Parental Illness and the Labour Supply of Adult Children

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Abstract

An important demographic trend is the aging of the population. As a result, demand for health care services for the sick and elderly is likely to increase. Since care for the sick and elderly is often provided informally by family members, parental illness may have important implications on the labour supply of adult children. Although previous studies show a negative relationship between hours worked and caregiving, they do not account for the potential endogeneity of the parental living arrangement to the child's labour supply. Using panel data and controlling for such endogeneity, we find that caregiving and cohabiting with a sick, elderly parent appear to have smaller effects on labour supply than the past literature suggests. Nonetheless, since cohabiting with a sick elderly parent does have negative effects on the labour supply of women and given that this form of living arrangement is relatively common, the aggregate costs associated with informal caregiving in an intergenerational living arrangement are considerable.

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1. Introduction

One of the most important social trends in Canada and the United States during the first several decades of the twenty-first century will be the aging of the population. One of the likely implications of this trend will be an increased demand for health care services. Although the sick and elderly often rely on formal care, much of the care they receive is informal and is provided by family members including children (Stone and Short, 1990; Stoller, 1983; Brody, 1981; Feder, 1991). Because adult children often assume caregiving responsibilities, the demographic trend of a growing elderly population and increasing life expectancy may have important implications for the labour market activity of the younger generation.

Several studies have examined the impact of informal caregiving, including its impact on caregivers' labour market activities (Muurinen, 1986; Stone *et al.*, 1987; White-Means, 1992, 1996; Johnson, 1983). Several findings are worth noting. First, individuals who assume primary caregiving responsibilities report important reductions in hours worked, participation and income (Muurinen, 1986; Stone *et al.*, 1987). Furthermore, women and whites are more likely to reduce hours, or leave work altogether to be caregivers (Stone *et al.*, 1990; White-Means, 1997). Finally, the impact of caregiving on labour supply is affected by whether the parent cohabits with a child, remains independent or moves into a nursing home.

The work cited above provides important first steps in understanding the work-caregiving relationship. However, it has some important limitations. First, information collected in past data sets has made it difficult to quantify the effect of parental illness on family labour supply. For example, although information is often provided about whether the primary caregiver reduced hours or left the labour force altogether, there is limited knowledge about the actual reduction of the hours worked. Also, little is known about the pattern of hours worked experienced by children before and during a parental illness. Finally, the data used in past studies has focussed on narrowly defined subgroups (for example, primary caregivers with sick elderly parents in hospital). Studies based on such data cannot provide information on how adult children in the wider population are

affected by a parental illness.

Another important issue neglected in many past studies is the potential endogeneity of parental living arrangements to the child's lifetime labour supply. Not surprisingly, different living arrangements are likely to induce different effects on the labour force activity of caregivers. However, because adult children may play a role in where the sick parent resides, the assumption that living arrangements are exogenous to adult children may result in biased estimates.[1,2] Estimating the effect of parental illness on children's labour supply in the presence of endogenous living arrangements provides a measure of how relying on the exogeneity of living arrangements may bias results.

The goal of this paper is to determine the effect of parental illness on the labour supply of adult children within a framework that addresses many limitations inherent in previous work. This is feasible mainly because this paper uses a longitudinal data set which includes information on children before and during a parental illness and across different parental living arrangements. It is also important to note that adult children are observed regardless of their caregiving status. As a result, obtaining valid estimates of the effect of different living arrangements on adult children who have chosen such living arrangements is possible. Also, estimating the effect of specific parental living arrangements (such as living in a nursing home or cohabiting with a child) while controlling for a specific form of endogeneity on the labour supply of adult children is

[1]Many studies have examined the determinants of the living arrangements of sick elderly individuals (Böersch-Supan *et al.* (1988), Dick *et al.*, (1992), Ettner (1994), Garber and MaCurdy (1989), Greene *et al*. (1993)) including the role of children (Böersch-Supan (1990), Engers and Stern (1996), Hiedemann and Stern (1998), Hoerger *et al*. (1996)). Although it is recognized that some of the children's characteristics may be endogenous to the living arrangement decision (such as participation or hours worked), this has been largely neglected in empirical work (except in that of Stern (1995)).

[2]Although studies that are based on survey data that inquire on whether the child reduced hours as a result of caregiving implicitly control for the potential endogeneity of caregiving to labour supply decisions they are nonetheless problematic. First, individuals may seek to justify their reductions in hours worked (or unemployment) by citing caregiving responsibilities. Furthermore, these studies are generally administered exclusively to caregivers in particular living arrangements. Thus, determining the effect of different living arrangements on adult children in general is not possible.

also possible.[3]

As noted above, past studies have generally neglected the potential endogeneity of living arrangements to the labour supply of adult children. As a result, interpretations of some findings have been problematic. For example, the finding that women cohabiting with sick elderly parents tend to work fewer hours relative to the general population does not necessarily imply that caregiving causes a reduction in hours worked. In fact, women who work less may be more likely to enter into an intergenerational living arrangement. Dealing with this type of endogeneity is necessary if the true impact of parental illness on hours worked is to be understood.

Whether or not adult children mitigate the negative effects of serious parental illness on future labour supply by anticipating future parental illnesses is another important issue. It is possible that children increase their labour supply before the parent's illness occurs in light of expected future declines in hours worked.[4] Estimating anticipatory behaviour is possible in this study given the panel nature of the data. Another possibility is that the decrease in hours worked by one family member is met with a similar increase in hours worked by another, thus reducing the financial impact of parental illness on the family unit. Because the data contain information on both the husbands' and the wives' hours worked, measuring the financial impact of parental illness on the family as a whole is also possible. Finally, parental illness may or may not have long-term effects on the labour supply of their adult children. Again, the panel nature of the data will allow for this issue to be addressed.

Examining the issues listed above is especially important from a public policy

[3]As will be discussed in detail further on, this paper addresses the potential endogeneity of living arrangements by controlling for unobserved individual heterogeneity using a fixed-effect framework. Although controlling for fixed-differences may control for certain forms of endogeneity, it may not control for all forms. A discussion of potential forms of endogeneity not controlled for here will follow in section 5.2.

[4]Even in the presence of perfect foresight with respect to parental illness, children will experience a net loss in lifetime utility when the parent becomes ill. As long as children value leisure (and providing informal care is not viewed as leisure) lifetime utility will decrease as increased hours worked in early periods is not matched by equal increases of leisure in the future.

perspective. If the costs associated with parental illness are to be estimated, then the limitations noted above must be properly addressed. Furthermore, estimating anticipatory behaviour, within-family transfers of labour and 'leisure', and the effect of different living arrangements on hours worked can shed light on the burden that illness among the elderly has on the younger generation. If the burden is large, then one may want to explore the possibility of subsidizing in-home care provided by family members.

Several results are worth noting here. First, the labour supply of women is found to be more affected by the presence of a sick elderly parent than that of men. Furthermore, among the different living arrangements studied here, cohabiting with a sick elderly parent has greatest effect on female labour supply. The results presented below also show the importance of controlling for the potential endogeneity of living arrangements to the labour supply decision of adult children. Although controlling for unobserved individual heterogeneity reduces dramatically the effect of cohabiting on the labour supply of women, intergenerational living arrangements nonetheless translate into reduced hours worked. Given that a significant proportion of the sick elderly parents in our data set cohabit with adult children, the effect of parental illness on family income is non-trivial.

The remainder of the paper is organized as follows. Section 2 focuses on the data. Paths of hours worked are presented in Section 3. The model and results are discussed in Section 4. Conclusions are drawn in Section 5.

2. The Data

The data are drawn from the Panel Study of Income Dynamics (PSID) and its Parent Health Supplement (PHS). The PSID is a panel data set containing information on American individuals and their families. Information on the presence of elderly parents is included in the PHS. The combined data sets contain detailed information on adult children and elderly parents' socioeconomic characteristics, parents' health as well as the parental living arrangement.

To be eligible for the PHS, the PSID head's (or spouse's) parent had to be 70 years of age or older in 1991 *or* the parent had to have died after 1980, being 70 years of age or older at the time of death. Once such a parent was identified, the PSID head or spouse

was asked if their parent (at any time between 1975 and 1991) had reached the point where they could no longer be expected to live independently and take care of their own daily needs without extra help. If a parent had reached such a threshold, a retrospective questionnaire was administered to the adult child about the parent. From this, I have constructed a panel of information for each parent and merged it to the adult child's PSID panel, creating a longitudinal data set of both adult children and elderly parents for the years 1975 to 1991. As a result, the panel provides detailed information from 1975 to 1991 about one PSID child (and their spouse if one exists) and their elderly parents.

Combining the PSID and the PHS leads to 2437 pairs of adult children and elderly parents. In 704 cases, the adult child (child-in-law) identified a parent as having reached the point where they could no longer be expected to care for themselves without help at some point between 1975 and 1991. Furthermore, adult children were asked about where and with whom the parent resided before and during the illness as well as the presence of particular conditions at the time of illness. Information about adult children is presented in Table 1. Of all adult children families with an elderly parent eligible for the PHS, 1821 families were composed of a husband and a wife, 179 were composed of a single male and 430 were composed of a single female.

The sample of sick elderly parents contains 270 males (fathers) and 434 females (mothers). Several potential explanations exist for the relatively large number of mothers. First, life expectancy is greater for women than for men. Hence, we should expect more women to be eligible for the PHS. On the other hand, it is possible that men are less likely to be identified as 'sick'. Because wives are more likely to outlive their husbands, many men may fail to be identified as needing help because care is provided by their wives. As a result, children's information about their father's needs may be limited.

Table 2 describes the living arrangements of sick elderly parents in the first year that they became too ill to care for their own needs without help. In this first year of 'illness', 38 percent continued to live independently, 39 percent moved into a nursing home and 23 percent moved in with an adult child (6 percent moved in with the PSID child and 17 percent moved in with a PSID sibling). It is important to note that some

parents who are coded as unable to care for themselves remain living independently for a few years before moving into a nursing home. Furthermore, cohabiting with a child appears to be the most unstable of all living arrangements, as many parents either return to independent living, move into a nursing home or die. Finally, in the first year when parents are identified as being no longer able to care for themselves, parents have on average 4.21 children and 48 percent are married.[5]

3. Paths of hours worked

As past studies have relied on cross-sectional data, little is known about the paths of employment and hours worked of adult children whose parents require care. This section presents paths of hours worked and participation rates of both adult sons and daughters before and after the parent was first unable to care for him or herself without help. Given that different living arrangement are likely to affect the amount of care that must be provided by a specific child, separate paths are presented for different living arrangement subsets.[6] Furthermore, a comparison group is constructed in each case to account for trends in hours worked that are unrelated to parental illness. In each case, the comparison group is constructed using individuals with elderly parents whose health was good enough to allow the parent to care for themselves across all survey years.[7]

Figure 1 illustrates the path of average hours worked for all women before and

[5]Approximately 90 percent of all married individuals have a 'healthy' spouse in their first year of illness.

[6]For each group studied below, confidence interval bands were constructed around hours worked. In many instances, there was no significant difference between the hours worked of the studied group and its comparison group. Hence, differences discussed in this section should not be interpreted as statistically different but rather suggestive of possible differences which should be examined in the context of an econometric model.

[7]Average hours worked of the comparison group are adjusted to reflect both the year and age composition of the daughters whose parents became ill during the survey years. Such adjustments are necessary to control for the general increases or decreases in labour supply over the sample period as well as cohort and life-cycle effects (Johnson and Skinner (1986) use a similar weighting method in their examination of labour force participation of women before and after a marriage dissolution). It is important to note that with each subset examined (e.g. the subset of children whose parents ended up in a nursing home) a new control group is constructed.

after their parent first became ill.[8,9] Although the general effects of parental illness on adult children's labour supply may not be appear to be important, different parental living arrangements may induce different behaviour from adult children. Parents who remain independent or cohabit with a family member may require informal care from their children. On the other hand, parents who are institutionalized and receive formal care are unlikely to require informal care from their children. In fact, the high price of formal care may actually lead children of institutionalized parents to increase their hours worked in order to contribute towards formal care expenses.[10] Consequently, institutionalized and non-institutionalized sub-groups are examined separately.

Figure 2 consists of the subset of women whose parents became ill but never entered a nursing home during the sample years. Referring to Figure 2, it is not surprising that the path of hours worked appears to be similar for daughters whose parents never enter a nursing home and the corresponding comparison group, three and four years prior to the parental illness. However, two years prior to the illness, average hours worked appear to decline for this group of daughters. In fact, one year after the onset of illness, daughters appear to work less than the comparison group.

Figure 3 consists exclusively of women whose parents entered a nursing home at the time of illness. These daughters appear to behave differently. The possible increase in women's hours of work four years prior to the parents' illness is of particular interest. Several reasons may account for this. On one hand, it is possible that daughters may increase their hours in order to contribute to formal care expenses. Alternatively, daughters who work relatively high numbers of hours, or who increase their hours worked

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[8]This sub-sample contains all women (i) who had a parent (or an in-law) who passed the illness threshold; and (ii) whose information on hours worked was available for at least 4 years prior and 4 years after the parent first required assistance.

[9]"At the time of illness" will be used henceforth as shorthand for "the first year the parent was identified as being unable to care for him or herself without help". Thus, the time of illness refers to one year in the data set.

[10]In fact, expected future expenses may lead children to work more before institutionalization takes place.

before the time of illness may be less willing to provide informal care, resulting in parental institutionalization. Or, it may be the case that daughters who work relatively more may be unwilling to provide care at early ages of illness which may contribute to the parent's poor health and his or her institutionalization. The econometric analysis which follows should help differentiate between the two scenarios.

Men also do not appear to be generally affected by parental illness. As is shown in Figure 4, which illustrates the path of hours worked for all men before and after the parent first required assistance, men decrease their hours worked as a result of parental illness. Differences in hours worked reach their peak (relative to the comparison group) at the onset of illness. The path of hours worked is again quite different if different living arrangements are examined separately. As is the case for women, men whose parents never enter a nursing home appear to decrease (on average) their hours worked considerably and, at the onset of illness, work on average about 200 hours less than the comparison group (Figure 5). However, Figure 6 suggests there is no major effect on hours for the sample of men whose parents eventually moved into a nursing home.

In order to determine the effect of parental illness on the entire family unit, the path of total hours worked for married couples is presented in Figure 7.[11] Although it is possible that one spouse increases his or her hours to compensate for decreased hours of the other, total family hours appear to be negatively correlated with the presence of a parental illness.

4. Theoretical Model

In this section, a simple model is presented which reflects an adult child's labour-leisure decision in the presence of an aging parent. In the model, adult children must decide on how many hours to work based on current and future realizations of prices, income, parental health and parental living arrangements. As different living arrangements of sick elderly parents are likely associated with different levels of expenditures (for formal care) and different time requirements (for informal care), different parental living arrangements

[11]The comparison group was weighted according to the female's age and birth year.

should be incorporated into the labour supply decision.

Even when an elderly parent can care for him or herself, adult children may wish to alter their labour supply in response to future expected illnesses. Such anticipatory behaviour is likely to depend on the parent's current and expected future health status as well as where the parent is likely to reside once he or she is unable to care for him or herself. Adult children may increase their labour supply if they expect their parent to become ill and move into a nursing home sometime in the near future in order to contribute to future formal care expenses. Similarly, adult children may increase their labour supply in anticipation of living with a sick parent due to potential future demands on their time.

From basic labour supply theory (see, for example Killingsworth, 1983), adult children's labour supply is assumed to depend on current and expected future prices and income. Accordingly, the traditional labour supply equation is modified here to incorporate the current and expected future parental living arrangement. Although the decision making process regarding where the parent will reside once he or she becomes too ill to care for him or herself is not modelled explicitly here, it is assumed to be determined by a process which takes into account both the parent's illness severity as well as familial characteristics.

More formally, child *i*'s hours worked at time t H_{it} is given as a function of current prices p_t, assets A_{it}, current parental health γ_{it}, current parental living arrangement R_{it}, future expected realizations of these variables (represented by the function V_{it}) as well as personal characteristics X_{it}, or

$$H_{it} = G[\, p_t, A_{it}, \gamma_{it}, R_{it}, V_{it}(.), X_{it}\,] \tag{4.1}$$

It is assumed that individuals are forward looking in future prices, income, parental living arrangements and parental health to a limited extent when making their current labour supply decisions. Specifically, adult children are forward looking up to some fixed number of years *k*. As a result, V_{it} is represented here as a vector

$$V_{it} = E_{it}[v_{it+1}, \ldots, v_{it+k}\,] \tag{4.2}$$

where each component of the vector includes future prices, assets, and parental living

arrangements i.e .v_{it+n}=[$R_{it+n,}$ p_{t+n}, A_{it+n}] where $n\epsilon\{1...k\}$.

As mentioned earlier, parental health and familial characteristics determine where the parent will reside. This assignment of living arrangements can be represented by a matching function *M,* where the living arrangement depends on familial characteristics F_{it} (such as the number of siblings) and the parent's health γ_{it}. [12]

$$R_{it} = M(F_{it}, \gamma_{it}) \tag{4.3}$$

and where the living arrangement R_{it} can take four different forms

$$R_{it} = \begin{cases} I_{it} & if \quad live\ independently \\ C_{it} & if \quad cohabit\ with\ i \\ B_{it} & if \quad cohabit\ with\ sibling \\ N_{it} & if \quad live\ in\ a\ nursing\ home \end{cases} \tag{4.4}$$

Although the matching function can depend exclusively on variables which are independent to the adult child's labour supply decision, several factors may affect both the living arrangement decision and the labour supply of adult children. For example, adult children who are relatively efficient in market production may be less willing to provide informal care, which may in turn contribute to parental institutionalization. Or, women who are relatively efficient at home production may be more likely to provide informal care and thus be more likely to cohabit. A component η_i of individual characteristics X_{it}, which is fixed over time, can appear both in the labour supply function and in the matching function i.e. X_{it}=$\{Z_{it}, \eta_i\}$ and R_{it}=$M(F_{it}, \gamma_{it}, \eta_i)$ to reflect this interdependence. Hence, using the above example, relatively productive daughters (with large values of η_i) can be, ceteris paribus, more likely to work many hours i.e. $\partial H_{it}/\partial \eta_i > 0$. Large values of η_i can also be associated with, ceteris paribus, a lower probability of cohabiting with a parent and a higher probability of having a parent move into a nursing home, where $\partial P(R_{it}=C_{it})/\partial \eta_i < 0$ and $\partial P(R_{it}=N_{it})/\partial \eta_i > 0$.

[12]Ceteris paribus, increasing the number of siblings should decrease the probability of a parent moving into a nursing home and increase the probability of cohabiting with a child.

5. Econometric Specification and Results

In the following sections, the two models presented above are estimated. In the first, a censored regression model (henceforth referred to as a general Tobit) will be used to estimate the labour supply equation of both men and women based on the assumption that the living arrangements of sick elderly parents are exogenous to the adult child's labour supply decision. In the second section, the exogeneity assumption is partially relaxed and the labour supply equation is estimated in a censored fixed-effect regression framework.

5.1 Labour supply assuming exogenous living arrangements

As a starting point for the analysis, general Tobit estimation is performed separately on the labour supply of adult sons and daughters assuming the exogeneity of living arrangements (see, for example, Greene, 1997). A Tobit model is used in order to deal with the censoring that occurs in the hours worked data because many individuals in the data do not work.[13] The results from the Tobit model should closely resemble past studies and serve as a benchmark in determining whether or not past studies have been seriously biased.

The reduced form expression for child *i*'s labour supply to be estimated is given as

$$H_{it} = \alpha_0 + \underline{\alpha}_1 \underline{X}_{it} + \underline{\alpha}_2 \underline{Q}_{it} + \underline{\alpha}_3 \underline{D}_{it} + \underline{\alpha}_4 \underline{P}_{it} + \underline{\alpha}_5 \underline{Y}_{it} + \mu_{it} \qquad (5.1)$$

where $\underline{X}$ represents a vector of individual characteristics such as race, marital status, age, education, number of siblings, number of grand-children between the ages of 1 and 13 and the number of grand-children between the ages of 14 and 17.[14] $\underline{Q}$, a vector, represents a series of prior-to-illness indicators. One indicator is included for each year

[13] Although censoring in hours worked is generally not a problem for men, many men in this sample are near retirement age.

[14] The number of siblings is included here for the same reason it was included in the matching function. Also, the number of siblings may affect the time requirements under any of the alternative living arrangements. Informal care to sick and elderly parents is generally provided by caregiving networks composed of spouses, adult children, friends and neighbours (see Stone *et al.* (1987) for a review of the literature). Hence, as the number of siblings increase, the caregiving responsibilities imposed on any child in any living arrangement should decrease.

prior to a parental illness (n) and the eventual parental living arrangement at the time of illness (4) [Therefore, (n)x(4) indicators are included]. For example, the indicator *(t-4)*Nursing Home* will be equal to one if the parent becomes ill exactly four years later and moves into a nursing home at the time of illness. These indicators are included to capture anticipatory effects that might occur before the parent becomes too ill to care for him or herself. They also allow for anticipatory behaviour to differ across eventual living arrangements. $\underline{D}$ is also a vector of indicators, one for each living arrangement in the first year of the parental illness. A vector of indicators for each living arrangement in years subsequent to the first year of illness is denoted as $\underline{P}$.[15] Calendar Year indicators $\underline{Y}$ are included to account for general trends in labour supply as well as cyclical effects. Finally, μ denotes a normal iid error term.[16]

In this section, it is assumed that the living arrangement decision is exogeneous to the child's labour supply decision. Under this assumption, a Tobit is performed on the reduced-form hours-worked equation for men and women separately. In this and the following section, *k* is assumed to be equal to 5. That is to say, individuals are assumed to be unaffected (from a labour supply viewpoint) by a parental illness that occurs 6 years or more into the future. Hence, all estimates should be interpreted relative to the comparison group which is composed of individuals whose parent either (i) remains healthy throughout the panel years; (ii) is healthy for at least 5 years; or (iii) is dead.[17] Regression results are presented in Table 3.[18]

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[15]Because of small sample, one single indicator represents a parent in a nursing home five or more years after the onset of the parental illness (similarly for independent living). Furthermore, one single indicator represents one or more years of cohabiting with child "i" after the onset of the parental illness (similarly for cohabiting with one of child "i"s siblings).

[16]Under the 'exogeneity of living arrangement' assumption, Tobit estimates will be consistent if $\mu_{it} \sim N(\mu,\sigma^2)$.

[17]For example, an adult child in 1982 would be treated as part of the comparison group if their parent (i) remained healthy from 1975 to 1991; or (ii) remained healthy at least until 1988; or (iii) was dead.

[18]Coefficient estimates are also plotted across different living arrangements for both men and women separately and are presented in Figures 8a to 11b. In each case, parameter estimates are plotted along with those estimated from the following section.

Several results are worth noting. First, general Tobit estimates indicate that men work relatively more hours prior to their parent's move into a nursing home. In fact, four years prior to such an episode, men work, on average, 205 hours a year more relative to a comparison group. This relative increase in hours suggests that men may be behaving in an anticipatory way. Men, predicting an imminent nursing home stay (and its cost), perhaps because the parent's health is deteriorating, increase their hours worked. However, as the model suggests, nursing home stays are likely to be, in part, endogenous to the labour supply decision. It may be the case that sons who work relatively more hours are unwilling to provide informal care, which may be contributing to parental institutionalization. Differentiating between these two effects will be possible in the following section.

Second, men do not continue to work relatively more hours while a nursing home stay is under way. My estimates suggest that men work 170 hours less, relative to the comparison group, two years after the parent becomes ill and moved into a nursing home. This result is somewhat difficult to interpret. One explanation might be that caregivers experience many negative non-financial impacts as a result of their caregiving activities.[19] For example, men may attempt to provide both informal care to the ailing parent while working more in anticipation of future expenses. These pressures may in turn adversely affect the health of adult male children which in turn may affect their future labour supply.

According to the general Tobit results, women do not behave in such an anticipatory way.[20] This is somewhat surprising given that women are believed to have

[19]These negative effects of caregiving include stress, emotional strain, neglect of other family responsibilities as well as increased family conflicts (see Stone *et al.* (1987) for a complete review of the literature).

[20]Insignificant parameter estimates of vector Q can not differentiate between (i) the fact that individuals do not react to expected future changes in parental health and living arrangement; or (ii) that children are unsuccessful at predicting future changes in parental health and living arrangements, and thus, are unable to modify their hours worked as a consequence. Furthermore, significant estimates for these 'anticipatory effects' may actually be causal in nature and not anticipatory behaviour. If, for example, an adult child experiences a positive employment shock (transitory increase in hours), that child may be less willing to provide informal care in the short-term which may contribute to the parental illness and increase

more flexible hours and many do not work full-time. However, women, relative to the comparison group, also work less after a parent moves into a nursing home.

It is expected that cohabiting with a sick elderly parent will have the greatest negative impact on hours worked compared to any of the other three living arrangements discussed here. Although the general Tobit results indicate that men are unaffected by such a living arrangement, they also indicate that the effect on female labour supply is dramatic. In the first year of cohabiting with a parent, women work over 470 hours less a year relative to the comparison group. According to these results, the long-term effect appears to be even larger. After one year of cohabiting has passed, women who cohabit with their parents work over 1100 hours less a year. This very large decrease in hours suggests that many women may be leaving the labour force altogether in order to provide care for their parents.

Again, these findings must be interpreted with caution. If living arrangements are not exogenous to the adult children's labour supply decision, the results discussed above may be seriously biased. It may be the case that daughters who work relatively less hours are more willing to cohabit with their sick and elderly parent. If such is the case, controlling for this form of endogeneity should reduce these parameter values substantially.

One puzzling result is that men work less if their parent cohabits with a sibling. In fact, the general Tobit estimates suggest that men whose parents cohabit with a sibling work, on average, 300 fewer hours per year. To explain this, one might hypothesize that parents are choosing to cohabit with their most productive son. If such is the case, and this selection is ignored, a negative relationship between hours worked and the parent living with a sibling is to be expected.

Finally, the general Tobit estimates indicate that women work less if their parent is unable to care for him or herself while remaining in independent living one year following the initial illness. Both men and women appear to be negatively affected by

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the probability of future nursing home stays.

parental illness 5 years after the parent was first identified as not being able to care for him or herself. This suggests that sons and daughters of such parents may still be providing some informal care which has negative effects on their labour supply.

In the previous section, interpretation of the results was made difficult because the potential endogeneity of living arrangements was neglected during estimation. Given that adult children likely influence where the parent shall reside, it is expected that the effect of parental illness on the living arrangement may be seriously biased. The following section addresses this issue by using a method which controls for the potential endogeneity of living arrangements.

5.2 Labour supply with endogenous living arrangements

In the previous section, general Tobit estimation leads to consistent estimates if living arrangements are exogenous to adult children's labour supply decisions and under standard assumptions about the error term. As my model suggests, however, adult children most likely influence where an ill parent will reside. In this section, I attempt to partially control for the endogeneity of parental living arrangements. In the case where some constant individual-specific unobserved characteristics influence both the hours worked decision and the parent's living arrangement, a fixed-effect model is appropriate. Examples of unobserved individual heterogeneity relevant to this model might include the relative productivity of the child *or* altruism towards a parent. By employing an econometric technique that controls for unobserved individual heterogeneity, one should be able to make clearer the causal relationship between parental illness and adult children's hours worked.

Although controlling for fixed effects may rid the parameter estimates of certain forms of endogeneity, other potential sources of endogeneity may remain. It is quite possible that individuals are selecting into different living arrangements based on certain individual specific characteristics which may not be reflected in hours worked in all periods. For example, individuals with particularly inflexible jobs may be less likely to provide informal care and thus be less willing to cohabit. However, in the absence of a sick elderly parent, adult children with and without flexible jobs may work a similar

number of hours. Because the effects on hours, caused by say the inflexibility of employment, is not constant over time, estimation that controls for fixed effects would be insufficient to control for this form of endogeneity.[21]

As before, k is set to 5 years prior to a parental illness. In other words, it is assumed that future parental illnesses and living arrangements are irrelevant to the labour supply decision when the parent's illness is experienced in the distant future.[22]

The above reduced-form labour supply equation (5.1) is further modified as follows. The error term is now composed of an iid error ε_{it} and an individual fixed effect η_i. The fixed-effect component may be correlated with different living arrangements i.e. $E[R_{it}\eta_i] \neq 0$. By using a fixed-effect technique, the η_i component is eliminated from the error term, leading to consistent estimates so long as ε_{it} is not serially correlated (see, for example, Greene, 1997).

It is important to recognize that the aforementioned problem associated with censoring of hours worked at zero must also be dealt with within the context of the fixed-effect model. As a result, a censored regression technique developed by Honoré (1992) will be used to deal with both censoring and fixed effects. This estimator (referred to henceforth as Honoré's estimator) for censored fixed-effect regressions has many desirable properties. It allows for non-normality of errors, is robust to heteroscedasticity across individuals, and allows for unbalanced panel data. However, Honoré's estimator is inconsistent under serial correlation of errors.[23]

The reduced form hours-of-work equation was estimated accounting for both censoring and fixed effects by using the method proposed by Honoré. Results are

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[21]Another possible form of endogeneity not controlled for using a fixed-effect framework is the case of transitory shocks to employment. If, for example, a daughter is laid-off at approximately the same time as her parent becomes ill, she may decide to provide informal care and cohabit. Using a fixed-effect framework will not capture this relationship and results will exhibit a negative relationship between cohabiting and hours worked.

[22]Limiting the forward looking behaviour of children is also necessary to identify the model in the presence of fixed-effects.

[23]A brief description of the Honoré estimator is presented in the appendix.

provided in Table 4.[24] Again, under the assumption of my model, the estimates should be interpreted relative to a comparison group which is composed of individuals whose parent either (i) remains healthy throughout the panel years; (ii) remains healthy for at least 5 years; or (iii) is dead.

As in the previous section, Honoré estimates indicate that men work relatively more in the years leading up to a parental nursing home stay.[25,26] However, unlike the previous estimates, men do not experience negative impacts on hours worked once the parent moves into a nursing home. Thus, the puzzling result that men are negatively affected, by having a parent move into a nursing home no longer holds.

The fact that both the general Tobit and the Honoré results indicate that men work more prior to a nursing home stay suggests that men may be behaving in an anticipatory way.[27] However, given that men also appear to be behaving in an anticipatory way when the parent remains in independent living but not when they cohabit with them, suggests

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[24]Coefficient for both the general Tobit and the Honoré procedure are plotted for each living arrangement type in Figures 8a through 11b.

[25] The anticipatory effect may actually be dampened if their parents health has begun to deteriorate prior to a nursing home stay. That is, sons' ability to increase their labour supply in anticipation of a future nursing home stay may be limited by their caregiving requirements.

[26]Although spent-down rules may discourage individuals from transferring money to their parents (as it may often be a perfect substitute for government funding), it is possible that sons and daughters wish to contribute towards items (such a better accommodations) which may not be covered by medicare and medicaid.

[27]Anticipatory behaviour across all 'types' of individuals prior to a nursing home stay is more likely if (a) elderly parents moving into a nursing home are stricken with illnesses that require formal care, and (b) such illnesses have many early warning signs which allow adult children to anticipate future formal care requirements. In order to test this hypothesis, a multinomial logit analysis is performed on the probability of entering a nursing home. Explanatory variables in this regression consist of a group of illness indicators, where each illness indicator represents the presence of a particular diagnosed condition i.e. an objective illness measure. Sick elderly parents are more likely to enter a nursing home if they suffer from mental illness , have problems controlling their bowels, suffer from osteoporosis, suffer from hearing loss or experience a stroke. They are less likely to enter a nursing home if they suffer from cancer, asthma, high blood pressure or back pain. Illnesses, especially mental illness (dementia and alzheimers for example) often have slow progression and often require formal care in later stages of the disease (this is probably not the case for stroke victims). However, individuals with high blood pressure, cancer and asthma can often be cared for within the home. Thus, the data suggest that some types of illness may exogenously impose nursing home care on the elderly they afflict and may allow for children to prepare for inevitable nursing home stays. See Table 5 for the results.

that some potential sources of endogeneity may not have been completely controlled for. Again, as noted before, sons and daughters who work relatively more during the early stage of a parent's illness may be less willing to provide informal care to their parents which may, in turn, increase the parent's future need for formal care and institutionalization.

Controlling for fixed effects also changes the parameter estimates for women. Although women whose parents experience a nursing home stay in the future do not appear to behave in an anticipatory way (according to the general Tobit results), the Honoré estimates suggest otherwise. For example, women increase their labour supply by 150 hours (on average) one year prior to a nursing home stay. They also work 170 hours more in the first year of a nursing home stay. It may be the case that women are responding to expected future nursing home expenses not covered by medicaid and medicare by increasing their hours worked. It is also possible that daughters are behaving strategically in order to avoid cohabiting with a sick elderly parent. By increasing their hours worked in periods immediately preceding a time when the parent will require caregiving, the child may in fact be signaling to the parent that he or she is unable to provide care because of labour market responsibilities.

General Tobit estimates indicate that men whose parents cohabit with a sibling experienced a negative impact on hours worked; a puzzling relationship to say the least. Once fixed effects are controlled for, however, this negative relationship is eliminated. If parents are selecting to move in with their most productive son, then sons whose parents cohabit with a sibling are likely to be, on average, less productive. Thus, by comparing the pool of adult sons whose parents cohabit with a sibling (a pool of relatively less-productive sons) to the comparison group, then the negative relationship between hours worked and the parent cohabiting with a sibling is no longer surprising. However, once the move has occurred, the labour supply of men who cohabit with a sick elderly parent appears to be unaffected.

As was expected, controlling for fixed effects leads to large changes in parameter values when estimating the effects of cohabiting on female labour supply. The general

Tobit estimates indicate that women work approximately 470 hours less, on average, in the first year of an intergenerational living arrangement. The effect appears to grow over time, where women who cohabit with their parent for at least one year working 1100 hours less than the comparison group. However, controlling for fixed effects reduces the estimated effect of cohabiting on labour supply by a substantial amount. According to Honoré estimates, women who cohabit with their parent do not experience any significant decrease in hours worked in the first year of cohabiting. In subsequent years of cohabiting with a parent, these estimates indicate that women work, on average, 465 hours less than the comparison group (less than half the amount suggested by the general Tobit estimates).

In the presence of fixed differences in productivity, such changes in parameter estimates are to be expected. Suppose for example that women are divided into two groups, a relatively less productive group of women (or with low opportunity costs of time) and a relatively more productive group of women (or with high opportunity costs of time) and that the former are more likely to cohabit. By comparing cohabiting women (those with low opportunity costs of time) to all women whose parents do not become ill during the panel years (a pool of women with both high and low opportunity costs of time), the parameter estimates will surely exhibit a negative relationship between hours worked and cohabiting. However, by examining the effect of cohabiting on an individual level, differences in types of women should not affect the parameter estimates. The Honoré estimates suggest that, although women who are relatively less productive in the labour market may be more apt to cohabit, the act of cohabiting does nonetheless appear to lead to negative effects on hours worked across all types of women.

Although cohabiting and nursing home stays seem to especially affect the labour supply behaviour of women, the financial impact on the family unit may nonetheless be small. The data, however, indicates that this is not the case. For example, the results presented above indicate that cohabiting with a parent leads to a reduction, on average, in female labour supply. The act of cohabiting is not, however, associated with increased hours for men. This is also the case when the parent experiences an illness but continues

to live independently.

Because the model was estimated separately for men and women, it is possible that single women or single men are driving some of the results. As a consequence, a similar model is estimated to determine if the total labour supply of married couples is negatively affected by intergenerational living arrangements. Honoré estimates suggest that total hours worked of married couples is approximately 360 hours less than the comparison group in the first year of cohabiting with a sick and elderly parent. Furthermore, joint hours worked are approximately 390 hours less (on average) in subsequent years of cohabiting. Thus, reductions in hours worked by one family member are not fully met with similar increases by another. Such total family reductions in hours worked are likely to translate into important losses in family income.

Given that the majority of the decrease in hours worked due to cohabiting is experienced by women, their lost wages associated with caregiving can be calculated. In order to do so, a measure of the forgone wages is necessary. Forgone wages were predicted using Heckman's (1979) selection method.[28] On average, females who cohabit with a sick and elderly parent experience a loss of $4,217dollars.[29,30] Given that in our data set, 22% of individuals whose parents become too ill to care for themselves move in with one of their children, the effect of cohabiting on the labour supply of women and the family income is potentially large. It is important to note, however, that parents may be transferring some income to their children in order to minimize the financial impact associated with cohabiting i.e. paying for informal care and cohabiting. Since four thousand dollars a year is a relatively small amount of money, it is quite feasible that

[28]The daughter's marital status, number of children in different age categories, as well as the parent's living arrangement were assumed to affect the probability of working but not the wage rate.

[29]Or, 465 hours at 9.07 (1987) dollars per hour, where 9.07 is the average predicted wage for individuals who cohabit with their parent in the 2nd year of cohabiting i.e. (t+1). Wages were converted to 1987 using the GDP deflator.

[30]Although this number is quite large, it is important to recall that the effect of cohabiting on hours worked was reduced by approximately 60% once the potential endogeneity of living arrangements was controlled for.

parents are able to fully compensate their caregiving child.

A final note shout be made about the effect of parental illness on the labour supply of their children. It is possible that parents who require caregiving are not equally 'ill' across different living arrangements. Mutlinomial Logit results (Table 5) show that parents are more likely reside in a nursing home (vs independent living) if they suffered a stroke or are mentally ill but are more likely to cohabit (vs independent living) if they have asthma, back pain, osteoporosis or have trouble hearing. This finding has important policy implications. If say, access to nursing home care was reduced, then individuals whose parents would otherwise live in a nursing home and who are now forced to cohabit would experience greater reductions in hours worked then estimated here.

5. Conclusion

Earlier studies have suggested an important relationship between caregiving and labour supply. Although adult children may provide the bulk of care to aging parents, how and if this informal care translates into reduced labour supply is unclear. On one hand, adult children who cohabit with their parents may experience important reductions in hours worked due to time-consuming informal care demands. On the other hand, adult children who work less may simply be more willing to cohabit with their parents. Similar questions exist with respect to the parents residing in nursing homes. Children who work many hours may be unwilling to provide the necessary informal care which may in turn contribute to institutionalization. If however, very ill elderly parents are forced into nursing homes, adult children may respond with an increase in hours worked in order to contribute towards formal care expenses. In this paper, an attempt is made to quantify the effect that parental illness has on adult children labour supply.

Controlling for the potential endogeneity of living arrangements to the labour supply of adult children reduces the estimated effect of parental illness on the children's number of hours worked. Although women experience negative impacts on their hours worked when they cohabit with a sick elderly parent, the results suggest that much of the negative relationship between caregiving and hours worked is due to unobserved individual heterogeneity. That is, women who work less are more likely to cohabit.

The results also suggest that men may anticipate parental nursing home stays and increase their labour supply in the years prior to such living arrangements. Given that nursing home stays are much more likely for parents who experience particularly serious illnesses (which often require formal care and often exhibit early warning signs), such anticipatory behaviour appears reasonable. In fact, the importance of early detection of such illnesses has often been argued from an "early preparation" standpoint. Generally, early detection is thought to be beneficial as it may give the families valuable time to prepare for inevitable institutionalization. The results presented here suggest that early detection may also allow family members to prepare financially for such institutionalization.

Even if parents tend to cohabit with daughters that work less and regardless if adult children anticipate nursing home stays, the costs associated with parental illness on families is non-trivial. Because reductions in hours worked by women (when parents are ill and either remain independent or cohabit) are not matched by similar increases in male labour supply, families, as a whole, experience considerable financial losses when a sick elderly parent moves in. Estimates presented here indicate that women who cohabit with a sick elderly parent lose over $4,000 a year from reduction in hours worked.

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Tables:

Table 1:
Summary statistics for Men and Women (adult children) whose parent(s) qualified for the Parental Health Survey (PHS) at the time of illness.

	Min.	Max.	Mean	St.Dev.
Age-Men	19	83	50	11.29
Age-Women	18	85	49	10.87
Hours Worked Annually -Men	0	5012	1814	1029
Hours Worked Annually -Women	0	3720	1114	932
Number of Children 1 to 13	0	6	0.6	0.99
Number of Children 14 to 17	0	2	0.2	0.5

Table 2:

Living arrangement statistics for elderly parents who qualified for the PHS at the time where they could no longer be expected to take care of themselves.

Living Arrangement	Frequency	Percentage	Std. Dev.
Independent	273	37.8	0.49
Nursing Home	264	39.1	0.49
Cohabit with head	40	5.7	0.23
Cohabit with other child	122	17.5	0.38

Table 3:

Results from Tobit estimation of hours worked for men and women.

WOMEN: Number of Obs= 30 781 Number of Ind= 2 252			MEN: Number of Obs= 28490 Number of Ind= 1 961	
Hours Worked	Coef(Tobit) WOMEN	Std.Err	Coef(Tobit) MEN	Std.Err.
(t-4)* Nursing home	36.77	92.26	196.39***	63.33
(t-4)* Nursing home	-92.04	87.44	204.15***	70.8
(t-3)* Nursing home	-82.69	84.9	174.51***	70.63
(t-2)* Nursing home	-8.59	77.18	100.28	67.92
(t-1)* Nursing home	50.81	80.42	113.22	73.84
(t)* Nursing home	45.39	79.46	8.71	71.13
(t+1)* Nursing home	13.67	91.98	-25.01	84.82
(t+2)* Nursing home	-18.01	109.39	-169.52*	101.45
(t+3)* Nursing home	-199.76	141.57	-122.14	129.24
(t+4)* Nursing home	-375.45**	178.86	21.26	154.38
(t+5)* Nursing home	-212.72**	103.96	-15.16	92.44
(t-5)*Independent	-20.38	82.9	12.22	66.67
(t-4)* Independent	102.33	81.05	-14.3	58.31
(t-3)* Independent	81.06	75.04	32.24	60.24
(t-2)* Independent	11.77	76.49	-76.46	62.32
(t-1)* Independent	-76.97	73	-54.6	61.55
(t)* Independent	-60.17	73.05	–63.95	65.74
(t+1)*Independent	-131.23*	72.31	11.09	58.43
(t+2)* Independent	-114.38	89.82	-28.3	77.53
(t+3)* Independent	-136.49	100.01	-114.74	81.49
(t+4)* Independent	-176.82	124.97	-7.02	100.77
(t+5)* Independent	-126.06*	75.43	-155.41***	58.88
(t-5)* Cohabit	-359.51	253.62	163.09	171.95
(t-4)* Cohabit	-302.32	266.1	184.69	137.9
(t-3) * Cohabit	-28.75	252.19	32.43	123.22

(t-2)* Cohabit	-86.72	267.7	153.93	207.06
(t-1)* Cohabit	-188.5	215.29	106.76	193.71
(t)* Cohabit	-477.65**	221.37	19.81	192.55
(t+)*Cohabit	-1149.92***	280.16	76.05	163.3
(t-5)*Live with sibling	155.25	128.06	-76.59	115.09
(t-4)* Live with sibling	70.19	132.86	-143.67	112.75
(t-3)* Live with sibling	105.68	116.14	-14.35	102.18
(t-2)* Live with sibling	29.99	113.78	-167.92	116.17
(t-1)* Live with sibling	-30.84	122.21	-165.86	111.33
(t)* Live with sibling	-107.07	123.97	-157.53	118.95
(t+)*Live with sibling	-191.64	176.74	-324.57*	177.49

(* coefficient significant at 10% level; ** coefficient significant at 5% level; *** coefficient significant at 1% level)

(As a result of small sample, one indicator was used for "cohabiting with a parent in any year after an illness occurred" (denoted as (t+)*Cohabit)) and for "cohabiting with a sibling in any year after an illness occurred" (denoted as (t+)*Live with sibling)))

(Indicators for years, age, marital status, education as well as the number of siblings were included in the estimation and all had reasonable signs and magnitudes)

Table 4:

Censored Fixed-Effects (Honoré) estimation of hours worked for men and women.

WOMEN: Number of Obs= 30 781 Number of Ind= 2 252			MEN: Number of Obs= 28490 Number of Ind= 1 961	
Hours Worked	Coef(Honoré) WOMEN	Std.Err.	Coef(Honoré) MEN	Std.Err
(t-5)*Nursing home	143.97*	76.87	112.98**	44.97
(t-4)* Nursing home	10.32	70.04	101.40*	57.89
(t-3)* Nursing home	26.23	66.33	87.75*	52.92
(t-2)* Nursing home	61.64	63.42	13.41	55.57
(t-1)* Nursing home	149.56**	74.8	50.39	63.45
(t)* Nursing home	168.26**	68.53	-40.46	62.54
(t+1)* Nursing home	94.6	71.49	-106.61	70.9
(t+2)* Nursing home	64.84	101.47	-105.98	81.31
(t+3)* Nursing home	-66.52	122.89	-74.93	95.82
(t+4)* Nursing home	-169.74	144.01	92.3	110.56
(t+5)* Nursing home	130.77	135.55	0.34	135.54
(t-5)*Independent	9.05	60.48	27.6	52.4
(t-4)* Independent	135.85**	65.62	8.99	46.88
(t-3)* Independent	147.08**	63.9	53.13	48.87
(t-2)* Independent	96.03	65.12	-41.77	55.66
(t-1)* Independent	-10.39	57.16	-13.85	54.69
(t)* Independent	-16	61.27	-19.28	55.81
(t+1)*Independent	-116.98*	64.36	0.48	49.43
(t+2)* Independent	-41.2	79.17	-25.79	62.9
(t+3)* Independent	-147.9	91.89	-127.07*	73.35
(t+4)* Independent	-34.17	126.74	-17.18	88.14
(t+5)* Independent	3.47	136.45	-134.55	115.08
(t-5)* Cohabit	-231.72	180.55	112.75	129.73
(t-4)* Cohabit	-206.21	239.68	116.64	104.09
(t-3) * Cohabit	158.17	227.46	-62.33	114.48

(t-2)* Cohabit	37.33	267.33	16.7	148.8
(t-1)* Cohabit	-86.31	218.81	18.23	18.23
(t)* Cohabit	-326.27	122.56	-32.75	150.27
(t+)*Cohabit	-465.19**	234.98	9.83	305.29
(t-5)* Live with sibling	55.24	98.97	116.29	82.51
(t-4)* Live with sibling	68.3	106.35	50.91	83.41
(t-3)* Live with sibling	33.83	107.25	134.31	88.03
(t-2)* Live with sibling	-32.46	120.91	7.4	96.7
(t-1)* Live with sibling	-67.89	121.17	-34.33	96.42
(t)* Live with sibling	-163.91	122.56	-8.79	108.45
(t+)*Live with sibling	-119.53	191.61	-72.13	242.41

(* coefficient significant at 10% level; ** coefficient significant at 5% level; *** coefficient significant at 1% level)

(As a result of small sample, one indicator was used for “cohabiting with a parent in any year after an illness occurred” (denoted as (t+)*Cohabit)) and for “cohabiting with a sibling in any year after an illness occurred” (denoted as (t+)*Live with sibling)))

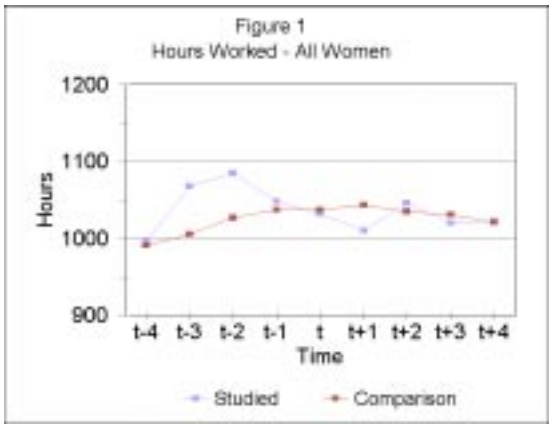
Table 5:
Multinomial Logit analysis of the probability of residing in a particular 'arrangement' by different illness

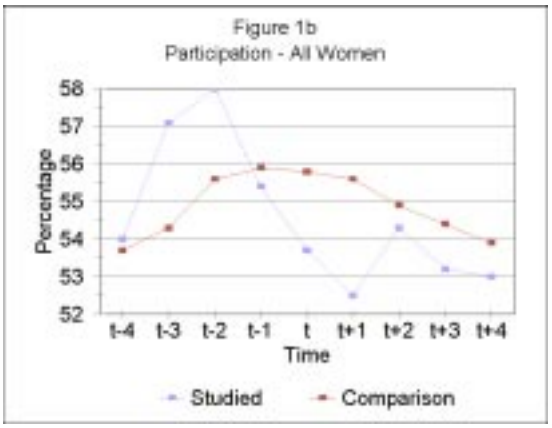
Number of os.= 662
Pseudo R2= 0.0786

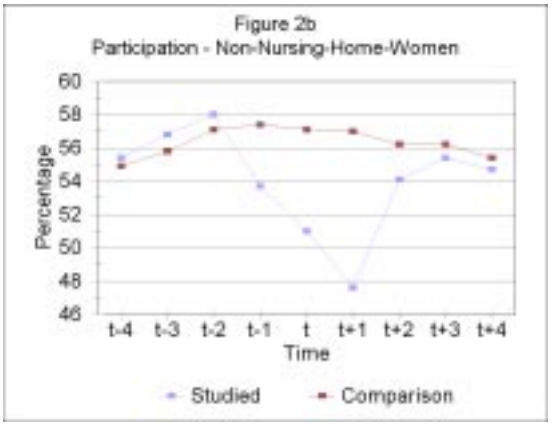
	Independent vs Nursing Home		Cohabiting vs Nursing Home	
	Coef.	Std. Err.	Coef.	Std. .Err.
Arthritis or rheumatism	-.86	.209	.19	.222
Cancer (but not skin cancer)	1.04***	.278	.12	.323
Stroke, ms, neuro. problem...	-.38*	.221	-.80***	.243
Cardiac pacemaker	.36	.458	-.47	.551
Amputated arm or leg	-.20	.596	.34	.612
Congestive heart failure, enlarged heart, heart problem	-.67	.258	.23	.266
Angina or chest pain	.21	.294	.18	.304
Asthma, chronic bronchitis...	.94***	.303	.65**	.325
Back problems...	.60	.299	.87***	.305
Osteoporosis, broken hip...	-.59**	.284	-.59**	.296
Stomach ulcer	-.02	.374	-.09	.400
Chronic inflamed bowel...	.23	.329	-.26	.381
Allergies s.a. hay fever...	.10	.324	-.16	.356
Trouble hearing	.03	.080	.04	.082
Trouble seeing even with glasses...	.02	.235	.42*	.240
Diabetes	-.06	.264	.05	.273
High blood pressure	.38*	.218	.30	.230
Hernia or rupture	.53	.370	-.39	.449
Problems controlling bowels or urination	-.68***	.243	-.49**	.255
Trouble with thinking, concentration or memory	-.35*	.213	-.39	.226

(* coefficient significant at 10% level; ** coefficient significant at 5% level; *** coefficient significant at 1% level)

Paths of Hours Worked:







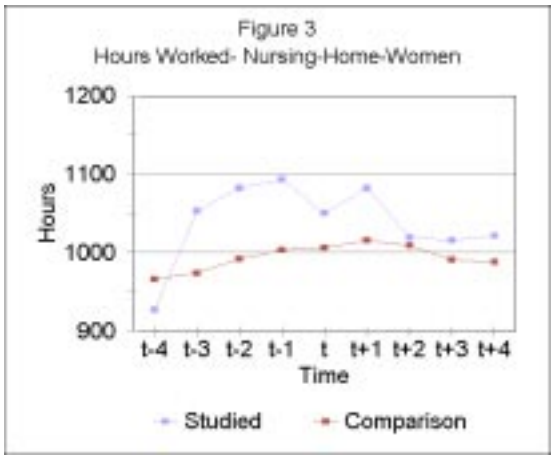


Figure 3
Hours Worked- Nursing-Home-Women
1200
1100
1000
900
Hours
t-4 t-3 t-2 t-1 t t+1 t+2 t+3 t+4
Time
Studied
Comparison

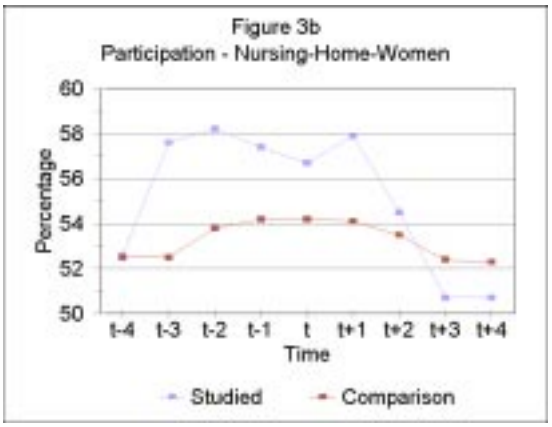


Figure 3b
Participation - Nursing-Home-Women
60
58
56
54
52
50
Percentage
t-4 t-3 t-2 t-1 t t+1 t+2 t+3 t+4
Time
Studied
Comparison

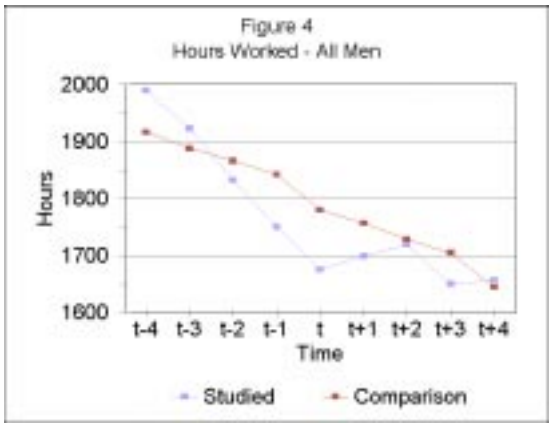


Figure 4
Hours Worked - All Men
2000
1900
1800
1700
1600
Hours
t-4 t-3 t-2 t-1 t t+1 t+2 t+3 t+4
Time
Studied
Comparison

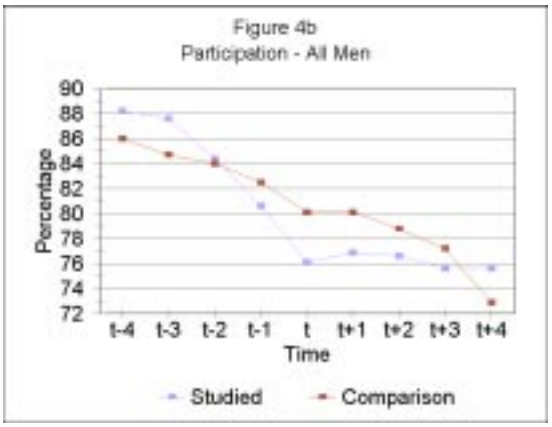


Figure 4b
Participation - All Men
90
88
86
84
82
80
78
76
74
72
Percentage
t-4 t-3 t-2 t-1 t t+1 t+2 t+3 t+4
Time
Studied
Comparison


Figure 5
Hours Worked - Non-Nursing-Home-Men
2000
1900
1800
1700
1600
Hours
t-4 t-3 t-2 t-1 t t+1 t+2 t+3 t+4
Time
Studied
Comparison

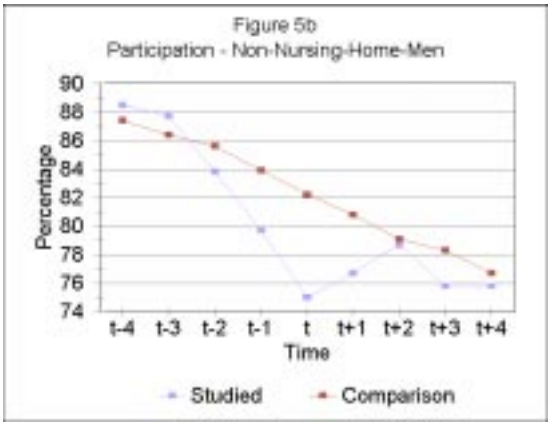


Figure 5b
Participation - Non-Nursing-Home-Men
90
88
86
84
82
80
78
76
74
Percentage
t-4 t-3 t-2 t-1 t t+1 t+2 t+3 t+4
Time
Studied
Comparison


Figure 6
Hours Worked - Nursing-Home-Men
2000
1900
1800
1700
1600
Hours
t-4 t-3 t-2 t-1 t t+1 t+2 t+3 t+4
Time
Studied
Comparison

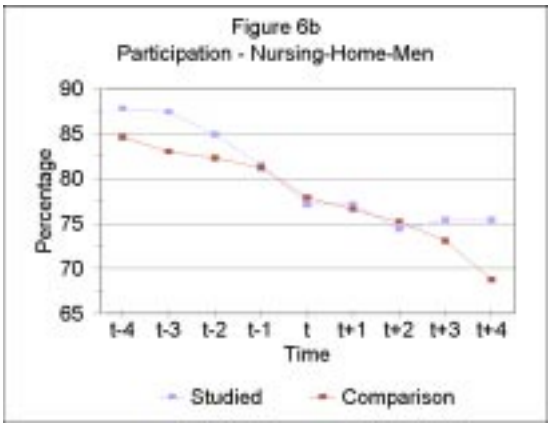


Figure 6b
Participation - Nursing-Home-Men
90
85
80
75
70
65
Percentage
t-4 t-3 t-2 t-1 t t+1 t+2 t+3 t+4
Time
Studied
Comparison

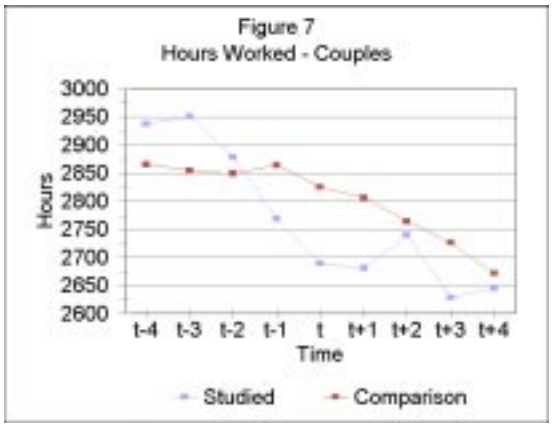
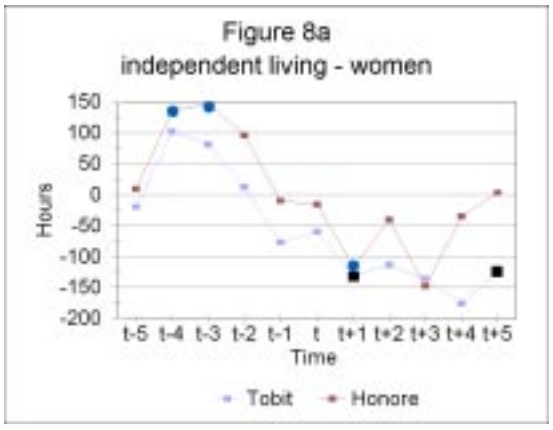
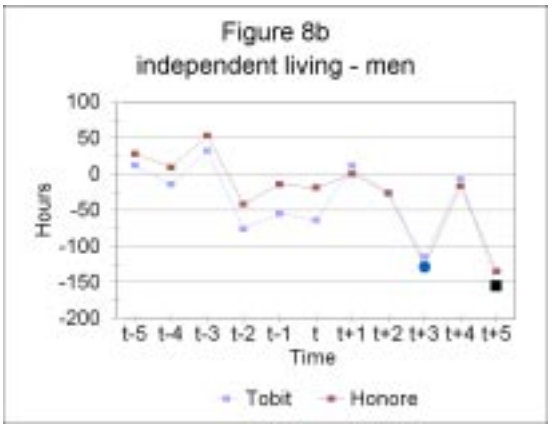
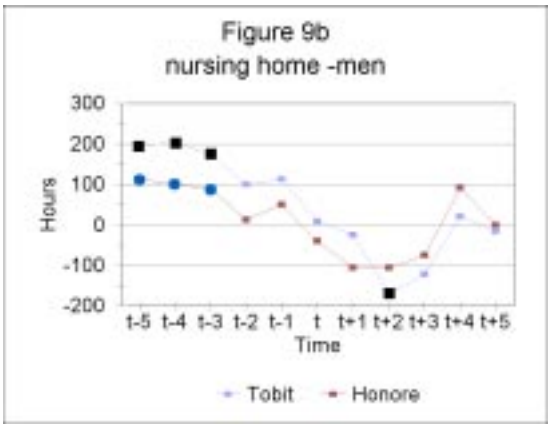


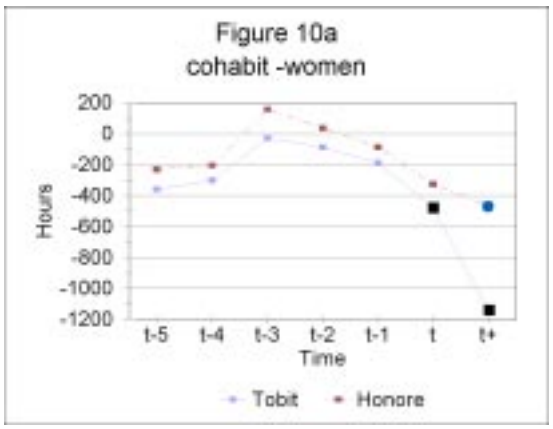
Figure 7
Hours Worked - Couples
3000
2950
2900
2850
2800
2750
2700
2650
2600
Hours
t-4 t-3 t-2 t-1 t t+1 t+2 t+3 t+4
Time
Studied
Comparison

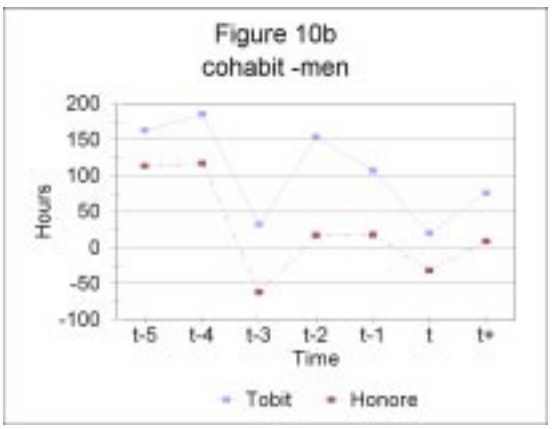
Coefficients for General Tobits and Honoré











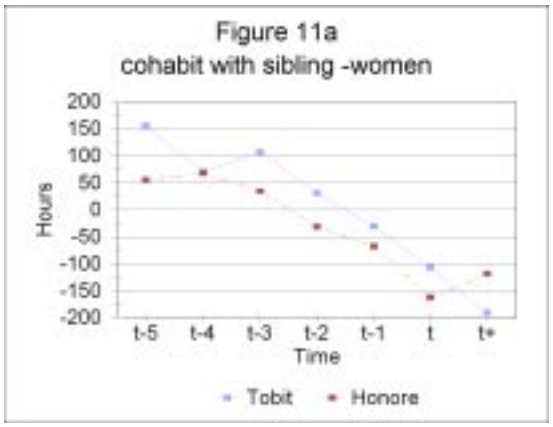


Figure 11a
cohabit with sibling -women
200
150
100
50
0
-50
-100
-150
-200
Hours
t-5
t-4
t-3
t-2
t-1
t
t+
Time
Tobit
Honore

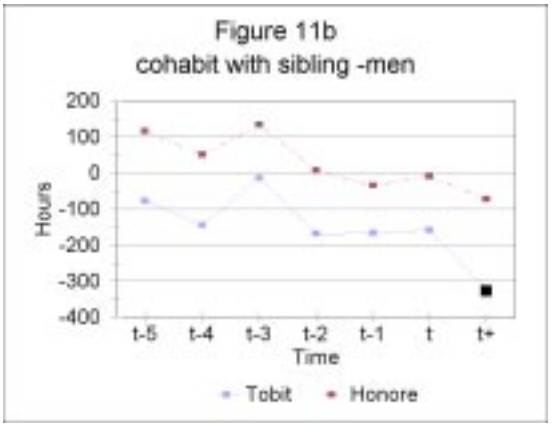


Figure 11b
cohabit with sibling -men
200
100
0
-100
-200
-300
-400
Hours
t-5
t-4
t-3
t-2
t-1
t
t+
Time
Tobit
Honore

Appendix: A brief discussion of Honoré's method

Honoré proposes a method to deal with fixed-effects in a censored regression framework for panel data. The traditional method used to eliminate fixed-effects is simply to difference each observation with other observations for the same family (or individual). However, because the data used here exhibit censoring, doing so will not lead to consistent estimates. It can easily be shown that, in the absence of censoring (i.e. where the observed dependent variables represent the true variables) and in the presence of iid error terms, the differenced error terms are symmetric and have zero expected value. However, in the presence of censoring, the observed differences in the error term will not be symmetric and will not have zero expected value. By exploiting the symmetry in the distribution in the latent variables, Honoré develops a method to trim the observed variables such that they exhibit the same symmetry as the latent variables.

The symmetry in the latent variables suggest orthogonality conditions that must hold at the true parameter value. These orthogonality conditions are then used to build the estimator. The estimator is robust to heteroscedasticity across families and non-normality or errors and allows for an unbalanced panel. Furthermore, the Honoré estimator is shown to be consistent and asymptotically normal. It is important to note that consistency is obtained as the number of individuals in the panel increases to infinity. Monte Carlo simulations suggest that the estimator performs well in small samples (where the number of individuals is greater than 200 and where each individual is observed for two periods). Given that the sample size used here is considerably larger than those used in the experiments, sample size should not be an issue.