Labor Supply of Married Women in Canada, 1995

by

Bin Zhao

(2947743)

Major Paper presented to the

Department of Economics of the University of Ottawa

in partial fulfillment of the requirements of the M.A. Degree

Supervisor: Professor David Gray

Ottawa, Ontario

April 2005

Labor Supply of Married Women in Canada, 1995

ABSTRACT

Based on the data from the 1996 Census for Canada, this study examines the labor supply behavior of married women in Canada. To eliminate the inherent selection bias, Heckman's sample selection bias procedure is employed in the wage rate and hours of work equations. Most estimated coefficients are consistent with prior expectations. The estimated elasticities for labor supply are similar to those found by Smith and Stelcner (1988) in their study based on the data from the 1981 census of Canada, and also to those reported in Nakamura and Nakamura (1979) based on the data from the 1971 census of Canada.

1. INTRODUCTION

The labor supply behavior of married women has been one of the more active areas in empirical labor economics research. One probable reason is that married women are believed to be more flexible in their patterns of labor supply. Another possible reason is that the labor force participation rates of women have increased greatly over the much of the last half-century. In 1961, Canadian women's labor force participation rate was less than 30%, but subsequently it increased by 10 percentage points every decade, reaching about 60% by 1991.[1]

Earlier studies on the labor force participation of the women obtained the result that the females' labor supply behavior is different from that of males. It was found that as the wage rate increases, the hours of labor supplied by women increases. In

[1] Benjamin, D., M. Gunderson, and W. C. Riddell (2002) P34-35, Figure 2.2

contrast, the response of males to the increase of wage rate was estimated to be negative. However, after the 1970s, the empirical findings indicated that the labor supply behavior of married women became more like that of males. Nakamura, Nakamura, and Cullen (1979), Nakamura and Nakamura (1981), Nakamura and Nakamura (1983) and Robinson (1985) obtained similar results that the own-wage elasticities of labor supply for females were small in magnitude and similar to those found for males.

Based on the data from Public Use Microdata File (PUMF) of Families of the 1996 Census for Canada, this study tries to update three aspects of the labor supply behavior of married women in Canada: the participation decision, the wage rate, and the decision of how many hours to work. To correct for the sample selection bias, this paper uses the Heckman (1980) technique. This study will compare wage elasticities with those reported by Nakamura, Nakamura, and Cullen (1979) and Smith (1988) based on the 1996 Canadian census, which are much more recent data.

This paper is organized according to the following outline. In the next section, several important previous studies on the labor supply of married women in Canada are reviewed, and their results on the wage elasticities are compared. The third section discusses the characteristics of the data and defines the variables that are included in the estimating equations. The fourth section presents the empirical results for the three labor supply equations. The final section summarizes the main findings of this paper.

2. REVIEW OF THE LITERATURE

Most studies of the behavior of married women involve predictions of how labor supply responds to changes in the wage rate. Heckman (1993) reviewed the labor supply studies over the preceding twenty years. He pointed out a fundamental change

that emerged in the late 1960s. Prior to that time, most labor supply models did not distinguish between the labor force participation decision and the choice of hours of work. However, the lack of distinction gave rise to a problem, namely how to deal with the wages of those people who are not employed. The issue was that one does not observe the wage of non-participants, but one knows that they made a choice to supply no hours. Heckman (1979) pointed out that this kind of non-random selection bias would, in general, occur if we estimate the wage rate equation and the labor supply equation based only on the samples of workers with positive hours worked. Heckman derived a practical empirical process designed to mitigate sample selection bias. In this paper, similar techniques are employed.

Labor economists often used the data for women to test labor supply behavior, partially because women were believed to be more sensitive to changes of the independent variables, and also partially because the labor supply of women was becoming more and more important because the rate of participation of women was dramatically rising in the past two decades. In the earlier literature before 1979, the researchers believed that the males worked more hours and received relatively higher wage rates than the females. The income effects of the wage rates for the males were expected to dominate the substitution effects. Consequently, the labor supply curve for the males was backward bending. Since the females worked fewer hours and had relative higher shadow wages, the substitution effects were expected to dominate the income effects. This implied that the labor supply curve of women had a positive slope. Many earlier empirical studies on the behavior of married women, for example, Hall (1973) and Boskin (1973) for the United States and Carliner (1980) for Canada, confirmed this view. However, Nakamura and Nakamura (1979, 1981, 1983), Robinson and Tomes (1985) and Smith and Stelcner (1988) presented contrary results

on the labor supply behavior of married women. They report that the estimated elasticities of own-wage for women were negative and similar to those reported for men.

Since this paper tries to update the study on the labor supply behavior of married women in Canada, the review on the earlier studies is indispensable. The literature review will begin with the study of Nakamura, Nakamura, and Cullen (1979).

2.1. Nakamura, Nakamura, and Cullen (1979)

In order to make clearer the model to be estimated in the next section, the model of Nakamura, Nakamura, and Cullen (1979) is reviewed first. These authors derive the model from maximizing a twice-differentiable quasi-concave conditional utility function $U(x, l; Z^*)$ subject to the income and time constraints.

$$px = A + I + wh \qquad (1)$$

$$T = l + h \qquad (2)$$

The variables are defined as follows.

x: the Hicksian composite good representing the consumption of all goods other than leisure.

l: the number of leisure hours for the wife.

T: the total time endowment available.

h: the number of hours of work supplied by wife. $0 \le h \le T$

p: the price of the Hicksian composite good.

A: the asset income

I: the husband's annual income

Z^*: the vector of the constraint variables.

The Lagrangean equation is $V = U(x, T-h; Z^*) + \gamma h + \lambda(A + I + wh - px)$

The Kuhn-Tucker conditions corresponding to (1), (2), $\gamma \geq 0$,

$$U_x - \lambda p = 0 \qquad (3)$$

$$-U_l + \gamma + \lambda w = 0 \qquad (4)$$

$$\gamma h = 0 \qquad (5)$$

where $U_x = \partial U / \partial x$ and $U_l = \partial U / \partial l$.

Rewriting (1) and (3), we obtain

$$x = (A + I + wh)/p \qquad (6)$$

$$\lambda = U_x / p \qquad (7)$$

From (4), we obtain $w = (U_1/\lambda) - (\gamma/\lambda) = w^* - (\gamma/\lambda)$, where

$$w^* = (U_1/\lambda) \qquad (8)$$

is the shadow price of a wife's time—the wage that women ask for one more working hour.

From (6) and (7), we obtain λ as a function of h, p, $A+I$, wh, and Z^*. Taking the log of both sides of (8) and linearizing it around Z_i^*, A_i, I_i, $\ln w_i$, and h_i for the i[th] married women, we obtain

$$\ln w_i^* = \begin{cases} \beta_0 + \beta_1 Z_i^* + \beta_2 A_i + \beta_3 I_i + \beta_4 \ln w_i + \beta_5 h_i + \mu_i^* & \text{if } h_i > 0 \\ \beta_0 + \beta_1 Z_i^* + \beta_2 A_i + \beta_3 I_i + \mu_i^* & \text{if } h_i = 0 \end{cases} \qquad (9)$$

Assume the wife's offered wage w is modeled as

$$\ln w_i = \alpha_0 + \alpha_1 Z_i + \alpha_2 E_i + \mu_i \qquad (10)$$

where Z and E are the vectors of personal and regional variables, respectively.

From (9), the wife's equilibrium hours ($w^* = w$) of work is expressed as:

$$h_i = \frac{1}{\beta_5}\left[(1-\beta_4)\ln w_i - \beta_0 - \beta_1 Z_i^* - \beta_2 A_i - \beta_3 I_i - \mu_i^*\right] \qquad \text{at } h_i > 0 \qquad (11)$$

The participation equation for married women is expressed as a probit model:

$$P(D_i = 1) = P(h_i > 0) = P\left(\ln w_i - \ln w_i^* \big|_{h_i=0} > 0\right) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\phi_i} e^{(-t^2/2)} dt \qquad (12)$$

where the dummy variable $D_i = \begin{cases} 1 & \text{if the } i^{th} \text{ married woman works} \\ 0 & \text{if the } i^{th} \text{ married woman does not work} \end{cases}$

ϕ_i can be defined as follows.

$$\phi_i = \ln w_i - \ln w_i^* = \frac{1}{\sigma}\left[(\alpha_0 - \beta_0) + \alpha_i Z_i - \beta_1 Z_i^* + \alpha_2 E_i - \beta_2 A_i - \beta_3 I_i\right] \qquad (13)$$

The equations (10) and (11) involve a problem of sample selection bias because data are missing on the variables for those whose hours of work is zero. Only those individuals whose market wages exceed their reservation wages are included in the sample because they can be observed. Since the sample is not selected at random, the wage rate and hours of work equations would be affected by the problem of sample selection bias. Heckman (1979) devised a procedure to deal with this econometric issue. It involves estimating an equation of the sample selection process and incorporating a variable capturing this process in the primary estimating equation (10 and 11 in this case). This additional exogenous variable in the second equation is called the inverse Mill's ratio.

Following the technique of Heckman (1979), the inverse Mill's ratio is expressed as

$$\lambda_i = \frac{f(\phi_i)}{1 - F(\phi_i)}, \qquad (14)$$

where $f(\phi_i)$ and $F(\phi_i)$ are, respectively, the density and distribution functions for the standard normal random variable. $F(\phi_i)$ is the probability that an observation is selected into the observed sample for the equations (10) and (11). The probit coefficient estimates may be used consistently to estimate ϕ_i, and hence λ_i.

The offered wage rate equation is written as:

$$\ln w_i = \alpha_0 + \alpha_1 Z_i + \alpha_2 E_i + \alpha_3 \lambda_i + V_i \qquad for\ h_i > 0 \qquad (15)$$

The hours of work equation is written as:

$$h_i = \frac{1}{\beta_5}\left[(1-\beta_4)\ln w_i - \beta_0 - \beta_1 Z_i^* - \beta_2 A_i - \beta_3 I_i\right] + \beta_6 \lambda_i + V_i^* \quad for\ h_i \rangle 0 \qquad (16)$$

The Family Public Use Sample from the 1971 census of Canada is used to estimate the three final equations. Most of estimated coefficients are statistically significant at a 95% level, with the exception of the coefficient of the provincial unemployment rate in the offered wage equation. Actually, what surprises the authors is that the signs of coefficients for the offered wages in the hours of work equation are negative. Most labor economists believe that they must be positive on the theoretical grounds. Furthermore, the wage elasticities evaluated at the mean hours of work are similar to these estimated for men. The wage elasticities evaluated at the mean hours of work for the eight age groups are showed in Table 1.

TABLE 1
The estimates of the labor supply elasticities for married women by Nakamura (1979)

	Age groups							
	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59
Wage elasticity	-0.194	-0.313	-0.173	-0.199	-0.32	0.094	0.299	0.12

Note: 1. See Nakamura, Nakamura and Cullen (1979), P. 800
2. Calculated from the Family File of the Public Use Sample of the 1971 Canadian Census.
3. Evaluated at the mean hours of work.

In Nakamura, Nakamura, and Cullen (1979)'s study, the probit equation (12) is first estimated for all the observations. Based on the estimated probit equation, one can calculate the selection correction term λ_i . Subsequently, the offered wage equation (15) and the hours of work equation (16) are estimated. The vector of Z_i^* includes those variables that can affect the reservation wage of married women, such

as the number of children younger than 6, the number of children aged at 6-14, and the product of these two figures for the number of children. These are all proxies of the cost of working for married women. The husband's income I_i, the asset income A_i, and the family income per person (excluding the wife's earning) are included as the proxies of the other sources of income. The number of children between 19-24 years of age variable acts as the proxy of the financial obligations. The vector Z_i includes the variables of educational attainment, religious affiliation, and the number of younger children (as the proxies of wife's recent working experience). E_i, the regional labor market condition variables, includes the average unemployment rate in 1970 for each province, the local opportunity for jobs index for each province, and the rural-area dummy variable. To capture how age affects the offered wage, the analysis is carried out for eleven different age groups.

2.2. Nakamura and Nakamura (1981)

Nakamura and Nakamura (1981) compare the labor behavior of married women in the United States and Canada. The model in their study is similar to the one employed in their earlier paper, but what was different is that in the newer study, the authors consider the impact of the differences between the income tax systems in the United States and Canada, which has an impact on net wages. The income of husbands is net of income taxes. The data used in their study are drawn from the State Public Use Sample of Basic Records of the 1970 U.S. Census and the Family File of the Public Use Sample of the 1971 Canadian Census. The results in their paper confirm the findings in the preceding study. Most of the wage elasticities of Canadian married women evaluated at the means of the hours and the income variables are negative, and range from –0.37 to 0.143 depending on the age group. For married women in the

U.S., the elasticities range from –0.39 to 0.204, and most of them are also negative. Table 2 presents their results.

TABLE 2
The estimates of the labor supply elasticities by Nakamura and Nakamura (1981)

	Own-wage		Income		Compensated wage	
Age group	U. S.	Can.	U. S.	Can.	U. S.	Can.
25-29	-0.39	-0.37	-0.253	-0.22	-0.137	-0.15
30-34	-0.244	-0.27	-0.358	-0.495	0.114	0.225
35-39	-0.165	-0.305	-0.049	-0.188	-0.116	-0.117
40-44	0.021	-0.086	-0.117	-0.269	0.138	0.183
45-49	-0.016	-0.107	-0.185	-0.207	0.169	0.1
50-54	-0.005	0.143	-0.086	-0.271	0.081	0.414
55-59	0.204	-0.051	-0.045	-0.076	0.249	0.025

Note: 1: See Nakamura and Nakamura (1981) table XI, P483.
2: Calculated from 1 percent sub sample from the 5 percent primary State Public Use Sample of Basic Records of the 1970 U.S. Census; from the 1 percent Family File of the Public Use Sample of the 1971 Canadian Census.
3. Evaluate at mean of wage variable and mean hours of work for each age group.

2.3. Carliner, Robinson, and Tomes (1980)

Carliner, Robinson, and Tomes (1980) study the labor supply and the fertility decisions of married women using the Family File of the Public Use Sample from the 1971 Canadian Census. Their results suggest that the highly educated women and those women living in cities are likely to supply more hours of work. The variable of husbands' income has a negative effect on the number of work hours supplied by married women. The coefficient of the variable of Catholic is insignificant for labor supply. Women living in Ontario and in the Prairie Provinces are likely to work more hours than women elsewhere at a given wage. The estimated coefficients of the educational attainment variables are positive. The authors suggest that if the variables of education were considered as the proxies for the potential market wages, the wage elasticities would be positive.

2.4. Nakamura, and Nakamura (1983)

In order to test the assumption that the coefficients of explanatory variables are stable over the range of variation for annual hours of work, Nakamura, and Nakamura (1983) study the part-time and full-time work behavior of married women. In their study, the effects of income taxes are also taken into account. The results suggest that the coefficients are unstable, and that the labor supply curves are backward bending both for the wives working long hours and for those working short hours. The uncompensated wage elasticities for both the part-time and full-time female workers are reported in the Table 3.

TABLE 3

Uncompensated wage elasticities by child status and annual hours of work for Canada and the United States

	Child status and hours of work of wife									
	Children<6		Children<6 and 6-14		Children 6-14		None<15		None ever born	
	0<h<1400	h>=1400	0<h<1400	h>=1400	0<h<1400	h>=1400	0<h<1400	h>=1400	0<h<1400	h>=1400
Canada	-0.108	-0.048	-0.128	-0.04	-0.197	-0.036	-0.179	-0.054	-0.083	-0.087
United States	-0.176	-0.031	-0.178	-0.049	-0.163	-0.03	-0.145	-0.033	-0.12	-0.037

Note: 1. See Nakamura and Nakamura (1983) table 3, P. 246.
2. Calculated from 1 percent sub sample from the 5 percent primary State Public Use Sample of Basic Records of the 1970 U.S. Census; from the 1 percent Family File of the Public Use Sample of the 1971 Canadian Census.
3. Evaluate at mean hourly wage rate and annual hours of work for each group.

In their study, Nakamura and Nakamura explain that the adjustment for sample selection bias is the main reason why their results for the estimated elasticity of labor supply tend to be negative. They argue that the earlier research obtains only the total effect that includes the positive effect of wages on the participation decision. Further, the results of the earlier studies are conditional on wives participating in the labor market, which leads to a larger and positively biased estimated coefficient for the wage rate variable in the labor supply equation.

2.5. Robinson and Tomes (1985)

Robinson and Tomes (1985) note in their article that there are some drawbacks in the census data. For example, data concerning the actual annual number of hours of work are unavailable. In previous studies, the annual hours of work normally were computed by multiplying the number of weeks worked by wives in one year by the number of hours worked in the reference week. The wage rates are computed by dividing the observed annual earnings by computed annual hours of work. Further, the hours of work are presented in intervals. These approximations give rise to the problem of measurement error. To deal with those problems, they employ data from the 1979 Quality of Life Survey to study female labor supply in Canada, which contains a direct measure of the hourly wage rate and the hours of work for women. Fewer sources of measurement errors are thought to be involved in this survey.

In their study, the authors estimate three different versions of female hours of work equations: one uncorrected for selection bias, one corrected for selection bias, and one including instrumental variables. An instrumental variable estimator for the wage rates is used in the hours work equation because the wage rate probably is not independent of disturbance term of the hours of work equation. The empirical results indicate that the wage elasticities in the three models are negative and statistically significant at a 95% confidence level. The values of wage elasticities for the probit equation and the wage rate equation are similar to the results obtained by Nakamura, Nakamura, and Cullen (1979), and to those values typically reported for men. Their results provide strong support for the findings of Nakamura (1979): the increase of offered wage rate lowers the hours of work for married women, and this negative effect may be much more than that for men. Table 4 presents the results of Robinson and Tomes.

TABLE 4
The estimates of labor supply elasticities by Robinson (1985)

	Hourly wage sample			Hourly paid sample		
	Uncorrected	Corrected	Wage inst.	Uncorrected	Corrected	Wage inst.
Compensated wage elasticity	-0.2242	-0.231	-0.8492	-0.1883	-0.2034	-0.437

Note: 1. See Robinson and Tomes (1985) TABLE 2, P. 161.
2. Calculated from the data of the 1979 Quality of Life Survey.

2.6. Borjas (1980)

Borjas (1980) questioned the negative relationship between the hours of work and the wage rates for women. As discussed in the previous paragraph, in most of the literature, the wage rate is computed by dividing the annual (weekly) earnings by the annual (weekly) hours. If the hours variable is not correctly measured, this could generate a negative relationship between the annual hours variable (in the left side of the hours of work equation) and the wage rate variable (in the right side of the hours of work equation). In other words, due to the appearance of hours variable on both sides of the hours of work equation, a negative correlation between the hours of work and the wage rates is created. This could result in a negative estimate of wage elasticity. When the issue is only measurement error, then we have a situation of attenuation bias, which biases the magnitude of the estimated coefficient toward zero. The author uses the predicted wage variable as the instrument variable for the offered wage in the hours of work equation. The predicted wages are not theoretically correlated to the hours of work. In his study, Borjas find that "once the correction steps were taken, it was found that the strong negative wage elasticities vanished. The unbiased estimates of the wage elasticities were zero or positive, depending on the specification of the labor-supply function."(Borjas 1980, P. 420)

2.7. Smith and Stelcner (1988)

Based on the data from the Public Use Sample Tape of the 1981 Canada Census, Smith and Stelcner (1988) re-examine the labor supply behavior of married women in Canada. In their study, they introduce a selection bias correction variable based on the procedure of Heckman (1980) (the inverse of the Mill's ratio) into the labor supply functions in order to mitigate the selection bias. They also use the technique adopted in Nakamura and Nakamura (1981) to deal with the effects of income taxes on the labor supply of married women. They reported that the elasticities of hours of work to the change of wage rate are small in magnitude and insignificant. Table 5 presents their results.

TABLE 5

Estimates of labour supply elasticities by Smith and Stelcner (1980)

	Annual hours		
Age group	Own-wage	Income	Compensated wage
20-34	0.149	-0.184	0.333
35-54	0.028	-0.077	0.105
20-54	0.1	-0.116	0.216

Note: 1. See Smith and Stelcner (1980) TABLE 4, P. 865.
2. Evaluated at the means of the fitted net wage rates, fitted labor supply, and virtual income.

Following the study of Smith and Stelcner (1988), this paper tries to model the labor force participation behavior of married women in Canada based on the data from the 1996 census of Canada. This paper applies the predicted wage variable as the instrumental variable for the offered wage in the hours of work equation to deal with the bias mentioned in Borjas (1980) and the same Heckman (1980) technique in Nakamura, Nakamura and Cullen (1979), Nakamura and Nakamura (1981, 1983), and Smith and Stelcner (1988) to correct the selection bias.

3. STATISTICAL MODEL

In order to update the other studies on married women in Canada, I follow the model presented in the previous review section. In this section, I will define the labor supply functions of participation, wage rate and hours of work for married women, along with their explanatory variables.

3.1. Labor Supply Equation

Labor supply decisions can be roughly divided into two basic categories: "between labor supply choices at the extensive margin (i.e., labor-force participation and employment choices) and choices at the intensive margin (i.e., choices about hours of work or weeks of work for workers)." (Heckman 1993, P. 116) To analyze these two different margins of labor choices, three different equations for labor supply will be derived.

Borrowing from the model in Nakamura and Nakamura (1979), the probit equation of participation for the i^{th} married woman, can be expressed as:

$$\begin{aligned} & prob(D_i = 1) \\ & = \int_{-\infty}^{\gamma' X_{1i}} f(t)dt \\ & = F(\gamma' X_{1i}) \end{aligned} \qquad (17)$$

The function $F(\cdot)$ denotes the standard normal distribution. A set of variables that are expected to affect participation of married women, such as age, education, husband's income, and language, are included in the vector X_1.

In order to analyze the intensive margin of labor supply, the offered wage rate equation (18) and the hours of work equation (19) are constructed. They are similar to the equations (15) and (16).

Offered wage rate equation: $\ln(w_i) = \alpha' X_{2i} + \beta\lambda_i + \mu_{2i}$ (18)

Hours of work equation: $h_i = \varphi' X_{3i} + \nu\lambda_i + \mu_{3i}$ (19)

The dependent variable $\ln(w_i)$ is the logarithm of hourly wage rate w_i, and h_i is the annual hours of work. The groups of independent variables X_{2i} and X_{3i} include the variables of schooling, language, mobility, and region. In order to mitigate the problem of sample selectivity bias, the variable of the inverse of Mills's ratio, λ_i, is incorporated into both of the labor supply equations (18) and (19).

3.2. Data and Variables

The data are taken from the Statistics Canada Census 1996 Public Use Microdata File (PUMF) of Families, based on a 2.8% sample of the population. The sample is restricted to 77,190 married couples having wives between fifteen and fifty-four years of age. The married women in this study are defined as the female spouses and female common-law partners. Divorced, separated, never married, and widowed women are not included in the sample. Observations with any of following characteristics are discarded: immigrants who arrived after 1995, wives who are unpaid family workers or self-employed, husbands over seventy-five years of age, residents in Prince Edward Island, the Yukon and the Northwest Territories, and missing data. An employed labor force participant is defined as a woman who reported positive earnings and positive labor supply.

The labor force participant equation (17), the hourly wage rate equation (18), and the hours of work equation (19) can be expressed as follows:

$$\Pr ob(D_i = 1) = \int_{-\infty}^{\gamma' X_{1i}} f(t)dt$$
$$= F(\gamma' X_{1i}) \tag{20}$$
$$= F\begin{pmatrix} \gamma_0 + \gamma_1 age_i + \gamma_2 age_i^{\,2} + \gamma_3 schooling_{1i} + \gamma_4 schooling_{2i} + \gamma_5 schooling_{3i} \\ + \gamma_6 schooling_{4i} + \gamma_7 schooling_{5i} + \gamma_8 schooling_{6i} + \gamma_9 children_{1i} \\ + \gamma_{10} children_{2i} + \gamma_{11} children_{3i} + \gamma_{12} language_{1i} + \gamma_{13} language_{2i} \\ + \gamma_{14} language_{3i} + \gamma_{15} language_{4i} + \gamma_{16} language_{5i} + \gamma_{17} citysize_i \\ + \gamma_{18} mobility_{1i} + \gamma_{19} mobility_{2i} + \gamma_{20} region_{1i} + \gamma_{21} region_{2i} + \gamma_{22} region_{3i} \\ + \gamma_{23} region_{4i} + \gamma_{24} virtualincome_i \end{pmatrix}$$

$$\ln(w_i) = \alpha' X_{2i} + \mu_{2i}$$
$$= \alpha_0 + \alpha_1 age_i + \alpha_2 age_i^{\,2} + \alpha_3 schooling_{1i} + \alpha_4 schooling_{2i}$$
$$+ \alpha_5 schooling_{3i} + \alpha_6 schooling_{4i} + \alpha_7 schooling_{5i} + \alpha_8 schooling_{6i}$$
$$+ \alpha_9 children_{1i} + \alpha_{10} language_{1i} + \alpha_{11} language_{2i} + \alpha_{12} language_{3i} \tag{21}$$
$$+ \alpha_{13} language_{4i} + \alpha_{14} language_{5i} + \alpha_{15} citysize_i + \alpha_{16} mobility_{1i}$$
$$+ \alpha_{17} mobility_{2i} + \alpha_{18} region_{1i} + \alpha_{19} region_{2i} + \alpha_{20} region_{3i}$$
$$+ \alpha_{21} region_{4i} + \alpha_{22} \lambda_i + \mu_{2i}$$

$$h_i = \varphi' X_{3i} + \mu_{3i}$$
$$= \varphi_0 + \varphi_1 (\ln \hat{w}_i) + \varphi_2 virtualincome_i + \varphi_3 citysize_i + \varphi_4 mobility_{1i}$$
$$+ \varphi_5 mobility_{2i} + \varphi_6 language_{1i} + \varphi_7 language_{2i} + \varphi_8 language_{3i} \tag{22}$$
$$+ \varphi_9 language_{4i} + \varphi_{10} language_{5i} + \varphi_{11} children_{1i} + \varphi_{12} children_{2i}$$
$$+ \varphi_{13} \lambda_i + \mu_{3i}$$

The explanatory variables are defined as following:

age_i : Age of the i[th] member in the sample.

age_i^2 : Square of age_i divided by 10.

Education: The first 5 variables are binary variables concerning educational attainment. The group of individuals without any trade certificate or with only a high school diploma or below is the omitted reference group.

$$schooling_{1i} = \begin{cases} 1 & \text{if university with post} - \text{graduate degree} \\ 0 & \text{if otherwise} \end{cases}$$

$$schooling_{2i} = \begin{cases} 1 & \text{if university with bachelor's degree} \\ 0 & \text{if otherwise} \end{cases}$$

$$schooling_{3i} = \begin{cases} 1 & \text{if university below bachelor's degree} \\ 0 & \text{if otherwise} \end{cases}$$

$$schooling_{4i} = \begin{cases} 1 & \text{if post-secondary, university} \\ 0 & \text{if otherwise} \end{cases}$$

$$schooling_{5i} = \begin{cases} 1 & \text{if trade certificate} \\ 0 & \text{if otherwise} \end{cases}$$

$schooling_{6i}$: Number of years of elementary/secondary schooling. This is a continuous variable.

Fertility: Both the presence of children as well as the composition of children within a family are likely to have an important impact on the labor supply of married women.

$children_{1i}$: Number of children ever born.

$children_{2i}$: Number of pre-school children at home

$children_{3i}$: Number of children 6-14 years of age at home

Languages: They are dummy variables concerning mother tongue and official language spoken. The group whose mother tongue is English and who speak only English is the reference group.

$$language_{1i} = \begin{cases} 1 & \text{if mother tongue English, English and French spoken} \\ 0 & \text{if otherwise} \end{cases}$$

$$language_{2i} = \begin{cases} 1 & \text{if mother tongue French, French only spoken} \\ 0 & \text{if otherwise} \end{cases}$$

$$language_{3i} = \begin{cases} 1 & \text{if mother tongue French, English and French spoken} \\ 0 & \text{if otherwise} \end{cases}$$

$$language_{4i} = \begin{cases} 1 & \text{if mother tongue other, English only spoken} \\ 0 & \text{if otherwise} \end{cases}$$

$$language_{5i} = \begin{cases} 1 & \text{if mother tongue other, French only or bilingual} \\ 0 & \text{if otherwise} \end{cases}$$

$citysize_i$: City size is denoted by the number of residents of the census metropolitan area where the i^{th} married women is living.[2] In the census file, a census metropolitan area (CMA) is defined as "one of a very large urban area, together with adjacent urban and rural areas which have a high degree of economic and social integration with that urban area. A CMA is delineated around an urban area (called the urban core and having a population of at least 100,000, based on the previous census)". [3]

Mobility: For the first mobility variable, the omitted reference group is the group of wives who immigrated to Canada before 1980 and who are native-born Canadians. For the second mobility variable, the omitted reference group is the group of wives who did not move among the provinces within Canada during 1991-1996.

$$mobility_{1i} = \begin{cases} 1 & \text{if immigrant to Canada in } 1980 \text{ or later} \\ 0 & \text{if otherwise} \end{cases}$$

$$mobility_{2i} = \begin{cases} 1 & \text{if from different province or census division } 1991-1996 \\ 0 & \text{if otherwise} \end{cases}$$

Region: They are binary variables indicating the regions where the individual was living in 1995. The group of those living in BC is the reference group.

$$region_{1i} = \begin{cases} 1 & \text{if Altantic} \\ 0 & \text{if otherwise} \end{cases}$$

$$region_{2i} = \begin{cases} 1 & \text{if Ontario} \\ 0 & \text{if otherwise} \end{cases}$$

---

[2] The data pertaining to the census metropolitan area of an individual are available from "1996 Census of Canada, Table 93F0021XDB96001: Population by Single Years of Age (110) Showing Sex (3), for Census Metropolitan Areas, Tracted Census Agglomerations, and Census Tracts (100% Data)".

[3] The report by the University of Western Ontario's Internet Data Library System, version II, for "Census of Canada, 1996. Public Use Microdata File (PUMF) of Families"

$$region_{3i} = \begin{cases} 1 & \text{if Quebec} \\ 0 & \text{if otherwise} \end{cases}$$

$$region_{4i} = \begin{cases} 1 & \text{if Prairies} \\ 0 & \text{if otherwise} \end{cases}$$

$virtualincome_i$: This income includes mainly the husband's income, government transfer payments, investment income, self-employment income, and other money income.

λ_i : The selection bias correction variable: the inverse of the Mill's ratio.

For the selection of explanatory variables, I follow Smith and Stelcner's (1988) study on the labor supply of married women in Canada based on the 1980 Census. Comparing labor supply behavior of married women between the years 1980 and 1995 is thus feasible. As described by Smith and Stelcner (1988), the variables of age and the number of children are included in order to measure the impact of working experience and interruption of the work experience. The variables of city size and regions are used to reflect the effects of local and regional labor market conditions and labor market opportunities. The language variables are included to assess the effects of different cultural backgrounds. The mobility variables are used to measure the impacts of international and inter-regional migration on labor supply. The virtual income is defined as the income of the family at zero hours worked by the wife. For the children variables, both the number of children ever born as well as the composition of children (according to age groups) have effects on the decision of participation of married women.

In the wage rate equation (21), I exclude the variable of composition of children and virtual income because the composition of children and virtual income have little correlation with the wage rates of wives. But I do include the variable of the number

of children ever born because this variable can be the proxy of working experience and interruptions of it that are supposed to have some impact on the wage rate. The dependent variable $\ln w_i$ is the logarithm of hourly wage rates. It is computed by dividing the i^{th} married women's annual earnings in 1995 by the hours worked in 1995, h_i. h_i is calculated by multiplying the actual weeks worked in 1995 by the actual hours worked in the reference week.

As discussed by Borjas (1980), the computed wage variable generally involves the "division bias" because the variable of h_i appears on both sides of the hours of work equation, and this bias militates toward a negative estimated coefficient for the wage rate variable in the hours of work equation. To deal with this bias, the predicted wage rate $\ln \hat{w}_i$ is used in the hours of work equation as an instrument for the observed wage rate. Since the wage rate is thought to have a strong correlation with educational attainment, only the fitted wage rate variable is included as an instrument of the wage rate in the hours of work equation.

In this paper, the effects of income taxes are not considered. In general, this omission would affect the coefficients of the estimates. Within a single country the hourly wage rate before taxes can be a proxy of income net of tax. Such correction may also be helpful in studying the labor supply for a single country. However, when comparing countries with very different tax laws (e.g. Nakamura and Nakamura 1981), correcting for income taxes would be imperative. One of important personal characteristics, religious affiliation, is believed to have an important impact on people's attitudes and tastes toward working. Since the 1996 census has no data on religious affiliation, religion variables are not included in this analysis[4].

[4] Questions on religions appear in the census every ten years.

4. EMPIRICAL RESULTS

4.1. Probit Estimates (Table 6)

The columns (1), (2), and (3) in Table 6 present the results of the estimated probit equation (20) for three different age groups: the 15-54 years of age group, the 15-34 years of age group, and the 35-54 years of age group, respectively.

Age: For all age groups pooled together (column one), the estimated coefficient of the age variable is positive, but that of age squared variable is negative. This indicates that the variable of age has a U-shaped effect on the probability of participating: the probability of participation of married women increases as their age increases. Since the estimated coefficient of age squared variable is negative, the total effect is positive but it will gradually reach a peak and then turn into a decreasing effect. The results for the pooled age group indicate that before age 54, the probability of participation of married women always increases with age and does not reach the peak. However, Benjamin, Gunderson, and Riddell (2002) show evidence that the labor force participation rate of married women in Canada in 1996 reached its peak in the 35-44 age group and steeply decreased for those over 55 years of age. Smith and Stelcner (1988) also show that the labor force participation of married women is a U-shaped profile (according to age) based on Canadian data in 1980. The age decomposition reveals is that the effects of the age and age squared variables are much sharper for women aged 15-34 years. For the 35-54 years of age group, the estimated coefficient is even insignificant.

Schooling: For all three age groups, the positive sign of the coefficients of schooling is consistent with the expectation that the schooling variables have positive effects on the probability of participation for married women. The value of the estimated coefficients of schooling variables—the point estimates for higher levels

TABLE 6

Probit estimates of probability of participation (dummy dependent variable equals 1 for workers)

Explanatory variable	Age groups 15-54 (1)	15-34 (2)	35-54 (3)
Constant	-1.082*	-1.391*	0.458
	(-12.205)	(-5.663)	(0.964)
Age: years	0.063*	0.105*	-0.017
	(14.305)	(5.687)	(-0.781)
Age: years squared/10	-0.01*	-0.017*	-0.0004
	(-16.915)	(-4.622)	(-0.179)
Schooling: university with post-graduate degree	0.478*	0.274*	0.542*
	(17.871)	(5.767)	(16.622)
Schooling: university with bachelor's degree	0.337*	0.253*	0.348*
	(19.416)	(9.013)	(15.455)
Schooling: university below bachelor's degree	0.248*	0.204*	0.256*
	(11.377)	(5.47)	(9.455)
Schooling: post-secondary, university	0.032	0.007	0.037
	(1.139)	(0.17)	(1.015)
Schooling: trade certificate	0.137*	0.113*	0.139*
	(5.523)	(2.866)	(4.304)
Schooling: number of years of elementary/secondary schooling	0.118*	0.093*	0.123*
	(33.794)	(13.296)	(30.083)
Children: number ever born	-0.008	-0.258*	0.022*
	(-1.135)	(-7.195)	(2.83)
Children: number of pre-schoolers at home	-0.375*	-0.19*	-0.341*
	(-35.889)	(-4.855)	(-23.917)
Children: number aged 6-14 at home	-0.128*	0.027	-0.117*
	(-13.872)	(0.697)	(-11.466)
Language: mother tongue English, English and French spoken	0.117*	0.121*	0.112*
	(4.342)	(2.818)	(3.215)
Language: mother tongue French, French only spoken	-0.022	0.077**	-0.062**
	(-0.839)	(1.674)	(-1.901)
Language: mother tongue French, English and French spoken	0.204*	0.261*	0.184*
	(8.5)	(6.26)	(6.231)
Language: mother tongue other, English only spoken	-0.094*	-0.142*	-0.076*
	(-6.168)	(-5.117)	(-4.172)
Language: mother tongue other, French only or bilingual	-0.013	-0.132*	0.059
	(-0.436)	(-2.625)	(1.518)
City size: resident of a census metropolitan area	0.004	-0.002	0.005
	(1.108)	(-0.375)	(0.998)

TABLE 6 (concluded)

Explanatory variables	Age groups 15-54 (1)	15-34 (2)	35-54 (3)
Mobility: immigrant to Canada in 1980 or later	-0.311*	-0.266*	-0.323*
	(-19.043)	(-9.874)	(-15.257)
Mobility: from different province or census division 1991-96	-0.314*	-0.295*	-0.345*
	(-22.981)	(-14.849)	(-18.106)
Region: Atlantic	-0.155*	-0.097	-0.188*
	(-3.976)	(-1.463)	(-3.861)
Region: Quebec	-0.189*	-0.236*	-0.158*
	(-7.183)	(-5.275)	(-4.831)
Region: Ontario	-0.0008	0.002	0.003
	(-0.044)	(0.078)	(0.15)
Region: Prairies	0.045*	0.038	0.053*
	(2.212)	(1.113)	(2.09)
Virtual income in units of $1,000 at zero labor supply	-0.003*	-0.00005	-0.0036*
	(-17.127)	(-0.12)	(-19.078)
Proportion of workers that participate	0.763	0.7651	0.7618
Number of observations	77,190	27,770	49,420

NOTE: Numbers in parentheses are t-statistics.
*: Statistically significant at the level of 97.5% confidence
**: Statistically significant at the level of 95% confidence

are greater than the point estimates for the indicators for lower levels— obviously indicate that the more educated the married woman is, the more likely she is to participate in the labor force. "In principle, higher education should be associated with higher market wages, and an increased likelihood of working. Alternatively, education may be correlated with preferences for working, or with reduced desired fertility, so that the reservation wages of more educated women may also be lower"(Benjamin, Gunderson, and Riddell 2002, P. 52). The positive estimated coefficient for the variable of the number of years of elementary/secondary schooling also confirms this trend.

Compared with the younger wives (column 2), the older wives (column 3) are more likely to be affected by the schooling variables. Ceteris paribus, the older wives with the same educational degree have a higher likelihood to participate in the labor force than younger wives have. This is probably because most the older wives are more likely to have completed their education.

Fertility: Normally the presence of children has a negative effect on the probability of participation for married women, so the estimated coefficients of the fertility variables are expected to be negative. As shown in Table 6, most of the estimated coefficients of the fertility variables are negative, with exception of the estimated coefficient for the variable of number of children ever born for the older wives group. It is positive and statistically significant. Deeper study of the effect of the composition of children can perhaps shed more light on this result. It is obvious that the coefficients of pre-school children are higher in the magnitude than those for the indicator of children aged 6-14 for all three estimating samples. The presence of younger children has much more negative effects than the presence of older children. Since older wives tend to have older children, the number of children ever born

should have a much less negative effect on older wives than that on younger wives. In the column 2, the coefficient of children: number aged 6-14 at home is positive but insignificant. In Smith and Stelcner's study (1988), the estimated coefficient for children number ever born is significant only for the younger group.

Language: The language-related factors have interesting effects on the probability of participation. Comparing the first three language variables, note that relative to the reference group of unilingual Anglophones, bilingual francophones have the highest probability of participation, and unilingual francophones have the lowest probability. This seems to imply that there is a huge gap in the participation between bilingual and unilingual francophones. Note also that the coefficients of unilingual francophone variables are negative for the 34-54 years of age group and for the pooled group. For the 15-34 age group, however, the effect is positive. This suggests that younger, unilingual, francophone wives tend to have a high rate of participation in the labor force. In Smith and Stelcner (1988), most of the coefficients of the language variables are insignificant. They also obtained the result that the French language has negative effects on participation.

Another part of the results that deserves some attention is the point that having a mother tongue other than English and French has a negative impact on the probability of participation, and this applies for the "English only spoken" and the "French only spoken or bilingual" indicators. This reflects the fact that married women with mother tongues other than English or French have a lower likelihood of participating, but these effects are stronger for the younger wives. Compared with unilingual wives, bilingual wives still have a higher probability of participation, which perhaps implies bilingualism has a strong positive factor affecting participation in the labor markets.

City size: The estimated coefficients for the indicators of city size are not statistically significant from zero. This probably indicates that the local labor market conditions have little effect on the participation of married women. In the Smith and Stelcner (1988) study based on the 1981 census, the estimates are all positive, indicating the larger the census metropolitan area, the more likely it is that the married women participate.

Mobility: Both of the mobility variables have negative effects on the probability of participation across all age groups. Those wives who immigrate to Canada after 1980 or who moved from different province or census division during 1991-1996 are less likely to participate in the labor force. The negative effects of mobility from outside of Canada and of mobility within Canada are similar in magnitude. Furthermore, the mobility variables have stronger negative impacts for the older married women than for the younger wives.

Region: In regards to the regional variables, moving from the east to the west of Canada, there is an empirical pattern of married women gradually becoming more likely to participate in the worker force. Relative to the reference group of wives living in BC, wives living in Atlantic Provinces and Quebec have the lower likelihood of participation, and wives living in the Prairies have the highest likelihood of participation. However, the effect on wives living in Ontario is not significant. This means that the likelihood of participation for wives living in Ontario is similar to that for wives living in BC. This pattern is driven mostly by older women, as many of the estimates for younger wives are insignificant. Older wives in the Atlantic Provinces have a lower than average probability of participating. However, older wives in both Quebec and the Prairie Provinces seem to have a higher than average likelihood of participation.

Virtual income: As expected, the level of non-labor income is estimated to have a negative effect on the participation probabilities of married women, and the group of 35-54 years of age is more responsive than the group of 15-34 years of age.

4.2. Estimates For The Wage Rate Equation (Table 7)

Table 7 presents the results for the hourly market wage rate equation. Most of the coefficients of the exogenous variables are statistically significant. This specification resembles a standard earnings function.

Age: The positive sign of the estimated coefficient for the age variable and the negative sign of the estimated coefficients for the age squared variable indicate that age-wage profile is U-shaped as discussed before. But the wage rate of the older wives group seems to be less influenced by their age, since the estimated coefficients of the age variables are all statistically insignificant.

Schooling: All schooling variables have the expected positive effects on the wage rate relative to the reference group (which has the lowest level of educational attainment), and the higher the degree, the stronger the positive effects on the wage rate. This result is consistent with the expectation that higher educational attainment increases the wage rate. Relative to the omitted reference category, those holding post-graduate degrees earn 65% more, those holding bachelor degrees earn 47% more, and those holding degrees below the bachelor level earn 28% more. Since the estimate of the trade certificate indicator is insignificant, those wives holding trade certificates earn about the same wages as the reference category. Comparing the three age groups, it appears that the effects of schooling on the three different age groups are very similar.

TABLE 7

Market wage parameter estimates, corrected for selectivity bias

(Dependent variable: logarithm of hourly wage rate)

	Age groups		
Explanatory variables	15-54 (1)	15-34 (2)	35-54 (3)
Constant	0.998*	0.39*	2.445*
	(17.887)	(2.505)	(9.069)
Age: years	0.074*	0.157*	0.008
	(27.392)	(13.702)	(0.686)
Age: years squared/10	-0.009*	-0.025*	-0.002
	(-25.01)	(-11.442)	(-1.277)
Schooling: university with post-graduate degree	0.65*	0.634*	0.689*
	(45.292)	(21.987)	(40.48)
Schooling: university with bachelor's degree	0.471*	0.469*	0.504*
	(47.065)	(25.986)	(40.327)
Schooling: university below bachelor's degree	0.282*	0.299*	0.295*
	(23.606)	(13.866)	(20.279)
Schooling: post-secondary, university	0.039*	0.006	0.06*
	(2.439)	(0.248)	(2.902)
Schooling: trade certificate	0.008	0.002	0.033**
	(0.576)	(0.076)	(1.798)
Schooling: number of years of elementary/secondary schooling	0.102*	0.102*	0.106*
	(34.175)	(16.121)	(30.02)
Children: number ever born	-0.06*	-0.144*	-0.054*
	(-16.055)	(-13.073)	(-13.259)
Language: mother tongue English, English and French spoken	0.085*	0.081*	0.107*
	(6.181)	(3.669)	(6.058)
Language: mother tongue French, French only spoken	-0.001	-0.003	0
	(-0.063)	(-0.093)	(0.018)
Language: mother tongue French, English and French spoken	0.186*	0.245*	0.183*
	(13.302)	(9.729)	(10.781)
Language: mother tongue other, English only spoken	-0.099*	-0.104*	-0.102*
	(-10.563)	(-5.714)	(-9.307)
Language: mother tongue other, French only or bilingual	-0.03	0.012	-0.052*
	(-1.605)	(0.375)	(-2.318)
City size: resident of a census metropolitan area	0.023*	0.028*	0.02*
	(10.248)	(7.247)	(7.287)

TABLE 7 (concluded)

Explanatory variables	Age groups 15-54 (1)	15-34 (2)	35-54 (3)
Mobility: immigrant to Canada in 1980 or later	-0.373*	-0.436*	-0.375*
	(-31.601)	(-20.861)	(-25.261)
Mobility: from different province or census division 1991-96	-0.243*	-0.268*	-0.275*
	(-24.524)	(-16.355)	(-19.433)
Region: Atlantic	-0.325*	-0.392*	-0.301*
	(-14.438)	(-10.555)	(-10.603)
Region: Quebec	-0.27*	-0.344*	-0.25*
	(-16.93)	(-12.174)	(-12.922)
Region: Ontario	-0.071*	-0.065*	-0.071*
	(-7.106)	(-3.732)	(-5.801)
Region: Prairies	-0.124*	-0.113*	-0.124*
	(-10.865)	(-5.716)	(-8.827)
Selection bias correction variable	-0.624*	0.856*	-0.643*
	(-30.16)	(-18.734)	(-23.804)
Adjusted R-squared	0.132	0.12	0.13
Mean of dependent variable	2.68	2.57	2.73
Standard deviation	0.65477	0.65825	0.6506
Number of observations	48,552	16,460	32,092

NOTE: Numbers in parentheses are t-statistics.
*: Statistically significant at the level of 97.5% confidence
**: Statistically significant at the level of 95% confidence

Fertility: The estimated coefficient of the fertility variable suggests that the children number ever born has a negative effect on the wage rate, and the effect for the younger wives group is stronger than that that for the older wives group. This indicates that the wage rates of younger married women are much more negatively influenced by the presence of children. A possible explanation is that older women might have already obtained significant labor market experience and human capital before they bear children.

Language: For these language variables, the omitted reference category is the group of anglophone wives who only speak English. Relative to the reference category, those married women whose mother tongue is neither English nor French are likely to earn less per hour. Since the estimates of unilingual francophones for the three age groups are insignificant, the wage rate of those women are not significantly different from that of the reference category. Compared with unilingualism, bilingualism consisting of English and French tend to bring married women higher wage rates. In addition, the effects of language variables on different age groups are also very similar.

City size: The estimates of city size are positive and significant, which shows that the wage rate levels for married women change among different census metropolitan areas: the wage rate for married women is higher in urban areas than in rural areas.

Mobility: In regards to the mobility variables, the results suggest that the married women who immigrated to Canada in 1980 or later earn about 37% less per hour than all other wives, including native Canadians and those who immigrated before 1980, and those who moved from a different province or census division during 1991-1996 earn about 24% less per hour than those who did not move within Canada. Immigrants to Canada are likely to be offered a lower wage rate than those who

migrated within Canada. The negative effects of the two mobility variables are not very different between younger and older wives.

Region: Relative to the reference category of BC, those wives living in other regions earn lower wage rates. Those living in Ontario earn the second highest wage rates, while those living in the Prairie Provinces earn the third highest wage rates. Wives living in Quebec earn the second lowest wage rates, and those living in Atlantic Provinces earn the lowest wage rates.

Selection bias: The estimated coefficients for the inverse of the Mills' ratio are significant in all equations. It is positive for the younger wives group, but for the older group and the pooled sample, it is negative. This empirical pattern suggests that the pooled results make very different selection effects between older and younger wives. It means that among younger wives, those who actually do work have higher wage rates than those who do not participate in the labor force (if their wages were observable), but among older wives, those who actually do work have lower wage rates than those who do not participate.

4.3. Estimates For The Hours Of Work Supplied (Table 8)

The variable of age is not included in the hours of work equation. In order to capture labor supply behavior of married women while accounting for differences between different age groups, the hours of work equation is estimated separately for 7 different age groups: the 15-24 years age group (column 1), the 25-34 years age group (column 2), the 35-44 years age group (column 3), the 45-54 years age group (column 4), the 15-34 years age group (column 5), the 35-54 years age group (column 6), and the 15-54 years age group (column 7). The last 3 groups are the same groups as in Tables 6 and 7. The results of regressions are presented in Table 8.

TABLE 8

Labor supply parameter estimates, corrected for selectivity bias (dependent variable: annual hours worked)

Age	15-24	25-34	35-44	45-54	15-34	35-54	15-54
Explanatory variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	1910.735*	1641.9*	1279.307*	755.934*	779.509*	1154.37*	1002.592*
	(8.41)	(18.931)	(17.185)	(7.954)	(10.072)	(21.854)	(25.54)
Logarithm of fitted wage	-639.783*	-73.333	230.302*	338.432*	424.129*	133.781*	232.745*
	(-3.311)	(-1.085)	(2.54)	(6.08)	(7.956)	(4.354)	(11.979)
Virtual income in $1,000s	5.633*	-0.647*	-1.811*	-1.958*	-1.526*	-1.642*	-1.675*
	(4.726)	(-1.85)	(-7.582)	(-8.796)	(-4.659)	(-10.643)	(-13.051)
City size: resident of a census	48.681*	32.953*	14.104*	15.137*	19.334*	17.188*	18.208*
metropolitan area	(4.052)	(7.883)	(3.912)	(3.768)	(4.857)	(6.617)	(8.591)
Mobility: immigrant to Canada	-148.2*	-71.449*	-9.293	39.433	-16.524	6.07	-0.979
in 1980 or later	(-2.178)	(-3.272)	(-0.499)	(1.509)	(-0.791)	(0.409)	(-0.082)
Mobility: from different province or	11.142	-41.238*	-79.88*	-16.856	-80.043*	-44.212*	-58.093*
census division 1991-96	(-0.252)	(-2.349)	(-4.52)	(-0.675)	(-5.109)	(-3.256)	(-6.354)
Language: mother tongue English,	-45.055	4.488	31.487	23.932	4.093	21.689	3.309
English and French spoken	(-0.794)	(0.187)	(1.359)	(0.867)	(0.182)	(1.221)	(0.24)
Language: mother tongue French,	-175.953*	-108.31*	-64.721*	-84.474*	-101.489*	-69.358*	-83.012*
French only spoken	(-3.194)	(-4.834)	(-3.519)	(-3.995)	(-4.934)	(-5.068)	(-7.303)
Language: mother tongue French,	-126.153*	-24.351	9.354	-73.863*	-35.314*	-29.226*	-32.804*
English and French spoken	(-2.698)	(-1.368)	(0.584)	(-3.99)	(-2.105)	(-2.416)	(-3.354)
Language: mother tongue other,	34.867	5.675	32.924*	41.946*	14.326	37.213*	31.013*
English only spoken	(0.531)	(0.288)	(2.112)	(2.489)	(0.753)	(3.256)	(3.166)
Language: mother tongue other,	-33.391	23.804	2.266	42.149	-20.724	16.275	20.284
French only or bilingual	(-0.313)	(0.72)	(0.082)	(1.203)	(-0.634)	(0.752)	(1.131)
Children: number of pre-schoolers	-79.828	-177.74*	-161.639*	-125.132*	-285.477*	-143.19*	-200.959*
at home	(-0.975)	(-6.266)	(-7.147)	(-2.317)	(-13.08)	(-10.831)	(-26.953)
Children: number aged 6-14	-40.081	-70.77*	-109.187*	-94.373*	-47.959*	-95.256*	-84.514*
at home	(-0.324)	(-6.013)	(-13.631)	(-7.677)	(-4.88)	(-19.396)	(-19.983)
Selection bias correction variable	538.507*	195.442*	155.04*	99.791*	-36.425	210.415*	125.361*
	(2.894)	(2.941)	(3.167)	(2.125)	(-0.722)	(8.025)	(7.295)
Adjusted R-squared	0.057	0.085	0.056	0.029	0.074	0.045	0.056
Mean of dependent variable	1427.58	1619.92	1647.41	1705.09	1594.14	1671.89	1645.53
Standard deviation	717.8517	684.805	680.7599	676.0354	694.6387	679.243	685.4003
Number of observations	2,206	14,254	18,469	13,623	16,460	32,092	48,552

NOTE: Numbers in parentheses are t-statistics.

*: Statistically significant at the level of 97.5% confidence.

**: Statistically significant at the level of 95% confidence

City size: The estimates for the variable of city size are positive and significant, which means that those married women living in urban areas are likely to supply more hours than those living in smaller metropolitan areas ceteris paribus. In the labor force participation equation, the estimated coefficient of this variable is insignificant. The regional labor market conditions probably have little effect on the participation of married women, but have some strong effects on how many hours are supplied by married women.

Mobility: The two mobility variables have very different effects on the hours supplied. The insignificance of mobility variable pertaining to immigration to Canada (in 1980 or later) indicates that the period of immigration has little effect on the number of the hours supplied by wives, with exceptions for the groups less than 34 years of age. In contrast, the estimated coefficient of interregional mobility within Canada is negative and significant for all but 15-24 age group and 45-54 age group, meaning that those married women who moved from a different province or census division during 1991-1996 tend to supply fewer hours of work. Another explanation may be that the married women move and take more time to establish themselves in new jobs. In addition, comparing the 7 columns in Table 8, note that the effect of interregional mobility on hours worked is stronger among younger wives than among older wives.

Language: The estimated coefficients on the language variables are of some interest. Relative to the reference group (those wives whose mother tongue is English and who speak English only), both unilingual and bilingual women whose mother tongue is French tend to work fewer hours than the other groups, and unilingual francophone wives supply the fewest hours. The probit model also implies that unilingual French mother tongue women do not tend to participate as often. In

contrast, the women whose mother tongue is other than English and French tend to supply more working hours than the other groups. The wage rate equation, however, indicates that those women with another mother tongue are likely to be offered a lower wage rate than the other groups. The estimates for the bilingual women who speak English are statistically insignificant, which means that there is no significantly different effect between bilingual wives who speak English and unilingual anglophone wives.

The estimations by separate age groups reveal some important differences in the behavior between the younger wives and the older wives. The probit model implies that the younger wives whose mother tongue is French are more likely to participate, but those younger women tend to supply fewer hours conditional on participation. In contrast, the older women whose mother tongue is other than English and French tend to participate more often and supply more working hours than younger women.

Fertility: As expected, the present of children at home has negative effects on the hours supplied by married women. The effect for pre-school children is negative and stronger than the effect for children aged 6-14. This is probably because pre-school children need more time for care than those children aged 6-14.

Selection bias correction variable: The estimates for the selection bias correction variable are positive and significant, except for the equation for the 15-34 years of age group, which means that there is a positive selection effect for married women: those wives who actually do work supply more hours of work than those who do not participate in the labor force.

Wage and income variables: As expected, most estimated coefficients of virtual income are negative, with exception for youngest group: the 15-24 years of age group. This implies that the wives older than 24 are likely to supply fewer hours of work

given a higher value for virtual income. In contrast, those wives under 24 years are likely to work more hours as the level of virtual income rises. Furthermore, the values of the estimated coefficients for virtual income among 7 age groups indicate that the older wives are, the larger the negative effects of virtual income are.

The estimated coefficients for the wage variable are negative for the first two age groups, but only that for the youngest group is statistically significant. For the other 5 groups, the estimates of wage are all positive and significant. Comparing the first 5 columns, we can find that the value of the estimated coefficients for the wage variable increase from negative to positive as the wives' ages increase. This suggests that for the younger wives, the increase of wage rate would lead to a decrease of the number of hours of work, and for the older wives, the increase of wage rate would lead to a increase of the number of hours of work. In the case of a wage increase, the income effect outweighs the substitution effect for the younger wives, but the substitution effect outweighs the income effect for the older wives.

Table 9 presents the point estimates for the income and wage elasticities for the 7 different age groups. All the elasticities are evaluated at the means of the fitted wage rates, the fitted number of hours supplied, and virtual income. For the 15-24 and

TABLE 9
Estimates of labor supply elasticities

	Annual hours		
Age group	Own-wage	Income	Compensated wage
15-24	-0.3482	0.0998	-0.448
25-34	-0.0606	-0.0156	-0.045
35-44	0.0255	-0.0535	0.079
45-54	0.1335	-0.065	0.1985
15-34	0.267	-0.036	0.303
35-54	0.08	-0.051	0.131
15-54	0.141	-0.048	0.189

NOTE: Elasticities are evaluated at the means of the fitted wage rates, fitted labor supply, and virtual income in table A1and A2.

25-34 age groups, the point estimates of labor supply responses to changes in the wage rate are negative, but for the other groups, the values of wage elasticities are positive. Compared with the values reported in Table 1, the wage elasticities for 15-24, 25-34, 35-44, and 45-54 year age groups in Table 5 are very similar to those found by the Nakamura and Nakamura (1979, 1981). In both cases, the younger wives seem to show a negative elasticity, which implies that younger wives will decrease their labor supply in response to the increase of wage rate. Wives older than 44 in Table 1 and those older than 35 in Table 9 seem to respond positively to the increase of wage rate.

Since the samples of 15-34, 35-54 and 15-54 have the same age division and explanatory variables as Smith and Stelcner (1988), the results in the Table 9 and 5 should be more comparable. They are very similar in the values for each group. The income elasticities in Table 9 are low in magnitude, but they still fall in the range of those found in the other studies. Compared with the younger wives, the older wives have stronger income effects and smaller wage effects in absolute value.

5. CONCLUSIONS

Based on the data from the 1996 Canada census, this paper examines three different aspects of the labor supply behavior of married women in Canada: the probability of participation, the hourly wage rate, and the hours of work. In the regressions for the wage rate equation and the hours of work equation, Heckman's procedure to correct for sample selection bias is employed. To address the endogeneity of the wage rate, the fitted hourly wage rate is employed as the instrumental variable for the offered wage rate in the hours of work equation.

The main empirical findings for the probability of participation of married women are: (1) In regards to the other explanatory variables, the schooling variables have the

largest positive effect on participation of married women. (2) The geographic mobility variables have remarkable negative effects on participation. Immigrants (who arrived after 1980) or married women who moved within Canada are less likely to participate in the labor force. (3) The language variables have some complex effects on the probability of participation. Those wives whose mother tongues are other than English or French have lower likelihoods of participation. Bilingualism has a significantly positive effect on participation. (4) Relative to wives living in BC, wives in Quebec and the Atlantic Provinces are less likely to participate in the labor force, those living in the Prairie Provinces are more likely to participate, and those living in Ontario have a similar probability of participation. (5) Regarding the fertility variables, the presence of children has a significantly negative effect on the participation of wives. The composition of children also has important effects: the younger the children are, the stronger the negative effects are. The following Table 10 summarizes the effects of explanatory variables on the probability of participation of married women.

Table 10 Summary of effects of explanatory variables in the participation equation

	Group		
Explanatory Variables	15-54	15-34	35-54
Age	U-shaped	U-shaped	0
Schooling	+	+	+
Fertility	-	-	-
Language1	+	+	+
Language2	0	+	-
Language3	+	+	+
Language4	-	-	-
Language5	0	-	0
City Size	0	0	0
Mobility	-	-	-
Region: Atlantic	-	0	-
Region: Quebec	-	-	-
Region: Ontario	0	0	0
Region: Prairies	+	0	+
Virtual Income	-	0	-

For the wage rate equation, the main findings are: (1) Compared with the other explanatory variables, the schooling variables have the largest positive effects on wage rate. The higher the degree married women have obtained, the higher the wage rates are. (2) In regards to the language variables, the traits of bilingualism for Anglophones and Francophones have positive effects on wage rate, while having a mother tongue other than English or French has a significantly negative effect. (3) The mobility variables have largely negative effects on the wage rate. The immigrants who arrived after 1980 tend to be offered lower wage rates. (4) The regional variables yield an empirical pattern for the wage rate. The wives living in BC earn the highest wage rate, followed by those living in Ontario, those living in Prairie Provinces and those living in the Atlantic Province. (5) In regards to the selection bias correction variable, among younger wives, those who actually do work have higher wage rates than those who do not participate in the labor force. Among older wives, however, those who actually do work have lower wage rates than those who do not participate. The effects of explanatory variables for the wage equation are summarized in Table 11.

For the hours of work equation, the main findings are: (1) The mobility variables tend to have an negative effect on the labor supply of married women. (2) Having a mother tongue of French tends to have a significant and negative effect on the labor supply of married women. However, having a mother tongue other than English or French tends to have a significantly positive effect on labor supply. As estimated in wage equation, those wives having another mother tongue are likely to be offered lower wage rates. (3) The fertility variables have the expected negative effects on the labor supply of wives for each age group. The presence of younger children has a stronger negative effect on the labor supply of wives than is the case for older

Table 11 Summary of effects of explanatory variables in wage rate equation

	Group		
Explanatory Variables	15-54	15-34	35-54
Age	U-shaped	U-shaped	0
Schooling	+	+	+
Fertility	-	-	-
Language1	+	+	+
Language2	0	0	0
Language3	+	+	+
Language4	-	-	-
Language5	0	0	-
City Size	+	+	+
Mobility	-	-	-
Region: Atlantic	-	-	-
Region: Quebec	-	-	-
Region: Ontario	-	-	-
Region: Prairies	-	-	-
Selection bias correction variable	-	0	-

Table 12 Summary of effects of explanatory variables in hours worked equation

	Group						
Explanatory Variables	15-24	25-34	35-44	45-54	15-34	35-54	15-54
Logarithm of fitted wage	-	0	+	+	+	+	+
Virtual income	+	-	-	-	-	-	-
City Size	+	+	+	+	+	+	+
Mobility1	+	+	0	0	0	0	0
Mobility2	0	-	-	0	-	-	-
Language1	0	0	0	0	0	0	0
Language2	-	-	-	-	-	-	-
Language3	-	0	0	-	-	-	-
Language4	0	0	+	+	0	+	+
Language5	0	0	0	0	0	0	0
Fertility	0	-	-	-	-	-	-
Selection bias correction variable	+	+	+	+	0	+	+

children. (4). The estimated wage elasticities for the first 4 age groups are very similar to those found by the Nakamura and Nakamura. For the younger groups, they are negative. For the older groups, they are positive. Estimates for the oldest 3 age groups are very similar to those found by Smith and Stelcner (1998). The values are very small and fall in the range of those in the earlier findings. The effects of those explanatory variables are summarized in the following Table 12.

Combining the findings in the three equations, one can get some ideas about the labor supply behavior of married women in Canada in 1995. Most of the estimated coefficients for the explanatory variables have the expected signs consistent with the theory of labour supply. The variables of schooling, bilingualism, and English as the mother tongue have positive effects on the labor supply of married women. The variables of fertility, French as the mother tongue, other mother tongues, mobility, and virtual income have negative effects on the labor supply of married women. The last estimated equation suggests that the different age groups seem to display very different labor supply behavior. For the older married women, the labor supply curve seems to have a positive slope, and for the youngest groups, the labor supply curve seems to have a negative slope. In the case of a wage change, for the younger married women, there appears to be negative wage elasticities, but the older married women seem to have positive wage elasticities. The similar age pattern can be found in the study of Nakamura, Nakamura and Cullen (1979). The values of the point estimates for the wage elasticities are small and fall within the range of those reported in the earlier findings.

The religious affiliations are believed to have important effects on the labor supply of married women. Due to the lack of data concerning religious affiliations,

this paper does not present their effects. Additionally, this study does not consider the effects of income taxes. Another future research project can incorporate them.

APPENDIX: TABLES

TABLE A1: Mean values

	Total sample			Workers						
Explanatory variable	15-54 (1)	15-34 (2)	35-54 (3)	15-24 (4)	25-34 (5)	35-44 (6)	45-54 (7)	15-34 (8)	35-54 (9)	15-54 (10)
Age	38	28	44	19	29	40	49	28	44	38
	(9)	(4)	(6)	(3)	(3)	(3)	(3)	(4)	(6)	(9)
Age squared	154	80	195	39	88	157	245	81	194	156
	(69)	(23)	(49)	(10)	(15)	(20)	(26)	(22)	(49)	(68)
Schooling1	0.06	0.05	0.06	0.01	0.06	0.07	0.08	0.05	0.07	0.07
	(0.23)	(0.21)	(0.24)	(0.11)	(0.24)	(0.25)	(0.26)	(0.23)	(0.26)	(0.25)
Schooling2	0.14	0.16	0.12	0.13	0.2	0.15	0.12	0.19	0.14	0.15
	(0.34)	(0.37)	(0.32)	(0.33)	(0.4)	(0.36)	(0.32)	(0.39)	(0.34)	(0.36)
Schooling3	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08
	(0.26)	(0.26)	(0.26)	(0.26)	(0.27)	(0.27)	(0.27)	(0.27)	(0.27)	(0.27)
Schooling4	0.04	0.05	0.03	0.08	0.04	0.04	0.03	0.05	0.03	0.04
	(0.19)	(0.21)	(0.18)	(0.27)	(0.2)	(0.19)	(0.16)	(0.21)	(0.18)	(0.19)
Schooling5	0.05	0.05	0.04	0.06	0.05	0.04	0.04	0.05	0.04	0.05
	(0.21)	(0.23)	(0.2)	(0.24)	(0.22)	(0.2)	(0.2)	(0.23)	(0.2)	(0.21)
Schooling6	11.65	11.88	11.52	11.98	12.06	11.89	11.54	12.05	11.74	11.84
	(1.49)	(1.25)	(1.6)	(1.04)	(1.03)	(1.21)	(1.55)	(1.03)	(1.38)	(1.28)
Children1	1.39	1.11	1.54	0.23	0.99	1.68	1.25	0.89	1.5	1.29
	(1.13)	(1.08)	(1.14)	(0.52)	(1.02)	(1.08)	(1.06)	(1)	(1.09)	(1.1)
Children2	0.38	0.71	0.19	0.21	0.61	0.27	0.01	0.55	0.16	0.29
	(0.65)	(0.76)	(0.49)	(0.47)	(0.73)	(0.55)	(0.12)	(0.72)	(0.44)	(0.58)
Children3	0.53	0.35	0.63	0.01	0.35	0.91	0.22	0.31	0.62	0.51
	(0.82)	(0.7)	(0.86)	(0.13)	(0.69)	(0.92)	(0.54)	(0.65)	(0.85)	(0.8)
Language1	0.05	0.06	0.05	0.09	0.07	0.05	0.05	0.07	0.05	0.06
	(0.22)	(0.24)	(0.21)	(0.29)	(0.25)	(0.23)	(0.22)	(0.26)	(0.22)	(0.24)
Language2	0.11	0.1	0.11	0.11	0.09	0.1	0.1	0.09	0.1	0.1
	(0.31)	(0.3)	(0.31)	(0.31)	(0.28)	(0.3)	(0.3)	(0.28)	(0.3)	(0.3)
Language3	0.12	0.12	0.12	0.15	0.14	0.13	0.12	0.14	0.13	0.13
	(0.32)	(0.33)	(0.32)	(0.36)	(0.35)	(0.33)	(0.33)	(0.35)	(0.33)	(0.34)
Language4	0.19	0.18	0.19	0.09	0.15	0.17	0.18	0.14	0.17	0.16
	(0.39)	(0.38)	(0.39)	(0.28)	(0.36)	(0.37)	(0.38)	(0.35)	(0.38)	(0.37)
Language5	0.04	0.04	0.04	0.02	0.03	0.04	0.03	0.03	0.03	0.03
	(0.19)	(0.2)	(0.19)	(0.15)	(0.18)	(0.19)	(0.17)	(0.18)	(0.18)	(0.18)
City size	2.13	2.11	2.15	1.85	2.09	2.08	2.11	2.06	2.09	2.08
	(1.58)	(1.57)	(1.58)	(1.51)	(1.58)	(1.58)	(1.58)	(1.57)	(1.58)	(1.58)
Mobility1	0.15	0.19	0.13	0.1	0.14	0.12	0.06	0.13	0.1	0.11
	(0.36)	(0.39)	(0.34)	(0.3)	(0.34)	(0.32)	(0.25)	(0.34)	(0.29)	(0.31)

TABLE A1 (concluded)

	Total sample			Workers						
Explanatory	15-54	15-34	35-54	15-24	25-34	35-44	45-54	15-34	35-54	15-54
variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Mobility2	0.19	0.29	0.13	0.38	0.24	0.12	0.07	0.26	0.1	0.15
	(0.39)	(0.46)	(0.34)	(0.48)	(0.43)	(0.32)	(0.25)	(0.44)	(0.29)	(0.36)
Region1	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.02
	(0.14)	(0.15)	(0.14)	(0.16)	(0.15)	(0.14)	(0.13)	(0.15)	(0.14)	(0.14)
Region2	0.26	0.27	0.26	0.28	0.25	0.25	0.24	0.25	0.25	0.25
	(0.44)	(0.44)	(0.44)	(0.45)	(0.43)	(0.43)	(0.43)	(0.44)	(0.43)	(0.43)
Region3	0.44	0.43	0.44	0.37	0.44	0.44	0.45	0.43	0.45	0.44
	(0.5)	(0.49)	(0.5)	(0.48)	(0.5)	(0.5)	(0.5)	(0.49)	(0.5)	(0.5)
Region4	0.16	0.17	0.16	0.21	0.17	0.17	0.16	0.18	0.17	0.17
	(0.37)	(0.37)	(0.36)	(0.41)	(0.38)	(0.38)	(0.37)	(0.38)	(0.37)	(0.38)
Virtual income	45.87	35.83	51.51	25.3	38.98	48.68	56.75	37.15	52.1	47.03
	(32.67)	(24.18)	(35.35)	(15.62)	(23.51)	(30.59)	(37.07)	(23.09)	(33.73)	(31.35)

NOTE: Numbers in parentheses are standard deviations

TABLE A2
Mean values of labor supply, wage, and income variables, workers only

Variable	15-24 (1)	25-34 (2)	35-44 (3)	45-54 (4)	15-34 (5)	35-54 (7)	15-54 (8)
Virtual income($'000)	25.3	38.98	48.68	56.75	37.15	52.1	47.03
	(15.62)	(23.51)	(30.59)	(37.07)	(23.09)	(33.73)	(31.35)
Annual earnings($'000)	13.911	24.223	28.092	29.218	22.841	28.57	26.628
	(9.647)	(15.104)	(18.213)	(18.273)	(14.912)	(18.247)	(17.402)
Ln wage rate							
Actual gross	2.21	2.62	2.73	2.74	2.57	2.73	2.68
	(0.71)	(0.68)	(0.71)	(0.68)	(0.7)	(0.7)	(0.7)
Fitted gross	2.27	2.62	2.72	2.72	2.58	2.67	2.67
	(0.19)	(0.23)	(0.25)	(0.23)	(0.24)	(0.25)	(0.26)
Annual hours							
Actual	1427.58	1619.92	1647.41	1705.09	1594.14	1671.89	1645.53
	(739.08)	(715.55)	(700.73)	(686)	(721.71)	(695.09)	(705.18)
Fitted	1619.39	1600.16	1631.79	1723.29	1590.32	1680.4	1647.61
	(212.55)	(252.88)	(219.8)	(180.61	(343.19)	(171.48)	(225.28)

NOTE: Numbers in parentheses are standard deviations

Reference

Benjamin, D., M. Gunderson, and W. C. Riddell (2002) "Labor Market Economics: Theory, Evidence, And Policy in Canada" 5th edition McGraw-Hill Ryerson Publishers, 31-75

Borjas, G. J. (1980) "The relationship between wages and weekly hours of work: the role of division bias." *Journal of Human Resources* 15, 409-23

Cain, G. G., and Dooley, M. D. (1976) "Estimation of a Model of Labor Supply, Fertility, and Wages of Married Women," *The Journal of Political Economy* 84, S179-S200

Carliner, G., C. Robinson, and N. Tomes (1980) "Female labor supply and fertility in Canada." *The Canadian Journal of Economics* 13, 46-64

Ehrenberg, R. G. and R. S. Smith (1982) *Modern Labor Economics: Theory and Public Policy* (Glenview, IL: Scott, Foresman and Co.)

Greene, W. H. (1981) "Sample Selection Bias as a Specification Error: A Comment," *Econometrica* 49, 795-8

Heckman, J. J. (1977) "A Beta-logistic Model for the Analysis of Sequential Labor Force Participation by Married Women," *The Journal of Political Economy* 85, 27-58

— (1978) "A Partial Survey of Recent Research on the Labor Supply of Women," *American Economic Review* 68, 200-7

— (1979) "Sample Selection Bias as a Specification Error," *Econometrica* 47, 153-62

— (1980) "Sample Selection Bias as a Specification Error: An Application to the Estimation of Female Labor Supply Function," *Female Labor Supply*, James Smith, ed., Princeton, NJ: Princeton University Press, 206-48

— (1993) "What has been learned about labor supply in the past twenty years?" *The American Economic Review* 83, 116-21

Nakamura, A. and M. Nakamura (1981) " A comparison of the labor force behavior of married women in the United States and Canada, with special attention to the impact of income taxes." *Econometrica* 49, 451-89

— (1983) "Part-time and full-time work behavior of married women: a model with a doubly truncated dependent variable." *The Canadian Journal of Economics* 16, 229-57

Nakamura, M., A. Nakamura, and D. Cullen (1979) " Job opportunities, the offered wage, and the labor supply of married women." *American Economic Review* 69, 787-805

Robinson, C. and N. Tomes (1985) "More on The Labor Supply of Canadian Women," *The Canadian Journal of Economics* 18, 156-63

Smith, J. B. and Stelcner, M. (1988) "Labor supply of married women in Canada, 1980," *The Canadian Journal of Economics* 21, 857-70

Speneer, B. G. (1973) "Determinants of the Labor Force Participation of Married Women: A Micro-study of Toronto Households," *The Canadian Journal of Economics* 6, 222-38