Labour Supply Effects of Informal Caregiving in Canada

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Dans cette étude, nous évaluons, à partir de données de l'Enquête sociale générale (de Statistique Canada) un modèle traditionnel de disponibilité de main-d'œuvre, et nous examinons comment le fait d'être aidant naturel influence le comportement qu'ont sur le marché du travail les gens qui fournissent des soins à des personnes âgées de leur entourage. Dans le cas des aidants naturels qui ont déjà un emploi, les résultats de notre analyse (méthode classique des moindres carrés) suggèrent que le fait d'être aidant naturel a tendance à réduire le nombre d'heures de travail rémunéré que ces personnes fournissent, et ce, chez les hommes et chez les femmes, même si l'impact est statistiquement significatif seulement dans notre échantillon de femmes. Par ailleurs, l'estimation par la méthode des probits suggère que le fait d'être aidants naturels a un effet négatif mais non significatif sur la probabilité qu'ont ces personnes d'avoir un emploi rémunéré.

This study uses Canadian data from the 1996 General Social Survey to estimate a conventional labour supply model and examine the impacts of caregiving to elderly persons on caregivers' labour market behaviour. The results of OLS regression for employed individuals suggest that caregiving negatively impacts the number of work hours for both males and females, although the impact is statistically significant only in the female sample. Probit estimation suggests that caregiving has a negative but insignificant effect on the probability of being employed.

INTRODUCTION

As have many other developed nations, Canada has been experiencing a growing elderly population. Between 1991 and 2001 the number of Canadians over 80 years of age rose 41 percent to 932,000 (Statistics Canada 2002). At the same time, the number of seniors who have chronic diseases such as diabetes, cancer, and Alzheimer's has also increased. The rising incidence of chronic diseases has substantially increased the demand for caregiving (Senior Info Exchange 1998). To meet the rising health-care demand, the Canadian government has developed publicly funded institutional care facilities for the elderly. However, the increased cost of health care has forced provinces, especially since the 1990s, to reduce spending on the institutional care system (ibid. 1998) and to rely increasingly on community-based alternatives (Fast, Williamson and Keating 1999).

In contrast with institution-based care delivered by paid health-care workers, a vital component of community-based care is informal (Parker 1990; Wood 1991) and typically is unpaid service given by family members, neighbours or friends. The magnitude of that care is substantial: informal caregivers have been estimated to provide as much

as 80 percent or even more of the support to the elderly in Canada (Keefe 2003).

Shifting the burden away from publicly funded systems may have reduced expenditures, but it has at the same time led to substantial economic as well as non-economic costs associated with informal caregiving. There is evidence that informal caregivers incur significant costs in terms of emotional, physical, and social well-being (Health Canada 2002; Seniors Info Exchange 1998). However, they also experience market costs via reduced labour supply and the resultant foregone income (Health Canada 2002; Fast, Williamson and Keating 1999). An estimated 70 percent of male caregivers and 46 percent of female caregivers are employed full-time, and to fulfill their responsibilities as providers of care many reduce hours in the labour market or relinquish employment opportunities (Fast, Williamson and Keating 1999).

Various studies have described the non-economic costs incurred by Canadian informal caregivers (Health Canada 2002; Cranswick 1997; VON of Canada 1997; Gignac, Kevin and Benjamin 1996; Keefe and Sheva 1997; CARNET 1993). Few have examined the labour-market-related costs of informal caregiving, even though there have been a number of non-Canadian works on the topic. Studies using Canadian data have employed descriptive statistics to identify correlations between caregiving and labour supply (Health Canada 2002; Fast, Williamson and Keating 1999; Cranswick 1997; CARNET 1993). However, since correlations do not tell us about causation, there is obvious scope for more sophisticated investigation. The present paper fills a portion of the gap in the quantitative analysis by investigating the impact of Canada's informal caregiving on labour-force participation and on work hours of those who work.

After a brief review of the literature, the following section sets out the empirical model and discusses issues underlying its use. A fourth section describes the data and other empirical features, followed by presentation of results. A final section concludes.

Previous Research

Investigations of informal caregiving in Canada have been concerned mainly with the psychological and sociological consequences of caregiving. Quantitative studies generally have employed United States data, drawing mixed conclusions concerning the impact of caregiving on labour supply.

Using data from the US National Long Term Care Survey (NLTCS), Stone and Short (1990) found that primary caregivers and those caring for elders with the greatest care needs were more likely to undertake work accommodation such as unpaid leave, reduced work hours, or rearranged work schedules. Their results suggest that the prospect of having to accommodate work to the demands of caregiving can significantly reduce the likelihood of being employed.

Boaz and Mueller (1992) used 1982 NLTCS data to examine the impact of caregiving responsibilities on working hours. They found that caregiving, measured by predicted hours of unpaid help, did not affect part-time work but did have a slight negative impact on full-time work. Their estimates showed one additional hour of unpaid help per week reducing the probability of full-time employment by 0.3 percent.

In one of the few non-US studies, Carmichael and Charles (1998) used data from the 1985 United Kingdom General Household Survey to investigate the influence of informal care on the labour supply of women. They concluded that the impact was relatively small. Caregiving had a negative impact on labour market participation only when it involved a substantial time commitment; and even when amounting to more than 20 hours per week reduced the probability of participation by just 2 percent.

Caregiving was found to have a significant impact on work hours, however, reducing them by about 2.4 percent per week. The study also found that informal caregivers providing fewer than 20 hour per week were more likely to participate in the labour market than those supplying greater amounts but worked fewer hours than those providing no care at all.

Kolodinsky and Shirey (2000) used an 11-year pooled cross-sectional sample compiled by the Panel Study of Income Dynamics (PSID) to examine the impact of co-residence with an elderly parent on an adult daughter's labour supply and hours of work. They found that simply co-residing with an elderly parent had no effect on hours of work, but living with a disabled elderly parent decreased weekly employment by ten hours.

Ettner (1996) used data from the 1987 United States National Survey of Families and Households (NSFH) to estimate the impact of caring for disabled elderly parents. That study found that providing non-co-residential care to the elderly parent had significant negative impacts on hours of paid work for women but had no impact on men's hours.

As did Ettner (1996), Wolf and Saldo (1994) used NSFH data and modelled informal care responsibility as endogenous. They examine the effect of caring for an elderly parent on the employment and work hours of married women, finding no reduction in either employment or hours of work.

Empirical studies on caregiving have to deal with two potential issues: the selection of individuals into employment or selection bias and the endogeneity of caregiving. NLTCS data, used by Stone and Short (1990) and Boaz and Mueller (1992) covers only the "frail" elderly population and their caregivers and suffers from endogeneity bias since the labour-force behaviour of employed persons who act as caregivers may not be typical. Carmichael and Charles (1998) and Kolodinsky and Shirey (2000) corrected for sample selection bias but assumed caregiving to be exogenous.

Ettner (1996) and Wolf and Saldo (1994) carried out adjustments for selection and endogeneity bias but both studies used NSFH data, which is problematic in that the survey's definition of caregiving is vague and no information is given about whether respondents actually provided any care to the co-residing elderly. Studies using more sophisticated econometric techniques, including Wolf and Saldo (1994), and Carmichael and Charles (1998), dealt only with female caregivers.[1]

The objective of the present study is to identify the separate impacts of caregiving on the Canadian labour market behaviour of both male and female caregivers, taking into account selection and endogeneity biases. The study is the first of its kind using Canadian data, employing information from the 1996 General Social Survey (GSS). Unlike studies using NLTS data, the sample includes both caregivers and non-caregivers. Unlike NSFH data, the GSS provides more detailed information about caregiving and care receiving. Unlike most of other studies that deal only with female caregivers, this study will focus on both male and female caregivers, which may be children, grandchildren, spouses, friends or neighbours of the elderly.

Model Specification

Theoretical Model

The standard neoclassical approach models the allocation of time (T), a fixed resource, between two uses: paid labour, rewarded at a fixed wage rate (W), and "leisure." Hours of work are chosen to maximize a single period function with utility dependent on leisure (L) and the consumption of goods (C), subject to a financial budget constraint imposed by the wage rate (W) and non-wage income (V).

Following Wolf and Saldo (1994), the basic framework can readily be expanded to include the

role of informal caregiving. Ignoring subscripts, individuals thus will be assumed to maximize utility functions:

$$U = U (C, L, CG) \quad (1)$$

where CG denotes time devoted to non-market care activity. The expanded model has both a time constraint and a financial constraint, respectively:

$$T = H + L + CG. \quad (2a)$$

$$C = WH + V. \quad (2b)$$

In choosing to work or not, individuals compare market wage rates with non-market or shadow wages where the former, in the Mincerian framework, are determined by education and age. An individual will accept paid employment only if the market wage at least equals the shadow (reservation) wage at zero hours.

Econometric Specification

Information on individual wage rates is not available for this study. Thus, the structural determinants of wages rather than the wage rates themselves must be utilized.

Following Killingsworth (1983) the empirical labour supply model to be estimated is:

$$H^* = \alpha + \beta_1 E + \beta_2 A + \beta_3 CG + \beta_4 V + \beta_4 Z + e_2 \quad (3)$$

where H* represents desired hours of paid work; E is the individual's education level; A is his or her age, serving as a proxy for experience; Z denotes a vector of socio-demographic variables, including marital status, presence of children, number of household members, country of birth, and health status; and e_2 represents the error term, a mean zero random variable reflecting the impact of unmeasured variables on the labour supply decision. Then:

$$\text{Work} = 1 \text{ if } H^* \geq 0, \text{ Work} = 0 \text{ if } H^* < 0 \quad (3a)$$

$$\text{Work Hours } H = H^* \text{ if Work} = 1 \quad (3b)$$

Education and work experience are expected to positively impact productivity and hence the available market wage rate, so the more educated and experienced an individual, the greater the expected work hours. Caregiving reduces both time available to work and productivity. Thus, caregiving responsibility is expected to reduce the number of desired work hours.[2] Non-wage income provides opportunities to work fewer hours for any given consumption level, implying that non-wage income will negatively impact desired work time.

Married individuals typically have greater financial responsibilities than single individuals and thus are expected to work more. The presence of children is expected to negatively impact the desired work hours of females since child-rearing reduces time available for paid work. The impact of household members aged 15 and over is expected to be positive; they may themselves provide caregiving to the elderly and can also assist females in child-rearing. The influence of health is expected to be positive, while the impact of country of birth is uncertain.

No data is available for non-wage income and this study does not control for monetary transfers such as cash gifts from the person receiving informal care from the respondent. However, according to the human capital model, education is positively related with income and thus spousal education levels are included as a proxy for other family income.

Econometric Issues

Selectivity bias arises in the present study because the work hours of non-participants are not observed and since the participants are self-selected they do not comprise a random sample. For example, preferences for work presumably are on average higher in a sample of employed individuals than they would be in the general population. The consequence is that the error terms in the work hour equation are

correlated with counterparts in the selection equation and a regression line derived from data for the working subpopulation will provide statistically biased and inconsistent measures of the structural labour supply parameters. Heckman's sample selection model thus will be used to mitigate that bias.[3]

Endogeneity bias arises if unobservable characteristics simultaneously affect both caregiving and work hours. For example, individuals may have greater preference for home production over market production, choosing to work less and providing more informal care. Similarly, individuals lacking marketable skills would be less likely to find worthwhile employment and thus be more likely to engage in caregiving. In each case, ordinary regression analysis not adjusting for endogeneity would be likely to overstate the negative impact of caregiving on work hours.[4] Instrumental variable techniques thus will be utilized to correct for possible endogeneity bias. The instruments selected for that purpose are: number of brothers, number of sisters, geographic proximity to mother (i.e., co-residence or not), and geographical proximity to father (co-residence or not).

The Data

The data used in this study is from the 1996 General Social Survey (GSS-cycle 11) published by Statistics Canada. The target population of this large-scale household survey was all persons aged 15 and over, excluding residents of the Yukon Territory, the Northwest Territories, and full-time residents of institutions. Approximately 13,000 respondents were interviewed between February and December 1996 with a response rate of 85 percent.[5]

The 1996 GSS focused on assistance given or received owing to long-term health issues or physical limitations but also due to temporary circumstances. In GSS-1996, a caregiver is defined as a person who assisted a respondent due to the respondent's long-term health or physical limitations or with "checking up" or emotional support. Informal care is defined as the performance of tasks by family and friends, without pay, that help maintain or enhance independence. Respondents were asked whether they had given informal care to others in the past 12 months.

This research conducts separate analyses of males and females by age group for individuals between the ages of 15 and 64. Economists typically focus on differences in family responsibilities as the source of observed gender differences in labour market choices. Becker (1985) argued that, on average, women devote less effort to labour market activities than men primarily because of greater family responsibilities and lower levels of marketable human capital, taking the responsibilities as given. Fuchs (1971) cited the tendency for females to specialize in labour-intensive household work as the chief constraint on women's investment in human capital and hence their choice of jobs. The sample of this study comprises 2,981 males and 3,435 females. Table 1 displays the mean labour-market-related characteristics of caregivers and non-caregivers.

Table 1 shows that 17.5 percent of the males and 23 percent of the females provided care to elderly persons. Female caregivers supplied significantly more caregiving hours than males, while caregiver females worked significantly fewer hours than non-caregiver counterparts.

In comparison with figures reported in other studies, caregiving rates are higher in the present sample. Just 7 percent of the females and 5 percent of the males provided care to the elderly in Ettner (1996), presumably because that investigation considered only those who provided care to disabled parents. In Carmichael and Charles (1998), 13.4 percent of the sample reported that they provided informal care to at least one dependent. However, Carmichael and Charles' sample, comprising female respondents between the ages of 21 and 59, considered only those who provided care "on a regular basis."[6]

TABLE 1
Labour Market Characteristics of Caregivers and Non-Caregivers

	Caregiver Male	*Non-Caregiver Male*	*Caregiver Female*	*Non-Caregiver Female*
Sample Size	521	2,460	795	2,640
Average Weekly Care Hours	4.57 (0.128)		4.90* (0.109)	
Proportion Employed	0.82 (0.0169)	0.84 (0.0072)	0.69 (0.0163)	0.71 (0.0087)
Average Weekly Hours Worked	42.75 (0.75)	43.34 (0.31)	33.70 (0.56)	35.08* (0.31)

Note: The figures in the parentheses show the standard error.
*significant at the 5 percent level.

In the present study, 82 percent of male caregivers and 69 percent of female caregivers were employed. These rates can be compared with Ettner's sample in which 77 percent of male caregivers and 64 percent of female caregivers worked. In Carmichael and Charles's sample, 51 percent of female caregivers participated in the labour force, while in Wolf and Saldo (1994) the corresponding figure was 56.8 percent. The Table 1 finding that working female caregivers were employed for significantly fewer hours per week than were non-caregivers is consistent with both Carmichael and Charles (1998) and Wolf and Saldo (1994).

Appendix Table A1 provides the socio-economic profiles of caregivers and non-caregivers. Significantly more caregivers are found in the 55–64 age group while there are significantly more non-caregivers in the 15–34 group. Appendix Table A2 presents the socio-economic characteristics of working compared with non-working individuals.

EMPIRICAL RESULTS

Caregiving is constructed as a dichotomous variable with a value of unity if the sample member provided unpaid care to an elderly person and zero otherwise. Table 2 reports the marginal employment probability impacts derived from the probit equation, in which the dependent variable is set equal to unity if the individual is employed and zero otherwise.

Table 2 suggests that caregiving negatively affects the probability of employment for both genders, although the impacts are not statistically significant. The other results also are in conformity with expectations. Education has a positive effect on the probability of being employed for both males and females. Age has a positive but declining marginal impact on employment probability and the effect becomes negative for age group 55–64. Being married has a positive impact on the probability of being employed for males, while the presence of children significantly decreases females' probability of working outside the home. Health has a significant positive impact on the employment probability for both males and females. Spousal education at the Bachelor's and higher levels has negative effects on the probability of being employed for both male and female, although the effect is significant only in the female sample.

The results of the work hour regression, restricted to individuals who are employed, are given in Table 3. These results control for selection bias, but not for endogeneity of caregiving.[7]

TABLE 2
Marginal Effects in Probit Regressions

	Male		*Female*	
Variable Name	*Estimated Coefficient*	*Robust Standard Error*	*Estimated Coefficient*	*Robust Standard Error*
Age (base category: age 15 to 24)				
Age 25–34	0.099*	0.017	0.101*	0.026
Age 35–44	0.069*	0.020	0.100*	0.027
Age 45–54	0.029*	0.023	–0.004	0.033
Age 55–64	–0.227*	0.045	–0.342*	0.040
Marital status (base: single)				
Married	0.152*	0.027	0.027	0.030
Divorced	0.043	0.022	0.049	0.029
Widowed	0.035	0.042	0.055	0.044
No. of 15+ household members (base: one member)				
No. 2 to 4	0.048	0.038	0.010	0.027
No. 5 and more	0.055	0.049	0.021	0.059
Presence of children	–0.019	0.020	–0.177*	0.021
Caregiving	–0.068	0.059	–0.016	0.019
Education (base: high school)				
Elementary school	–0.075*	0.039	–0.272*	0.052
Some college/university	0.054*	0.015	0.100*	0.019
Trade diploma	0.066*	0.014	0.173*	0.017
Bachelor/Master's/PhD	0.086*	0.015	0.246*	0.016
Country of birth (base: Canada)				
UK/ Europe	–0.010	0.026	–0.020	0.035
US / South America	0.039	0.039	–0.049	0.048
Asia/Africa	–0.089*	0.034	–0.100*	0.043
Health	0.074*	0.005	0.075*	0.007
Spousal education (Base category: high school)				
Spouse – elementary school	0.053	0.048	0.065	0.044
Spouse – some college/ university	0.030	0.031	0.028	0.042
Spouse – trade diploma	–0.019	0.022	–0.033	0.031
Spouse – Bachelor/Master's/PhD	–0.013	0.030	–0.070*	0.033
Pseudo R-Square	0.2214		0.1674	

Note: *significant at the 5 percent level.

TABLE 3
Regressions with Dependent Variable Weekly Work Hours

	Male		*Female*	
Variable Name	*Estimated Coefficient*	*Robust Standard Error*	*Estimated Coefficient*	*Robust Standard Error*
Age (base category: age 15–24)				
Age 25–34	7.96*	1.22	8.52*	1.14
Age 35–44	7.93*	1.30	8.38*	1.14
Age 45–54	6.91*	1.29	6.70*	1.18
Age 55–64	4.70*	1.60	–2.49	1.98
Marital status (base: single)				
Married	6.64*	1.19	2.68*	0.983
Divorced	2.82*	1.21	3.72*	1.07
Widowed	0.322	2.55	2.86	1.80
No. of 15+ in household (base: one)				
No. 2 to 4	3.75	3.09	1.45	0.918
No. 5 and more	4.68	2.91	1.88	2.00
Presence of Children	–0.626	0.733	–5.14*	–0.848
Caregiving	–0.870	0.774	–2.14*	–0.664
Education (base: high school)				
Elementary school	2.69	1.84	–0.794	3.05
Some college/university	0.725	0.898	2.09*	0.913
Trade diploma	–0.169	0.722	3.32*	0.951
Bachelor/Master's/PhD	1.17	0.765	7.03*	1.48
Country of birth (base: Canada)				
UK/Europe	–1.06	0.987	0.270	1.07
US/South America	–1.11	1.54	0.336	2.00
Asia/Africa	–2.85*	1.25	–2.20	1.54
Health	0.419	0.295	0.834*	0.426
Spousal education (base: high school)				
Spouse – elementary school	2.61	2.07	2.28	1.17
Spouse – some college/university	–2.13	1.24	–0.780	1.27
Spouse – trade diploma	–1.19	0.844	–1.44	1.05
Spouse – Bachelor/Master's/PhD	–0.069	0.935	–3.33*	1.06
Lambda	0.335	0.661	7.38*	2.94
Constant	34.73*	1.17	21.83*	3.44
Log pseudo likelihood	–11651		–11780	

Note: *significant at the 5 percent level.

Table 3 shows *lambda* to be statistically significant in the female regression, suggesting positive selectivity bias, but insignificant in the male regression, implying the absence of bias there.

In the female sample, the caregiving coefficient is negative and significant with respect to weekly work hours, but in the male sample it is not.[8] Ettner (1996) also found that caregiving had no impact on male work hours, but non-co-residential care to elderly parent had significant negative impact on female hours. The present study's conclusion that caregiving significantly reduces female work hours is also consistent with Carmichael and Charles (1998) and with Kolodinsky and Shirey's (2001) findings that caring for disabled parents had a significant negative impact on daughters' work hours.

This investigation utilizes a procedure suggested by Rivers and Vuong (1988) to check whether caregiving is endogenous in the probit employment equation. To check for endogeneity in the work hour equation it uses a procedure suggested by Hausman (1978). The first step involves identifying variables that are correlated with the responsibility for caregiving but do not directly influence labour market decisions. The instruments selected for that purpose are: number of brothers, number of sisters, geographic proximity to mother (co-residence or not), and geographical proximity to father. The binary caregiving variable was then regressed on the instruments and all exogenous variables.

Appendix Table A3 displays results from the caregiving regressions. They show that age and co-residence with mother have significant positive effects on the likelihood of being a caregiver. Having four or more sisters has a significant negative coefficient in the female regression. From the F-statistics, the six instruments are jointly significant in the regressions for both males and females, implying that the identified instruments have significant impacts on the probability of being a caregiver.[9] The residuals obtained from these regressions then were included in the probit employment equation and OLS work hour equation along with the caregiving variable to determine whether the residuals had significant coefficients in these equations.

Appendix Tables A4 and A5 show the results.[10] In neither equation is the residual variable (Res) significant, implying that caregiving was not endogenous.

Conclusion

This study used Canadian data from the 1996 General Social Survey to estimate a conventional labour supply model and examine the impacts of caregiving to elderly persons on caregivers' labour market behaviour. In the empirical estimation, the study utilized the Heckman sample selection procedure to check for selectivity bias that might have arisen from excluding individuals who are not employed. The results showed evidence of selectivity bias in the case of the female data, but not in the male data.

The results of OLS regression for employed individuals suggest that caregiving negatively impacts the number of work hours for both males and females, although the impact is statistically significant only in the female sample. The probit estimation of the employment probability model suggests that caregiving has a negative but insignificant effect on the probability of being employed. Other findings, generally as hypothesized, are that: (i) education has a positive effect on the probability of being employed for both genders and a significant positive impact on female work hours; (ii) being married positively impacts males' probability of being employed, although both married and divorced individuals work more than single individuals; (iii) the presence of children negatively affects female employment probabilities and also reduces female work hours; (iv) spousal education at the bachelor's and higher levels has a statistically

significant negative impact on females' probability of being employed and also on female work hours; and (v) health status has a significant positive impact on the probability of being employed for both males and females while positively influencing the number of hours worked by females.

The results suggest that females who provide care to elderly persons work about 2.14 hours fewer per week than non-caregivers, amounting to about 6 percent of an average female non-caregiver's weekly work hours. As a consequence of informal caregiving, therefore, female caregivers earn less and contribute less to pension funds, and the government collects less tax revenue. These findings have obvious implications for policy in light of the fact that the elderly population in Canada is predicted to continue its increase. According to Statistics Canada projections (2001), the number of people aged 65 and over is expected to rise from nearly 4 million in 2000 to just under 8 million by 2026. The projection also suggests that people aged 80 and over will experience the most rapid growth and there will be around 1.9 million seniors in this group by 2026, more than double the 2000 level. Since aging is associated with increased incidence of chronic conditions and disability, pressures to provide informal care can be expected to increase as well (Keefe, Carriere and Legare 2004).

The present study has determined that a substantial share of the female population is involved in care of the elderly and that a high percentage of female caregivers work. Working 2.14 hours less per week by a female caregiver may not represent a substantial loss from an individual caregiver's point of view. However, the aggregate number of female work hours lost due to caregiving is substantial and can be expected to rise as the demand for informal care continues to grow. Policymakers, while projecting future labour supply would thus be well advised to take into account the expected female work hour offset stemming from informal elder care.

Future studies on caregiving may look for better instruments since the results of endogeneity tests crucially depend on the quality of instruments. Precision of the endogeneity tests and IV estimates could have been improved if better instruments were available. In efforts to identify fully the costs of informal caregiving, future studies might usefully investigate the impact on the probabilities of being employed full-time versus part-time. Similarly, future studies might usefully examine the impact of informal caregiving on absenteeism. Finally, since the health of caregivers may be affected by stress associated with caregiving activity, the impacts of caregiving on health-system utilization by caregivers would be a potentially valuable line of inquiry.

Notes

For their insightful comments and suggestions the author thanks Professor Ardeshir Sepehri, Professor Wayne Simpson, Professor Evelyn Forget, Professor Livio Di Matteo, the editor of this journal, and two referees. The author is grateful to Professor Jim Seldon for his editorial assistance and valuable comments. All remaining errors and omissions are the responsibility of the author.

[1]Wolf and Saldo (1994) use a double selection procedure to deal with both selection and endogeneity bias. In the first stage, they utilize a bivariate probit technique to estimate caregiving and employment equations. They then use the resultant selection terms in the work hour equation. Carmichael and Charles (1998) use the Heckman two-step procedure to deal with selection bias. The selection term λ obtained from the first stage probit employment equation is included in the work hour equation to eliminate selection bias. Owing to data limitations they did not attempt to correct for endogeneity bias.

[2]It is assumed that individuals can work as many hours as desired, subject to a non-negativity constraint.

[3]This study estimates Heckman sample selection model using Maximum Likelihood approach.

[4]Second-order effects from correlations with other regressors may change the direction of bias (Ettner 1996), making it difficult to predict whether ordinary regression

will over- or underestimate the effects of caregiving. One must then rely on empirical analysis to reveal it.

[5]The GSS-1996 consists of Canadians aged 15 and over. Around 46 percent of individuals in the GSS survey are in the 65 and over age group. Sample size for this study is restricted to individuals in the age group 15 to 64. Some individuals are not included in the study because of missing data for key variables. Because of these reasons, about half of the original respondents end up in the sample for this study.

[6]This study focuses on the individuals in the working age group (15–64). Around 15 percent of working individuals in the sample come from the 15–24 age group. On the other hand, relatively more people in the 55 to 64 age group provide informal care.

[7]The study also runs regression for male sample without correcting for sample selection bias. There are minor changes in the coefficients except that the variable "age 55–64" has now significant negative impacts on work hours.

[8]The t-statistic formula $(b_1 - b_2) / \{\text{Est. Var } [b_1] + \text{Est. Var } [b_2]\}^{1/2}$ with $(n_1 + n_2 - 4)$ degrees of freedom rejected the null hypothesis at 1 percent level that caregiving variable has similar impact for both male and female.

[9]For the male regression F = 4.97 with P –Value= .00000, R-Squared: 0.04; for the female regression F = 12.53 P-value= .00000, R-Squared: 0.05.

[10]Table A5 suggests that caregiving is not an endogenous variable in the labour supply regressions. However, the caregiving coefficient in the female regression indicates that caregiving reduces weekly work hours by 11. This coefficient is about five times larger than the caregiving coefficient in Table 3.

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APPENDIX

TABLE A1
Socio-Economic Profiles of Individuals (by caregiving status and gender)

	Caregiver Male	*Non-Caregiver Male*	*Caregiver Female*	*Non-Caregiver Female*
Sample size	521	2,460	795	2,640
Age group				
15–24	0.14* (0.015)	0.19 (0.007)	0.11* (0.011)	0.18 (0.007)
25–34	0.21* (0.018)	0.26 (0.008)	0.20* (0.014)	0.27 (0.008)
35–44	0.29 (0.019)	0.26 (0.008)	0.29 (0.016)	0.27 (0.008)
45–54	0.21 (0.017)	0.18 (0.007)	0.25* (0.015)	0.16 (0.007)
55–64	0.15* (0.015)	0.11 (0.006)	0.15* (0.012)	0.12 (0.006)
Marital status				
Single	0.24* (0.021)	0.34 (0.011)	0.24* (0.015)	0.28 (0.010)
Married	0.65* (0.020)	0.55 (0.010)	0.58* (0.017)	0.55 (0.009)
Divorced	0.07 (0.011)	0.09 (0.005)	0.13 (0.012)	0.14 (0.006)
Widow	0.04* (0.002)	0.01 (0.002)	0.04 (0.007)	0.03 (0.003)
No. of children less than 15 years of age				
One or more children	0.32 (0.020)	0.29 (0.009)	0.34* (0.016)	0.38 (0.009)
Respondents' personal income				
No income	0.02 (0.007)	0.04 (0.004)	0.09 (0.011)	0.10 (0.006)
Less than $5,000	0.06 (0.011)	0.05 (0.005)	0.11 (0.012)	0.13 (0.007)
$5,000– $14,999	0.16 (0.021)	0.17 (0.015)	0.30 (0.014)	0.28 (0.008)
$15,000–$29,999	0.26 (0.021)	0.23 (0.009)	0.27 (0.017)	0.26 (0.009)
$30,000–$49,999	0.31 (0.022)	0.28 (0.010)	0.16 (0.014)	0.17 (0.008)
$50,000–$79,999	0.13* (0.016)	0.18 (0.008)	0.05 (0.009)	0.05 (0.004)
$80,000 and over	0.05 (0.010)	0.05 (0.005)	0.012 (0.004)	0.006 (0.001)
Education level				
Elementary school	0.03 (0.007)	0.03 (0.003)	0.03 (0.006)	0.04 (0.003)
High school	0.35 (0.020)	0.37 (0.009)	0.34 (0.016)	0.36 (0.009)
Some college/university	0.16 (0.016)	0.16 (0.007)	0.18 (0.013)	0.17 (0.007)
Trade diploma	0.26 (0.019)	0.25 (0.008)	0.29 (0.016)	0.26 (0.008)
Bachelor/Master's/PhD	0.19 (0.017)	0.18 (0.007)	0.15 (0.012)	0.16 (0.007)
Country of birth				
Canada	0.87* (0.014)	0.83 (0.007)	0.90* (0.010)	0.83 (0.007)
US/South America	0.02 (0.006)	0.02 (0.002)	0.02 (0.005)	0.04 (0.003)
UK/Europe	0.06 (0.010)	0.08 (0.005)	0.04 (0.007)	0.07 (0.005)
Asia/Africa	0.04 (0.008)	0.06 (0.004)	0.03 (0.005)	0.05 (0.004)

Notes: Standard errors are in the parentheses.
*denotes significant differences between caregiving and non-caregiving individuals at 5 percent level.

TABLE A2
Socio-Economic Profiles of Individuals (by employment status and gender)

	Working Male	*Non-Working Male*	*Working Female*	*Non-Working Female*
Sample size	2,508	473	2,445	990
Caregiving variable				
Caregiver	0.17 (0.007)	0.20 (0.018)	0.22 (0.008)	0.24 (0.013)
Age group				
15–24	0.15* (0.007)	0.29 (0.020)	0.16 (0.007)	0.16 (0.011)
25–34	0.28* (0.008)	0.10 (0.014)	0.28* (0.009)	0.19 (0.012)
35–44	0.29* (0.009)	0.15 (0.016)	0.29* (0.009)	0.21 (0.013)
45–54	0.19* (0.007)	0.14 (0.016)	0.19* (0.007)	0.15 (0.011)
55–64	0.08* (0.005)	0.30 (0.021)	0.06* (0.005)	0.26 (0.014)
Marital status				
Single	0.31* (0.008)	0.45 (0.010)	0.30* (0.008)	0.25 (0.012)
Married	0.60* (0.009)	0.41 (0.022)	0.55 (0.010)	0.56 (0.015)
Divorced	0.08* (0.005)	0.11 (0.014)	0.13 (0.006)	0.14 (0.011)
Widow	0.009* (0.001)	0.03 (0.008)	0.02* (0.003)	0.05 (0.007)
No. of children less than 15				
one or more children	0.33* (0.009)	0.13 (0.015)	0.36 (0.009)	0.38 (0.015)
Respondents' personal income				
No income	0.007* (0.001)	0.21 (0.021)	0.01* (0.002)	0.32 (0.016)
Less than $5,000	0.05* (0.004)	0.10 (0.016)	0.09* (0.006)	0.21 (0.014)
$5,000– $14,999	0.12* (0.012)	0.38 (0.021)	0.23* (0.009)	0.35 (0.017)
$15,000–$29,999	0.24* (0.009)	0.20 (0.020)	0.33* (0.010)	0.07 (0.009)
$30,000–$49,999	0.32* (0.010)	0.08 (0.014)	0.23* (0.009)	0.01 (0.004)
$50,000–$79,999	0.20* (0.008)	0.02 (0.008)	0.07* (0.005)	0.005 (0.002)
$80,000 and over	0.06* (0.005)	0.005 (0.003)	0.009 (0.002)	0.003 (0.002)
Education level				
Elementary school	0.02* (0.002)	0.10 (0.013)	0.01* (0.002)	0.10 (0.009)
High school	0.34* (0.009)	0.47 (0.022)	0.32* (0.009)	0.60 (0.012)
Some college/university	0.16* (0.007)	0.14 (0.016)	0.18* (0.007)	0.15 (0.011)
Trade diploma	0.26* (0.008)	0.15 (0.016)	0.29* (0.009)	0.19 (0.012)
Bachelor/Master's/PhD	0.20* (0.008)	0.10 (0.013)	0.19* (0.008)	0.06 (0.007)
Country of birth				
Canada	0.84 (0.007)	0.81 (0.017)	0.85* (0.007)	0.82 (0.012)
US/South America	0.02 (0.003)	0.01 (0.005)	0.03 (0.003)	0.04 (0.006)
UK/Europe	0.07 (0.005)	0.08 (0.012)	0.06 (0.004)	0.07 (0.008)
Asia/Africa	0.05* (0.004)	0.07 (0.012)	0.04 (0.004)	0.05 (0.007)

Notes: Standard errors are in the parentheses.
*denotes significant differences between working and non-working individuals evaluated at 5 percent level.

TABLE A3
OLS Regressions (dependent variable: caregiving = 1, non caregiving = 0)

	Male		*Female*	
Variable Name	*Estimated Coefficient*	*Standard Error*	*Estimated Coefficient*	*Standard Error*
Age 25–34	0.021	0.025	0.081*	0.026
Age 35–44	0.062*	0.027	0.149*	0.027
Age 45–54	0.082*	0.029	0.239*	0.029
Age 55–64	0.131*	0.033	0.194*	0.032
Married	–0.0007	0.026	–0.016	0.025
Divorced	–0.007	0.029	–0.021	0.025
Widowed	–0.118*	–0.17	0.034	0.042
No. 2 to 4	0.019	0.023	0.017	0.023
No. 5 and more	0.122*	0.047	0.109*	0.051
Presence of children	0.001	0.026	0.0003	0.018
Elementary school	–0.0003	0.038	–0.028	0.037
Some college/university	0.005	0.020	0.055*	0.020
Trade diploma	0.008	0.018	0.049*	0.018
Bachelor/Master's/PhD	0.011	0.021	0.025	0.023
UK/Europe	–0.054	0.025	–0.099	0.028
US/South America	–0.006	0.958	–0.095*	0.028
Asia/Africa	–0.071*	1.722	–0.066*	0.033
Health	0.0005	0.006	0.008	0.006
Spouse – elementary school	0.024	0.045	0.089	0.038
Spouse – some college/university	0.046	0.034	–0.040	0.036
Spouse – trade diploma	0.051	0.023	–0.004	0.025
Spouse – Bachelor/Master's/PhD	0.020	0.026	0.010	0.026
No. of brother 1 to 3	–0.005	0.015	0.031*	0.016
No. of brother 4 and more	0.076*	0.025	0.033	0.026
No. of sister 1 to 3	0.012	0.016	–0.002	0.016
No. of sister 4 and more	0.008	0.025	–0.048*	0.024
Co-residence with mother	0.068*	0.020	0.141*	0.020
Co-residence with father	–0.002	0.022	–0.017	0.022
Constant	0.062	0.037	0.054	0.038

Note: *denotes that the coefficient is significant at the 5 percent level.

TABLE A4
Marginal Effects in Probit Regressions to Test the Endogeneity of the Caregiving Variable
(dependent variable: employed = 1, not employed = 0)

	Male		*Female*	
Variable Name	*Estimated Coefficient*	*Robust Standard Error*	*Estimated Coefficient*	*Robust Standard Error*
Age 25–34	0.096*	0.017	0.095*	0.027
Age 35–44	0.058*	0.023	0.088*	0.031
Age 45–54	0.014	0.026	–0.028	0.043
Age 55–64	–0.268*	0.056	–0.361*	0.045
Married	0.155*	0.027	0.034	0.031
Divorced	0.045	0.022	0.053	0.029
Widowed	0.057	0.038	0.053	0.044
No. 2 to 4	0.056	0.085	0.003	0.027
No. 5 and more	0.098	0.066	0.003	0.064
Presence of children	–0.019	0.020	–0.178*	0.022
Caregiving	0.119	0.102	0.099	0.120
Residual	–0.218	0.181	–0.123	0.136
Elementary school	–0.077*	0.040	–0.266*	0.052
Some college/university	0.055*	0.015	0.094*	0.021
Trade diploma	0.065*	0.014	0.168*	0.017
Bachelor/Master's/PhD	0.087*	0.015	0.245*	0.016
UK/Europe	0.004	0.027	–0.007	0.037
US/South America	0.041	0.038	–0.036	0.049
Asia/Africa	–0.069*	0.035	–0.090*	0.044
Health	0.073*	0.005	0.076*	0.007
Spouse – elementary school	–0.061	0.049	–0.078	0.047
Spouse – some college/university	0.021	0.034	0.034	0.042
Spouse – trade diploma	0.009	0.024	–0.033	0.031
Spouse – Bachelor/Master's/PhD	–0.017	0.031	–0.071*	0.033

Note: Residuals are the difference between the observed values and those predicted by the regression equation.
*denotes that the coefficient is significant at the 5 percent level.

TABLE A5
OLS Regressions to Test the Endogeneity of the Caregiving Variable (dependent variable: work hour)

	Male		*Female*	
Variable Name	*Estimated Coefficient*	*Robust Standard Error*	*Estimated Coefficient*	*Robust Standard Error*
Age 25–34	8.11*	1.24	9.00*	1.16
Age 35–44	8.30*	1.36	9.42*	1.24
Age 45–54	7.36*	1.34	8.49*	1.45
Age 55–64	5.43*	1.79	–1.27	2.09
Married	6.59*	1.19	2.27*	0.999
Divorced	2.75*	1.21	3.45*	1.09
Widowed	–0.45	2.71	3.11	1.79
No. 2 to 4 children	–3.54	3.13	–1.03	0.925
No. 5 and more	–3.76	3.21	0.437	2.08
Presence of children	1.14	0.764	–5.04*	0.846
Caregiving	–7.06	6.91	–11.19*	4.36
Residual	6.24	6.99	6.29	5.84
Elementary school	2.73	1.89	–1.05	3.04
Some college/university	0.713	0.896	3.74*	0.953
Trade diploma	–0.155	0.724	2.58*	0..958
Bachelor/Master's/PhD	1.14	0.764	7.21*	1.46
UK/Europe	–1.46	1.09	–0.705	1.13
US/South America	–1.16	1.46	–0.616	2.05
Asia/Africa	–3.25*	1.14	–2.92	1.55
Health	0.433	0.295	0.780	0.425
Spouse – elementary school	–2.47	2.09	–1.54	1.79
Spouse – some college/university	–1.88	1.26	–1.22	1.30
Spouse – trade diploma	–0.897	0.866	–1.49	1.05
Spouse – Bachelor/Master's/PhD	–0.019	0.940	–3.29*	1.06
Lambda	0.303	0.691	7.43*	2.89
Constant	35.33*	1.89	23.01*	3.49

Note: Residuals are the difference between the observed values and those predicted by the regression equation.
*denotes that the coefficient is significant at the 5 percent level.