_t} U_t = E\left[\sum_{t'=t}^{T} \beta^{t'-t} u_{d_{t'}} | \mathbf{S}_t\right], \quad (7)$$

where d_t is the woman's decision at time t, D_t is her decision set at time t which varies depending on whether her parent is alive and her available job offers, u_{d_t} is the period utility from her decision at time t, T is the terminal period of the model,[22] β is the discount factor, and $\mathbf{S}_t$ is a vector of the woman's state variables. A woman's state variables include her last period's employment decision, E_{t-1}, her last period's caregiving decision, CG_{t-1}, her age, age_t, her years of work experience, $exper_t$, her education, $educ_t$, her marital status, mar_t, whether she has a sister, sis_t, her parent's realized health state at time t, H_t^p, and her type, ℓ. In addition, utility from each choice depends on the realized wage unobservable and unobserved utility arguments, denoted by vector $\boldsymbol{\epsilon}_t$. The vector of state variables at time t is given by:

$$\mathbf{S}_t = \{E_{t-1}, CG_{t-1}, age_t, exper_t, educ_t, mar_t, sis_t, H_t^p, \ell, \boldsymbol{\epsilon}_t\}. \quad (8)$$

The lifetime utility maximization problem given in equation 7 can be rewritten in terms of value functions. The maximum expected value of discounted lifetime utility

[20] Estimation of the health transitions controlling for the parent's age shows that the impact of the parent's age is trivial after conditioning on last period's health state. Given this result and the fact that it is a cumbersome state variable to track, I omit parental age from these transitions.

[21] In the data there is recovery to better health states, so I do not restrict the health transition matrix to be diagonal.

[22] The terminal period occurs at age 70. At that time the woman cannot work, but she may make a final caregiving decision.

at time t can be represented by the period t value function:

$$V_t(\mathbf{S}_t) = \max_{d_t \in D_t} \left[V_{d_t}(\mathbf{S}_t) \right], \tag{9}$$

where $V_{d_t}(\mathbf{S}_t)$, the choice-specific expected lifetime value function, obeys the Bellman equation

$$\begin{aligned} V_{d_t}(\mathbf{S}_t) &= u_{d_t} + \beta E(V_{t+1}\left(\mathbf{S}_{t+1} | d_t, \mathbf{S}_t\right)) \quad \text{if } t < T \\ V_{d_t}(\mathbf{S}_t) &= u_{d_t} \quad \text{if } t = T. \end{aligned} \tag{10}$$

Thus, the value of any decision at time t is a function of the period utility from that choice plus the discounted expected value of future behavior given the woman's choice at time t. The expectation is taken over the distribution of future unobserved utility from each choice and future wage unobservables as well as the parental health transition probabilities and job offer probabilities.[23]

3.7 Solution Method

The dynamic programming problem is solved by backward recursion given a set of model parameters. In the last period, expected values of the optimal choice are calculated for each reachable state space $\mathbf{S}_T$ and each potential choice set via Monte Carlo simulation. For example, for a set of terminal period state variables $\mathbf{S}_T$, n draws of the wage unobservable and unobserved utility arguments are drawn and the maximum of the choice-specific value functions is calculated and recorded for each draw.[24] The average of the maximum value functions over the n draws is the expected maximum value of arriving at time T with that choice set available and state space $\mathbf{S}_T$. Moving back one period, that expected value is used to do the same calculation for period $T-1$, and this procedure is repeated until the first period is reached. This process is described in greater detail in Keane and Wolpin (1994).

3.8 Model Summary

The model allows for current and long-term labor market effects of caregiving in several ways. First, job offer probabilities depend on the woman's prior work decision.

[23] Women make decisions assuming their marital status will be the same next period, and that whether they have a sister will be the same next period since fewer than 4 percent of women in the data experience a change in marital status between periods and fewer than 2 percent experience a change in whether they have a sister between periods.

[24] 175 draws are used for the numerical integration.

Thus, if a woman leaves work or decreases her work hours at some point during a caregiving episode, she may face a reduced probability of receiving offers in future periods, and hence find it difficult to return to work or increase her work hours. Second, wage offers depend on a woman's years of work experience, whether she worked last period, and whether the offer is associated with a part-time job. Thus, women who leave work while caregiving forgo returns to experience and may face lower future wage offers due to human capital depreciation. In addition, if women make adjustments on the intensive margin while caregiving and transition to part-time work, they may face a lower wage offer. Third, the health transitions are modeled such that the parent's health could improve, be sustained, or deteriorate. As a result, the caregiving trajectory is uncertain and the associated work adjustments (for example to non-work or part-time work) could potentially last several periods.

4 Identification

Since only accepted job offers are observed, the econometrician typically cannot distinguish whether a woman's decision not to work was the result of rejecting a job offer or not receiving an offer. Furthermore, if she receives a job offer, it is typically difficult to distinguish whether rejection occurs because she has a high preference for leisure or she received a low wage offer. A variety of assumptions allow for separate identification of the utility from leisure, the wage offer parameters, and the parameters of the job offer probabilities. Exclusionary restrictions and functional form assumptions both help. For example, the job offer probabilities depend non-linearly on whether the woman has reached age 62, but the utility from leisure is the same for all women of a given type ℓ, and wage offers depend continuously on age and aged squared. Thus, if women age 62 and over are observed to work infrequently, this would be explained by low job offer probabilities, not a higher preference for leisure or lower wage offers. In addition, the job holding assumption helps to separately identify the utility from leisure from the job offer parameters. A woman who works full-time (part-time) is assumed to have a full-time (part-time) job offer with certainty in the next period, which means when a woman moves from full or part-time work to non-work, the econometrician knows a job was available and the expected wage offer. Thus, the utility from leisure can be identified by women transitioning from full or part-time work to non-work, since non-work was chosen over an offered wage. The offer probabilities are then separately identified by observed transitions from non-work to full or part-time work, from part to full-time work, and from full to part-time work.

The utility from caregiving parameters are separately identified from the utility from leisure in several ways. First, women who no longer have a parent alive only make work choices, thus their leisure time is only a function of their work choice, and their work decisions help to identify the utility from leisure. The assumed exogeneity of parental death allows the utility from leisure to be pinned down by this subgroup of women. Second, the utility from leisure is assumed to be the same for all women of a given type ℓ, while utility from caregiving varies with parental health. Thus, if women with parents in a certain health state are observed to caregive more than women with parents in another health state but who are otherwise similar, this would be explained by differences in the utility from caregiving over different health states, not by a lower preference for leisure. In addition, utility from caregiving varies with whether the woman has a sister or not. If women without sisters are observed to caregive more frequently than women with sisters, this again would be explained by differences in the utility from caregiving, not by a lower preference for leisure.

Identification of the wage offer parameters can be viewed as a sample selection problem since only accepted wage offers are observed in the data. The solution to the dynamic programming problem generates the sample selection rules (i.e. generates an implicit reservation wage). The functional form, distributional, and exclusionary assumptions made in the model serve the same purpose as a sample selection correction in either a two-step or full information maximum likelihood procedure (Eckstein and Wolpin, 1999). The distributional assumption is the normality of the time-varying wage unobservable, ϵ_t, in the log wage offer function. In addition, the model generates selection into work that is driven by observables besides those of the wage offer. First, non-labor income which enters consumption varies with whether the woman has reached age 62, her marital status, and the interaction between the two, but wage offers do not. Second, women with parents alive make a caregiving choice which depends in part on their parents' realized health state and whether they have a sister, neither of which affect the wage offer. The caregiving choice is made simultaneously with the work choice and different joint choices lead to different amounts of leisure time. The caregiving choice, however, does not have a direct impact on wage offers.

Last, permanent unobserved heterogeneity enters the model in two places. Unobserved types differ in their utility from leisure and their wage offer intercept. The idea is to allow women to differ in permanent ways unobserved to the econometrician and estimate the distribution of types to fit the persistence of their choices and observed wages. When two women who are equivalent in their observable characteristics persistently make different choices or have persistently different accepted wages, this implies they likely differ in unobservable characteristics. Thus, identification of the unobserved type proportions is achieved through across group variation in caregiving and work choices and wages. It is important to note that the inclusion of unobserved heterogeneity introduces serially correlated state variables. For example, the sum of the permanent heterogeneity component in the wage offer, $\beta_{0,\ell}$, and the i.i.d. wage unobservable, ϵ_t, is a serially correlated state variable. Thus, women can select into caregiving and work on the basis of persistent differences in the utility from leisure and wage offers which are unobserved by the econometrician.

5 Data and Empirical Implementation

The data are drawn from the *Health and Retirement Study* (HRS) which is representative of the non-institutional US population born between 1931 and 1941 and their spouses. The HRS is a panel survey which provides longitudinal information on labor supply, family structure, intergenerational transfers, health, income, and assets. The baseline interviews were completed in 1992, and at that time, respondents were approximately 51 to 61 years old or were married to individuals in that age range. Follow-up interviews took place biennially. The HRS is well-suited for this study since it follows a large sample of individuals at midlife over time, many of whom have elderly parents alive. In addition, it contains information on parents of all respondents, regardless of whether the parent needs or is receiving care. Thus, I am able to examine the behavior of women who do and do not provide care.

I restrict the sample to female HRS respondents between the ages of 42 and 70. In addition, I restrict potential care recipients to be mothers and there are several reasons for this restriction. First, only 21 percent of the women in the HRS report having a father alive in the 1992 wave of the survey, whereas about 47 percent report having a mother alive.[25] In addition, fathers are less likely to receive care than mothers (Hiedemann and Stern, 1999; Byrne et al., 2009). In the HRS data, less than one-third of the fathers ever receive care, but over one-half of the mothers receive care at some point in the sample period.[26] The sample is restricted to women who report

[25] By the 2000 wave, only 10 percent have a father alive, whereas 30 percent have a mother alive.

[26] Szinovacz and Davey (2008) explain that fathers are less likely to receive care from children since wives are more likely to provide care for their husbands, and adult children are then likely to

having a mother alive the first time they are surveyed, and I use the 1994 through 2008 data for estimation of the model. The sample size is 3,094 women with 18,066 person-wave observations.

5.1 Caregiving and Work Measures

Since the HRS interviews occur biennially, a decision period in the model corresponds to two calendar years. In implementing the model, the total time available in a decision period, $\overline{T}$, is equal to 10,220 hours (14 hours per day times 730 days). Thus, time allocated to caregiving and work is assigned based on two-year decision periods.

The HRS asks respondents if they or their spouses spent 100 or more hours in the past two years helping their parents with "basic personal needs like dressing, eating, and bathing." The survey then asks who was helped and how many hours of care were separately provided by the respondent and her spouse. After 1992, respondents were also asked whether they helped with "household chores, errands, transportation, etc." Again, the survey asked who was helped and how many hours of care were separately provided by the respondent and her spouse. A woman is considered a caregiver if she has provided either type of care, and the hours she has spent providing both types of care are summed to determine whether she is a light or intensive caregiver. In the data, light caregivers are defined as women who provide less than 1,000 hours of care over a two-year period, and intensive caregivers are defined as those who provide 1,000 or more hours of care over a two-year period. In the model, those who lightly caregive are assumed to caregive for 300 hours per period, while those who intensively caregive provide 2,000 hours of care per period.[27]

Regarding employment status, a woman is considered to be working full-time if she works 35 or more hours per week for 36 or more weeks per year; less than this is considered part-time. In the model, those who work full-time are assumed to work 4,000 hours over the two-year period, while those who work part-time work 2,000 hours per period.[28] A woman is considered to be not working if she is retired, unemployed, or reports not being in the labor force. Respondents are asked to report

be called upon to care for their widowed mothers.

[27]The threshhold of 1,000 hours of care is chosen because it corresponds to approximately 10 hours per week if care is distributed evenly over the two years, and 10 hours is a threshhold often used in the literature for intensive caregiving (Ettner, 1995; Carmichael and Charles, 2003). Among those classified as light (intensive) caregivers the median hours of care over two years is 300 (2,000) hours.

[28]In the data, the median hours worked per week by part-time (full-time) workers is 20 (40) hours. For both types of workers, the median number of weeks worked per year is 50.

hourly wages if they are working. If the respondent reports her pay at a different frequency, the RAND HRS data files adjust the pay rate appropriately using the respondent's reported usual hours worked per week and usual weeks worked per year.

5.2 Demographic and Parental Measures

The HRS contains information on the respondent's education, years of work experience, non-labor income, and family structure. In terms of family structure, in each survey wave, the woman reports her marital status, how many living siblings she has, and the gender of the siblings. The woman reports various sources of non-labor income including capital income, income from pensions and annuities, income from Social Security Disability Insurance or SSI, income from Social Security retirement, spouse, or widow benefits, income from unemployment or worker's compensation, income from other government transfers, and her spouse's labor earnings (if she is married).

The HRS reports for each respondent's parent whether he/she needs help with activities of daily living, whether he/she can be left alone for an hour or more, and in waves after 1996 whether the parent has a memory or cognition problem. The HRS does not contain information about how many or which activities of daily living the parent needs help with, but only that help is required with at least one activity. The resulting health transition matrix from the multinomial logit specification discussed in Section 3.5 is given below.

	t			
$t-1$	*Healthy*	*ADL*	*Alone*	*Death*
Healthy	0.784	0.098	0.048	0.070
ADL	0.133	0.425	0.183	0.258
Alone	0.139	0.092	0.396	0.373
Death	0	0	0	1

5.3 Permanent Unobserved Heterogeneity

Women enter the HRS sample at various ages during midlife. Thus, I observe decisions beginning in the middle of the lifecycle that are conditioned on state variables that arise from prior unobserved decisions. If these "initial" conditions are not exogenous (i.e. if there is unobserved heterogeneity in preferences or constraints) direct estimation will lead to bias.[29] To account for this problem, I assume the probabilities of the unobserved heterogeneity types can be represented by parametric functions of the initial state variables. If the wage unobservables and unobserved utility arguments are serially uncorrelated, the initial state variables are exogenous given type.[30]

The unobserved type probabilities also depend on initial conditions that are not in the woman's state space. Specifically, the type probabilities depend on the woman's initial log wage and initial discretized liquid assets. Liquid assets are composed of the net value of the woman's stocks, mutual funds, and investment trusts, her checking, savings, and money market accounts, and her CDs and bonds. Thus, savings enter the model through the unobserved heterogeneity, which allows women who enter the model with low or high wealth to exhibit persistent differences in caregiving and work choices as well as wages. The specification of the type probability function is given in Appendix C.

5.4 Descriptive Statistics

Table 1 provides descriptive statistics for those without a mother alive and for non-caregivers, light caregivers, and intensive caregivers conditional on the woman's mother being alive.[31] Light caregivers are about 2 percentage points less likely to be working than non-caregivers whereas intensive caregivers are 11 percentage points less likely to be working than non-caregivers. Both light and intensive caregivers are about 2 percentage points more likely to be working part-time than non-caregivers. While non-caregivers and light caregivers who work appear to earn about the same hourly wage, the average accepted wage for intensive caregivers is about two dollars lower. Thus, the data seems to suggest a negative relationship between caregiving and labor force participation and wages that is particularly large for intensive caregivers. Those with a mother no longer alive are older which likely explains why almost 60 percent of this group is not working.

The data indicates that caregiving frequency and intensity vary with the health of the mother. Non-caregivers are more likely to have healthy mothers than light and intensive caregivers, and light caregivers are more likely to have a mother who needs help with ADLs or has a memory or cognition problem than non-caregivers. About

[29] "Initial" conditions are those that exist at the time the woman is first observed in the sample.

[30] Aguirregabiria and Mira (2010) provide a detailed discussion of this initial conditions problem and possible solutions, including the one described above.

[31] All dollar amounts are adjusted by the Consumer Price Index using 2008 as the base year.

two-thirds of intensive caregivers have non-healthy mothers, and intensive caregivers are 16 percentage points more likely to have a mother who cannot be left alone compared to both non- and light caregivers. Table 2 shows the percentage of mothers in each health state that receive light or intensive care from their daughters. Less than 30 percent of healthy mothers receive informal care and almost all care provided is light. Over half the mothers with ADL needs or a memory problem receive care, and of those receiving care, about a quarter of them are receiving intensive care from their daughter. Caregiving for a mother who cannot be left alone for an hour or more is less common than caring for a mother with ADL needs or a memory problem which may reflect the increased caregiving burden when a parent cannot be left alone.[32] However, over half the women providing care to a mother who cannot be left alone are providing intensive care.

Table 1 also indicates that non-caregivers are more likely to have a sister than light and intensive caregivers, and light caregivers are more likely to have a sister than intensive caregivers. Caregivers are slightly better educated than non-caregivers and have more years of work experience than non-caregivers, but are also slightly older on average.

6 Estimation

I pursue a non-likelihood-based estimation strategy, efficient method of moments (EMM), which is a type of indirect inference (see Gourieroux et al., 1993; Gallant and Tauchen, 1996). The basic idea is to fit simulated data obtained from the structural model to an auxiliary statistical model. This auxiliary statistical model can be easily estimated and must provide a complete enough statistical description of the data to be able to identify the structural parameters. Following Tartari (2006) and van der Klaauw and Wolpin (2008), the auxiliary model I use in estimation consists of a combination of approximate decision rules that link endogenous outcomes of the model and elements of the state space as well as structural relationships such as the

[32]This may also reflect the mother receiving formal care from a home aide or a nursing home. The HRS does not contain data on formal home health care utilization by parents of respondents, but does contain information about whether the mother resides in a nursing home at the time of the survey. Formal home health care utilization is somewhat rare—approximately 13 to 14 percent of the non-institutionalized elderly rely on formal home health care (Johnson, 2007; Kaye et al., 2010), but generally in combination with informal care. In 2002, only 4 percent of the disabled elderly relied solely on paid help (Johnson, 2007). Only 8 percent of the mothers in the estimation sample reside in a nursing home. The model has been estimated including nursing home utilization, and the results are qualitatively and quantitatively similar to those from the model presented.

wage equation and job offer probabilities.

Specifically, using the actual data, y_A, I estimate a set of M_A auxiliary statistical relationships with parameters θ_A. By construction, at the maximum likelihood estimates, $\widehat{\theta}_A$, the scores of the likelihood function, L_j for $j = 1, \ldots, M_A$, are zero. That is, $\frac{\partial L_j}{\partial \theta_{A,j}} = 0$ where $\theta_{A,j}$ is the vector of model j's parameters. Denoting θ_B the parameters of the behavioral model, the idea behind EMM is to choose parameters that generate simulated data, $y_B(\theta_B)$, that make the score functions as close to zero as possible. This is accomplished by minimizing the weighted squared deviations of the score functions evaluated at the simulated data. Thus, the EMM estimator of the vector of structural parameters θ_B is:

$$\widehat{\theta}_B = \underset{\theta_B}{\text{argmin}} \frac{\partial L}{\partial \theta_A} \left(y_B(\theta_B); \widehat{\theta}_A \right) \Lambda \frac{\partial L}{\partial \theta'_A} \left(y_B(\theta_B); \widehat{\theta}_A \right), \tag{11}$$

where Λ is a weighting matrix and $\frac{\partial L}{\partial \theta_A} \left(y_B(\theta_B); \widehat{\theta}_A \right)$ is a vector collecting the scores of the likelihood functions across auxiliary models.

6.1 Auxiliary Statistical Models

The solution of the optimization problem described is a set of decision rules in which the optimal choice made in any period is a function of the state space in that period. One class of auxiliary models used consists of parametric approximations to these decision rules.[33] Following van der Klaauw and Wolpin (2008), to keep these approximations parsimonious, I specify the decision rules as parametric functions of subgroups of state space elements. A second set of auxiliary models comprises quasi-structural relationships related to the wage equation and job offer probabilities. Appendix D contains a list of the auxiliary models used in estimation. The auxiliary models imply 435 score functions which are used to identify 67 structural parameters.[34] The structural parameters being estimated include the parameters of the utility function, job offer probabilities, wage offers, unobserved type probabilities as well as the covariance matrix of the unobserved utility from each choice and the variance of the wage unobservable.

[33]For example, the utility function is unobserved to the econometrician so it is impossible to provide auxiliary models which approximate the utility function itself. However, the outcome of the utility function is a set of caregiving and work choices each period. Thus, auxiliary models that are related to these choices identify the utility parameters.

[34]Estimates of the auxiliary parameters are not reported but are available upon request.

6.2 Simulating Data for Estimation

I perform path simulations as follows. At a given set of structural parameters, having solved the optimization problem conditional on those parameters, I simulate one-step-ahead decisions. That is, given the state variables of a woman in a given period, I simulate her decisions by drawing a vector of the disturbances and choosing the alternative with the highest value function. The permanent unobserved heterogeneity is incorporated as follows. The probability that a simulated individual is a given type depends on her initial state variables. Given that probability, each simulated observation is assigned a particular type by drawing randomly from the type probability function. The score functions from the auxiliary models are evaluated using the simulated decisions and the criterion function is calculated.[35] I iterate on the parameters using the Nelder-Mead simplex method until the criterion function is minimized.

7 Results

7.1 Parameter Estimates

Parameter estimates and standard errors are provided in Table 3. The model allows for two types of women who differ in their utility from leisure and wage offer intercept. The estimated distribution of types is 50.5 percent type 1 and 49.5 percent type 2.[36] A number of estimates are worth highlighting and make clear the static and dynamic labor market tradeoffs faced by caregivers. First, the estimates suggest initiating care provision is costly regardless of the mother's health. In addition, direct utility from providing care is greater (or less negative) when mothers are not healthy, and in particular when they have ADL needs or a memory or cognition problem.[37] Thus, those who start caregiving are likely to continue to do so, especially if their

[35]For the purpose of calculating the score function, I perform 60 simulations for each sample observation and average that observation's score functions over the simulations.

[36]The model was also estimated allowing for three types, but model fit did not improve above that of the model with two types. In addition, the model has been estimated with two and three types where types differ in their wage offer intercept, utility from leisure, and utility from caregiving, but fit did not improve in these cases either.

[37]The model was also estimated with nursing home utilization to see if nursing home use of mothers who cannot be left alone was generating the observed ordering of caregiving utilities (for example, $\alpha_3 > \alpha_4$). Nursing home utilization occurred with some probability which depended on the mother's realized health state and last period's nursing home use. A (dis)utility parameter from caregiving while the mother is in a nursing home was introduced and estimated. The remaining caregiving utility parameter estimates were nearly identical to those presented here without nursing home use incorporated. Results from estimation of the model with nursing home use are available upon request.

mother is no longer healthy, since they have already incurred the initiation cost. As a result, the model generates persistence in caregiving, an important dynamic channel. A woman considers that if she provides care today, she will likely to do so again next period, and she will make a work decision today which accounts for this persistence in caregiving and the long-term tradeoffs it generates.

The estimates of the job offer probabilities underscore the importance of the labor market frictions. Table 4 presents the implied offer probabilities by whether the woman is younger or older than 62. Women who do not work face very low probabilities of receiving either a full or part-time offer next period. In fact, women age 62 and over who do not work receive a full-time offer next period with only 1 percent probability. Thus, women who do not work are likely to find it difficult to return to work in the future. Table 4 also shows that while moving between full and part-time work is easier than moving from non-work to employment, substantial frictions still exist. For example, the probability of receiving a part-time offer given a woman worked full-time last period ranges from 27 to 41 percent. This probability is larger for women who have reached the age of 62, which captures the observed fact that many women transition from full to part-time work before retirement. These job offer probability estimates highlight important dynamic tradeoffs for caregivers. Those who leave work to provide care face low probabilities of receiving future offers, potentially leading to withdrawal from the labor force earlier than desired or expected. In addition, if a woman wishes to move from full to part-time work while providing care, such an option is not always available, and she may have to choose between combining full-time work with care responsibilities or not working. If she does work part-time while caregiving, she is not guaranteed to be able to move to full-time work in the future, but is more likely to do so if she is younger.

The wage offer parameters are reasonable and as expected. There is a wage penalty for not working in the previous period—a woman who did not work last period can expect a 13 percent lower wage offer than an otherwise similar woman who worked last period. These estimates also make clear static and dynamic tradeoffs between caregiving and work. Women who leave work to provide care forgo experience and the associated wage returns, and face a lower expected wage if they return to work. The estimates show that part-time jobs are associated with lower wage offers ($\beta_7 = -0.253$), which is important since both light and intensive caregivers are more likely to work part-time than non-caregivers. In addition, if a woman is considering decreasing her work hours while caregiving she must consider first that such an option may not be available since she may not receive a part-time offer, and second that the decrease in hours will lead to a lower expected wage.

7.2 Model Fit

To examine the within-sample fit of the model, the parameter estimates are used to create a simulated sample consisting of 15 replicas of each sample individual's initial state variables. Table 5 reports the actual and simulated proportions of women working full-time, part-time, or not at all by their caregiving choice, conditional on the woman's mother being alive. The model predictions match the observed fact that light and intensive caregivers are more likely to be in part-time work than non-caregivers, and that intensive caregivers are less likely to be in full-time work than both non- and light caregivers. Table 6 reports the actual and simulated proportions of combined caregiving and work choices, conditional on the woman's mother being alive. Generally, the model fits these choice proportions well, but slightly overstates non-work, regardless of caregiving choice. Table 7 compares the actual and simulated proportions of women lightly and intensively caregiving by the mother's health status. The model fits very well along these dimensions. In particular, it is able to match the fact that intensive caregiving is more frequent for mothers who are not healthy, and that caregiving is most prevalent when a mother has ADL needs or a memory problem. The model also fits accepted wages well, predicting an average accepted log wage of 2.622 compared to 2.669 in the actual data.

Importantly, the model should not only fit choice proportions, but also transitions in caregiving and work status. Table 8 shows observed caregiving transitions in the actual and simulated data. The model matches the fact that about two-thirds of caregivers continue caregiving (regardless of intensity) in the next period, conditional on the mother being alive. This prediction explicitly shows the persistence in caregiving generated by the model. The model also fits well the proportion of women who did not provide care in the previous period but caregive in the current period (regardless of intensity). Last, the model matches well the proportion of women who stop caregiving, due to either the death of the mother or the woman stopping care provision. Table 9 compares observed employment transitions in the actual and simulated data. The model matches the fact that transitions from non-work to full or part-time work are rare, and transitions from part-time to full-time work and vice versa occur with slightly higher probability.

7.3 The Value of Elder Parent Care

The structural approach adopted in this paper allows for calculation of the value of elder parent care, which reflects both the static and dynamic value of caregiving. To determine this value, I implement a counterfactual scenario in which women who would otherwise begin care provision are not allowed to do so. Specifically, the parameter estimates are used to create a simulated baseline sample consisting of 15 replicas of each sample individual's initial state space variables. The estimates are used to create another simulated sample of 15 replicas of each sample individual, but a woman is not allowed to provide care (of either intensity) in the period in which she initiated care provision in the baseline scenario. The removal of caregiving choices from the decision set comes as a surprise in that period, and she must make the best choice that does not involve providing care.[38] She makes this decision expecting the caregiving choices to be available in all future periods. I then calculate the lump-sum transfer needed to make a woman indifferent between her choice in the non-caregiving counterfactual and her choice in the baseline in the period in which she initiated care (i.e. the transfer needed to equalize the realized period value function in the non-caregiving counterfactual to the realized period value function in the baseline when she initiated care).[39]

Figure 1 shows the distribution of transfer payments, excluding the top 90th percentile of transfers. The median transfer is $66,370 per two-year period, which is about half the cost of two years of nursing home care in a semi-private room (MetLife, 2010b). The transfers vary with the mother's health. The median value of initiating care is $63,501 when a mother is healthy, $75,539 when a mother has ADL needs or a memory problem, and $64,929 when a mother cannot be left alone. The value of initiating care provision is larger when a mother has ADL needs or a memory problem for several reasons. First, the direct utility from both light and intensive caregiving is largest for those with mothers in this health state compared to the others. Second, mothers who have ADL needs or a memory problem remain in that health state with 43 percent probability and transition to death with 26 percent probability on aver-

[38]Since women are surprised when they have the caregiving choices removed and the same draws for the idiosyncratic shocks and unobserved utility arguments are used in the baseline and counterfactual scenarios, all pre-caregiving outcomes are unchanged, in particular prior work decisions.

[39]The transfer is necessarily positive since the woman is forced to make a choice from a constrained decision set in which the optimal choice is removed.

age. Thus, the daughter is likely to provide care next period since she will be able to again receive the direct utility from providing care if her mother remains in that health state, and the initiation cost will have already been incurred. When a mother cannot be left alone she remains in that health state with 40 percent probability and transitions to death with 38 percent probability on average. The probability of providing care again next period is lower for these women. If her mother remains in the cannot be left alone health state, she derives less direct utility from the second period of caregiving than a woman whose mother has ADL needs or a memory problem. The transfers reflect these dynamic channels that operate via the caregiving initiation costs and the parental health transitions.

Several previous studies, particularly in the gerontology literature, have also assigned a monetary value to informal care. However, these studies typically calculate this value by multiplying the average hours of care provided by the average or median wage of a home health aide (the replacement wage approach), the minimum wage, or some average of the two (Ernst and Hay, 1994; Arno et al., 1999; Chappell et al., 2004; Feinberg et al., 2011). For example, Feinberg et al. (2011) estimate the economic value of informal care based on caregivers providing an average of 18.4 hours of care per week at an average value of $11.16 per hour, which amounts to a value of $21,356 over two years. This value is substantially lower than the median transfer I calculate above based on value function differences. Johnson and LoSasso (2000) perform a back of the envelope calculation and find the loss in annual work hours for female caregivers in the US translates on average into about $7,800 in lost wages per year in 1994 dollars, or $22,663 over two years in 2008 constant dollars, similar to that found in Feinberg et al. (2011). Ernst and Hay (1994) find the net cost of informal care for an Alzheimer's patient is $20,900 per year in 1991 dollars, or $66,076 over two years in 2008 dollars. This value is larger than those of the other studies since they estimate the weekly hours of informal care per week at 52.5, which is substantially higher than that found in most studies and the sample used in this paper. Their methodology based on 20 hours of care provision per week produces a value of $33,866 over two years. The structural approach employed in this paper allows for calculating a value of caregiving which incorporates the direct utility from providing care, the utility cost from initiating care, parental health transitions, and the option value of providing care. These features are not reflected in the approaches used in the above-mentioned studies, and it appears calculations based on the replacement wage approach or current foregone wages substantially underestimate the value of elder parent care.

8 Policy Experiments

One of the goals of this paper is to use the structural estimates to analyze how various government sponsored elder care policies affect a woman's caregiving and work decisions. For each policy I simulate a dataset using 15 replicas of each sample individual's initial state space variables and compare the results to those of the baseline dataset simulated without the policies.[40] I consider a two-year unpaid leave, a two-year paid leave, and a caregiver allowance for intensive caregivers.[41]

8.1 Unpaid Leave

Currently in the US, the Family and Medical Leave Act (FMLA) of 1993 allows workers to take up to a 12-week unpaid leave to care for an ill family member and guarantees the worker will return to his/her job at the same wage. According to the US Department of Labor, caring for an ill parent was the next to least common reason (out of six) surveyed leave-takers utilized the FMLA, with only 10.6 percent of leave-takers using FMLA for that reason (Cantor et al., 2001). When asked about reasons for needing a leave (but not necessarily taking one), however, caring for an ill parent was the second most common reason. Some speculate this low take-up is due to the short duration and unpaid status of the leave. Motivated by the fact that an average caregiving spell lasts about four years (National Alliance for Caregiving and AARP, 2009), the first policy experiment involves an unpaid leave longer than the 12 weeks allowed under the FMLA. The policy experiment allows a woman to take a two-year unpaid leave from work to caregive intensively for her mother. Family work leaves of such length or longer are common in several European countries, such as Austria, Bulgaria, and Germany.

The policy is implemented as follows: Women who worked in the prior period (either full or part-time) have the option of caregiving intensively and not working during the current period with a guarantee that they will have a job offer for the type of job they left in the following period. There is also no wage penalty for not working

[40] I use the same draws for the idiosyncratic shocks and unobserved utility arguments in the baseline and policy simulations.

[41] Throughout the analysis of the policy experiments, it is important to keep in mind the partial equilibrium setup of the model. The demand side of the labor market is considered completely exogenous. Thus, I assume employers do not adjust their behavior in response to the policies.

during the leave.[42] Thus, the leave alleviates a woman from combining work and intensive caregiving for a period, but she forgoes her labor income for that period. At the same time, the leave eliminates the uncertainty about returning to work since her job is held for her during the leave.

About 33 percent of women who are eligible take the unpaid leave, where eligible means the woman worked last period and is intensively caregiving in the current period. About 19 percent of women who intensively caregive are doing so while on leave. Columns 1 and 2 of Table 10 report the proportion of women providing intensive care by the mother's health status in the baseline simulation and in the unpaid leave simulation. The unpaid leave generates modest increases in intensive care provision.

There is evidence that the leave helps women to better maintain employment during and after a caregiving spell. Columns 1 and 2 of Table 11 report the employment status of women during and after intensive care provision in the baseline and unpaid leave simulations. The leave induces more work, especially full-time work, among these ever intensive caregivers compared to the baseline. Figure 2 shows the proportion of unpaid leave-takers in full and part-time work in the years before and after they take the leave compared to the corresponding periods in the baseline when the leave is not available. Women seem to take the unpaid leave at a time in the baseline when intensive care provision induces them to leave work, particularly full-time work. About 39 percent of those who take the leave left work in the equivalent period in the baseline and did not return. The unpaid leave, however, returns women to work and many of them continue working for several periods. There is a 49 (27) percent increase in the proportion of women in full-time (part-time) work in periods after the leave is taken compared to the corresponding periods in the baseline. Thus, it appears allowing women to take a leave to intensively caregive but removing the uncertainty about the availability of job offers after the leave encourages more full and part-time work for these women compared to when such a leave is unavailable. These results highlight the importance of labor market frictions for these caregivers.

8.2 Paid Leave

The second policy experiment is similar to the leave described above except the woman receives a lump-sum payment while on leave to intensively caregive, and the payment is linked to the health of the care recipient. Currently in the US, California

[42] The leaves are aimed at women facing heavy caregiving burden and are not available to light caregivers.

and New Jersey have paid family leave programs, but caregivers can only take a leave for a maximum of 6 weeks, and payment is tied to the worker's wage. Payments to caregivers are very common in Europe and Canada,[43] and payments to care recipients that are indexed to their health or level of need are also common.[44] I consider a combination of these pre-existing policies in that the payment is provided directly to the caregiver while on leave, and the payment varies with the health of her mother.

I simulate the paid leave under two payment schemes. The first pays $6,600 to women who intensively care for mothers with ADL needs or a memory problem and $13,200 to women who intensively care for mothers who cannot be left alone. These amounts are loosely based on the monthly payments under Germany's Cash Allowance for Care extrapolated to a two-year period. The second payment system pays $18,250 to women who intensively care for mothers with ADL needs or a memory problem and $36,500 to women who intensively care for mothers who cannot be left alone.[45] These amounts are based on the recently suspended CLASS Act, which aimed to create a voluntary government insurance benefit to provide long-term care support. Benefits were to be triggered once a participant needed ADL help or comparable assistance because of cognitive impairment. The law specified the average minimum benefit be $50 per day with benefit amounts to be scaled based on the level of impairment.[46] I take a conservative approach and provide $25 per day for two years to women caring for mothers with ADL needs or a memory problem and $50 per day for two years to women caring for mothers who cannot be left alone.

Under the first payment scheme, 39 percent of eligible women take the paid leave, and not surprisingly even more (46 percent) take the leave under the second payment scheme. Table 10 shows that the paid leaves, particularly under the second payment scheme, generate somewhat larger increases in intensive care provision than the un-

[43]For example, the Swedish Temporary Care Leave pays a caregiver 80 percent of her normal labor income for a maximum leave of 60 days. Canada's Compassionate Care Benefit pays 55 percent of a caregiver's average earnings for up to six weeks while she cares for a terminally ill family member. Ireland's Carer's Benefit pays a maximum of 205 euros per week for up to 104 weeks to caregivers who leave work to "care for a person in need of full-time care and attention."

[44]For example, Austria's Cash Allowance for Care, Germany's Cash Allowance for Care, Luxembourg's Cash Allowance for Care, and the United Kingdom's Attendance Allowance.

[45]Under both payments schemes, women who intensively care for healthy mothers can take a leave, but do not receive a payment. I make this assumption since the European and Canadian policies typically require the care recipient to have sufficient need for care.

[46]CLASS Act took effect in January 2011, but in October 2011, the Obama administration announced the program was suspended.

paid leave. Table 11 shows that the employment effects of the paid leave during and after intensive care provision are nearly identical to those of the unpaid leave. Figure 3 shows the proportion of paid leave-takers under the second payment scheme in full and part-time work in the years before and after they take the leave compared to the corresponding periods in the baseline. There is a 40 (26) percent increase in the proportion of women in full-time (part-time) work in periods after the paid leave is taken compared to the corresponding periods in the baseline. Again, these results are similar to those of the unpaid leave. Thus, the main differences between the unpaid and paid leaves are the take-up rate and subsequently how much intensive care provision is induced and government expenditure on the leave payments.

8.3 Caregiver Allowance

The last policy experiment provides a payment to women who intensively caregive for their non-healthy mothers that is not linked to their employment status and may be received indefinitely. This policy experiment can inform about the labor market effects that would have occurred if the care recipient under the CLASS Act transferred the benefit payment in full to her caregiving daughter. The payment amounts are identical to those of the second paid leave payment scheme—$18,250 for intensively caregiving for a mother with ADL needs or a memory problem and $36,500 for intensively caregiving for a mother who cannot be left alone. As seen in Table 10, the caregiver allowance generates the largest increase in intensive care provision among all the policies considered compared to the baseline. Two channels may be driving these results—first, the policy does not require the woman to leave work to receive the payment and second, the payment can be received indefinitely. I decompose this policy and simulate it under the leave rules, meaning a woman can receive the payment at most every other period, rather than indefinitely as long as she is providing intensive care. The decomposition shows the large increases in care provision are due mainly to the fact that the woman does not have to leave work to receive the payment. At the same time, this policy discourages work among intensive caregivers due to the income effect of receiving this payment indefinitely. Table 11 shows that the caregiver allowance leads to a 2.5 percentage point increase in non-work among women who ever provide intensive care, which is mostly due to a reduction in full-time work.

8.4 Retirement Effects of Policies

Since a caregiver is typically in her fifties and sometimes early sixties, the policy experiments may have important retirement effects. Table 12 shows the employment status of women between the ages of 62 (the Social Security Early Entitlement Age) and 70 who ever provided intensive care in the baseline simulation, the work leave simulations, and the caregiver allowance simulation. Both the unpaid and paid leaves slightly increase the proportion of women 62 and over who work part-time compared to the baseline, and lead to moderate increases in full-time work. The caregiver allowance slightly decreases the percentage of women working full-time age 62 and over. Thus, it appears the work leaves reduce some early withdrawal from the labor force for women who have ever provided intensive care.

The retirement effects are stronger for women who took a leave at some point in the simulations. Table 13 compares the employment status of women 62 and over in the baseline and the policy simulations who ever took an unpaid or paid leave. The leaves decrease non-work by 16 to 17 percentage points compared to the baseline, which suggests the leaves are effective in preventing early retirement for many of these leave-takers. Given the average age of a leave-taker is between 57 and 58, these results show that the one period removal of uncertainty regarding the ability of a caregiver to return to work has effects for several periods. In addition, the unpaid leave is just as effective as the paid leaves in encouraging work after age 62, which is an important consideration for policy makers who may aim to protect the employment of caregivers while minimizing the government expenditure needed to do so.

8.5 Welfare Comparison of Policies

Using the estimates, I determine the value of the policy experiments for those who take them up. I calculate the lump-sum transfer needed to equalize the woman's realized period value function in the baseline (without any policies available) to her realized value function in the policy simulation in the period in which she takes up the policy being analyzed.[47] Table 14 shows the median value of each policy experiment for all women who take up each particular policy, for the subset of women who take up the policy and were already intensively caregiving in the equivalent period in the baseline, and for women who were induced to provide intensive care by the policy.

[47] The transfer is calculated for the period in which a woman takes a leave for the unpaid and paid leave experiments and during periods of intensive care provision for an unhealthy mother for the caregiver allowance experiment.

About 50 to 60 percent of the median value of the larger paid leave can be achieved with the unpaid leave, which suggests much of the benefit of the paid leaves comes from the guarantee the woman can return to work. In addition, the unpaid leave generates comparable welfare gains to the caregiver allowance which does not require a woman to leave work to receive the payment. These results further emphasize the importance of the labor market frictions for caregivers and the benefit of eliminating the uncertainty regarding the availability of full and part-time jobs.

Interesting patterns emerge when comparing the welfare gains for the subgroup of women who are induced to caregive by each policy. Those induced to intensively caregive for a non-healthy mother by the smaller paid leave enjoy about \$10,000 more in welfare than those induced by the unpaid leave, which lies between the \$6,600 and \$13,200 leave payments. Those induced to intensively caregive for a non-healthy mother by the larger paid leave enjoy about \$9,000 more in welfare than those induced by the smaller paid leave, which is less than the \$11,650 and \$23,300 increase in leave payments. This can be explained in part by the differential take-up of the leaves. As the payments increase across the leaves, more women take them and are induced to intensively caregive. These marginal leave-takers necessarily value the leaves less than women who take all three leaves. The median value of the caregiver allowance for women induced to intensively caregive by this policy is only slightly larger than the \$18,250 payment and well below the \$36,500 payment. This value is also below the median value of the unpaid leave for those induced to intensively caregive by that policy, highlighting again the value of guaranteeing caregivers can return to work. These results have important implications for policy makers who may be concerned with balancing government expenditure with the welfare gains generated by the policies, particularly for women induced to care by the policies.

9 An Extended Model with Search

In the model presented above, the job offer probability estimates reflect both search by the woman and contact made by the firm. It is assumed that women who are identical in observables face the same offer probabilities. The extended model allows for an explicit search choice when a woman does not work, which affects her offer probabilities in addition to the vector $\mathbf{Z}_{it}$. I provide a brief description of the extended model below.

The employment choice set is augmented such that women face four choices: (1)

Do not work and do not search; (2) Do not work but do search; (3) Work part-time; and (4) Work full-time. A disutility from search parameter is added to the utility function and estimated. In addition, the offer probabilities are a function not just of whether the woman did not work in the prior period, but whether she searched while not working. This allows those who actively search for a job to have higher offer rates than those who do not (for example, those who consider themselves retired). The offer probabilities are the same as in equation 4, but now

$$\lambda^E \mathbf{Z}_t = \lambda_0^E + \lambda_1^E I(E_{t-1} = 0) + \lambda_2^E I(E_{t-1} = S) + \lambda_3^E I(age_t \geq 62) + \\ \lambda_4^E I(educ_t = 2) + \lambda_5^E I(educ_t = 3),$$

where $E_{t-1} = 0$ means the woman did not work and did not search and $E_{t-1} = S$ means the woman did not work but did search. The remaining features of the model are unchanged.

The main reason search is not included in the baseline model is that information on search is very limited in the HRS, only reporting whether those currently not working have very recently searched for a job.[48] Fewer than 5 percent of non-working women in the sample report that they recently searched for work. Table 15 compares the utility function parameter estimates in the baseline versus the extended model. Generally, the parameter estimates from the extended model are very similar to those of the baseline model. There is a large disutility from search, but Table 16 shows that offer probabilities are higher for those who search while not working compared to those who do not. Even with search included, however, women still face substantial labor market frictions when they do not work. Table 17 shows the actual and simulated proportion of women working full-time, part-time, not working but searching, and not working and not searching by their caregiving status, conditional on the woman's mother being alive. The extended model fits these proportions and other aspects of the data well, but does not improve model fit above that of the baseline model.[49]

Importantly, the basic conclusions from the value of caregiving and policy experiment simulations are qualitatively and quantitatively similar to those of the baseline. For example, the median value of care provision is $62,174 over two-years in the

[48] After 2000, the HRS did not ask questions about search to those who previously reported consecutive survey waves of non-search.

[49] A comparison of the remaining parameter estimates and more model fit results are available upon request.

extended model, compared to $66,370 in the baseline model. In addition, both the unpaid and paid leaves increase employment of women who ever provide intensive care relative to the simulation without such policies available. The larger paid leave generates a 3 and 5 percentage point increase in the percentage of women working part-time and full-time, respectively, among those who ever provide intensive care. The caregiver allowance discourages work among these women, decreasing full-time work by 2.5 percentage points relative to the extended model simulated without any policies. The leaves generate only modest increases in intensive care provision, while the allowance increases intensive care provision by 7 percentage points for mothers who have ADL needs or a memory problem and by 14 percentage points for mothers who cannot be left alone. Thus, it appears splitting out the searchers from the group of women who are not working does not have important implications for the estimates or policies considered in this paper.

10 Conclusion

In this paper, I developed and estimated a dynamic discrete choice model of caregiving and work to study how elder parent care affects a woman's labor force participation and wages over the short and long-term. In contrast to the previous literature, I model caregiving and work decisions in an explicitly intertemporal framework. Women make forward-looking decisions in a model which incorporates parental health uncertainty, human capital accumulation, and labor market frictions.

The model is estimated using data from the *Health and Retirement Study* by efficient method of moments. Based on the estimates, the model was shown to reasonably fit many aspects of the data. The estimates highlight various static and dynamic labor market tradeoffs faced by caregivers. Women who begin care provision are likely to continue to do so, especially if their parent is in poor health. In addition, women are more likely to provide intensive care when their parent is no longer healthy, and intensive caregivers are less likely to be working. The estimates also underscore the importance of labor market frictions. Women who do not work face low probabilities of receiving job offers in the future. As a result, if a woman leaves work while caregiving she may find it difficult to return. If she works part-time while caregiving, she is not guaranteed to be able to increase her hours in the future. The wage offer estimates show women who leave work forgo experience and the associated wage returns, and also face a lower expected wage if they return to work.

The estimates were used to calculate the value of elder parent care. The median value of initiating care was found to be \$66,370 over two-years, about half the cost of two years of nursing home care, but two to three times larger than the values found in the previous literature. These previous values were calculated using the replacement wage approach or current foregone wages from providing care, and do not reflect the dynamic value of initiating care provision. Thus, calculations that ignore forward-looking behavior and the intertemporal nature of caregiving and work underestimate the value of elder parent care.

The estimated model was used to analyze three counterfactual policy experiments: a two-year unpaid leave, a two-year paid leave, and a caregiver allowance for intensive caregivers. The leaves generate modest increases in intensive caregiving and substantial decreases in non-work among women during and after intensive care provision, further highlighting the importance of the labor market frictions. There is also evidence that the leaves reduce early withdrawal from the labor force. The caregiver allowance on the other hand generates substantial increases in intensive care provision but discourages work among those who ever intensively caregive. A comparison of the welfare gains generated by the policies shows that about half the value of the paid leave can be achieved with the unpaid leave, and the caregiver allowance generates gains comparable to the unpaid leave. The welfare gains generated by the unpaid leave alone emphasize the value of guaranteeing a caregiver can return to work. The policy experiments illustrate the existence of two important tradeoffs faced by policy makers: (1) Protecting the employment of caregivers versus encouraging informal care provision by the family; and (2) Balancing government expenditure with the welfare gains generated by the policies.

Appendix

A Utility Function

The period utility function is given by:

$$u_t = \ln(C_t) + \alpha_{1,\ell} \ln(L_t) + \alpha_{CG,H^p} + \alpha_{CG,CG_{-1}} + \alpha_{CG,sis} + \nu_{t,E,CG}$$

where

$$\alpha_{1,\ell} = \alpha_{1,1} I(type = 1) + \alpha_{1,2} I(type = 2)$$

and

$$\begin{aligned}\alpha_{CG,H^p} = \alpha_2 I(CG_t = 1)I(H_t^p = healthy) + \alpha_3 I(CG_t = 1)I(H_t^p = ADL)\\ +\alpha_4 I(CG_t = 1)I(H_t^p = alone) + \alpha_5 I(CG_t = 2)I(H_t^p = healthy)\\ +\alpha_6 I(CG_t = 2)I(H_t^p = ADL) + \alpha_7 I(CG_t = 2)I(H_t^p = alone)\end{aligned}$$

and

$$\begin{aligned}\alpha_{CG,CG_{-1}} = \alpha_8 I(CG_t \neq 0)I(CG_{t-1} = 0)I(H_t^p = healthy)\\ +\alpha_9 I(CG_t \neq 0)I(CG_{t-1} = 0)I(H_t^p = ADL)\\ +\alpha_{10} I(CG_t \neq 0)I(CG_{t-1} = 0)I(H_t^p = alone)\end{aligned}$$

and

$$\begin{aligned}\alpha_{CG,sis} = \alpha_{11} I(CG_t \neq 0)I(sis_t = 1)I(H_t^p = healthy)\\ +\alpha_{12} I(CG_t \neq 0)I(sis_t = 1)I(H_t^p = ADL)\\ +\alpha_{13} I(CG_t \neq 0)I(sis_t = 1)I(H_t^p = alone).\end{aligned}$$

The direct utility from not caregiving is normalized to zero across all health states.

B Non-Labor Income

Non-labor income is assumed to arrive from a degenerate distribution that depends on a woman's education, age, and marital status. Outside the structural model, I estimate the following regression:

$$\begin{aligned}\ln(y_t) =& \gamma_0 + \gamma_1 I(educ_t = 2) + \gamma_2 I(educ_t = 3) + \gamma_3 I(mar_t = 1) + \gamma_4 I(age_t \geq 62)\\ &+ \gamma_5 I(mar_t = 1)I(age_t \geq 62) + \gamma_6 I(age_t \geq 62)I(E_t = 0),\end{aligned} \tag{12}$$

where y_t is non-labor income and $I(mar_t)$ is an indicator for whether the woman is married. Non-labor income depends on whether the woman is over the age of 62 since she can begin claiming Social Security retirement benefits at that age. The interaction term between marital status and achieving the Social Security Early Entitlement Age is meant to capture the drop in her spouse's labor earnings due to retirement as well as his potential receipt of Social Security benefits. Every period in the model, the woman receives non-labor income based on her characteristics as generated by equation 12. The estimates from the non-labor income regression are reported in Table 18.

C Unobserved Type Probability Function

$$Pr(type = \ell) = \frac{\exp(\mu^{\ell}\mathbf{\Omega})}{1 + \sum_{m=2}^{2} \exp(\mu^{m}\mathbf{\Omega})} \qquad \ell \in \{1, 2\}, \tag{13}$$

where

$$\begin{aligned}\mu^{\ell}\mathbf{\Omega} =& \mu_0^{\ell} + \mu_1^{\ell} I(E_{-1} = PT) + \mu_2^{\ell} I(E_{-1} = FT) + \mu_3^{\ell} I(mar_0 = 1) + \mu_4^{\ell} age_0 \\ &+ \mu_5^{\ell} \ln w_0 + \mu_6^{\ell} I(w_0 = 0) + \mu_7^{\ell} I(asset_0 = 2) + \mu_8^{\ell} I(asset_0 = 3),\end{aligned}$$

where E_{-1} is the work choice of the woman preceding the period in which she enters the sample (period $t = 0$). Recall that I do not use the 1992 survey wave data in the estimation, but the work choice of a woman observed in 1992 serves as her previous period's employment choice when she enters the estimation sample. If the woman enters the model with no wage (either because she did not work or the wage was not reported), she is assigned the average log wage observed in the data, and an indicator variable denotes that she entered without a wage. The woman's initial liquid assets are discretized into terciles. Coefficients for type 1 are normalized to zero.

D Auxiliary Models

The following list consists of auxiliary models used in estimation:

1. Multinomial logits of non-work, part-time work, and full-time work on combinations of age, age squared, experience, experience squared, education indicators, indicators for last period's employment decision, an indicator for reaching age 62, and a marital status indicator.

2. Logits of caregiving (any intensity) versus not caregiving on combinations of parental health status indicators, an indicator for having a sister, and lagged caregiving for those with a mother alive.

3. Multinomial logits of no care, light care, and intensive care on combinations of parental health status indicators, an indicator for having a sister, and lagged caregiving for those with a mother alive.

4. Multinomial logits of the combined work-caregiving decision (9 choices total) on combinations of experience, education indicators, lagged caregiving, indicators

for last period's employment decision, an indicator for reaching age 62, a marital status indicator, an indicator for having a sister, and parental health status indicators for those with a mother alive.

5. Logit of transitions from not caregiving to caregiving (any intensity) on parental health status indicators for those with a mother alive.

6. Logit of transitions from caregiving (any intensity) to not caregiving on parental health status indicators for those with a mother alive.

7. Multinomial logits of transitions from non-employment to no work, part-time work, or full-time work; from part-time work to no work, part-time work, or full-time work; from full-time work to no work, part-time work, or full-time work on experience, education indicators, and an indicator for reaching age 62.

8. Logits of transitions from non-full-time work to full-time work and from non-part-time work to part-time work on an indicator for not working last period, education indicators, and an indicator for reaching age 62.

9. Regressions of log accepted wages on combinations of age, age squared, experience, experience squared, education indicators, and indicators for last period's employment decision.

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Tables and Figures

Table 1: Descriptive Statistics

	Mother Not Alive	Non-Caregiver	Light Caregiver	Intensive Caregiver
Employment				
% Not working	59.35	41.69	43.55	52.54
% Working part-time	16.38	17.47	19.46	19.15
% Working full-time	24.27	40.85	36.99	28.31
Mean accepted wage[a]	$21.09	$20.74	$20.31	$18.16
Mother's Health				
% Healthy		75.25	64.97	35.87
% ADL needs or memory problem		12.63	22.82	35.73
% Cannot be left alone		12.12	12.20	28.39
Demographics and Family Structure				
Mean age	62.07	56.76	58.53	59.81
% Married	77.99	81.90	80.61	74.93
% Has sister	71.90	75.05	69.10	61.22
% Less than HS education	21.81	20.48	14.48	14.27
% HS degree	40.22	38.07	43.04	41.97
% Some college	37.96	41.45	42.48	43.77
Mean years of experience	26.25	23.94	26.21	27.02
N	7,125	7,187	3,032	722

[a] Conditional on working.

Table 2: Parental Health and Caregiving

	Healthy	ADL Needs	Alone
% Not caregiving	70.81	48.87	60.23
% Lightly caregiving	25.80	37.24	25.59
% Intensively caregiving	3.39	13.89	14.18
N	7,637	1,858	1,446

Table 3: Main Parameter Estimates

Description	Parameter	Estimate	S.E.
Utility Parameters			
Leisure (Type 1)	$\alpha_{1,1}$	1.532	0.011
Leisure (Type 2)	$\alpha_{1,2}$	2.056	0.067
Light caregiving when $H^p = healthy$	α_2	-0.266	0.021
Light caregiving when $H^p = ADL$	α_3	0.304	0.009
Light caregiving when $H^p = alone$	α_4	-0.225	0.025
Intensive caregiving when $H^p = healthy$	α_5	-1.047	0.037
Intensive caregiving when $H^p = ADL$	α_6	0.156	0.017
Intensive caregiving when $H^p = alone$	α_7	0.022	0.027
Initiating care when $H^p = healthy$	α_8	-1.916	0.016
Initiating care when $H^p = ADL$	α_9	-1.893	0.030
Initiating care when $H^p = alone$	α_{10}	-1.540	0.054
Caregiving and has a sister when $H^p = healthy$	α_{11}	-0.160	0.021
Caregiving and has a sister when $H^p = ADL$	α_{12}	-0.162	0.024
Caregiving and has a sister when $H^p = alone$	α_{13}	-0.318	0.047
Log Wage Offer Parameters			
Intercept (Type 1)	$\beta_{0,1}$	0.351	0.001
Intercept (Type 2)	$\beta_{0,2}$	0.378	0.003
Age	β_1	0.058	9.74E-06
Age squared	β_2	-0.0006	1.01E-06
Experience	β_3	0.046	3.07E-05
Experience squared	β_4	-0.0006	1.44E-06
HS degree	β_5	0.251	0.006
Some college	β_6	0.658	0.005
Part-time	β_7	-0.253	0.004
Did not work last period	β_8	-0.132	0.005
Variance of wage unobservable	σ^2_w	0.437	0.001
Part-Time Job Offer Logit Parameters			
Intercept	λ^{PT}_0	-0.992	0.013
Did not work last period	λ^{PT}_1	-1.556	0.058
Age 62+	λ^{PT}_2	0.376	0.049
HS degree	λ^{PT}_3	0.263	0.030
Some college	λ^{PT}_4	0.072	0.027
Full-Time Job Offer Logit Parameters			
Intercept	λ^{FT}_0	-0.227	0.030
Did not work last period	λ^{FT}_1	-2.101	0.068
Age 62+	λ^{FT}_2	-2.526	0.293
HS degree	λ^{FT}_3	0.289	0.058
Some college	λ^{FT}_4	0.300	0.047

Description	Parameter	Estimate	S.E.
Unobserved Type Probability Parameters			
Type 2: Intercept	μ_0^2	-0.051	0.105
Type 2: Worked part-time before initial period	μ_1^2	1.026	0.997
Type 2: Worked full-time before initial period	μ_2^2	-2.120	0.121
Type 2: Married at initial period	μ_3^2	-0.116	0.036
Type 2: Age at initial period	μ_4^2	0.012	4.87E-04
Type 2: Initial log wage	μ_5^2	0.074	0.016
Type 2: No initial log wage	μ_6^2	0.025	0.104
Type 2: Initial asset tercile 2	μ_7^2	0.604	0.130
Type 2: Initial asset tercile 3	μ_8^2	-0.225	0.233
Other Parameters			
Discount factor (not estimated)	β	0.95	

Covariance Matrix for Unobserved Utility Arguments

This matrix governs the unobserved utility from each joint caregiving and work choice when women have a mother alive:

	$\nu_{0,0}$	$\nu_{0,1}$	$\nu_{0,2}$	$\nu_{PT,0}$	$\nu_{PT,1}$	$\nu_{PT,2}$	$\nu_{FT,0}$	$\nu_{FT,1}$	$\nu_{FT,2}$
$\nu_{0,0}$	1.000								
$\nu_{0,1}$	−0.618	1.913							
	(0.019)	(0.023)							
$\nu_{0,2}$	−0.291	0.162	1.335						
	(0.039)	(0.029)	(0.023)						
$\nu_{PT,0}$	−0.010	0.00	0.00	0.563					
	(0.059)			(0.036)					
$\nu_{PT,1}$	0.00	0.00	0.00	0.272	2.525				
				(0.035)	(0.041)				
$\nu_{PT,2}$	0.00	0.00	0.00	0.369	1.175	2.065			
				(0.104)	(0.065)	(0.068)			
$\nu_{FT,0}$	−0.065	0.00	0.00	0.00	0.00	0.00	1.087		
	(0.065)						(0.079)		
$\nu_{FT,1}$	0.00	0.00	0.00	0.00	0.00	0.00	−0.770	1.696	
							(0.042)	(0.023)	
$\nu_{FT,2}$	0.00	0.00	0.00	0.00	0.00	0.00	−0.184	−0.483	1.160
							(0.053)	(0.056)	(0.052)

The variance of the unobserved utility from not working and not caregiving has been normalized to one. Most covariances of unobserved utility across work choices are set equal to zero since not all terms of the covariance matrix can be identified (Train, 2009).

This matrix governs the unobserved utility from each work choice when women do not have a mother alive:

	ν_0	ν_{PT}	ν_{FT}
ν_0	1.000		
ν_{PT}	0.030	0.343	
	(0.023)	(0.042)	
ν_{FT}	−0.846	0.00	1.272
	(0.039)		(0.120)

The variance of the unobserved utility from not working has been normalized to one.

Table 4: Offer Probabilities

	Younger than 62	62 and Older
% PT offer | E_{t-1}=0	7 - 9	10 - 13
% FT offer | E_{t-1}=0	9 - 12	1
% PT offer | E_{t-1}=FT	27 - 32	35 - 41
% FT offer | E_{t-1}=PT	44 - 52	6 - 8

There are a range of offers in each cell since offers vary with the woman's education.

Table 5: Employment Status by Caregiving Type

	Non-Caregiver		Light Caregiver		Intensive Caregiver	
	Actual	Simulated	Actual	Simulated	Actual	Simulated
% Not working	41.69	46.12	43.55	46.67	52.54	53.35
% Working part-time	17.47	16.34	19.46	18.59	19.15	17.85
% Working full-time	40.85	37.54	36.99	34.74	28.31	28.80

Table 6: Joint Caregiving and Work Choices

	Actual	Simulated
% Not working, not caregiving	27.42	29.30
% Not working, light caregiving	12.05	13.77
% Not working, intensive caregiving	3.44	3.72
% Working part-time, not caregiving	11.49	10.38
% Working part-time, light caregiving	5.38	5.49
% Working part-time, intensive caregiving	1.25	1.24
% Working full-time, not caregiving	26.87	23.85
% Working full-time, light caregiving	10.24	10.25
% Working full-time, intensive caregiving	1.85	2.01

Table 7: Caregiving by Mother's Health Status

	Healthy		ADL Needs		Alone	
	Actual	Simulated	Actual	Simulated	Actual	Simulated
% Lightly caregiving	25.80	28.13	37.24	36.59	25.59	25.52
% Intensively caregiving	3.39	3.64	13.89	13.92	14.18	14.58

Table 8: Caregiving Transitions

	Actual	Simulated
% Caregivers who care again next period	68.00	66.96
% Transitioning from non-caregiving to caregiving	22.40	22.82
% Transitioning from caregiving to non-caregiving	42.43	44.17

Table 9: Employment Transitions

	$\mathbf{E_t = 0}$	$\mathbf{E_t = PT}$	$\mathbf{E_t = FT}$
$\mathbf{E_{t-1} = 0}$	89.48 (A) 90.14 (S)	6.64 (A) 6.35 (S)	3.87 (A) 3.51 (S)
$\mathbf{E_{t-1} = PT}$	24.66 (A) 24.21 (S)	58.60 (A) 59.47 (S)	16.75 (A) 16.32 (S)
$\mathbf{E_{t-1} = FT}$	13.91 (A) 16.35 (S)	10.64 (A) 9.98 (S)	75.45 (A) 73.67 (S)

The relative frequency of each cell within its row is reported.
(A): Actual (S): Simulated

Table 10: Intensive Care Provision by Mother's Health

	Baseline	Unpaid Leave	Paid Leave I	Paid Leave II	Caregiver Allowance
% Intensively caregiving $\|H^p = healthy$	3.64	4.20	4.21	4.24	3.78
% Intensively caregiving $\|H^p = ADL$	13.92	15.78	16.46	17.67	21.07
% Intensively caregiving $\|H^p = alone$	14.58	16.62	18.23	20.66	27.85

Table 11: Employment of Women Who Ever Provide Intensive Care

	Baseline	Unpaid Leave	Paid Leave I	Paid Leave II	Caregiver Allowance
% Not working	58.94	52.58	51.49	50.17	61.50
% Working part-time	16.32	17.53	17.89	18.13	16.19
% Working full-time	24.74	29.89	30.62	31.70	22.31

Employment status shown for women in periods during and after intensive care provision.

Table 12: Employment of Women 62 and Over Who Ever Provide Intensive Care

	Baseline	Unpaid Leave	Paid Leave I	Paid Leave II	Caregiver Allowance
% Not working	68.04	62.17	60.94	59.55	70.16
% Working part-time	15.61	16.92	17.37	17.72	15.43
% Working full-time	16.35	20.91	21.69	22.73	14.41

Employment status shown for women in periods during and after intensive care provision.

Table 13: Employment Comparison of Women 62 and Over Who Ever Took a Leave

	Unpaid Leave Takers		Paid Leave I Takers		Paid Leave II Takers	
	Baseline	Policy	Baseline	Policy	Baseline	Policy
% Not working	62.02	44.83	60.03	43.29	57.79	41.95
% Working part-time	16.18	20.48	17.06	21.61	17.42	21.84
% Working full-time	21.80	34.69	22.91	35.10	24.79	36.21

Table 14: Welfare Comparison of Policy Experiments

	Unpaid Leave	Paid Leave I[a]	Paid Leave I[b]	Paid Leave II[a]	Paid Leave II[b]	Caregiver Allowance
Median value	$27,561	$33,434	$39,999	$43,987	$51,567	$31,033
Always caregivers	$30,582	$38,241	$45,903	$53,333	$67,005	$36,637
Induced caregivers	$25,965	$31,691	$35,948	$39,011	$44,928	$19,818

[a] Includes those on leave caring for a healthy parent, but not receiving a payment.

[b] Excludes those on leave caring for a healthy parent.

Always caregivers are those who were intensively caregiving in the equivalent period in the baseline.

Induced caregivers are those who were not intensively caregiving in the equivalent period in the baseline.

Table 15: Baseline versus Extended Model Utility Estimates

Parameter Description	Baseline	Extended
Leisure (Type 1)	1.532	1.524
Leisure (Type 2)	2.056	2.146
Light caregiving when $H^p = healthy$	-0.266	-0.281
Light caregiving when $H^p = ADL$	0.304	0.261
Light caregiving when $H^p = alone$	-0.225	-0.289
Intensive caregiving when $H^p = healthy$	-1.047	-0.890
Intensive caregiving when $H^p = ADL$	0.156	0.177
Intensive caregiving when $H^p = alone$	0.022	0.014
Initiating care when $H^p = healthy$	-1.916	-1.906
Initiating care when $H^p = ADL$	-1.893	-1.801
Initiating care when $H^p = alone$	-1.540	-1.368
Caregiving and has a sister when $H^p = healthy$	-0.160	-0.135
Caregiving and has a sister when $H^p = ADL$	-0.162	-0.175
Caregiving and has a sister when $H^p = alone$	-0.318	-0.319
Search		-2.774

Table 16: Extended Model Offer Probabilities for those Not Working

	Younger than 62	62 and Older
% PT offer | E_{t-1}=0	5 - 7	9 - 12
% PT offer | E_{t-1}=S	28 - 35	40 - 48
% FT offer | E_{t-1}=0	6 - 9	1
% FT offer | E_{t-1}=S	44 - 54	7 - 11

There are a range of offers in each cell since offers vary with the woman's education.

Table 17: Employment Status by Caregiving Type in the Extended Model

	Non-Caregiver		Light Caregiver		Intensive Caregiver	
	Actual	Sim	Actual	Sim	Actual	Sim
% Not working, not searching	39.66	44.56	42.15	45.90	51.13	52.22
% Not working but searching	2.03	2.08	1.40	1.15	1.41	1.67
% Working part-time	17.47	16.42	19.46	18.59	19.15	18.61
% Working full-time	40.85	36.94	36.99	34.74	28.31	27.50

Table 18: Non-Labor Income Estimates

Description	Parameter	Estimate	S.E.
Intercept	γ_0	8.198	0.047
HS degree	γ_1	0.285	0.034
Some college	γ_2	0.601	0.035
Married	γ_3	1.432	0.044
Age 62+	γ_4	0.813	0.060
Married and age 62+	γ_5	-0.999	0.061
Age 62+ and not working	γ_6	0.090	0.041

Figure 1: Distribution of the Value of Caregiving

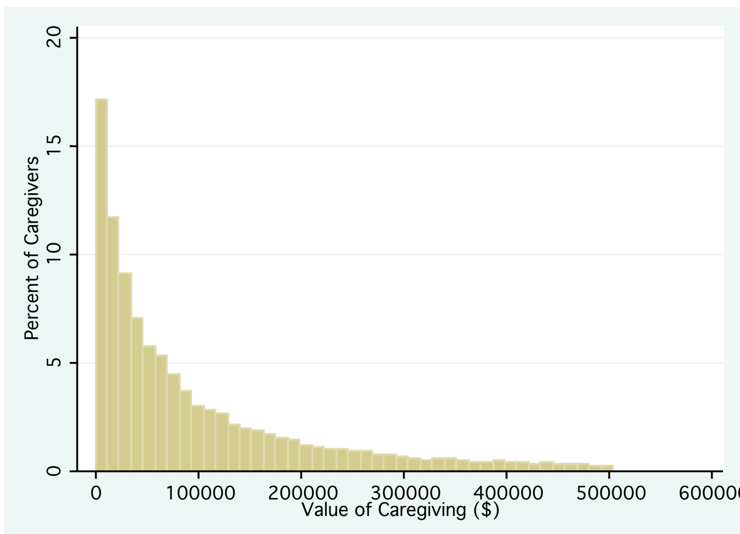

Figure 2: Unpaid Leave Results

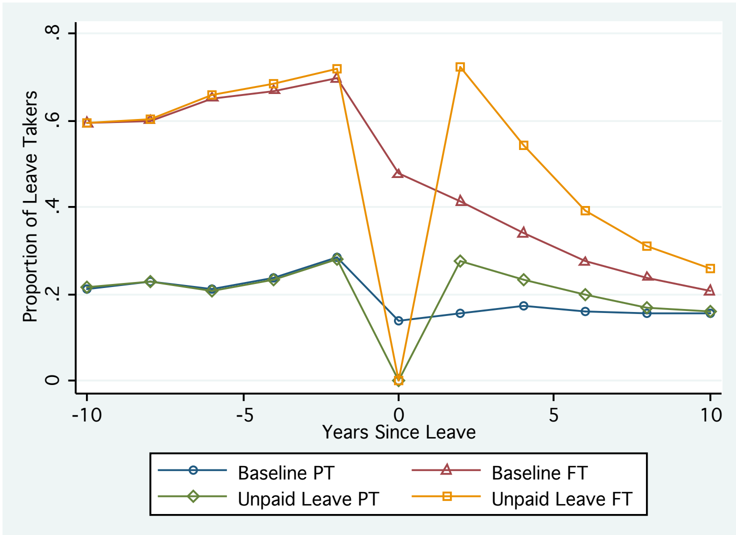

Figure 3: Paid Leave Results