Care Provision to Elderly Parents and Women's Hours Worked in the Labor Market

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1. Introduction

Due to the aging of the baby boomers, the population over 65 years of age is expected to radically expand over the years 2010 through 2030, doubling in size from the year 2000 (He et. al., 2005; USDHHS, 2000).[1] A large proportion of the elderly population depends on informal care as a primary source of care. Additionally, women are disproportionately the ones to provide such care (Himes, 1994; Walker et. al, 1995; FCA, 2003; Zissimopoulos, 2001).[2] Together, these facts imply that there will likely be greater care burdens on women of working age in the near future. There is still very little known about the impact of care for the elderly on those who provide care, yet the answers would be informative for developing policies to deal with the aging population in the United States. For example, understanding how hours worked responds to provision of informal caregiving and formal market purchased care would be informative for understanding consequences of policies that alter the mix of care provision.[3]

This paper estimates the effect of three jointly-decided care provision methods to elderly parents – informal caregiving, formal market purchased care and monetary transfers - on the labor market involvement of their adult daughters. In isolating a causal effect of care provision on labor market outcomes, one must address potential selection into caregiving. Both in this paper and previous literature, Ordinary Least Squares (OLS) estimation finds a negative relationship between women's informal care provision to elderly parents and labor market involvement. At the same time, OLS estimates also find some evidence of a positive relationship between elderly parents' use of formal market purchased care and women's labor market involvement. These estimates would initially suggest that a policy that shifts care provision away from informal toward formal care provision, such as an increase in

[1] Longer life expectancies and previously low fertility rates also contribute to the aging of the US population (USDHHS, 2000, 2007; Hamilton et al., 2003; Stein 2007).

[2] Roughly 65% of the elderly population relies solely on informal care, while 30% supplement informal care with formal care. Among caregivers, 59%-75% are women and female caregivers provide 50% more time caregiving than male caregivers (FCA, 2003).

[3] Although shocks to parental need for care can be exogenous to labor market outcomes, caregiving is a choice variable and therefore estimates of one choice variable on another cannot be interpreted as causal in the standard way of thinking about causal relationships. Despite this, estimates that are free from selection are valuable in examining the relationships between choices. Policy cannot directly affect parental need for care but *can* alter other factors that influence care provision.

availability or a reduction in prices of formal care options, would also encourage women to work. Provision of informal care is time consuming and therefore could draw the caregiver from time available for work in the labor market. However, even if there were no causal link between time spent caregiving or formal care use and hours worked, these correlations could arise due to selection. For example, those women who have jobs that demand more hours of work or have higher pay have a higher opportunity cost to providing informal care. These women are also likely to have more resources which make alternative methods of care relatively more affordable.

To address endogeneity in the care provision decision, this paper uses an instrumental variables approach. While previous studies have estimated the effect of informal care provision on labor market outcomes using instrumental variables, the literature has largely ignored the joint nature of multiple care decisions in estimating this effect. Formal market purchased care and monetary transfers could serve as other forms of care provision that are jointly decided with informal caregiving and can also affect the caregiver's labor market outcomes. If these methods are omitted from the analysis, then they provide another channel through which the instrument can affect labor market outcomes besides through informal caregiving and can bias results. In studying the effect of caregiving on the caregiver's labor market outcomes, it is therefore important to consider the multiple ways in which care can be provided. As far as the author is aware, this is the first paper to address the endogeneity of informal care, formal market purchased care and transfers between the adult daughter and elderly parent in the labor market decision. All three are treated as jointly decided endogenous care provision methods.

To provide a framework for evaluating the relationships between methods of care and hours worked, I present a standard time allocation model incorporating each of the care provision methods and labor market decisions. I then use the model as a framework for determining variables that could serve as instruments, explicitly stating the specific assumptions made. I discuss modifications to the theory and alternative theories, along with the different sets of instruments implied by these modifications. Variations of the model imply three potential sets of instruments, each under different assumptions. The first set of instruments implied by the model are variables representing parental resources and parental

need for care. Secondly, the model also suggests use of sibling variables as instruments for care provision. Additionally, shocks to parental need for care serve as instruments under the most relaxed assumptions. To estimate specifications with the implied instruments, I make use of the 1991 Parent Health Supplement of the Panel Study of Income Dynamics. While the supplement is asked in only one year, I make use of a unique feature of the way questions are asked in the supplement and the longitudinal nature of the remaining data to identify shocks to parental need for care.

In this paper, I find negative and significant effects of providing informal care to elderly parents. I also find positive and significant effects of parental use of formal care on women's hours worked in the labor market. In both cases, the shift in hours is large enough to be consistent with a move between full time and part time or between part-time work and not working.

2. Background

Literature most related to the question addressed here falls primarily into one of three categories. The first group of studies attempts to isolate a causal effect of informal caregiving on women's labor market outcomes, while accounting for the endogeneity of caregiving in the labor market decision. These papers are also generally motivated by the idea that time spent caregiving may draw caregivers from labor market work. As mentioned, each of these papers focuses on the connection between informal care provision and labor market work, without addressing other forms of care provision in estimation. While not concerned with labor market outcomes, another branch of literature analyzes the relationship between informal care and monetary transfers. The majority of these studies focus on whether an exchange motive exists between giving monetary transfers and receipt of informal care. Lastly, a third group of studies have examined the role of multiple potential caregivers in the care provision decision.

The earlier studies addressing the first category mentioned, analyzing the effect of informal caregiving on women's labor market outcomes, were all done for the United States (Wolf and Soldo, 1994; Ettner, 1995, 1996). Using the 1987 wave of the National Survey of Families and Households (NSFH) and a double-selection model, Wolf and Soldo (1994) find

insignificant results, concluding that there is no effect of informal care provision on hours worked. Estimation is identified off of the exclusion of the following variables: having an old sick parent, having a healthy parent, the number of brothers and the number of sisters. From the 1987 wave of the Survey of Income and Program Participation, Ettner (1995) uses socio-economic status of parents, parental education and the number of siblings as instruments. She finds a large negative effect of care provision on hours worked for those who co-reside with a parent. From the 1987 wave of the NSFH, Ettner (1996) uses age of parents, health of parents, socioeconomic status of parents, the number of brothers and sisters and an indicator for whether parents are still living and married to each other all as instruments. Ettner (1996) finds a negative and significant effect of informal caregiving on female labor market outcomes when the parent is not co-residing. Results from these early studies for the United States are somewhat inconclusive. This is likely in part due to data limitations; these studies each have poor measures for at least one of the key variables in their estimation.[4] Ettner (1995; 1996), also acknowledges that some of the instruments, such as parental education and parental socioeconomic status are more problematic as instruments than others.[5]

Also studying the United States, Johnson and LoSasso (2000) use two waves of the Health and Retirement Study (HRS), 1994 and 1996, to estimate a simultaneous panel data model for the effect of caring for a dependent parent on yearly hours worked. Johnson and LoSasso (2000) also use exclusion restrictions to address endogeneity of the caregiving decision, but improve upon previous literature by using the two years of data to also address unobserved individual heterogeneity. They also overcome many of the data limitations of previous studies. Variables included in the caregiving equation but excluded from the hours worked equation include: parental age and health, brothers and sisters, parental marital status and parental resources. They find a large negative and significant effect of informal care provision on hours worked.

[4] The analysis in Wolf and Soldo (1994) is limited by having no measure of parental need for care. The measure of care provision used in Ettner (1995) is categorical, primarily distinguishing between co-residence or not. Ettner (1995) cannot identify daughter's who are potential cargivers since no reliable measure for parental need for care or even a measure for whether non-co-residential parents are living is available in the data. In Ettner (1996), the care provision variable is binary and must be constructed from other variables as a care provision variable is not available.

[5] For example, parental education is often used as a proxy for unobserved ability in education and labor market studies and is unlikely to be excludable.

Of the most recent studies, the majority study the effect of informal care on labor market outcomes for women in Europe. Heitmueller (2007) uses the British Household Panel Study (BHPS) to estimate the effect of informal caregiving (to anyone) on labor force participation.[6] He uses the instruments of the health status of others in the household and the ages of respondents' three closest friends and finds a significant reduction in labor force participation for coresident care only. Crespo and Mira (2010) use two waves of data from the Survey of Health, Aging and Retirement in Europe (SHARE), dividing European countries into northern, continental and southern groupings, to estimate the effect of informal care provision on women's employment status. Using parental health as an instrument, Crespo and Mira (2000) find mostly small and insignificant effects, concluding no effect for northern and continental countries and a small negative effect in southern countries.

Detailed longitudinal data on both the elderly parents and the adult daughter is generally lacking for the United States.[7] While the most detailed data for Europe is also only available for few years, some research has made use of better longitudinal data for Europe. Heitmueller and Michaud (2006) use 13 waves of the BHPS (1991-2003) to estimate a dynamic bivariate probit model for caregiving for an elderly person on employment using past transition rates into caregiving as an instrument. They find a negative effect for coresident caregiving only. Spiess and Schneider (2003) use the European Community Household Panel (ECHP) for the years 1994-1996 to estimate a difference-in-differences model of the effect of starting, continuing and stopping caregiving on hours worked in the labor market. They find that in northern European countries starting caregiving has a negative effect on hours, but not continuing or stopping, while it is not starting but continuing caregiving that has an effect on hours in southern European countries. Casado et al. (2007) use the ECHP from 1994 to 2001 to estimate a dynamic ordered probit model for the effect of informal care on labor force participation of middle-aged women in Spain. Casado et al (2007) finds a significant negative effect of informal caregiving on labor force participation for those coresiding only. Both Spiess and Schneider (2003) and Casado et al. (2007) use estimation methods that directly

[6] He distinguishes between coresident and non-coresident caregiving, but cannot distinguish the relationship between the caregiver and the care recipient, therefore grouping many potentially different types of care into one measure.

[7] Johnson and LoSasso (2000) who have used the most years of data in studies for the United States only use two waves of the HRS.

address individual heterogeneity, but do not directly address simultaneity as the previously discussed papers have.

Estimates of caregiving on hours worked for the United States generally appear to be negative. Research for European countries finds negative effects for only some countries, but not others, or for people co-residing and providing care over longer periods of time. Living and care arrangements differ notably between the United States and European countries as well as between European countries. There is also clear variation in the direction of changes in care arrangements over time for different countries (Tomassini, et al., 2004).

A second branch of research examines the relationship between two methods of care provision, monetary transfers and informal care provision. Transfers and bequests may play a role in the caregiving decision if parents compensate their children for care provision. Parents could do this either directly, through expectations of care provision that arise from past financial support provided or through the promise of future bequests. On the other hand, children could transfer funds to parents to substitute for providing caregiving themselves (providing money instead of time). This could happen through direct payments or through helping to make payments for a nursing home or home nurse.

Various connections between informal care and transfers have been established, yet mixed evidence makes it still unclear how important of a role transfers plays in the overall care decision. Zissimopoulos (2001) finds evidence consistent with a tradeoff between time and money transfers that varies with wage. On the other hand, Hurd et at (2007) finds that much of the differences in transfers over time are driven by individual heterogeneity rather than responses to shocks. Despite this finding, Hurd et at (2007) do observe transfers to adult children that vary with parental health – increasing with new physical limitations and decreasing with chronic disease. While this descriptive evidence could imply payment for caregiving, Zissimopoulos (2001) notes that at older ages, transfers typically flow from the adult child to the elderly parent and studies finding flows in the opposite direction typically use data on younger parents.

Much of the literature concerned with monetary transfers and informal caregiving has focused on whether bequests or transfers are provided with an exchange motive. There is generally a lack of compelling evidence for bequests as an exchange motive in the literature.

Checkovich and Stern (2002) find that, when care is provided by a family member, it is most likely to be provided by one primary caregiver. If bequests were closely tied to caregiving, then we would expect to see variation in bequest amounts among children based on the care they provide their parents, yet 83-88% of bequests are split equally among children (McGarry, 1999; Wilhelm, 1996). The question of whether inter-vivos transfers are used in exchange for care provision is still unsettled in the literature. Some papers find suggestive evidence in support of an exchange motive (McGarry, 1999; McGarry and Scheoni, 1995), while others find suggestive evidence against (Norton and Van Houtven, 2006, Cox and Rank, 1992).[8]

In addition to the two branches of research discussed so far, recent research related to care provision has turned toward evaluating the interactions between many potential care providers in the care provision decision, using the framework of bargaining models (Pezzin and Schone, 1999; Engers and Stern, 2002; Stern, 1995; Checkovich and Stern, 2002). Most of the papers that use the bargaining framework focus on the influence that child and parent characteristics have on the care provision decision (Engers and Stern, 2002; Stern, 1995; Checkovich and Stern, 2002; Pezzin and Schone, 1999). Despite the advantages that bargaining models have for evaluating the interactions between decision-makers, as currently specified they are not conducive to treating labor market involvement as the outcome of interest.[9]

In general, it is unclear in the bargaining model literature whether strategic play occurs between siblings. Checkovich and Stern (2002) do find that the availability of an alternative caregiver will reduce the care provided by an individual, but do not determine whether this occurs simply because the burden is shared by more people or strategic play occurs. Similarly,

[8] McGarry (1999) and McGarry and Scheoni (1995) find that inter-vivos transfers are highly correlated with adult children's incomes while informal care is not highly correlated with the financial situation of either the parent or child. Norton and Houtven (2006) find that caregiving (binary) provided by an adult child increases their chances of receiving a transfer greater than $500 by 11 to 14 percentage points, which is a quite small amount of money. A small payment could simply serve as payment for purchases that the adult child made on the elderly parent's behalf and not actually compensate for their time spent caregiving. Cox and Rank (1992) interpret a positive correlation between an adult child receiving a transfer and providing care as evidence for transfers as a form of exchange but acknowledge that this correlation could occur under a theory of altruism as well.

[9] This literature treats care arrangements as discrete and mutually exclusive categories, where the different players in the family bargaining problem have valuations of each caregiving situation This literature is limited in that discrete care options do not account for intensity of care and mutually exclusive care options do not allow for multiple methods of care to be used at the same time, which we know from descriptive evidence occurs quite regularly.

Engers and Stern (2002) find evidence that favors a voluntary model where individuals can opt out of the decision-making process over a collective model, but it is not clear to what extent this affects the other players' decisions.

Overall, the first category of literature discussed is clearly the most closely related to the question analyzed here. This paper contributes to the literature by improving upon existing methodology by including in estimation the endogenous care provision methods that were omitted in previous papers, and may have previously served as sources of bias. The inclusion of these additional endogenous care provision methods in estimation therefore provides more reliable estimates of the causal effect of care provision to the elderly on adult daughters' labor market outcomes. Doing so also draws on the second branch of literature, which analyzes connections between informal care and monetary transfers. Consistent with the third branch of literature, parental marital status and the role of sibling are also considered as variables influencing the care provision decision, as they may serve as additional sources of care.[10]

3. Theoretical Framework

I present a basic time-allocation model as a starting framework for considering the analysis of the relationships between parental need for care, care provision to elderly parents, and labor market involvement. The model incorporates the joint decision of the adult daughter on the hours she will work in the labor market as well as the hours of informal caregiving, monetary transfers and formal market purchased care she will provide to her elderly parent. The model also incorporates the decision of the elderly parent on the amount of formal care that he or she will purchase. For simplicity, the most basic version of the model is presented first. The basic set-up is based on the model introduced by Nizalova (2006), which is a fairly standard time allocation model. I have incorporated a component of parental physical well-being, similar to that in Pezzin and Schone (1999). I also build upon this framework with additional extensions and modifications to the model. I then use the model to motivate instruments. Extensions (discussed later) include incorporating a sibling as an additional

[10] Parental marital status and siblings variables are included as instruments in some specifications. Because of the complications introduced both into the model and subsequent estimation, this paper does not incorporate strategic interactions.

caregiver, incorporation of altruistic components into each utility function and multi-directional transfers.

Starting with the basic set-up, let us denote the caregiver (the adult daughter) with a capital letter G and the care recipient (the elderly parent) with a capital letter R. The caregiver is referred to as caregiver and the care recipient is referred to as care recipient even if no informal care is provided $(t_g = 0)$.

The single caregiver's optimization problem is:

$$\underset{t_g, D, t_w, t_{mG}}{\text{Max}} \; U^G = U^G(X_G, L_G, U^R) \tag{1a}$$

s.t.

$$X_G + p_t t_{mG} = I_G + w t_w - D \tag{1b}$$

$$t_g + t_w + L_G = T \tag{1c}$$

The altruistic caregiver maximizes her utility function (U^G) with respect to the four choice variables: time spent informal caregiving (t_g), net transfers to parents (D), time spent on labor market work (t_w), and formal market purchased care (t_{mG}). Her utility function is a function of her consumption (X_G), leisure (L_G) and the utility of her elderly parent (U^R). She maximizes her utility subject to her budget constraint (1b) and time constraint (1c). In her budget constraint, she can purchase composite consumption (X_G) at unit price and formal market care (t_{mG}) at price p_t using her unearned income (I_G), earned income (wage w times hours worked t_w) less any transfers (D) she gives to her elderly parent. Her total time T is divided between informal caregiving (t_g), labor market work (t_w) and leisure (L_G).

The single care recipient's optimization problem is:

$$\underset{t_{mR}}{\text{Max}} \; U^R = U^R(X_R, W^R) \tag{2a}$$

s.t.

$$X_R + p_t t_{mR} = I_R + D \tag{2b}$$

$$W^R = W^R\left(N_R, Z^R, \psi\right) \tag{2c}$$

$$Z^R = Z^M\left(t_m; \gamma\right) + Z^G\left(t_g; \lambda\right) \tag{2d}$$

$$t_m = t_{mG} + t_{mR} \tag{2e}$$

The care recipient's utility function (U^R) is a function of his or her consumption (X_R) and physical well-being (W^R).[11] In the care recipient's budget constraint (2b), he or she can purchase consumption (X_R) and formal market care (t_{mR}) at price p_t using his or her unearned income (I_R) and transfers (D) from his or her adult daughter. The care recipient's physical well-being measure (W^R) is a function of his or her disabilities or need for care (N_R), the amount of care received (Z^R), as well as a parameter for how effectively care alleviates need (ψ). As shown in equation (2d), total care produced can come from either market care (Z^M), which is a function of the combined hours of formal market care purchased (t_m) and a market productivity parameter (γ), and informal care (Z^G), which is a function of hours of informal care received (t_g) and an informal care productivity parameter (λ).

4. Motivating Instruments from the Model

Before discussing the various extensions, I use the model above to determine what assumptions are necessary for certain variables to serve as instruments. I then discuss various modifications to the model, alternative stories and the instruments they imply. First, solving

[11] The caregiver is assumed to be healthy and still of working age, while the care recipient is assumed to be retired and potentially in need of care. For this reason, the care recipient has a physical well-being measure while the caregiver does not and the caregiver has a time constraint while the care recipient does not.

the optimization problem presented in the previous section for the caregiver and care recipient results in the following first-order conditions:[12]

$$t_{mG}: \quad p_t U^G_{X_G} = U^G_{U^R} U^R_{W^R} W^R_{Z^R} Z^M_{t_{mG}} \qquad \text{(formal market care equations)}$$

$$t_{mR}: \quad p_t U^R_{X_R} = U^R_{W^R} W^R_{Z^R} Z^M_{t_{mR}}$$

$$t_g: \quad U^G_{L_G} = U^G_{U^R} U^R_{W^R} W^R_{Z^R} Z^G_{t_g} \qquad \text{(caregiving equation)}$$

$$t_w: \quad U^G_{L_G} = w U^G_{X_G} \qquad \text{(labor market work equation)}$$

$$D: \quad U^G_{X_G} = U^G_{U^R} U^R_{X_R} \qquad \text{(transfers equation)}$$

The formal market purchased care equations represent the trade-off between formal market care purchased by the caregiver (t_{mG}) and the caregiver's consumption (X_G) and formal market care purchased by the recipient (t_{mR}) and the care recipient's consumption (X_R). The hours of caregiving equation represents the trade-off between the caregiver's time spent on leisure (L_G) and informal caregiving (t_g). The hours of labor market work equation represents the trade-off between the caregiver's leisure (L_G) and consumption (X_G). Lastly, the transfers equation represents the trade-off between the caregiver's consumption (X_G) and the care recipient's consumption (X_R).

At this point, one route to take would be to assume a functional form for the utility functions U^R and U^G, the parental well-being function W^R and the care production functions Z^M and Z^G and solve the first-order conditions for each of the choice variables. Instead of assuming a specific functional form, this paper assumes only one such property of a functional form: separable utility. Separable utility means that the marginal utility of one argument in the utility function is independent of the other arguments of the utility function. For example, looking at the derivative of the caregiver's utility function $U^G\left(X_G, L_G, U^R\right)$

[12] U^A_B represents the partial derivative of the utility function of person A with respect to the argument of the utility function, B. This paper assumes that there are no boundary solutions and assumes quasi-concavity of the utility functions U^G and U^R.

with respect to consumption (X_G), separable utility would mean that $U^G_{X_G}$ does not depend on the other arguments of the utility function, L_G and U^R, and only depends on X_G. In other words, the caregiver's marginal utility of consumption can be expressed as $U^G_{X_G} = U^G_{X_G}\left(X_G\right)$.[13]

The assumption of separable utility functions can be combined with the first-order conditions above to determine which variables enter as arguments in each of the equations. We can therefore arrive at a linear approximation to a system of equations. However, one might worry that the assumption of separable utilities is too restrictive, especially with respect to the arguments consumption (X_G) and leisure (L_G). This assumption can be relaxed so that the caregiver's marginal utility of consumption, $U^G_{X_G}$, does not depend on the utility function of the care recipient, U^R, but is allowed to depend on both X_G and L_G. Likewise, the caregiver's marginal utility of leisure, $U^G_{L_G}$, does not depend on the utility function of the care recipient, U^R, but is allowed to depend on both X_G and L_G. With this relaxed assumption of separable utilities - namely that consumption and leisure are separable from the care recipient's utility in the caregiver's utility function - the marginal utilities with respect to each argument of the caregiver's utility function can be expressed as $U^G_{X_G} = U^G_{X_G}\left(X_G, L_G\right)$, $U^G_{L_G} = U^G_{L_G}\left(X_G, L_G\right)$ and $U^G_{U^R} = U^G_{U^R}\left(U^R\right)$.[14]

Assuming separable utility functions without relaxing the separability of consumption and leisure does not make a difference for the resulting exclusion restrictions that will be used to motivate potential instruments. However, relaxing this aspect of separability makes the identifying assumption less restrictive. This relaxed version of separable utility functions provides a reasonable starting point for evaluating which variables might serve as instruments implied by the model.

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[13] The restriction made is that $U^G_{X_G}$ is not a function of L_G and $U^G_{X_G}$ is not a function of U^R.

[14] The actual restriction made is that $U^G_{X_G}$ is not a function of U^R, $U^G_{L_G}$ is not a function of U^R and $U^G_{U^R}$ is not a function of either X_G or L_G.

Combining this assumption with the first-order conditions, one can determine which variables enter as argument in each of the equations.[15] Knowing which variables enter each of the first-order conditions, one can write a linear approximation to the system as the following equations:

$$\boldsymbol{t_m} + \beta_2 t_g + \beta_3 t_w + \beta_4 D + \beta_5 p_t + \beta_6 w + \beta_7 I_G + \beta_8 I_R + \beta_9 N_R = \varepsilon_m \quad (4a)$$

$$\alpha_1 t_m + \quad \boldsymbol{t_g} + \alpha_3 t_w + \alpha_4 D + \alpha_5 p_t + \alpha_6 w + \alpha_7 I_G + \alpha_8 I_R + \alpha_9 N_R = \varepsilon_g \quad (4b)$$

$$\varphi_1 t_m + \varphi_2 t_g + \quad \boldsymbol{t_w} + \varphi_4 D + \varphi_5 p_t + \varphi_6 w + \varphi_7 I_G \qquad = \varepsilon_w \quad (4c)$$

$$\delta_1 t_m + \delta_2 t_g + \delta_3 t_w + \quad \boldsymbol{D} + \delta_5 p_t + \delta_6 w + \delta_7 I_G + \delta_8 I_R + \delta_9 N_R = \varepsilon_g \quad (4d)$$

where (4b) corresponds to the first-order condition for informal caregiving (t_g), (4c) corresponds to the first-order condition for labor market work (t_w) and (4d) corresponds to the first-order condition for transfers (D). Equation (4a) comes from adding t_{mG} and t_{mR} (market care purchased by the caregiver and recipient separately) to get an equation for t_m (overall market purchased care). The linear approximations corresponding to the first-order condition for t_{mG} and t_{mR} separately would be:

$$\boldsymbol{t_{mG}} + \rho_2 t_g + \rho_3 t_w + \rho_4 D + \rho_5 p_t + \rho_6 w + \rho_7 I_G + \rho_8 I_R + \rho_9 N_R = \varepsilon_m$$

$$\boldsymbol{t_{mR}} + \mu_2 t_g + \quad \mu_4 D + \mu_5 p_t + \quad \mu_8 I_R + \mu_9 N_R = \varepsilon_m$$

Equations 4a-4d are shown with error terms on the right-hand side of the equation while all other variables are kept on the left-hand side; this makes it easy to see which variables are excluded from each equation.

We know that for an instrument to produce consistent estimates it must explain the endogenous variable(s), yet have no effect on the dependent variable except through the endogenous variable(s). Under the separability assumption made in this paper we can identify a set of variables that do just that. The excluded variables in equation (4c), the labor market

[15] An example of how this is done is presented on page 14.

work equation (t_w), are the unearned income of the care recipient (I_R) and the care recipient's need for care (N_R). These same two terms directly enter the other equations (the care provision equations). Under the relaxed assumption of separable utilities used to define this system, measures that represent these two variables would serve as potential instruments.

Analytically, it is straightforward to show how one arrives at these equations and why the different variables do or do not enter each of the equations.[16] To give an example, I use the FOC for t_w: $U^G_{L_G} = wU^G_{X_G}$. Since the utility function of the caregiver is $U^G = U^G\left(X_G, L_G, U^R\right)$, without any assumption of separability $U^G_{L_G}$ and $U^G_{X_G}$ could each be functions of all of the argument of the utility function X_G, L_G and U^R. In this case no variables would be excluded from the labor market, t_w, equation (4c). Assuming the separability assumption that neither $U^G_{X_G}$ or $U^G_{L_G}$ are functions of U^R, The FOC for t_w, $U^G_{L_G} = wU^G_{X_G}$, then becomes: $U^G_{L_G}\left(X_G, L_G\right) = wU^G_{X_G}\left(X_G, L_G\right)$. This excludes the term U^R from entering the equation for the FOC for t_w, since it does not enter as an argument of the marginal utilities of leisure or consumption. This therefore excludes variables unique to the care recipient's utility function. Given the caregiver's budget and time constraints, $X_G + p_t t_m = I_G + wt_w - D$ and $t_g + t_w + L_G = T$, the FOC for t_w, being a function of X_G and L_G, includes the following variables (put in terms of the choice variables): $t_m, t_g, t_w, D, p_t, w, I_G$. The variables N^R and I^R are excluded because they only enter the equation through U^R when either $U^G_{L_G}$ or $U^G_{X_G}$ is a function of U^R.

To clarify the implications of the model, it is valuable to be able to justify intuitively why variables do or do not enter each of the equations. In equation 4c, the labor market work equation (t_w), the variables for parental unearned income (I_R) and parental need for care (N_R) do not appear. One would expect these variables to directly affect all caregiving

[16] In fact, just by looking at the F.O.C.s we can see that the F.O.C. for hours of labor market work is the only one that does not contain marginal utility terms for both the caregiver and care recipient; it only contains marginal utility terms for the caregiver. Therefore by assuming that the caregiver's marginal utility of consumption and leisure are not functions of the care recipient's utility, those variables that are unique to the care recipient's optimization problem will not appear.

decisions, being measures of resources and need directly related to care for the parent. However, except through the various care decisions, these parental variables should not influence the daughter's labor market decisions.

On the other hand, all variables enter each of the market purchased care (t_m) equation (4a), the informal caregiving (t_g) equation (4b) and the transfers (D) equation (4d). Each of these variables is a method of care provision that the adult daughter can provide to her elderly parent and each directly benefits the care recipient, therefore all of the variables relevant to care provision from the position of the caregiver and/or the care recipient will enter these equations.

5. Modifications and Extensions

I also make a number of realistic modifications to the model presented. I incorporate a sibling as an alternative caregiver; the sibling is modeled symmetrically to the original caregiver and is denoted with S. In the basic version of the model, the utility of the care recipient enters as an argument of the utility of the caregiver. I modify the model so that each utility function has the others' utility functions as arguments $U^R = U^R(U^G, U^S)$, $U^G = U^G(U^R, U^S)$ and $U^S = U^S(U^G, U^R)$; each person cares about the others in the decision-making process. Lastly, I allow for multi-directional transfers to flow from each person to all of the others.[17] When this is done there are many additional choice variables, creating a very large system of equations. The caregiver can choose the hours she works in the labor market t_{wG}, the amount of informal care hours she will provide her parent t_{gG}, the amount of formal market care she will purchase t_{mG}, and the amount of monetary transfers she will give her parent d_{GR} and her sibling d_{GS}. Modeled symmetrically the sibling can choose t_{wS}, t_{gS}, t_{mS}, d_{SR} and d_{SG}. The elderly parent chooses the amount of formal market care he or she will purchase t_{mR}, and the transfers he or she will provide each child d_{RG} and d_{RS}. The

[17] This section describes the implications of these modifications. For further information on the model set-up, first order conditions and finding the exclusion restrictions with these modifications refer to Appendix A.

modifications to the model result in 13 choice variables and therefore 13 equations in the system (see Table 1 in Appendix A).

Using these 13 equations, we can simplify analysis by combining the equations to correspond to the original four care provision and labor market equations, shown in equations 4a through 4d.[18] For example, an equation for formal market purchased care, t_m, would contain all of the explanatory variables in equations for formal market care purchased by the caregiver, sister and recipient: t_{mG}, t_{mS} and t_{mR}. Doing this, we can compare how the implied instruments change. In addition to N_R and I_R, sibling variables other than direct transfers between siblings are omitted from the hours worked equation of the caregiver. This means that if between-sibling transfers do not occur, then all other sibling variables could be used as instruments. Other sibling decisions affect the caregiver only through changes in care provision and do not directly affect the caregiver's labor market work. Only direct monetary transfers received would influence labor market outcomes directly.

6. Alternative Cases

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In order to evaluate the reasonableness of the separability assumption that leads to the care provision and labor market equations, 4a-4d, it is helpful to discuss the counter-argument to the assumption made, that the care recipient's utility is separable from the caregiver's consumption and leisure in the caregiver's utility function. For example, in what cases would the caregiver's marginal utility of leisure be a function of her parent's utility? If the caregiver does not take a vacation that she would have taken otherwise because her parent is in need of care, then this could violate this necessary assumption for I_R and N_R to serve as instruments. However, each of the care provision methods already enter the hours worked equation, so it must be that the situation just described does not simply occur because the adult daughter

[18] One reason to reduce the number of equations back to the original four is to draw comparisons on how the modifications altered the instruments in the original framework. Additionally, estimation of the 13 equations would require an extensive amount of data beyond what is available for estimation. For example, while the overall level of formal care used by the parents is observed in the data, the contributions that each daughter makes to the purchase of formal care are not. The way in which one moves from the 13 equations to knowing which variables to include in the original four equations, incorporating the modifications, is shown in Appendix A.

stays home to provide care. In other words, it must be the case that the adult daughter would have a greater chance of staying home from vacation at different parental need levels even if she were not going to provide any care. This must occur through another mechanism, such as some form of guilt that induces changes in consumption or leisure but not care provision.

When the model incorporates a sibling and we assume no direct transfers from the sibling to the caregiver, then siblings' variables can also be used as instruments as long as the sibling's utility is assumed to be separable from the consumption and leisure in the caregiver's utility function. The separability assumption that is necessary for sibling variables to serve as instruments is similar to the case made for parents, but is harder to dispute than for parents. One would need to tell the same story of the adult daughter altering her behavior out of guilt alone, only for someone who is not in need of care. Absent direct sibling-to-sibling monetary transfers, then siblings can still serve as an instrument even when one relaxes the assumptions about the adult daughter and elderly parents made in the care provision and labor market equations, 4a-4d.

Although the necessary assumptions for equations 4a-4d and use of measures of I_R and N_R as instruments are not very restrictive, there are concerns outside the framework of the time allocation model presented here which might warrant deviations from these instruments. The model presented here is a static model. If there are dynamics over time, then they would not be captured by this model. Fevang et al. (2008) present a 3-period model, where in time 0 the parent does not yet need care, in time 1 the parent needs care and in time 2 the parent is deceased. In their model, assuming an imperfect credit market, inheritance will cause a decrease in hours worked in time 2, after the parent's death. Fevang et. al (2008) acknowledge that the presence of an inheritance (even without a bequest motive) could be problematic in comparing labor market outcomes before and after the parent's death in that even if there is an actual decrease in hours worked due to informal caregiving, there may be no estimated effect because the comparison period also experiences a decrease in hours worked for a different reason.[19]

The role of inheritance is more likely to be an issue if identification of the effect of caregiving on hours worked comes from the death of a parent, which in this paper it does not.

[19] In their model, this concern is no longer an issue if credit markets are assumed to be perfect.

A similar bias may occur, however, from recent unobserved transfers. If there are unobserved transfers received by informal caregivers, then this could exaggerate any decrease in hours found (bias toward finding a reduction in hours) since we would expect both caregiving and transfers to decrease hours worked. On the other hand, unobserved transfers received by those not providing care would produce the opposite bias when comparisons are being drawn between caregivers and non-caregivers. Additionally, by not having data over time, there is always the risk that transfers in the surrounding years, which are unobserved, may be having an effect on hours worked in the observed year.

An additional concern that is specific to the use of the instruments implied by the model, parental unearned income I_R and parental need for care N_R, is the situation where the daughter has power of attorney, which may occur when the parent's decision-making capabilities are compromised. This could occur, for example, if the parent were to have dementia. In this case, there would be no care recipient optimization problem and the altruistic component entering the caregiver's utility would be the parental physical well-being rather than her parent's utility. Resources would be pooled, eliminating the need for transfers. Under this situation, all variables enter each of the first-order conditions, providing no exclusion restrictions. In this case, sibling's variables could still hold as instrumental variables, under the same assumption of no between-sibling monetary transfers, yet a shock to parental need would be necessary as parental need levels would no longer serve as an instrument.

Under the different scenarios described in this paper, there are three potential sets of instruments for identification, each with their own set of assumptions. Under the first case, the relaxed assumption of separable utility functions that leads to the care provision and labor market equations, 4a-4d, holds and parental unearned income and parental need for care serve as valid instruments for care provision methods in the hours worked equation. Under the second case, at least one of the situations described above compromises the use of parental unearned income and parental need for care variables as instruments and shocks to parental need are necessary as instruments instead. Shocks to parental need for care hold as instruments under all of the described cases, but are also the hardest to find in practice. Under the third case, allowing for multi-directional transfers between the elderly parent and adult

children, but assuming no direct monetary transfers between siblings, then sibling variables serve as instruments as well. The use of siblings' variables as instruments does not depend on which of the first two cases is assumed.

7. Data

To provide empirical examples using the instruments described above, I make use of the 1991 Parent Health Supplement of the Panel Study of Income Dynamics (PSID). [20] Information is asked of the adult daughter about herself, her parents and, if married, her parents-in-law. [21] The standard demographic and labor market variables for the adult daughter can be taken from the regular PSID, while relevant need and care related variables are available in the supplement. For a parent to be eligible for the supplement, he/she must be living and at least 70 years old in 1991 or have died no earlier than 1980 and have been at least 70 at the time of death. [22] Questions in the supplement are asked about each eligible parent as of two points in time: for 1991 when the interview was given, and for the first time when that parent could no longer live independently (if this event has occurred by 1991).

Table 1 shows the break-down of variables for the PSID asked for 1991 and the PSID asked for the year that a parent could no longer live independently. While, for the most part, relevant measures are available for each desired variable in both time frames, there are a number of differences in how they are recorded. For example, informal care provision is measured in either yearly hours spent caregiving or a binary measure for providing help with daily needs for 1991, and is measured by whether the adult daughter helped her parents a lot (in terms of time) at the time of parental dependence. While a financial support measure is

[20] The PSID consists of two samples: a cross-sectional national sample and a national sample of low-income families. With weighting, the PSID is nationally representative as of 1968. Hispanics and Latinos are not represented in the Parent Health Supplement of the PSID. The PSID website provides reports evaluating how representative the 1968 PSID sample is of the current population. These reports find that the PSID lines up well with the CPS on various labor market variables and with the NHIS on various health measures. The reports were viewed 10/20/2008 and are available at:
http://psidonline.isr.umich.edu/Publications/Papers/Report_on_income_quality_v3.pdf and
http://psidonline.isr.umich.edu/Guide/Quality/report_on_health_qsv2.pdf

[21] Zissimopoulos (2001) finds that for males, a wife serves as a substitute helper to his parents, while for females a husband serves as a complementary helper. Women provide care to both their own parents and parents-in-law.

[22] Initial questions such as life status, marital status, and year of death are asked of both parents if either is eligible. Further questions about need for care and care arrangements are asked only about eligible parents.

available for the PSID measured at the time that the parent could no longer live independently, this measure is not available in the PSID for 1991. Additional control variables available in both timeframes (not listed in Table 1) include: the adult daughter's age, race, education, home ownership, health, marital status, husband's age, husband's education and the presence and ages of children.

As described in the previous section, the first set of instruments considered in this paper is parental need for care, N_R, and parental resources, I_R. In the PSID, measures for N_R that are available both for 1991 and in the year that a parent first becomes dependent are whether parents are living, parental marital status and parental dependency. For the year that a parent becomes dependent, there are also measures of parental Activities of Daily Living (ADLs) and Instrumental Activities of Daily Living (IADLs).[23] I also include a measure for whether a parent had ADLs or IADLs that lasted for more than three months prior to becoming dependent. These measures capture the extent of parental need for care. Whether the parent can drive a car is also available for the years where a parent becomes dependent. The measures for parental resources, I_R, available in the PSID that is asked in both time frames is whether the parents would be in debt, even or ahead if they were to sell their assets to pay their debts.

As described in the previous section, one or more of the discussed scenarios could occur that invalidate the assumption necessary for I_R and N_R to serve as instruments. We instead must rely on shocks to parental need for care as an instrumental variable, as these measures in levels are no longer considered exogenous. It is difficult to find shocks to parental need for care in cross-sectional data.[24] To do this, I make use of the fact that the 1991

[23] ADLs are important tasks to daily living such as bathing, brushing teeth, dressing, grooming, eating, help in the bathroom, help taking medication and mobility around the house. IADLs are less time sensitive and include tasks such as use of a telephone, managing finances, cleaning, laundry, shopping, meal preparation and mobility outside the house. These definitions are taken from the National Center for Health Statistics and can be found at http://www.cdc.gov/nchs/datawh/nchsdefs/list.htm (viewed 9/25/2008). Clearly a parent with more ADLs versus IADLs needs more care, but it is unclear which type would induce more informal care provision. For example, it is possible that a large number of ADLs could induce use of formal care, while the same number of IADLs would not. I use the number of IADLs and ADLs as separate IVs.

[24] As far as the author is aware, nearly all of the commonly used US datasets that have been used to address the relationship between informal care and the caregiver's labor market involvement are also cross-sectional in terms of either parental variables and/or adult daughter variables. The data limitation comes from needing detailed measures on *both* parental care and adult daughter's labor market involvement in the same years. The

Parental Health Supplement asks questions in 1991 for the year that each parent can no longer live independently.

For each daughter-parent pair, I define the year in which the parent experiences a change from being able to live independently to not being able to live independently as the year of parental dependence.[25] Although parental health in general may deteriorate at a more steady rate, the year of parental dependence characterizes the kind of need change where an elderly parent starts to impose a burden on his or her children and is more exogenous than looking at health levels as a proxy for parental need.[26]

Since PSID data is longitudinal for most all demographic variables, other control variables for the daughter are available both in the 1991 cross-section and for the different years that elderly parents in the dataset experience their years of parental dependence. For the 1991 cross-section, the year for which data is recorded is the same for all women in the sample, but they may experience parental changes in different years. For some, the parent may have been dependent for many years, while for others it is a recent development. I also construct a cross-section of women-parent pairs in the years of parental dependence. In this case, all women are observed in their year of parental dependence – precisely when the change occurs - but this year may vary across women and parents.

Not all women have a parent become dependent by 1991; these women would therefore not have a recorded year of parental dependence. To compare those with newly dependent elderly parents to those whose parents do not become dependent by 1991 requires choosing a year for comparison to assign those women where parental dependence has not yet occurred. Ideally, we would compare women whose parents are of similar age, where some of the adult daughters have a parent become unable to live independently anymore and others' parents remain able to live independently. I use the predicted years from a regression of the parental year of dependence on adult daughter's age to assign the year for which labor market

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exception is the HRS, which has two years of data available. However, even a few years of detailed data are unlikely to provide enough observed parental need changes for sufficient variation in estimation.

[25] The adult daughter may have multiple parents (and parents-in-law) who may have different years for which this occurs, some of which may have died since and some of which may still be able to live independently.

[26] This shock to parental dependence is most likely to be accompanied by some medical change as well. One would expect some relationship between this change and a medical change. In the PSID, having a parent become dependent at the time of parental dependence has a correlation with the number of parental ADLs of 0.6679 and a correlation with the number of parental IADLS of 0.8494.

and demographic variables will be recorded for those observations that did not already have a year of parental dependence. This can be thought of matching on age.[27]

The third case of potential instruments considered (as described in the previous section) is siblings' variables. Sibling variables can serve as instruments under the assumption of no direct monetary transfers between siblings. In the PSID there are measures for the number of siblings (and sisters) the adult daughter has; this is also recorded for her husband if she is married. The number of sisters that the husband has can serve as a particularly useful instrument since husbands' sisters serve as substitute caregivers for parents-in-law. There is likely a preference for caring for one's own parents compared to parents-in-law. For this reason, one's own siblings and husband's siblings will likely impact the mix of care provided to parents and parents-in-law differently. This paper uses both measures as separate instruments. As mentioned, the assumption necessary for use of siblings as an instrument does not depend on which of the first two cases hold (whether N_R and I_R serve as instruments or a shock to parental need is necessary).

8. Empirical Results

Estimates from OLS regressions that do not address selection concerns are presented in Tables 2 and 3. Both tables include regressions that treat yearly hours worked and an indicator for working as separate dependent variables. Regressions are presented with and without controls. The unit of observation in regressions is a daughter-parent pair, allowing information on an adult daughter to be included in up to four observations: by being paired with either of her own parents or either of her parents-in-law. For this reason, errors are clustered at the level of the adult daughter in all regressions. [28] Only adult daughters with ages

[27] The adult daughter's age is used because it cannot be altered or affected by any of the other variables and is likely highly correlated with parental ages, which are missing with too high frequency to be useful. For more details on how the created measure for the year of parental dependence relates to actual years of parental dependence, see Appendix B. Appendix B shows that while the group of assigned years of parental dependence will differ somewhat from the actual ones (due to different ages), including the assigned years in the distribution of years of parental dependence does not affect the overall distribution much. It should be noted, however, that the goal in assigning comparison years is to include in the sample adult daughters at comparable stages in their lives, not to replicate the existing distribution of years of parental dependence.

[28] Regressions using the PSID are weighted to compensate for the data being comprised of two separate probability samples with unequal selection probabilities and for non-response rates in different years. All

25 through 60 are used in estimation to avoid complications of education and retirement decisions. Students and self-employed are also excluded from the sample. Additionally, all regressions presented here exclude ever-coresiding daughter - parent pairs. In the case of coresidence, it is unclear what tasks the daughter may include in her reported caregiving hours. Neither data nor theory support treating coresidence as a limiting case of proximity; rather, they are fundamentally different (Compton and Pollack, 2009). Excluding coresiding observations reduces the usable sample by only 1-2%.

OLS estimates from both timeframes – at the time of parental dependence and in 1991 - are somewhat similar in sign for each care provision variable, with estimates at the time of parental dependence larger in magnitude and more significant than estimates for 1991. For 1991, estimates for the effect of informal caregiving on hours worked in the labor market are negative and insignificant whether informal caregiving is measured by help with daily needs or yearly hours of help. On the other hand, helping parents a lot at the time of parental dependence is significantly associated with a decrease of approximately 148 to 190 yearly hours, corresponding to roughly a drop of 2.85 to 3.65 hours of work per week.[29] Employment outcomes are similarly different for informal care provision: additional hours providing care in 1991 results in a significant zero-effect on working, while helping parents a lot at the time of parental dependence is significantly associated with a reduction in the probability of being employed of 13-14 percentage points.

In 1991, parental use of formal care has a positive but insignificant relationship with whether and how much the adult daughter works. At the time of parental dependence, having a parent in a formal care arrangement is associated with a statistically significant increase of 156 yearly hours, which corresponds with approximately 3 hours of work per week, and an increase in the probability of being employed of 7.5 percentage points. Giving parents financial support at the time of parental dependence has a positive but insignificant effect on both hours worked in the labor market and the probability of working.

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estimation in this paper is weighted using the appropriate weights. The PSID also provides variables that can be used with Stata's svy command to adjust for complex sample survey design. Unlike the previously mentioned weights, the svy command cannot be used with clustering on the adult daughter as well. I have run Tables 4 and 5 with this adjustment and findings are unchanged.

[29] Results estimated in terms of yearly hours are divided by 52 weeks per year to arrive at approximate hours per week results. Discussion of results in terms of hours per week is provided for a more intuitive interpretation of coefficients.

One explanation for the differences in magnitude between OLS estimates in the two timeframes could be the different measures available. For example, in 1991, the available measures for informal care are yearly hours helping and helping with daily needs, while at the time of parental dependence, the available measure is whether the daughter helped her parents a lot. While estimates based on yearly hours helping would be expected to differ from the more subjective measures of helping with daily needs and helping a lot, one would not expect estimates for these measures to differ much from each other. While estimates for these measures differ in significance, the magnitudes are in fact quite similar. A more likely explanation for why estimates differ between regressions using 1991 and the years of parental dependence is timing. Using the PSID at the time of parental dependence could produce larger estimates because data is recorded directly at the time when a parent first becomes dependent. While in 1991 some parents are dependent, this may not be a new situation.

Estimates from the time of parental dependence show statistically significant relationships that would be consistent with both a causal effect or with an explanation based on selection alone. Informal caregiving is negatively related to labor market outcomes. This could be because informal caregiving is time consuming and draws the caregiver from her labor market work, or it could be because women with less commitment to the labor market are more available to provide care. Formal market purchased care is positively related to labor market work. This could be because formal care is expensive and induces the caregiver to work more, but could also be explained by those women with more commitment to the labor market having more financial resources and a larger opportunity cost to providing care themselves. A similar explanation could be given for the positive relationship found between giving parents financial support and labor market involvement of the caregiver, although estimates for this measure were insignificant. The fact that the estimates found here are the expected sign for both causal and selection interpretations further motivates the need for analysis using instrumental variables.

Tables 4 and 5 present results from regressions using the instrumental variables previously discussed. Table 4 presents results using the PSID in 1991 and Table 5 presents results using the PSID at the time of parental dependence. Instrumental variables regressions are estimated using LIML since studies have shown LIML to perform better than two-stage

least squares in the presence of weak instruments (Stock and Yogo, 2005). Estimates in both tables are repeated using hours per week worked and an indicator for working as the dependent variable. For these dependent variables, estimates are presented using four different sets of instruments: (1) parental need for care variables, (2) parental need for care and parental resource variables, (3) parental need for care and sibling variables and (4) parental need for care, parental resource and sibling variables.

First stage diagnostics presented in Table 4, using the 1991 cross-section of the PSID, shows first stage F-statistics for formal care that are acceptable in size, ranging from 12 to 28, and for informal caregiving that are quite small, some as low as 0.45 (Staiger and Stock, 1997). Small first stage F-statistics provide an indication of a weak first stage, which could potentially bias both point estimates and standard errors (Staiger and Stock, 1997; Bound et. al, 1995). Estimation results presented in Table 4 are also statistically insignificant. Weak instruments and lack of significance limit the conclusions that can be drawn from the 1991 instrumental variables results.

On the other hand, estimation results in Table 5, which use the PSID at the time of parental dependence, have much better first stage diagnostic information and statistically significant estimates. First stage F-statistics for helping a parent a lot and use of formal care at the time of parental dependence are large, ranging from 17 to 33, and therefore do not appear to suffer from weak instruments. The first stage F-statistics for giving the parent financial support are smaller in magnitude, ranging from approximately 4 to 7. Due to smaller first stage F-statistics for one of the three first stage regressions, Tables 4 and 5 also report the Kelinberg-Paap test statistic as an additional check for weak instruments. While the first stage F-statistic tests whether a specific endogenous regressor is weakly identified, the Kleibergen-Paap statistic can be used to gauge identification of the equation overall. Stock and Yogo (2005) propose a test for weak instrument bias in standard errors that is applicable when there are multiple endogenous regressors. Stock and Yogo (2005) do not however report critical values for 3 endogenous regressors when using LIML. Approximating with the case of 2 endogenous regressors, the critical values from a 5% test that the worst case relative bias using LIML is approximately 25% or less range from 1.96 to 2.27 for the specifications presented in Table 4 (the critical value depends on the number of instruments used, which

varies across specifications in Table 4). Comparing the Kleibergen-Paap statistics in Table 4 to these ranges, specifications using parental resources as instruments have Kelinberg-Paap statistics that are close to or above the critical values, while Kleibergen-Paap statistics for other specifications are slightly smaller. These comparisons suggest potential for bias in estimated standard errors for some specifications. It should be noted, however, that while the Kleibergen-Paap statistic is the appropriate measure when errors are clustered,[30] the critical values presented in Stock and Yogo (2005) are intended to be compared to the Cragg-Donald statistic, rather than the Kleibergen-Paap statistic.[31] Additionally, the available critical values are for two endogenous regressors, while the specifications in Table 4 use three endogenous regressors, making them less directly comparable.[32]

Table 6 presents selected first stage results for the first 4 columns of Table 4. First stage estimates for instruments are generally the expected sign, are significant and do not vary much in magnitude, sign or significance across the four specifications. Most parental need variables that approximate health in some way have a positive and significant relationship with care provision. Whether a parent can drive has a negative and significant relationship with a parent using formal care. This is not surprising since not being able to drive substantially limits ones' ability to do many daily tasks, such as grocery shopping, picking up prescriptions at a pharmacy or taking oneself to a scheduled doctor appointment. Being able to drive is likely to play a key role in the degree of independence of an elderly person. Whether the parent is married also has a negative and significant relationship with use of formal care. To the extent that one spouse may be able to help with the limitations of the other, being married will permit an elderly person to stay out of a formal care facility longer. Lastly, having sisters and siblings in general are also negatively related with formal care use, which is expected since they serve as additional sources of informal care.

When the PSID at the time of parental dependence is used, as in Table 4, the parental need for care variables can be viewed as shocks to parental need since, at that time, the parent

[30] The Kleibergen-Papp test statistic is robust to heteroskedasticity and within group serial correlation of errors.
[31] While not the appropriate measure due to clustered standard errors, the Cragg-Donald statistics for specifications in Table 4 are larger than the corresponding critical values in all but one specification in Table 4.
[32] Both Tables 4 and 5 present p-values from the Hansen J test of overidentifying restrictions. With large p-values, all regressions presented in both tables clearly fail to reject the null that overidentifying restrictions are valid.

actually experiences a change from being able to live independently to not being able to live independently. As previously discussed, shocks to parental need for care hold as instruments under all of the described cases in Section 6. Table 4 presents estimates showing significant effects of both informal and formal care provision on hours worked in the labor market. Estimates in Columns 2 and 4 indicate that helping a parent a lot (informal care) at the time of parental dependence results in a decrease in 1,057-1,087 yearly hours worked, which corresponds to approximately 20-21 hours per week. This is comparable to switching from full-time employment to part-time employment or from part-time employment to no longer working. Estimates for helping parents a lot on whether the adult daughter is working are insignificant, which could indicate that the negative estimates found for yearly hours worked can more likely be attributed to an actual hours reduction rather than stopping working. Columns 2 and 4 present estimates from regressions where parental resources are used as instruments. This finding appears to be sensitive to the set of instruments used, as the specifications presented in Columns 1 and 3 that do not use parental resources as instruments do not produce significant results for helping parents a lot. Table 4 also finds evidence of a positive and significant effect of formal care on hours worked. From Column 1, we see that parental use of formal care results in an increase of 968 yearly hours worked. This corresponds to approximately 18.6 additional hours of work per week. Although estimates in Columns 2-4 are not significant at conventional levels, the similar signs and magnitudes of estimates are supportive of this finding.

There are a few considerations that have not been incorporated into estimation that could potentially matter for results, such as the distinction between one's own parent and parents-in-law, bequests and distance to parents. I therefore ran additional checks for robustness of results to address each of these concerns. Because there may be different methods of caring for parents and parents-in-law, specifications reported in this paper already use one's own sisters and husband's sisters as separate instruments. I also re-ran the specifications in Table 4 using a binary variable for a parent being the adult daughter's own parent as an additional instrument. Results from these specifications are similar in sign, magnitude, significance and strength of instruments as those reported in Table 4.

Unobserved bequests in the years surrounding the year studied, being a large transfer, would bias results toward finding a negative effect on hours worked. The PSID contains a variable for whether the adult daughter received a large lump sum transfer such as a settlement or inheritance in each year. I ran six alternative specifications using these variables. I control separately for receiving a lump sum payment within 1 year, 2 years or 5 years of the year of parental dependence. I also estimate three separate specifications where I exclude from the sample adult daughters receiving large lump sum transfers within 1 year, 2 years and 5 years of the year of parental dependence. In all cases, results do not differ in any notable way from those presented in Table 4.

Distance to parents can be thought of as a cost to providing informal care. One might be concerned that those women living closer to their parent may be more aware of their parent's care needs and financial situation. This concern could potentially be addressed by the inclusion of distance-to-parent variables as instruments, viewing distance as a cost to providing care. However, one cannot address this concern using the data in this paper, as the measure is only available for a small sub-sample, resulting in weak instruments and making estimates unreliable. [33]

9. Concluding Remarks

Understanding the effect that care provision to elderly parents has on the adult daughter's labor market outcomes is an important question for policy purposes. This is especially the case since (1) the caregiving burden falls disproportionately on women, often affecting adult daughters of working age and (2) The US is entering a time when the elderly population both overall and as a percentage of the population is beginning to expand rapidly. Absent any specific policy, estimation of the effect that providing informal care to elderly parents has on the adult daughter's labor market outcomes presents a difficult endogeneity

[33] Measures for distance to parents are only available for those women whose parents become dependent, which limits the sample size quite dramatically, from roughly 2700 to 440 observations. I ran the same specifications in Table 4, restricting data to dependent parents only and using distance-to-parent dummies as instruments, which produced weak instruments. Weak instruments in this case are likely due to the reduction in sample size required to perform this check, rather than use of distance measures as instruments, since the same weak instruments problem occurs when the specifications in Table 4 are run just restricting the sample to dependent parents. It is not particularly surprising that use of smaller sample sizes is unsuccessful, as estimation using multiple endogenous regressors is particularly demanding of the data.

issue. This paper presents a time allocation model as a framework for motivating different sets of instruments, discussing the assumptions and implications of each. I then provide empirical estimates using each of the different sets of instruments.

A limitation to estimation of the effect of care provision methods on the adult daughter's labor market outcomes is the lack of data available on both the adult daughter and elderly parent. There are some datasets containing this data in a cross-section, yet detailed longitudinal data containing all necessary variables is lacking for the United States. Despite this, I am able to determine shocks to parental need for care by taking advantage of a unique feature of the PSID. The most reliable estimates result from use of data at the time when a parent experiences a change from being able to live independently to not being able to live independently. Instrumental variables results find negative and significant effects of providing informal care to elderly parents on women's hours worked in the labor market and positive and significant effects of parental use of formal care on women's hours worked in the labor market. While estimates for informal caregiving may be sensitive to the instruments used, this does not appear to be the case for estimates for formal care use. In both cases, the shift in hours is large enough to be consistent with a move between full time and part time or between part-time work and not working. A lack of significant results when a binary variable for working is used as the dependent variable suggests that the results can more likely be attributed to an actual hours reduction rather than adult daughters starting or stopping working in response to care provision.

10. References

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Table 1: Comparison of available measures for key variables

Dataset	**PSID: Parent Health Supplement**	
years	asked in 1991 about 1991	asked in 1991 about year parent became dependent
Dependent Variable		
Labor Market	yearly hours worked	yearly hours worked
Endogenous Variables		
Formal Care	parent in nursing home or rehabilitation unit hired home health aide / nurse	parent in nursing home or rehabilitation unit hired home health aide / nurse
Informal Care	yearly hours caregiving help parent with daily needs	helped parent a lot (time)
Transfers		gave financial support to parent
Potential Instruments		
Parental Need for Care	parent living currently dependent parent parent ever dependent parent married	parent living parent becomes dependent parental ADLs and IADLs parent needs helps for 3+ months parent can drive vehicle
Siblings	adult daughter's sisters, husband's sisters, has siblings, husband has siblings	adult daughter's sisters, husband's sisters, has siblings, husband has siblings
Parental Resources / Costs	parent in debt/even/ahead if they sold assets to pay off debt	parent in debt/even/ahead if they sold assets to pay off debt

Note: All questions are asked of the adult daughter about her elderly parents and parents-in-law. ADL stands for Activities of Daily Living and IADLs stands for Instrumental Activities of Daily Living. ADLs are generally the more necessary every day activities, while IADLs are generally less necessary but still quite important.

Table 2: OLS regressions using the PSID 1991 cross-section

	1	2	3	4	5	6	7	8
Dependent Variable	yearly hours worked				indicator for working			
helped parent with daily needs	-174.4		-106		-0.103		-0.0698	
	(226.0)		(253.5)		(0.124)		(0.138)	
yearly hours helping parent		-0.228		-0.478		3.29×10^{-4}***		2.44×10^{-4}**
		(0.300)		(0.312)		(1.05×10^{-4})		(9.83×10^{-5})
parent used formal care arrangement	57.25	56.91	96.80	103.00	0.0177	0.0117	0.0441	0.0401
	(102.5)	(102.8)	(112.1)	(112.6)	(0.0524)	(0.0524)	(0.0598)	(0.0602)
Controls			X	X			X	X
Observations	3,059	3,059	2,413	2,413	3,057	3,057	2,413	2,413
R-squared	0.000	0.000	0.100	0.100	0.000	0.000	0.097	0.097

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: The unit of observation in regressions is the adult daughter - parent pair. All specifications are clustered at the level of the adult daughter. Only adult daughters aged 25 through 60 are included in regressions. Specifications also exclude women who are self-employed or students and all ever-cohabiting pairs. Controls included in regressions are whether the adult daughter is a homeowner, married or permanently cohabiting, whether she has children under 6 years old, 6 through 17 years old and/or children 18-23 years old, and whether she has ever been disabled. Controls for age and age squared, and race and education dummies are included for both the adult daughter and, if married, her husband.

A formal care arrangement refers to either entering a formal care facility such as a nursing home or rehabilitation unit or hiring a home health aide or paid nurse

Table 3: OLS regressions using the PSID at the time of parental dependence

	1	2	3	4
Dependent variable	yearly hours worked		indicator for working	
helped parent a lot	-189.5**	-148.7	-0.144***	-0.130***
	(85.48)	(91.43)	(0.0466)	(0.0503)
parent used formal care arrangement	10.66	156.1*	0.0181	0.0756*
	(80.25)	(84.03)	(0.0412)	(0.0435)
gave parent financial support	71.46	21.59	0.0885	0.0738
	(125.8)	(139.6)	(0.0627)	(0.0701)
Controls		X		X
Observations	3,619	2,736	3,574	2,707
R-squared	0.002	0.113	0.005	0.112

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: See notes for Table 2

Table 4: Instrumental variables results using the PSID 1991 cross-section

	1	2	3	4	5	6	7	8
Dependent variable	yearly hours worked							
Instruments								
NR (parental need for care) variables	X	X	X	X	X	X	X	X
IR (parental resources) variables			X	X			X	X
sibling variables					X	X	X	X
First stage diagnostics	F-statistics on the excluded instruments							
helped parent with daily needs	2.72		1.60		1.62		1.16	
yearly hours helping parent		0.98		0.64		0.57		0.45
parent used formal care arrangement	27.91	27.91	17.01	17.01	16.03	16.03	12.00	12.00
Hansen J p-value	0.9057	0.8929	0.8759	0.9464	0.9192	0.9942	0.9727	0.9611
Kelinberg- Paap statistic	0.779	0.338	0.678	0.487	0.725	0.279	0.681	0.367
Endogenous variables								
helped parent with daily needs	507.2		-2,884		12,859		9,249	
	(6,077)		(6,258)		(19,465)		(26,191)	
yearly hours helping parent		9.645		-12.57		-622.2		-54.34
		(44.69)		(25.83)		(62,537)		(199.5)
parent used formal care arrangement	281.8	-49.22	515.2	790.8	-752.9	24,442	-593.6	2,611
	(602.8)	(1,690)	(662.8)	(1,098)	(1,953)	(2.406e+06)	(2,545)	(7,951)
Observations	2,413	2,413	2,413	2,413	2,413	2,413	2,413	2,413

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: For information on controls, see notes for Table 2

NR variables include: whether the elderly parent ever became dependent, is alive, is currently alive and dependent and whether the parent is married. IR variables include: dummies for whether the parent would be in debt, break even or come out ahead if they were to sell off their assets to pay off debts. Sibling variables include: dummies for whether the adult daughter has siblings and sisters (separately), as well as spousal siblings and sisters.

Table 4: Instrumental variables results using the PSID 1991 cross-section (continued)

	9	10	11	12	13	14	15	16
Dependent variable	indicator for working							
Instruments								
NR (parental need for care) variables	X	X	X	X	X	X	X	X
IR (parental resources) variables			X	X			X	X
sibling variables					X	X	X	X
First stage diagnostics	F-statistics on the excluded instruments							
helped parent with daily needs	2.72		1.6		1.62		1.16	
yearly hours helping parent		0.98		0.64		0.57		0.45
parent used formal care arrangement	27.91	27.91	17.01	17.01	16.03	16.03	12	12
Hansen J p-value	0.9778	0.7564	0.9931	0.5761	0.8952	0.9528	0.9858	0.9377
Kelinberg- Paap statistic	0.779	0.338	0.678	0.487	0.725	0.279	0.681	0.367
Endogenous variables								
helped parent with daily needs	-4.201		-3.695		-1.705		-2.500	
	(4.066)		(3.919)		(9.709)		(5.221)	
yearly hours helping parent		0.0199		-0.00224		0.0509		-0.00936
		(0.0419)		(0.0169)		(0.284)		(0.0609)
parent used formal care arrangement	0.481	-0.643	0.437	0.195	0.280	-1.837	0.337	0.507
	(0.469)	(1.313)	(0.410)	(0.740)	(0.853)	(9.770)	(0.510)	(2.546)
Observations	2,413	2,413	2,413	2,413	2,413	2,413	2,413	2,413

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: See table notes previous page

Table 5: Instrumental variables results using the PSID at the time of parental dependence

	1	2	3	4	5	6	7	8
Dependent variable	yearly hours worked				indicator for working			
Instruments								
NR (parental need for care) variables	X	X	X	X	X	X	X	X
IR (parental resources) variables		X		X		X		X
sibling variables			X	X			X	X
First stage diagnostics								
helped parent a lot	30.55	22.98	22.26	18.08	30.44	22.72	22.2	17.91
parent used formal care arrangement	32.72	24.1	24.26	19.26	30.93	22.81	22.96	18.26
gave parent financial support	7.15	5.49	5.23	4.33	6.96	5.35	5.1	4.22
Hansen J p-value	0.7022	0.7951	0.7096	0.7536	0.3433	0.3687	0.6988	0.4164
Kelinberg- Paap statistic	0.832	2.046	0.754	1.722	0.779	2.053	0.718	2.018
Endogenous variables								
helped parent a lot	-475.3	-1,079*	-202.7	-1,047*	0.0160	-0.312	0.397	-0.287
	(753.9)	(575.3)	(1,133)	(627.2)	(0.569)	(0.292)	(1.273)	(0.341)
parent used formal care arrangement	986.7*	763.7	999.6	707.3	0.438	0.359	0.519	0.362
	(547.8)	(555.9)	(693.8)	(605.0)	(0.381)	(0.272)	(0.694)	(0.325)
gave parent financial support	-1,668	819.2	-2,556	858.5	-1.386	-0.184	-2.752	-0.274
	(2,342)	(1,102)	(3,860)	(1,198)	(1.758)	(0.496)	(4.444)	(0.573)
Observations	2,734	2,734	2,734	2,734	2,705	2,705	2,705	2,705

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: For information on controls, see notes for Table 2

NR variables include: whether the parent became dependent that year, whether the parent was living, the number if ADLs and IADLs the parent had, whether the parent could drive a vehicle, whether the parent was married and whether the parent had physical limitations that lasted for more than 3 months. IR variables include: dummies for whether the parent would be in debt, break even or come out ahead if they were to sell off their assets to pay off debts. Sibling variables include: dummies for whether the adult daughter had siblings and sisters (separately), as well as spousal siblings and sisters.

Table 6: First stage results corresponding to Table 5, columns 1-4

	1	2	3	4	5	6	7	8	9	10	11	12
Specification	Column 1			Column 2			Column 3			Column 4		
Dependent variable in first stage (endogenous variable)												
helped parent a lot	X			X			X			X		
parent used formal care arrangement		X			X			X			X	
gave parent financial support			X			X			X			X
Instruments:												
Parental need variables												
dependent parent	0.212***	0.343***	0.0698	0.264	0.278*	0.0695	0.212***	0.344***	0.0698	0.264	0.279*	0.0695
	(0.0685)	(0.0845)	(0.0481)	(0.197)	(0.160)	(0.131)	(0.0686)	(0.0845)	(0.0481)	(0.197)	(0.161)	(0.131)
parent alive	0.000918	0.0624***	0.00981	-0.00113	0.0615***	0.00684	0.000826	0.0623***	0.00976	-0.00120	0.0613***	0.00679
	(0.0122)	(0.0115)	(0.00787)	(0.0123)	(0.0115)	(0.00770)	(0.0122)	(0.0114)	(0.00788)	(0.0123)	(0.0115)	(0.00771)
number of ADLs	-0.00629	-0.00990	-0.00810	-0.00548	-0.00924	-0.00697	-0.00623	-0.0100	-0.00813	-0.00538	-0.00936	-0.00701
	(0.0110)	(0.0106)	(0.00682)	(0.0110)	(0.0107)	(0.00644)	(0.0110)	(0.0106)	(0.00683)	(0.0110)	(0.0107)	(0.00645)
number of IADLs	0.0261**	0.0427***	0.00256	0.0265**	0.0427***	0.000909	0.0260**	0.0429***	0.00256	0.0264**	0.0428***	0.000920
	(0.0129)	(0.0129)	(0.00820)	(0.0129)	(0.0130)	(0.00789)	(0.0129)	(0.0129)	(0.00821)	(0.0129)	(0.0130)	(0.00790)
parent can drive	-0.00455	-0.0173***	-0.00420	-0.00450	-0.0173***	-0.00383	-0.00432	-0.0176***	-0.00425	-0.00421	-0.0175***	-0.00391
	(0.00655)	(0.00627)	(0.00441)	(0.00652)	(0.00624)	(0.00415)	(0.00658)	(0.00629)	(0.00441)	(0.00654)	(0.00625)	(0.00415)
parent married	0.000445	-0.0282***	0.00229	0.00135	-0.0280***	0.00319	0.000134	-0.0279***	0.00242	0.000922	-0.0278***	0.00335
	(0.0115)	(0.0105)	(0.00944)	(0.0114)	(0.0105)	(0.00895)	(0.0116)	(0.0105)	(0.00949)	(0.0114)	(0.0105)	(0.00901)
needs help with any physical limitations	-0.0284	-0.195*	0.0696	-0.0304	-0.200*	0.0799	-0.0281	-0.196*	0.0696	-0.0301	-0.200*	0.0800
	(0.0944)	(0.113)	(0.0639)	(0.0954)	(0.113)	(0.0618)	(0.0945)	(0.113)	(0.0640)	(0.0955)	(0.113)	(0.0618)
need for help with limitations lasted 3mo+	0.173***	0.00535	0.0199	0.174***	0.00508	0.0169	0.174***	0.00516	0.0201	0.174***	0.00485	0.0171
	(0.0533)	(0.0514)	(0.0353)	(0.0532)	(0.0513)	(0.0351)	(0.0533)	(0.0513)	(0.0353)	(0.0532)	(0.0513)	(0.0351)
Siblings variables												
adult daughter has sister(s)							-0.00833	-0.0427**	0.00694	-0.00731	-0.0421**	0.00750
							(0.0195)	(0.0184)	(0.00939)	(0.0193)	(0.0185)	(0.00895)
spouse of adult daughter has sister(s)							0.0399	0.0283	0.00866	0.0402*	0.0284	0.00741
							(0.0245)	(0.0210)	(0.0105)	(0.0242)	(0.0208)	(0.00969)
adult daughter has sibling(s)							0.00354	-0.0721*	-0.0209	0.0108	-0.0688*	-0.0264
							(0.0361)	(0.0392)	(0.0181)	(0.0325)	(0.0386)	(0.0179)
spouse of adult daughter has sibling(s)							-0.0444	0.0219	0.00275	-0.0530	0.0176	0.00629
							(0.0376)	(0.0318)	(0.0138)	(0.0327)	(0.0303)	(0.0145)
Parental resources variables												
parent behind if sold assets to pay debt				-0.241	-0.0250	0.0622				-0.243	-0.0194	0.0635
				(0.241)	(0.201)	(0.175)				(0.241)	(0.200)	(0.175)
parent even if sold assets to pay debt				0.0235	0.129	0.135				0.0238	0.128	0.135
				(0.210)	(0.164)	(0.148)				(0.210)	(0.164)	(0.149)
parent ahead if sold assets to pay debt				-0.0626	0.0618	-0.0278				-0.0622	0.0611	-0.0280
				(0.202)	(0.154)	(0.135)				(0.202)	(0.154)	(0.136)
Observations	2,734	2,734	2,734	2,734	2,734	2,734	2,734	2,734	2,734	2,734	2,734	2,734
R-squared	0.396	0.385	0.138	0.401	0.388	0.162	0.396	0.386	0.139	0.401	0.389	0.163

Robust pval in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: see notes for Table 4.