1981

Family Labour Supply and Fertility: A Two Regime Model

Chris Robinson

Nigel Tomes

ISSN: 0318-725X
ISBN: 0-7714-0298-8

RESEARCH REPORT 8114

FAMILY LABOUR SUPPLY AND FERTILITY: A TWO REGIME MODEL

by
Chris Robinson*
and
Nigel Tomes**

ABSTRACT

We re-examine the central hypothesis of the "new microeconomics of fertility" that, because children are female-time intensive, fertility is inversely related to the mother's wage. A model of lifetime family labour supply and completed fertility is presented with two groups of families depending on whether the wife ever works in the labour market. Fertility and husband's labour supply are predicted to differ between the two groups.

In the 1971 Canadian Census data over 20% of married women 35+ have never worked. The probability of a wife ever working is positively related to her husband's lifetime wage or schooling, implying complementarity. Correcting for self-selection in lifetime participation, we find no evidence that children are female-time intensive. Results obtained using wife's current participation are markedly different.

September, 1981

*University of Western Ontario

**University of Western Ontario and Economic Research Center/NORC, Chicago.

FAMILY LABOUR SUPPLY AND FERTILITY: A TWO REGIME MODEL

1. INTRODUCTION

A recent development in the economic analysis of household behaviour has been to view the family as a firm engaged in the 'home production' of utility-yielding commodities which utilize the time of family members and market-purchased goods as factor inputs (Becker, 1965, 1981; Michael and Becker, 1973; Pollak and Wachter, 1975). This approach focuses attention on the value of the time of family members as important determinants of the allocation of time and expenditures. In the application of the household production model to fertility behaviour the central hypothesis has been succinctly stated by Gary S. Becker: "The value of the time of parents, especially of mothers, is a major cost of having and rearing children. Therefore,...it is not surprising that the number of children a family has is strongly negatively related to the mother's value of time, as measured by her wage if she is in the labor force" (Becker, 1974, p. 318). Evidence in support of this proposition [see Mincer, 1963; De Tray, 1974; Ben Porath 1974 for examples] is regarded as vindication of the economic approach to fertility behaviour. T. W. Schultz states: "[T]he negative effects of increases in the price of the mother's time on the number of children leaves little room for doubt that there is a role for economics in analyzing fertility" (1974b, p. 9).

In this paper we call into question the conventional wisdom that children are female-time intensive.[1] Although this may be true of pre-school children, observation suggests that as children mature they become increasingly goods intensive, so that in a lifetime context the factor intensity of children is not obvious a priori. Evidence from the 1971 Canadian Census indicates that, controlling for lifetime labour force participation, an increase in the lifetime value of the mother's time raises the number of children, implying that children are not factor-intensive in mother's time. Our results suggest an alternative explanation of the observed inverse relationship between women's wages (or education) and family size as the outcome of the interaction between women's lifetime labour supply and fertility behaviour. In addition we present evidence that the times of spouses are complements in the household (non-market) sector of the economy.

In the following section we present the theoretical model which forms the basis for our empirical investigation. In the standard one-period lifetime household production model the family is supposed to maximize, subject to its budget constraint, a utility function which depends on family size and the family's consumption of goods and leisure. The solution to this problem yields a demand function for numbers of children and labour supply functions for family members which depend on non-labour income, wage rates and prices. Following the work of Willis (1974) and Kneisner (1976) we distinguish between two groups of families ("regimes"): those in which the wife works in the labour market and families where the wife allocates her time entirely to the household. Willis has shown that the determinants of fertility differ between these two groups. More recently, Kneisner has shown that the husband's labour supply functions differ according to whether the wife is working or not and that these differences indicate whether the leisure of husbands and wives are complements or substitutes. Our model integrates the insights of Willis and Kneisner. Willis treats fertility as endogenous but takes the husband's labour supply as given, while Kneisner takes the family's fertility as exogenously determined and concentrates exclusively on the joint determination of husband's and wife's labour supply. In the model presented in Section 2 both the lifetime labour supplies of husband and wife and completed family size are jointly determined.

Section 3 presents empirical estimates of the model using data from the 1971 Canadian Census. In accordance with the lifetime focus of the theory, information on whether the wife _ever_ participated in the labour market is used to estimate parameters of the wife's lifetime labour supply schedule. In contrast to previous empirical work our estimates employ lifetime measures. Completed family size and husband's lifetime labour supply are related to lifetime wage rates. The subsamples of families where the wife ever worked and never worked are used to estimate separate fertility and husband's labour supply schedules, while controlling for the fact that families self-select into one of the two regimes. The coefficients of these equations are predicted to differ according to whether the value of the wife's time is held constant. The results obtained using lifetime participation to partition the sample and lifetime wage variables differ dramatically from those obtained using current labour force participation and current wage rates.

2. A TWO REGIME MODEL OF LIFETIME FAMILY LABOUR SUPPLY AND FERTILITY

Consider a husband-wife family at the date of marriage, endowed with perfect foresight, maximizing a one-period utility function defined over their remaining joint lifetime:

$$U = u(N,Q,Z) \tag{1}$$

where N represents the number of children born to the couple, Q represents an index of the average well-being of their offspring termed child "quality" (De Tray, 1974; Willis, 1974; Becker and Lewis, 1974), and Z represents a composite of all other utility-yielding commodities. Adopting the household production approach, the two groups of commodities--those related to children and other commodities--are assumed to be produced in the home, using as inputs market purchased goods and the time of the couple, according to the linear homogeneous production functions:

(2) $$C = QN = f(X, C_f, C_m; e) \quad , \; f_e \geq 0$$

(3) $$Z = g(y, H_f, H_m; e) \quad , \; g_e \leq 0$$

Child-related activities ("child services") are assumed to depend on the product of the number of children and the average "quality" per child[2] (De Tray, 1974; Willis, 1974). The production function (2) relates lifetime child services to parental expenditures on child-related goods (X), and inputs of female time (C_f) and male time (C_m) associated with children. Similarly, equation (3) relates the composite commodity Z to inputs of goods (y), and the "leisure" times of husband and wife (H_m and H_f, respectively). The time inputs of husband and wife may be either (net) substitutes or complements in the production of either commodity. The work of Kneisner (1976) suggests that complementarity between the non-market times of spouses should not be ruled out a priori.[3] The last term, e, in equations (2)-(3) represents differences across families in "tastes" regarding children (due to say differences in parental altruism or time preference) or in relative "home productivity" in the production of child-related commodities versus other commodities.

The family faces the following expenditure and time constraints:

(4) $$I_F = V + w_f L_f + w_m L_m = P_x x + P_y y$$

(5i) $$T_f = L_f + C_f + H_f \qquad L_f \geq 0$$

(5ii) $$T_m = L_m + C_m + H_m \qquad L_m > 0, \; T_f = T_m = T$$

where I_F represents the family's lifetime income, V is lifetime non-labour income, w_m and w_f are the lifetime wage rates of the husband and wife (respectively) determined by factors such as ability, schooling, and lifetime luck in the labour market, all of which are assumed exogenous. P_x and P_y represent the prices of goods x and y. In equation (5) T represents the exogenous length of the marital lifetime. The optimal allocation of each spouse's time is assumed to result in all husbands working in the labour market at some point in the lifetime, but not necessarily all the wives. Since the husband always works, the time constraint (5ii) can be substituted into the expenditure constraint (4) to give:

(6) $$V + w_f L_f + w_m T_m = P_x x + P_y y + w_m H_m + w_m C_m$$

The problem facing the couple is to maximize (1) subject to (2), (3), (5i) and (6). For purposes of exposition, however, it is convenient to consider a special case in which the utility function (1) is of the form:

(1)' $$U = U(NQ, Z)$$

and to assume that child quality is exogenously determined from the point of view of the individual family (i.e., $Q = \bar{Q}$).[4]

Substituting equations (2) and (3) into (1)' and maximizing subject to (5i) and (6) yields the first-order conditions:

(7i) $$\frac{U_c}{\Psi} = \frac{P_x}{f_x} = \frac{w_m}{f_{C_m}} = \frac{\delta_f}{\Psi f_{C_f}} \equiv \pi_c$$

(7ii) $$\frac{U_z}{\Psi} = \frac{P_y}{g_y} = \frac{w_m}{g_{H_m}} = \frac{\delta_f}{\Psi g_{H_f}} \equiv \pi_z$$

(7iii) $$w_f \le \frac{\delta_f}{\Psi} \equiv w_f^*$$

where U_j is the marginal utility of commodity j, f_i and g_k are the marginal products of inputs i and k in commodities C and Z (respectively), Ψ is the marginal utility of income and δ_f is the marginal utility of wife's time. The first-order conditions (7i) and (7ii) define the shadow prices of commodities π_c and π_z, so that the marginal rate of substitution between child services and other commodities is equated to the ratio of shadow prices (i.e., $U_c/U_z = \pi_c/\pi_z$). Equation (7iii) determines whether the wife will be a lifetime labour force participant. If at zero hours of work the value of the wife's time in home production [$\delta_f/\Psi \equiv w_f^*(L_f = 0)$: the wife's "shadow wage"] exceeds her market wage rate (i.e., the inequality in (7iii) applies) she will choose not to work in the labour market, and is at a corner solution with respect to her lifetime labour supply. Conversely, if at zero hours of work the value of the wife's time in home production is less than her market wage rate, labour will be supplied to the market until (7iii) holds as an equality (i.e., $w_f^*(L_f > 0) = w_f$). In this case, when the wife is at an interior solution with respect to her lifetime labour supply, the value of the wife's home time at the margin is equated to the market wage rate. These two possibilities of the wife either being a lifetime labour force participant or not, define the two groups of families (regimes) whose behavioral response to changes in wages, prices, etc., are predicted to differ in systematic ways. In the following subsections the determinants of family size (N) and family labour supply for these two groups are examined.

A. Family Labour Supply and Fertility when the Wife is a Labour Force Participant

When the wife is a lifetime labour force participant and the value of her non-market time is equated to the wage rate, equation (5i) can be substituted into the income constraint (6) to yield the lifetime "full income" constraint for the family:

(8) $F \equiv w_f T_f + w_m T_m + V = P_x x + P_y y + w_f(C_f+H_f) + w_m (H_m + C_m)$

The first-order conditions (7i)-(7iii) imply demand functions for N and Z and labour supply functions for both spouses as functions of non-labour income, wage rates, and prices. Written in log derivative form, in terms of the underlying behavioral parameters, these demand and supply functions are:

(9) $d\,\ell n\, N = S_V \eta_n\, d\,\ell n\, V + [S_L^m \eta_n + (K_z^m - K_c^m) S_z \sigma]\, d\,\ell n\, w_m + [S_L^f \eta_n - S_z \sigma (K_c^f - K_z^f)]\, d\,\ell n\, w_f$
$\qquad - [S_x \eta_n + K_c^x S_z \sigma]\, d\,\ell n\, P_x + S_y(\sigma - \eta_n)\, d\,\ell n\, P_y$

(10) $d\,\ell n\, Z = S_V \eta_z\, d\,\ell n\, V + [S_L^m \eta_z - (K_z^m - K_c^m) S_c \sigma]\, d\,\ell n\, w_m + [S_L^f \eta_z + S_c \sigma (K_c^f - K_z^f)]\, d\,\ell n\, w_f$
$\qquad + S_x(\sigma - \eta_z)\, d\,\ell n\, P_x - [S_y \eta_z + K_z^y S_c \sigma]\, d\,\ell n\, P_y$

(11) $S_L^f d\,\ell n\, L_f = - S_V S_J \eta_J\, d\,\ell n\, V - [S_L^m S_J \eta_J + S_c S_z \sigma (K_c^f - K_z^f)(K_z^m - K_c^m) + (K_z^f K_z^m S_z \theta_{mf}$
$\qquad + K_c^f S_c K_c^m \mu_{xf})]\, d\,\ell n\, w_m$
$\qquad + [S_c S_z \sigma (K_c^f - K_z^f)^2 + S_c (1 - K_c^f)\mu_f + K_z^f S_z (1 - K_z^f)\theta_f - S_L^f S_J \eta_J]\, d\,\ell n\, w_f$
$\qquad + S_x [S_J \eta_J + S_z \sigma (K_c^f - K_z^f) - K_c^f \mu_{xf}]\, d\,\ell n\, P_x$
$\qquad + S_y [S_J \eta_J - S_c \sigma (K_c^f - K_z^f) - K_z^f \theta_{yf}]\, d\,\ell n\, P_y$

(12) $S_L^m\, d\,\ell n\, L_m = -S_V S_K \eta_K\, d\,\ell n\, V$
$\qquad + [S_c S_z \sigma (K_c^m - K_z^m)^2 + K_c^m S_c (k - K_c^m)\mu_m + K_z^m S_z (1 - K_z^m)\theta_m - S_L^m S_K \eta_K]\, d\,\ell n\, w_m$
$\qquad - [S_L^f S_K \eta_K + S_c S_z \sigma (K_c^f - K_z^f)(K_z^m - K_c^m) + (K_z^f K_z^m S_z \theta_{mf} + K_c f_{sc} K_c^m \mu_{mf})]\, d\,\ell n\, w_f$
$\qquad + S_x [S_K \eta_K + S_z \sigma (K_c^m - K_z^m) - K_c^m \mu_{xm}]\, d\,\ell n\, p_x$
$\qquad + S_y [S_K \eta_K - S_c \sigma (K_c^m - K_z^m) - K_z^m \theta_{ym}]\, d\,\ell n\, p_y$

where $S_i = \pi_i i/F$ (e.g., $S_z = \pi_z Z/F$, $S_L^m = w_m L_m/F$, etc.) are shares of the household's lifetime full income spent on Z, accounted for by husband's earnings, etc.; $K_j^i = P_i i/\pi_j j$ (e.g., $K_z^m = w_m H_m/\pi_z Z$, etc.) are shares of goods and time in the 'full' (time and goods) cost of each commodity; η_j is the full income elasticity of commodity j; σ is the elasticity of substitution between N and Z in (1)'; θ_{ij} and μ_{ij} are the Hicks-Allen partial elasticities of substitution between inputs i and j in the production of commodity Z, and C respectively where inputs i and j are (net) substitutes or complements as $\theta_{ij} \gtrless 0$, or $\mu_{ij} \gtrless 0$; $(1-K_z^f)\theta_f \equiv K_z^y\theta_{yf} + K_z^m\theta_{mf} > 0$, $(1-K_c^f)\mu_f \equiv K_c^x\mu_{xf} + K_z^m\mu_{mf} > 0$ and $(1-K_z^m)\theta_m \equiv K_z^y\theta_{ym} + K_z^f\theta_{mf} > 0$, $(1-K_c^m)\mu_m \equiv K_c^x\mu_{xm} + K_z^f\mu_{mf} > 0$; are the own elasticities of substitution between the time inputs of each spouse and the other inputs in (3) and (2) (Allen 1938, pp. 502-5); $S_J\eta_J \equiv [K_c^f S_c \eta_h + K_z^f S_z \eta_z]$, is the full income elasticity of demand for wife's non-market time $(J = C_f + H_f)$, which will be positive as long as the female-time intensive commodity is not strongly inferior. Similarly $S_K\eta_K \equiv [K_c^m S_c \eta_h + K_z^m S_z \eta_z]$ is the full income elasticity of demand for the husband's non-market time $(K = C_m + H_m)$.

Equation (9) represents the fertility demand equation for families in which the wife is a labour force participant. This equation yields standard predictions if conventional assumptions are made. If numbers of children are normal an increase in non-labour income is predicted to raise family size. However empirical support for this proposition has been mixed, due possibly to difficulties in measuring the appropriate variable or perhaps because of the interaction of quality and quantity dimensions of choice.[5] If children are less time-intensive in the husband's time than other commodities (i.e., $K_z^m > K_c^m$), then an increase in the husband's wage will lead to substitution away from other commodities and towards children.[6] If this substitution effect dominates the (possibly negative) income effect, numbers of children will increase in response to higher husband's wages. Exactly the same predictions apply to the effect of wife's wages if children are not female-time intensive. However, typically it has been assumed that the time of the mother is a major cost in having and rearing children,[7] so that higher women's wages raise the marginal cost of children leading to a negative substitution effect. The finding of an inverse relationship between women's wages or education has been taken as evidence in support of this proposition concerning the time-intensity of children. However our empirical results, reported below, cast doubt on this conventional interpretation.

Regarding the labour supply schedules (11) and (12) the own wage elasticities are in general ambiguous. An increase in the wage rate of one spouse raises the shadow price of the commodity which is intensive in that spouse's non-market time and also leads to substitution away from that spouse's time in the production of commodities. Whether the labour supply of that spouse increases or decreases depends on whether substitution in consumption and production offsets the opposing income effect which augments the demand for non-market time.[8] The 'stylized fact' that the labour supply of married men is backward bending while that of married women is upward sloping, has been interpreted as indicating that the income effect dominates for men and the substitution effect for women.[9]

The cross-wage elasticities in (11) and (12) contain three terms: an income effect, substitution in consumption between commodities and substitution in production. Under fairly weak conditions the income effect of an increase in the wage of one spouse reduces the amount of labour supplied to the market by the other spouse (see footnote 8). The remaining substitution effects are in general ambiguous. An increase in the wage of the wife raises the marginal cost of the commodity which is intensive in the wife's time. Whether this increases or reduces the husband's labour supply depends on whether the husband's time is used intensively in the same commodity which is female-time intensive.[10] If husband's and wife's time are complements, in the sense that the time inputs of both spouses are employed intensively in the production of the same commodity, then substitution between commodities resulting from an increase in the wife's wage, reduces the husband's labour supply. Conversely if the ranking of commodities by the time-intensity of spouses times differ this substitution effect will increase the husband's labour supply. The final term represents the effects of substitution in production: the weighted average of the substitution between time inputs in the production of each commodity (θ_{mf} and μ_{mf}). If the non-market times of spouses are substitutes this latter term will be positive, tending to produce a negative cross-wage elasticity. However if the non-market times of spouses are complements in production this latter term will be positive. In summary, under the conventional assumptions that the non-market times of spouses are normal, that the ranking of commodities by time-intensity differs between spouses and the time inputs of husbands and wives are substitutes in household production (see, e.g., Carliner, et al., 1980), the cross-wage elasticities are predicted to be negative. However if the times of spouses are complements either in consumption or production, a possibility suggested by the work of Kneisner (1976), the cross-wage elasticity may be positive.[11]

B. Family Labour Supply and Fertility when the Wife is a Non-Labour Force Participant

Next, consider the demand for children and husband's labour supply when the wife is a non-labour force participant. The predicted elasticities for this regime may be compared with those just presented for families in which the wife works at some point in the marital lifetime. In order to facilitate this comparison, equations (9), (11) and (12) are re-written in more compact notation:

$$(9)' \quad d\ \ln N = \varepsilon_{NV}\ d\ \ln V + \varepsilon_{Nw_m}\ d\ \ln w_m + \varepsilon_{Nw_f}\ d\ \ln w_f + \varepsilon_{NP_x}\ d\ \ln P_x + \varepsilon_{NP_y}\ d\ \ln P_y$$

$$(11)' \quad d\ \ln L_f = \varepsilon_{fV}\ d\ \ln V + \varepsilon_{fw_m}\ d\ \ln w_m + \varepsilon_{fw_f}\ d\ \ln w_f + \varepsilon_{fP_x}\ d\ \ln P_x + \varepsilon_{fP_y}\ d\ \ln w_f$$

$$(12)' \quad d\ \ln L_m = \varepsilon_{mV}\ d\ \ln V + \varepsilon_{mw_m}\ d\ \ln w_m + \varepsilon_{mw_f}\ d\ \ln w_f + \varepsilon_{mP_x}\ d\ \ln P_x + \varepsilon_{mP_y}\ d\ \ln P_y$$

where ε_{Nj} is the (gross) elasticity of fertility with respect to j and ε_{jK} is the (gross) elasticity of the labour supply of individual j (j=m,f) with respect to K. Equations (9)-(12) relate these elasticities to the underlying behavioral parameters.

When the wife is a lifetime non-labour force participant, allocating all of her time to the non-market sector, her time is supplied perfectly inelastically to the home. Under these conditions equation (11)', rather than determining the allocation of the wife's time between the home and the market, determines the shadow wage, w_f^* at which the wife would be indifferent between working one hour in the labour market and specializing entirely in the home. Thus the wife's shadow wage is jointly determined together with fertility and the husband's labour supply. Since the demand for the wife's time in the home depends on non-labour income, the husband's wage and prices, these variables enter as determinants of the shadow price of the wife's time:

$$(13)\ d\ \ell n[w_f^*(L_f=0)] = -(\mathcal{E}^c_{fw_f})^{-1}\{\mathcal{E}_{fV}\ d\ \ell n\ V + \mathcal{E}_{fw_m}\ d\ \ell n\ w_m + \mathcal{E}_{fP_x}\ d\ell n\ P_x + \mathcal{E}_{fP_y}\ d\ \ell n\ P_y\}$$

where $\mathcal{E}^c_{fw_f} > 0$ is the compensated own-wage elasticity of female labour supply.

According to the first-order condition (7iii), whether the wife ever works in the labour market depends on a comparison between the market wage and the shadow price of the wife's time evaluated at zero hours of work $w_f^*(L_f = 0)$. Given a distribution of the unobserved taste or home productivity parameter e, the probability of observing a woman in the market depends on the observed determinants of w_f and $w_f^*(L_f = 0)$. An increase in the wife's productivity in the labour market, and therefore her wage rate, increases the probability that she will be observed working. Since the exogenous variables in (13) influence the shadow wage these variables also affect the probability of the wife working. For women whose shadow wage is only slightly above their market wage, a change in an exogenous factor which decreases the shadow price of her time will cause her to become a labour force participant. Although the equation relating the probability of participation to these exogenous variables is not a labour supply schedule its parameters are related to those of (12)' and contain some information concerning the behavioral parameters of the model. For example, assuming the wife's home time is a normal good ($\mathcal{E}_{fV} < 0$) an increase in non-labour income raises the shadow wage and hence reduces the probability of labour force participation. Similarly, if the non-market times of husband and wife are substitutes both in consumption (having opposite factor intensities) and in production (in terms of elasticities of substitution θ_{mf}, $\mu_{mf} > 0$), so that $\mathcal{E}_{fw_m} < 0$, the probability of a wife working would be inversely related to her husband's wage rate. However, if the non-market times of spouses were sufficiently strong complements either in consumption (having the same factor intensities) or in production, the cross-wage elasticity $\mathcal{E}_{fw_m}$ could be positive so that an increase in the husband's wage could lower the wife's shadow wage and therefore raise the probability that the wife works. Empirical evidence concerning these predictions is presented in Section 3.

Changes in the wife's market wage that do not cause the wife to enter the labour force have no effect on commodity demands, family expenditures or the allocation of the time of family members. For families in which the wife is a non-labour force participant, the price of the wife's time is her endogenous shadow wage: w_f^*. The demand for children and the husband's labour supply schedule expressed in terms of the exogenous variables are:

$$(14) \quad d\,\ln N = [\varepsilon_{NV} - \frac{\varepsilon^c_{Nw_f}}{\varepsilon^c_{fw_f}}\varepsilon_{fV}]d\,\ln V + [\varepsilon_{Nw_m} - \frac{\varepsilon^c_{Nw_f}}{\varepsilon^c_{fw_f}}\varepsilon_{fw_m}]d\,\ln w_m$$

$$+ [\varepsilon_{NP_x} - \frac{\varepsilon^c_{Nw_f}}{\varepsilon^c_{fw_f}}\varepsilon_{fP_x}]d\,\ln P_x + [\varepsilon_{NP_y} - \frac{\varepsilon^c_{Nw_f}}{\varepsilon^c_{fw_f}}\varepsilon_{fP_y}]d\,\ln P_y$$

$$(15) \quad d\,\ln L_m = [\varepsilon_{mV} - \frac{\varepsilon^c_{mw_f}}{\varepsilon^c_{fw_f}}\varepsilon_{fV}]d\,\ln V + [\varepsilon_{mw_m} - \frac{\varepsilon^c_{mw_f}}{\varepsilon^c_{fw_f}}\varepsilon_{fw_m}]d\,\ln w_m$$

$$+ [\varepsilon_{mP_x} - \frac{\varepsilon^c_{mw_f}}{\varepsilon^c_{fw_f}}\varepsilon_{fP_x}]d\,\ln P_x + [\varepsilon_{mP_y} - \frac{\varepsilon^c_{mw_f}}{\varepsilon^c_{fw_f}}\varepsilon_{fP_y}]d\,\ln P_y$$

where the superscript c denotes a compensated elasticity. The following predictions can be made concerning the compensated elasticities which appear in (14) and (15): $\varepsilon^c_{fw_f} > 0$, $\varepsilon^c_{Nw_f} \lesseqgtr 0$ as $K^f_c \gtreqless K^f_z$, $\varepsilon^c_{mw_f} < 0$ if sign $(K^f_c - K^f_z) = -$sign $(K^m_c - K^m_z)$ and $\theta_{mf}, \mu_{mf} > 0$, $\varepsilon^c_{mw_f} > 0$ if sign $(K^f_c - K^f_z) =$ sign$(K^m_c - K^m_z)$ and $\theta_{mf}, \mu_{mf} < 0$

otherwise this cross-wage elasticity is ambiguous in sign.

The coefficients of these equations, which represent the total effect of changes in the exogenous variables on fertility and labour supply, are composed of two terms. The first term is the direct effect of a change in the exogenous variable on the dependent variable, assuming the constraint on the supply of the wife's time to the home is not binding (and hence the wife's shadow price of time is constant), and corresponds to the elasticities in equations (9)' and (12)'. The second term reflects the effect of the constraint, that all the wife's time is supplied inelastically to the home. This additional constraint, not binding on families with working wives, results in additional terms reflecting the simultaneous determination of the fertility, husband's labour supply and wife's shadow price of time. Because of these additional terms the elasticities in equations (14) and (15) for families with non-working wives are predicted to differ systematically from the corresponding elasticities in equations (9)' and (12)' for households with working wives.[12]

C. Inferences from a Comparison of Fertility and Husband's Labour Supply in the Two Regimes

Inferences regarding the time intensity of children and the substitutability (complementarity) of husband's and wife's time may be made from a comparison of (14) and (15) with (9)' and (12)'. Consider first the time intensity of children. The coefficients on the male wage rate in (9)' and (14) differ by the term $\{-(\varepsilon^c_{Nw_f}\varepsilon_{fw_m})/\varepsilon^c_{fw_f}\}$; since $\varepsilon^c_{fw_f} > 0$, the sign of this additional term in the equation for families with non-participating wives is given by $\text{sign}\{-(\varepsilon^c_{Nw_f}\varepsilon_{fw_m})\}$. Thus, given the sign of ε_{fw_m} from estimation of the wife's probability of participation, a comparison of the male wage coefficients in the fertility equations under the two regimes permits the inference of the sign of $\varepsilon^c_{Nw_f}$, and hence the female time intensity of children. Willis (1974) noted the possibility that family size may be positively related to husbands' wages for families with working wives and inversely related for families with non-working wives, based on the assumptions of female time intensity of children and substitutability between male and female time (i.e. $\varepsilon^c_{Nw_f} < 0$). Notice, however, that exactly the same result could occur if husband's and wife's times are sufficiently strong complements that $\varepsilon_{fw_f} > 0$ and children are not female time intensive so that $\varepsilon^c_{Nw_f} > 0$. Given the estimates presented in section 3 below it is possible to distinguish between these two cases. Similar inferences follow from a comparison of the non-labour income coefficient under the two regimes.[13] A more direct inference regarding the female time intensity of children may be made from the sign of the wife's wage coefficient in (9)' if normality of N is assumed.

In a similar fashion inferences may be made regarding the substitutability of husband's and wife's time by comparing the own wage elasticity of the husband's labour supply schedule in the two regimes. Since $\varepsilon^c_{fw_f} > 0$, the sign of the additional term in the male wage coefficient in (15) as compared to (12) is given by sign$[-(\varepsilon^c_{mw_f}\varepsilon_{fw_m})]$. Given the sign of ε_{fw_m} from the estimation of the wife's participation probability, a comparison of the own-wage elasticities for the two groups of married men [equations (12)' and (15)] indicates the sign of the compensated cross-wage elasticity, $\varepsilon^c_{mw_f}$. Based on a comparison of this type, Kneisner (1976) found that the compensated cross-wage elasticity was positive. In the context of the model presented above such a finding would imply that the non-market times of spouses are complements either in consumption (having the same ranking of factor intensities) or in production or both.

3. ECONOMETRIC SPECIFICATION

The data used to test the theoretical predictions derived in the last section are the 1/100 family file of the 1971 Canadian Census. The sample was restricted to married women aged 35-60 whose husbands were: employed in the civilian labour force, with positive earnings, weeks and usual hours of work.[14] This selection ensured completed fertility cohorts with a measure of the husband's wage, and resulted in a sample of 17,405 families. The variables employed in the empirical analysis are described in detail in Appendix B. They are discussed briefly below.

Since the sample consists of completed fertility cohorts the couple's lifetime fertility is measured by the number of children (NKIDS). Previous studies (e.g., Cain and Dooley, 1976; Fleisher and Rhodes, 1979; Carliner, et al., 1980) have typically employed measures of current wage rates for men and working women and current labour supply (annual hours for both spouses and the current labour force participation status of wives). Ad hoc hypotheses are required to relate these current variables to the theoretical model of lifetime fertility and lifetime labour supply. This study departs from previous empirical work in the use of measures of wage rates and labour supply which correspond more closely to the theoretical lifetime concepts. Results using measures of current wages and labour supply are presented for purposes of comparison. In order to compute lifetime wages, wage-experience profiles were estimated for men and women which vary by education, language and immigrant status--characteristics which are assumed exogenous.[15] The discounted present value of these profiles, adjusted for secular economic growth, are used to represent lifetime wage rates for men and for women who worked in the labour force at some point in their lifetime.

In contrast to other large data sets (e.g., the U.S. census) the 1971 Canadian census contains a direct measure of lifetime labour supply: whether or not the wife ever worked in the labour market. In the sample used in this study over 20% of married women reported that they had never worked in the labour market.[16] This information on lifetime labour force participation is used in a number of ways. First the determinants of lifetime labour force participation are analyzed, providing insight into the underlying parameters of the lifetime model, and the results are contrasted with the determinants of current (1970) labour force participation. Second the lifetime labour force participation variable is used to distinguish between families with working and non-working wives. This permits a direct test of the predictions of Willis and Kneisner that the fertility and husband's labour supply of the two groups differ according to whether or not the value of the wife's time is held constant. These differences come about because in the case of non-working women the female market wage rate is an "irrelevant price", whereas for working women it is the shadow price of time. In the one-period lifetime models of Willis and Kneisner the female wage is only an irrelevant price if the wife never works in the lifetime. Thus in testing for the predicted differences in behavior of the two types of family, the appropriate partition into the two regimes is according to whether the wife ever works in the market, rather than whether she happened to be working "last month" or "last year", as is currently the case in the literature (Kneisner, 1976). Many wives who are lifetime market participants will be out of the market for some periods of their lifetime, therefore the classification of families into the two regimes on the basis of current data is particularly suspect since it will tend to pick up life cycle or timing effects rather than lifetime regime effects. Thirdly, the correction procedures for sample selection bias proposed by Heckman (1976, 1979) are implemented to permit the appropriate comparison between the two groups of families.

The econometric specification is an endogenous switching model of the type discussed in Poirier and Ruud (1981) which is estimated using the procedure developed by Heckman (1976, 1979). Letting bars denote the regime of non-participation by the wife, the model for family i is

(17) $$N_i = X_{N_i}\beta_N + U_{N_i}$$

(18) $$\bar{N}_i = \bar{X}_{N_i}\bar{\beta}_N + \bar{U}_{N_i}$$

(19) $$L_{M_i} = X_{M_i}\beta_M + U_{M_i}$$

(20) $$\bar{L}_{M_i} = \bar{X}_{M_i}\bar{\beta}_M + \bar{U}_{M_i}$$

(21) $$L^*_{f_i} = X_{L_i}\beta_L + U_{L_i}$$

(22) $$P_i = 1 \text{ if } L^*_{f_i} > 0$$
$$= 0 \text{ if } L^*_{f_i} \leq 0$$

where N_i and $\bar{N}_i$ represent desired family sizes in the two states, X_{N_i} and $\bar{X}_{N_i}$ are the vectors of exogenous variables in (9)' and (14) respectively, β_N and $\bar{\beta}_N$ are the corresponding coefficient vectors, and U_{N_i} and $\bar{U}_{N_i}$ are the respective disturbances (which may be identical) reflecting omitted variables summarized by e in equations (2)-(3). Similarly, (19) and (20) correspond to equations (12)' and (15) in the previous section. In equation (21), $L^*_{f_i}$ is desired labour supply of the wife, which depends on the determinants of the shadow wage and market wage (X_{L_i}). Desired lifetime labour supply of the wife is not observed; however, we observe whether it exceeds or falls short of zero--i.e., whether the wife participates or not. This is represented in (22) by P_i which equals unity if the wife participates and zero otherwise. In addition, the indicator P_i specifies the observability of (18)-(20), i.e. we observe:

$$\left.\begin{aligned} N_i^o &= X_{N_i}\beta_N + U_{N_i} \\ L_{M_i}^o &= X_{M_i}\beta_M + U_{M_i} \end{aligned}\right\} \text{ if } P_i = 1$$

$$\left.\begin{aligned} N_i^o &= \bar{X}_{N_i}\bar{\beta}_N + \bar{U}_{N_i} \\ L_{M_i}^o &= \bar{X}_{M_i}\bar{\beta}_M + \bar{U}_{M_i} \end{aligned}\right\} \text{ if } P_i = 0$$

The statistical specification is:

$$[U_{N_i}, \bar{U}_{N_i}, U_{M_i}, \bar{U}_{M_i}, U_{L_i}]' \sim N(0,\mathcal{E}) \qquad i=1,2,\ldots,T$$

are independently distributed where $\mathcal{E}$ is a positive definite matrix with non-zero off diagonal elements. Consistent estimates of the coefficient vectors β_N, $\bar{\beta}_N$, β_M, $\bar{\beta}_M$ may be obtained by noting that the conditional (or regime) regression functions may be written:

$$E[N_i^o | P_i = 1] = X_{N_i}\beta_N + \frac{\sigma_{U_N U_L}}{\sigma_{U_L U_L}^{\frac{1}{2}}}\lambda_{A_i}$$

$$E[N_i^o | P_i = 0] = \bar{X}_{N_i}\bar{\beta}_N - \frac{\sigma_{\bar{U}_N U_L}}{\sigma_{U_L U_L}^{\frac{1}{2}}}\lambda_{B_i}$$

$$E[L^o_{M_i} | P_i = 1] = X_{M_i}\beta_M + \frac{\sigma_{U_M U_L}}{\sigma^{\frac{1}{2}}_{U_L U_L}} \lambda_{A_i}$$

$$E[L^o_{M_i} | P_i = 0] = \bar{X}_{M_i}\bar{\beta}_M - \frac{\sigma_{\bar{U}_M U_L}}{\sigma^{\frac{1}{2}}_{U_L U_L}} \lambda_{B_i}$$

where $\lambda_{A_i} = \frac{f(X_{L_i}\beta^*_L)}{F(X_{L_i}\beta^*_L)}$, $\lambda_{B_i} = \frac{f(X_{L_i}\beta^*_L)}{1-F(X_{L_i}\beta^*_L)}$

where f is the standard normal p.d.f., F is the standard normal c.d.f. and β^*_L is the normalized value of β_L. The two-step procedure of Heckman (1976, 1979) may be applied using a probit analysis of (21)-(22) to estimate λ_{A_i} and λ_{B_i} and including these estimates in the censored OLS regressions of (17)-(20).

In the absence of direct measures of lifetime hours of work of husbands, a crude measure was constructed by multiplying 1970 hours of work by the number of potential working years between the completion of schooling and retirement. Although less than ideal this measure incorporates the fact that, with a given date of retirement, individuals with greater investments in schooling collect the returns to their human capital investment over a shorter working career. In order to control for the distribution of lifetime hours over the life cycle, concerning which the theoretical model is silent, the ages of both spouses are included in the estimating equations.

In order to estimate the model, a specification of the determinants of the prices of the goods inputs: P_x and P_y, in terms of observable variables is required. Since the marital lifetimes of different couples commence and terminate at different dates, and prices are expected to vary over time, the average prices of goods faced by couples over their lifetimes will differ across cohorts. Hence the ages of both spouses are introduced as determinants of market prices. Prices may also differ across regions and between rural and urban areas reflecting differences in taxes, transportation costs and the prices of local amenities. In general not only absolute prices but also the price of child related goods relative to other goods (P_x/P_y) will vary across cohorts and with location. In particular it is often hypothesized that the cost of raising children is successively lower in small towns, in rural areas, and on farms as compared to cities (e.g., Rosenzweig and Evenson 1977). Because the psychic marginal cost of using efficient birth techniques to prevent conception may be higher for Catholics, it is also hypothesized that the cost of having children is lower for Catholics than non-Catholics. The specification is thus:

$$(16)\quad \begin{cases} P_y = k\ (\text{Age, Region, Urban/Rural}) \\ P_x = z\ (\text{Age, Region, Urban/Rural, Catholic}) \\ P_x/P_y = m\ (\text{Age, Region, Urban/Rural, Catholic}) \end{cases}$$

Additional variables are introduced in the regressions to control for differences in 'tastes' and/or 'home productivity'. The religion, language and immigration variables may be interpreted in this manner. More generally the immigration variable may reflect the fact that immigrant couples faced different constraints than the native-born at some point in their lifetime. Lastly, a dummy variable is introduced to distinguish families in which at least one spouse has been married more than once. The fertility and labour supply of such couples may differ from once-married couples, due to their divergent past experience. For example the presence of children from a previous marriage may affect fertility in subsequent marriages.[17]

4. EMPIRICAL RESULTS

The first stage in the estimation of the coefficient vectors in the fertility and husband's labour supply equations in the two regimes is the estimation of the probability of a family with given observed characteristics being in a particular regime--i.e., the probability of labour force participation. The second stage consists of estimating the fertility and husband's labour supply within each regime. The empirical results are considered in turn below.

A. Labour Force Participation

Table 1 reports the probit estimates of the coefficient vector β_L^*, indicating the effect of the exogenous variable on the probability of a wife ever participating in the market (LTLFP). For purposes of comparison results are also presented for current participation (LFP70). The most striking result is that an increase in the husband's lifetime wage (column 1) or education (up to high school, column 2) increases the probability that the wife will ever work. This finding in the lifetime participation equations implies a positive cross-wage elasticity--complementarity--in the lifetime model. In contrast, in the current participation equations (columns 3 and 4) an increase in the husband's current wage or schooling reduces the probability of the wife currently working. These results indicate that current participation is a poor proxy for lifetime participation and represents a markedly different dimension of labour supply. The lifetime participation equation represents the "true" participation equation for the entire sample, i.e., indicating the probability of being in a lifetime corner solution with respect to labour supply. However, the current participation equation reflects two choices: The decision to ever participate in the lifetime and also, amongst lifetime labour force participants, the decision

Table 1: Lifetime and Current Labour Force Participation

Reg. No.	(1)	(2)	(3)	(4)
Dependent Var.	LTLFP	LTLFP	LFP70	LFP70
LTWAGE*	0.207 [7.113]			
WAGE70*			-0.112 [15.275]	
Husband's Schooling:				
SCHHS		0.009 [6.685]		-0.007 [3.661]
COLNo Deg		-0.001 [0.241]		-0.005 [0.651]
COLDeg		0.002 [0.517]		-0.035 [9.335]
Wife's Schooling:				
SCHHS	0.024 [18.102]	0.023 [16.296]	0.025 [13.924]	0.027 [13.461]
COLNo Deg	0.003 [0.422]	0.005 [0.593]	0.029 [3.459]	0.041 [4.738]
COLDeg	0.013 [1.765]	0.018 [2.337]	0.026 [3.970]	0.041 [5.999]
LTV	- .0001 [0.619]	- .0001 [0.380]		
V70			- .0003 [1.152]	- .0006 [2.055]
Region:				
NFL	-0.076 [3.816]	-0.077 [3.853]	-0.225 [7.543]	0.210 [7.055]
ATL	-0.076 [6.087]	-0.076 [6.067]	-0.100 [5.767]	-0.080 [4.612]
QUE	-0.066 [6.682]	-0.065 [6.582]	-0.146 [10.647]	-0.136 [9.938]
PR	-0.003 [0.328]	-0.005 [0.449]	-0.016 [1.345]	-0.004 [0.372]
BC	-0.019 [1.777]	-0.020 [1.853]	-0.054 [4.111]	-0.059 [4.559]

Table 1 (cont'd.)

Reg. No.	(1)	(2)	(3)	(4)
Dependent Var.	LTLFP	LTLFP	LFP70	LFP70
Urban/Rural:				
TOWN	-0.037	-0.037	-0.033	-0.027
	[4.834]	[4.879]	[3.191]	[2.668]
RNF	-0.058	-0.058	-0.086	-0.072
	[6.718]	[6.755]	[7.156]	[6.053]
FARM	-0.024	-0.024	-0.001	0.027
	[1.392]	[1.380]	[0.035]	[1.161]
Language:				
FR	-0.064	-0.069	-0.034	-0.029
	[4.065]	[4.393]	[1.563]	[1.335]
OTHLANG	0.008	-0.010	0.012	0.012
	[0.483]	[0.624]	[0.645]	[0.658]
FRSP	-0.060	-0.063	-0.028	-0.026
	[3.830]	[3.955]	[1.266]	[1.189]
OTHLANGSP	-0.038	-0.035	0.020	0.028
	[2.580]	[2.319]	[1.128]	[1.565]
Religion:				
CATH	-0.022	-0.020	-0.010	-0.013
	[1.624]	[1.468]	[0.569]	[0.783]
JEW	0.048	0.047	-0.004	-0.025
	[0.601]	[0.593]	[0.048]	[0.284]
CATHSP	-0.022	-0.022	-0.005	-0.008
	[1.649]	[1.603]	[0.320]	[0.470]
JEWSP	-0.051	-0.052	0.002	0.014
	[0.654]	[0.661]	[0.020]	[0.160]
AGE	-0.007	-0.011	0.006	0.003
	[1.364]	[1.989]	[0.781]	[0.369]
AGESQ	.00009	.00009	- .00003	.000003
	[1.579]	[1.579]	[0.396]	[0.043]
AGESP	0.025	0.024	0.064	0.064
	[3.389]	[3.317]	[6.568]	[6.524]
AGESPSQ	-0.0003	-0.00003	- .0007	- .0007
	[3.876]	[3.815]	[7.139]	[7.101]
IMMIG	-0.001	-0.001	0.028	0.034
	[1.479]	[1.459]	[2.470]	[2.970]
SECMAR	0.040	0.040	0.046	0.047
	[3.510]	[3.519]	[3.280]	[3.360]
$\mathcal{L}$	2770.52	2769.87	1355.06	1245.95
N	17405	17405	17405	17405
N of limits	3525	3525	9868	9868

Table 1 (cont'd.)

Notes to Table 1

1. * designates natural logarithm of variable entered.

2. Absolute value of asymptotic t-statistic reported in parentheses.

3. All equations included constant not reported.

4. Probit equations estimated by maximum likelihood. Reported coefficients are the marginal effects of the independent variables evaluated at the mean.

whether or not to participate in the current period, that is the timing of lifetime labour supply over the life cycle. The coefficients of the current labour force participation equation may tell us little concerning the determinants of the lifetime decision.

The other variables display a similar effect on both participation measures with a few exceptions. An additional year of schooling by the wife increases the probability that the wife will ever work and also that she worked in 1970, presumably because schooling increases market productivity relative to home productivity. However an additional year of college for women without a college degree does not significantly affect lifetime participation. The wife's age variables imply an inverse 'U' relationship between both participation measures and age which is explicable in terms of the interaction of life cycle factors and secular trends. Women in Ontario and the prairie provinces display higher participation rates than women elsewhere. Lastly, differences in lifetime participation rates across language groups are more marked than differences in current participation. Other things equal we find no significant differences across language groups in current labour force participation.[18] However, if either spouse has a French mother tongue or if the wife's mother tongue is neither official language,[19] this lowers the probability that the wife will ever work.

B. <u>Fertility</u>

Table 2 columns (3) and (5) present the estimates of β_N and $\bar{\beta}_N$, the coefficient vectors from the fertility equations for families with a lifetime participant wife and a lifetime non-participant wife, respectively. In column (4) wife's education is used in place of the constructed proxy for the wife's lifetime wage. The lambda regressors, λ_A and λ_B are included to correct for the self-selection into the two regimes and the high significance

Table 2: The Determinants of Fertility

Dependent Variable = NKIDS*

Reg. No.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Sample:	ALL	ALL	LTLFP	LTLFP	LTNLFP	LTNLFP	LFP70	LFP70	NLFP70	NLFP70
LTWAGE*		-0.048 [1.000]	0.198 [3.587]	0.203 [3.506]	-0.279 [1.924]	-0.433 [2.221]				
WAGE70*	0.046 [4.647]						0.044 [2.854]	0.069 [4.036]	-0.016 [1.205]	0.007 [0.494]
LTWAGESP*			0.083 [1.867]							
WAGE70SP*							-0.078 [6.923]			
Wife's Schooling:										
SCHHS	-0.027 [11.066]	-0.025 [9.677]		0.005 [1.010]		-0.021 [1.171]		-0.035 [6.585]		-0.018 [3.957]
COLNo Deg	0.002 [0.202]	0.003 [0.289]		-0.001 [0.089]		-0.007 [0.187]		0.018 [1.051]		-0.009 [0.529]
COLDeg	0.004 [0.442]	0.009 [0.978]		0.008 [0.891]		-0.007 [0.150]		-0.003 [0.217]		0.022 [1.551]
LTV		-0.001 [2.364]	-0.001 [3.061]	-0.001 [3.000]	.0001 [0.066]	.0002 [0.204]				
V70	-0.001 [3.167]						-0.003 [4.028]	-0.003 [3.914]	-0.007 [1.406]	-0.0004 [0.805]
Region										
NFL	0.298 [7.661]	0.287 [7.359]	0.196 [4.336]	0.198 [4.352]	0.271 [3.203]	0.335 [3.327]	0.173 [2.160]	0.304 [3.598]	0.210 [4.200]	0.279 [5.129]
ATL	0.119 [4.979]	0.109 [4.561]	0.026 [0.920]	0.030 [1.045]	0.058 [1.045]	0.121 [1.566]	0.085 [2.139]	0.143 [3.479]	0.058 [1.839]	0.093 [2.796]
QUE	-0.083 [4.416]	-0.086 [4.536]	-0.182 [7.983]	-0.178 [7.640]	-0.062 [1.402]	-0.011 [0.175]	-0.213 [6.210]	-0.141 [4.159]	-0.121 [4.384]	-0.066 [2.037]
PR	0.106 [5.988]	0.101 [6.012]	0.099 [5.571]	0.099 [5.548]	0.116 [2.403]	0.121 [2.490]	0.109 [4.542]	0.115 [4.772]	0.082 [3.515]	0.090 [3.850]
BC	0.018 [0.975]	0.020 [1.081]	0.012 [0.596]	0.012 [0.639]	-0.048 [0.927]	-0.032 [0.604]	0.027 [0.986]	0.061 [2.114]	-0.054 [2.185]	-0.028 [1.073]

Table 2 (cont'd.)

Reg. No.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Sample:	ALL	ALL	LTLFP	LTLFP	LTNLFP	LTNLFP	LFP70	LFP70	NLFP70	NLFP70
Urban/Rural										
TOWN	0.133 [9.468]	0.128 [9.078]	0.091 [5.531]	0.093 [5.539]	0.098 [3.088]	0.125 [3.173]	0.135 [6.054]	0.151 [6.693]	0.106 [5.809]	0.116 [6.304]
RNF	0.204 [12.593]	0.193 [11.841]	0.102 [5.103]	0.105 [5.122]	0.222 [6.000]	0.264 [5.106]	0.135 [4.804]	0.183 [6.225]	0.186 [8.571]	0.208 [9.135]
FARM	0.346 [10.679]	0.326 [10.093]	0.260 [7.222]	0.261 [7.238]	0.480 [6.713]	0.496 [6.804]	0.337 [7.179]	0.352 [7.505]	0.347 [7.780]	0.336 [7.517]
Language										
FR	0.111 [3.676]	0.106 [3.498]	-0.013 [0.358]	-0.010 [0.266]	0.133 [1.844]	0.184 [2.225]	0.098 [2.085]	0.113 [2.404]	0.095 [2.419]	0.101 [2.553]
OTHLANG	-0.005 [0.197]	-0.013 [0.508]	-0.002 [0.058]	0.0003 [0.011]	-0.037 [0.485]	-0.044 [0.575]	-0.014 [0.392]	-0.037 [1.000]	0.044 [1.225]	0.030 [0.826]
FRSP	-0.011 [0.361]	-0.010 [0.344]	-0.089 [2.541]	-0.085 [2.384]	-0.126 [1.757]	-0.082 [1.010]	0.022 [0.471]	0.031 [6.645]	-0.039 [0.982]	-0.036 [0.930]
OTHLANGSP	-0.088 [3.510]	-0.089 [3.562]	-0.120 [4.428]	-0.117 [4.333]	-0.169 [2.256]	-0.138 [1.736]	-0.054 [1.524]	-0.088 [2.437]	-0.065 [1.870]	-0.084 [2.406]
Religion										
CATH	0.059 [2.497]	0.059 [2.487]	0.035 [1.370]	0.036 [1.433]	0.033 [0.511]	0.049 [0.741]	-0.002 [0.047]	-0.004 [0.115]	0.114 [3.529]	0.117 [3.622]
JEW	0.058 [0.464]	0.066 [0.524]	0.165 [1.269]	0.161 [1.239]	-0.189 [0.448]	-0.231 [0.545]	0.132 [0.752]	0.107 [0.608]	-0.006 [0.036]	0.013 [0.074]
CATHSP	0.100 [4.286]	0.099 [4.258]	0.078 [3.128]	0.080 [3.209]	0.086 [1.320]	0.105 [1.556]	0.126 [3.739]	0.125 [3.709]	0.071 [2.221]	0.070 [2.184]
JEWSP	-0.024 [0.192]	-0.030 [0.238]	-0.117 [0.900]	-0.112 [0.862]	0.123 [0.294]	0.164 [0.391]	-0.010 [0.057]	0.011 [0.066]	-0.032 [0.182]	-0.044 [0.246]
AGE	0.053 [5.464]	0.054 [5.518]	0.048 [4.475]	0.049 [4.509]	0.045 [1.965]	0.050 [2.141]	0.078 [5.215]	0.074 [5.000]	0.038 [3.007]	0.036 [2.874]
AGESQ	-.0005 [4.664]	-.0005 [4.865]	-.0004 [3.783]	-.0004 [3.784]	-.0004 [1.922]	-.0005 [2.127]	-.0007 [4.523]	-.0007 [4.412]	-.0003 [2.285]	-.0003 [2.277]

Table 2 (cont'd.)

Reg. No.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Sample:	ALL	ALL	LTLFP	LTLFP	LTNLFP	LTNLFP	LFP70	LFP70	NLFP70	NLFP70
AGESP	0.035 [2.632]	0.035 [2.601]	0.063 [4.055]	0.059 [3.838]	0.082 [2.698]	0.064 [1.858]	0.025 [1.113]	-0.008 [0.355]	0.098 [5.374]	0.073 [3.706]
AGESPSQ	-.0006 [3.951]	-.0006 [3.924]	-.0009 [5.430]	-.0009 [5.252]	-.0010 [3.215]	-.0008 [2.172]	-.0005 [2.025]	-.0001 [0.405]	-.0013 [6.421]	-.0010 [4.540]
IMMIG	-0.129 [8.217]	-0.125 [7.803]	-0.156 [9.123]	-0.153 [8.947]	-0.019 [0.421]	-0.014 [0.310]	-0.136 [5.939]	-0.146 [6.348]	-0.095 [4.365]	-0.109 [4.932]
SECMAR	-0.146 [7.565]	-0.149 [7.650]	-0.118 [5.540]	-0.120 [5.556]	-0.051 [0.992]	-0.083 [1.425]	-0.136 [4.739]	-0.163 [5.563]	-0.109 [4.082]	-0.129 [4.708]
λ_A			0.700 [7.659]	0.665 [6.157]			0.249 [3.796]	-0.089 [0.896]		
λ_B					-0.118 [1.639]	0.145 [0.612]			-0.253 [3.839]	0.019 [0.179]
R^2	.091	.090	.081	.080	.092	.092	.088	.088	.087	.089
N	17405	17405	13880	13880	3525	3525	7537	7537	9868	9868

Notes to Table 2:

1. * designates the natural logarithm of variable entered.
2. Absolute value of t statistics reported in parentheses.
3. All equations included a constant (not reported)
4. λ_A and λ_B are the estimated values of the truncated means of the normal density to selection: $\lambda_A = f(\cdot)/F(\cdot)$ and $\lambda_B = - f(\cdot)/[1-F(\cdot)]$, where $F(\cdot)$ is the accumulative normal density and $f(\cdot)$ is its probability density function (see Heckman [1976, 1979]).

level of the λ_A coefficient indicates that selection bias would be present if the effect of the endogenous switching between regimes was ignored. Indeed, estimates of the important coefficients are sensitive to the inclusion of these correction factors. The most interesting finding is that, controlling for selection, an increase in the wife's wage rate <u>increases</u> completed family size (column 3), though the significance level of the coefficient is only 6 percent. This contrasts dramatically with the standard finding of a strong negative effect of the wife's wage on completed family size, usually attributed to the assumed female time intensity of children, and suggests on the contrary that children may not be intensive in female time. The female wage coefficient reflects both an income and a substitution effect. In principle the sign of the income effect could be obtained from the sign of the coefficient on non-labour income (LTV). However, the unreliability of non-labour income measures renders the estimate suspect.

As noted earlier, since the sign of the difference in the husband's wage coefficient in the two regions is given by sign$\{-(\mathcal{E}^c_{Nw_f}\,\mathcal{E}_{fw_N})\}$, an indirect inference on the wife's time intensity may be made given the sign of $\mathcal{E}_{fw_N}$ from the probit analysis. For families with working wives the male wage coefficient is positive and significant (t=3.59) while those with non-working wives have a negative coefficient (t=1.924). This conforms to the prediction of Willis (1974). However, given the positive probit estimate of $\mathcal{E}_{fw_M}$, the difference in the coefficients on husband's wage implies that $\mathcal{E}^c_{Nw_f} > 0$. Hence, the underlying mechanism is not that proposed by Willis--substitutability of husband's and wife's time and femaletime intensity of children--but rather is the converse--complementarity of husband's and wife's time and non-female time intensity of children.

These results are sensitive to the inclusion of the correction factors for censoring, and more generally to the sample partitioning by whether or not the wife ever works.[20] Columns (7)-(10), for example, present results when the sample is partitioned by current participation status of the wife. The wife's wage rate (or education) now has the usual negative effect on fertility and the difference in the husband's wage coefficient across regimes all but disappears. This is expected since partitioning the sample by current participation status does not classify the sample according to whether (9)' or (14) is the relevant fertility equation. For all current participants the lifetime participant's fertility equation (9)' is the relevant one. For non-current participants approximately 60% are lifetime participants and 40% non-participants, hence their equation will be a combination of (9)' and (14). Similar reasoning predicts that education as a proxy for the wife's wage rate will have the same effect for 60% of current non-participants as for current participants. This is confirmed by the similarity of the wife's schooling coefficients in (8) and (10) to the wife's wage coefficient in (7).

If wife's education is a proxy for the wife's wage then for lifetime participants education should have the same effect as wife's lifetime wage (columns (3) and (4)). In contrast for lifetime non-labour force participants (column 6) wife's education should be irrelevant and in particular need not have the same direction of effect as the wife's wage rate for the participants sample. We find that wife's education is not significant for either group (columns 4 and 6). Also presented for comparison (columns 1 and 2) is a "standard" fertility equation for the full sample. This exhibits the usual negative effect of wife's education on family size (see, for example, Ben Porath

1974). The results above, however, suggest that this negative relation is due to a complex interaction between schooling,participation and fertility that results from switching between participation regimes with significantly different fertility equations. A possible alternative explanation is that the censoring factors (λ_A and λ_B) are capturing non-linear terms in wife's schooling, or wage rate.[21] However, experiments with more flexible functional forms in the censored regressions always yielded positive partial effects of the wife's education or wage rate.

The remaining fertility results, broadly common to all samples may be summarized as follows: The non-labour income variables are negative and significant. However the imperfect nature of these proxy variables makes the interpretation of this finding difficult (see also Table 3 below). Holding the characteristics of both spouses constant, couples in Newfoundland, the Maritimes and the Prairie Provinces have significantly higher fertility, and couples in Quebec significantly lower fertility than families in Ontario or British Columbia. Other things equal, households in small cities (TOWN), rural non-farm and farm locations have successively more children, which may reflect differences in the relative price of child-related goods. If either spouse is Catholic this is associated with greater family size. Fertility also differs significantly between language groups.[22] If the husband has a French mother tongue this is associated with more children; however a French language mother tongue of the wife has no significant effect on fertility. If the wife has neither an English nor French mother tongue (OTHLANGSP) this is associated with lower fertility. This language effect may be acting as a proxy for the immigrant status of the wife, since the immigrant status of the husband is also associated with fewer children. The SECMAR variable indicates that the fact that one spouse has been married previously reduces marital fertility.

Lastly the vector of age variables is significant suggesting that the cross-section equation is inadequate to account for the secular changes in fertility.

C. Labour Supply

Columns (2) and (4) in Table 3 present estimates of the coefficient vectors, β_M and $\bar{\beta}_M$ in the husband's labour supply equations in the two regimes (12)' and (15).[23] Column (3) uses wife's education in place of the constructed proxy for the wife's lifetime wage. Of principal interest is the difference between the own wage coefficients in the two regimes since the sign of the difference is given by $\text{sign}\{-(\varepsilon^c_{Mw_f}\varepsilon_{fw_M})\}$ and given $\varepsilon_{fw_M} > 0$ from the probit analysis, this permits us to infer the sign of $\varepsilon^c_{Mw_f}$. In fact, however, the difference in the coefficients is insignificant, implying neither complementarity nor substitutability by this indirect test. The effect of the wife's wage or schooling is negative, though the significance level is low. The wife's wage coefficient in particular is consistent, given normality of husband's time, with weak or zero complementarity. These results are in contrast to the probit estimate of ε_{fw_M} which suggests strong complementarity. One possible explanation is that the proxy for lifetime male labour supply is poor, reflecting primarily current labour supply. Again the significant coefficient λ_A indicates the presence of endogenous selection.

For purposes of comparison with the existing literature, Table 3 also includes estimates of the husband's current labour supply for the two regimes partitioned by the wife's current labour force status (columns 7-10). The estimates in columns (7) and (9) are consistent with Kneisner's (1976) findings of complementarity between husband's and wife's time via the indirect inference method. The positive coefficient of the wife's wage rate is also consistent

Table 3: Husband's Labour Supply

Reg. No.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent Variable	LTHRS*	LTHRS*	LTHRS*	LTHRS*	LTHRS*	ANNHRS*	ANNHRS*	ANNHRS*	ANNHRS*	ANNHRS*
Sample:	ALL	LTLFP	LTLFP	LTNLFP	LTNLFP	ALL	LFP70	LFP70	NLFP70	NLFP70
LTWAGE*	-0.331 [12.784]	-0.380 [13.194]	-0.361 [11.954]	-0.339 [3.779]	-0.252 [2.083]					
WAGE70*						-0.223 [44.071]	-0.798 [11.742]	-0.641 [24.471]	0.213 [8.323]	-0.444 [24.185]
LTWAGESP*		-0.026 [1.113]								
WAGE70SP*							0.975 [7.356]			
Wife's Schooling										
SCHHS	0.005 [3.907]		0.001 [0.439]		0.012 [1.067]	0.020 [16.160]		0.059 [13.696]		0.059 [17.290]
COLNoDeg	-0.012 [1.884]		-0.010 [1.623]		-0.007 [0.034]	-0.004 [0.748]		0.031 [2.977]		0.043 [4.496]
COLDeg	-0.013 [2.654]		-0.012 [2.542]		-0.008 [0.280]	-0.008 [1.723]		0.060 [7.494]		0.053 [6.607]
LTV	0.001 [3.555]	0.001 [4.157]	0.001 [4.210]	-0.0001 [0.094]	-0.0001 [0.211]					
V70						-0.002 [8.585]	-.0002 [0.202]	0.003 [8.024]	-.0001 [0.400]	.0011 [3.955]
Region										
NFL	-0.125 [5.952]	-0.112 [4.746]	-0.115 [4.852]	-0.120 [2.286]	-0.152 [2.436]	-0.167 [8.392]	-0.378 [3.810]	-0.558 [9.820]	0.150 [4.487]	-0.454 [13.153]
ATL	-0.040 [3.132]	-0.027 [1.785]	-0.031 [2.033]	-0.021 [0.612]	-0.055 [1.140]	-0.088 [7.238]	-0.123 [2.638]	-0.277 [10.150]	0.108 [5.083]	-0.240 [11.712]
QUE	-0.011 [1.088]	-0.013 [1.126]	-0.017 [0.405]	0.049 [1.767]	0.022 [0.557]	-0.021 [2.207]	-0.328 [5.653]	-0.284 [10.040]	0.163 [9.156]	-0.195 [9.285]
PR	-0.012 [1.291]	-0.010 [1.070]	-0.010 [1.030]	-0.031 [1.027]	-0.034 [1.113]	-0.033 [3.814]	-0.066 [2.327]	-0.073 [5.050]	0.023 [1.583]	-0.068 [5.336]

Table 3: (cont'd.)

Reg. No.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent Variable	LTHRS*	LTHRS*	LTHRS*	LTHRS*	LTHRS*	ANNHRS*	ANNHRS*	ANNHRS*	ANNHRS*	ANNHRS*
Sample:	ALL	LTLFP	LTLFP	LTNLFP	LTNLFP	ALL	LFP70	LFP70	NLFP70	NLFP70
Region (cont'd.)										
BC	-0.058 [5.870]	-0.045 [4.508]	-0.046 [4.574]	-0.121 [3.746]	-0.130 [3.892]	-0.046] [4.903]	-0.114 [3.296]	-0.114 [6.416]	-0.021 [1.375]	-0.115 [7.988]
Urban/Rural										
TOWN	-0.007 [0.092]	0.005 [0.580]	0.003 [0.290]	0.010 [0.523]	-0.004 [0.178]	-0.024 [3.336]	-0.053 [2.003]	-0.087 [6.151]	0.034 [2.967]	-0.079 [7.709]
RNF	-0.074 [8.404]	-0.055 [5.245]	-0.058 [5.439]	-0.081 [3.544]	-0.103 [3.219]	-0.123 [14.819]	-0.192 [5.472]	-0.284 [13.611]	0.031 [2.023]	-0.252 [17.298]
FARM	-0.014 [0.828]	0.014 [0.765]	0.013 [0.692]	-0.103 [2.325]	-0.112 [2.478]	-0.109 [6.566]	0.197 [2.814]	-0.150 [5.345]	-0.010 [0.342]	-0.187 [7.824]
Language										
FR	-0.005 [0.324]	0.016 [0.864]	0.011 [0.567]	-0.021 [0.486]	-0.048 [0.945]	-0.015 [0.972]	-0.089 [1.587]	-0.062 [2.205]	0.028 [1.162]	-0.075 [3.571]
OTHLANG	-0.048 [3.371]	-0.045 [3.097]	-0.043 [2.993]	-0.084 [1.773]	-0.079 [1.655]	-0.039 [2.058]	-0.036 [0.845]	-0.035 [1.624]	-0.021 [0.987]	-0.031 [1.652]
FRSP	-0.028 [1.693]	-0.012 [0.645]	-0.017 [0.893]	-0.023 [0.527]	-0.047 [0.925]	-0.019 [1.219]	-0.110 [1.960]	-0.065 [2.304]	0.018 [0.760]	-0.041 [1.988]
OTHLANGSP	-0.002 [0.152]	0.003 [0.248]	0.002 [0.137]	0.007 [0.147]	-0.009 [0.180]	-0.016 [1.234]	-0.016 [0.393]	0.007 [0.333]	0.003 [0.146]	0.002 [0.133]
Religion										
CATH	-0.0006 [0.049]	-0.004 [0.321]	-0.006 [0.439]	0.047 [1.169]	0.038 [0.930]	-0.007 [0.537]	-0.069 [1.715]	-0.030 [1.490]	0.014 [0.720]	-0.012 [0.701]
JEW	0.085 [1.259]	0.092 [1.365]	0.096 [1.412]	-0.126 [0.481]	-0.102 [0.388]	0.135 [2.110]	-0.244 [1.155]	0.149 [1.432]	0.022 [0.202]	0.136 [1.448]
CATHSP	-0.005 [0.406]	0.002 [0.125]	0.002 [0.016]	-0.023 [0.557]	-0.032 [0.769]	-0.010 [0.849]	0.032 [0.823]	-0.001 [0.057]	0.004 [0.215]	-0.033 [1.944]
JEWSP	-0.010 [0.151]	-0.002 [0.025]	-0.007 [0.097]	0.111 [0.429]	0.088 [0.340]	-0.051 [0.792]	0.090 [0.441]	-0.092 [0.889]	0.041 [0.377]	-0.024 [0.257]

Table 3 : (cont'd.)

Reg. No.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent Variable	LTHRS*	LTHRS*	LTHRS*	LTHRS*	LTHRS*	ANNHRS*	ANNHRS*	ANNHRS*	ANNHRS*	ANNHRS*
Sample:	ALL	LTLFP	LTLFP	LTNLFP	LTNLFP	ALL	LFP70	LFP70	NLFP70	NLFP70
AGE	0.014 [2.757]	0.013 [2.357]	0.013 [2.250]	0.027 [1.887]	0.024 [0.669]	0.027 [5.493]	0.027 [1.530]	0.034 [3.842]	0.018 [2.317]	0.044 [6.491]
AGESQ	-.0002 [4.368]	-.0002 [3.930]	-.0002 [3.759]	-.0004 [2.504]	-.0003 [2.225]	- .0003 [6.471]	-.0003 [1.643]	-.0004 [4.309]	-.0002 [2.928]	-.0005 [6.622]
AGESP	0.007 [0.997]	0.005 [0.603]	0.008 [0.944]	-0.013 [0.709]	-0.004 [0.174]	0.006 [0.883]	0.158 [4.790]	0.115 [7.510]	-0.070 [6.262]	0.074 [6.402]
AGESPSQ	-.0001 [1.181]	-.0001 [0.797]	-.0001 [1.063]	-.0001 [0.711]	.00003 [0.108]	- .0001 [1.003]	-.002 [4.948]	-.0013 [7.782]	.0008 [6.615]	-.0009 [6.879]
IMMIG	0.009 [0.987]	0.006 [0.690]	0.005 [0.523]	0.044 [1.519]	0.040 [1.388]	0.003 [0.344]	0.062 [2.246]	0.040 [2.890]	-0.044 [3.322]	0.046 [3.842]
SECMAR	-0.009 [0.853]	-0.013 [1.189]	-0.010 [0.911]	-0.049 [1.546]	-0.031 [0.867]	-0.021 [0.214]	0.062 [1.700]	0.030 [1.700]	-0.040 [2.498]	0.041 [2.786]
λ_A		-0.114 [2.397]	-0.065 [1.155]				1.029 [5.499]	0.832 [9.593]		
λ_B				0.095 [2.125]	-0.046 [0.312]				0.694 [15.333]	0.841 [10.832]
R^2	0.026	0.028	0.028	0.027	0.027	0.129	2SLS	2SLS	2SLS	2SLS
N	17405	13880	13880	3525	3525	17405	7537	7537	9868	9868

Notes: 1. Columns (1)-(6) estimated by OLS, Columns (7)-(10) estimated by two-stage least squares (2SLS) treating the wage rates as endogenous variables. Additional exogenous variables were the vector of schooling variables.

2. See Notes to Table 2.

with this. As in the fertility case, the inclusion of female schooling as a proxy for the wife's wage rate is expected to be irrelevant for lifetime non-labour force participants but to be similar to the wife's wage effect for current non-labour force participants. The results in columns (5) and (10) confirm these expectations.

Finally, columns (1) and (6) present "standard" husbands labour supply equations for the total sample using lifetime and current variables, respectively. For the lifetime variables, the own wage coefficient is negative and is about twice the (absolute) magnitude of typical estimates using current measures of labour supply and wage rates (Lewis, 1975). When the labour supply function is estimated using current variables (column 6), the own wage elasticity is -0.22, about 2/3 of the estimated lifetime elasticity (column 1).

Within the framework of the one period model the differences between lifetime and current labour supply regressions reflect the fact that current and lifetime hours are different dimensions of labour supply and current and lifetime wage rates are different prices. Estimates based on the full sample (columns 1 and 6) are subject to potential misspecification due to the pooling of different regimes.

The remaining variables have essentially the same effect across the samples and may be summarized briefly: The non-labour income variables (LTV and V70), when significant, often take on the 'incorrect' positive sign. Rather than conclude that non-market time ('leisure') is an inferior good, we suggest that this may reflect unobserved differences in preferences for goods versus leisure or in rates of time preference.[24] Married men in the Maritimes (NFL and ATL) and British Columbia supply fewer hours to the labour market than males in Ontario. Males with a rural non-farm location also work significantly fewer hours than males located in cities. The French language variables are seldom significant, however, when they attain significance (columns 7, 8 and 10). They indicate that the husbands of families in which either spouse has a French mother tongue supply less labour to the market than families with an English mother tongue. Lastly, holding other characteristics constant we find no significant differences in husband's labour supply by religion, with the single exception of Jewish husbands who worked greater hours in 1970 (column 6).

D. Additional Results

Additional tests of our model were performed. Since in the past fertility patterns have differed significantly between Quebec and the rest of Canada (see, for example, Rao 1974) and the fraction of lifetime labour force participants is also markedly different (see Appendix B), we re-estimated the model separately for Quebec and the rest of Canada. The results (not presented here) in both cases were remarkably similar to those reported in Tables 1-3. An increase in the husband's lifetime wage (or schooling) increases the probability that the wife will ever work, implying complementarity. For lifetime participants, an increase in the husband's wage increases fertility, while for lifetime non-participants the opposite is true. Furthermore, once we control for self-selection in lifetime labour force participation, the wife's lifetime wage (or schooling) has no impact upon completed family size. Thus we find no convincing evidence that children are female-time intensive.

We have also re-estimated the model restricting the sample to wives between the ages of 45 and 60. This excludes the younger cohorts of our sample for whom lifetime labour force participation may be a poor proxy if never working wives plan to enter the labour force in furute years. In the over-44 sample, where the mean age of the spouse is 51 years measured lifetime participation should be a good proxy for the true variable. Restricting ourselves to this older sample, strengthens our results in a number of respects: An increase in the husband's lifetime wage raises the probability of the wife ever working implying complementarity. Correcting for self-selection, an increase in the husband's lifetime wage raises the number of children (t=3.57). An increase in the wife's lifetime wage also raises fertility (t=1.91). Furthermore, if we allow the coefficient on the wife's wage to differ according to the wife's language group (FRSP), both wage coefficients are positive and significant at the 5% level. The estimated elasticity of family size with respect to the wife's lifetime wage is +0.16 (t=2.216) for non-French women, and +0.36 (t=2.147) for French women. These results strengthen our earlier conclusion that numbers of children do not appear to be female-time intensive.

5. SUMMARY AND CONCLUSIONS

The one-period model of completed family size and lifetime labour supply indicates that the fertility and labour supply behavior of families where the wife participates in the labour market will differ from that of families with never participating wives. Systematic differences arise because families with non-working wives face the additional binding constraint of an inelastic supply of wife's time to the home. Moreover, a comparison of these two regimes permits inferences regarding the female time intensity of children and the substitutability of husband's and wife's time. In the context of the one-period lifetime model, the relevant criterion for separating families into the two regimes is the <u>lifetime</u> rather than <u>current</u> participation status. Evidence presented in Section 4 suggests that when this procedure is followed considerable doubt is cast on the conventional wisdom that children are female time intensive. The usual inverse relation found between the wife's wage or education and completed family size appears to be the result of a complex interaction between wage rates, lifetime labour force participation and fertility. Some support is also found for complementarity between the home time of the husband and wife, though the evidence is not entirely consistent: The results of the female participation equation suggest strong complementarity, while proxies for the husband's lifetime labour supply suggest weak or zero complementarity.

In contrast, when the sample is split by current participation of the wife rather than lifetime participation, the results support the conventional wisdom concerning the female time intensity of children,[25] and replicate Kneisner's finding of complementarity between husband and wife's time. It is difficult to reconcile these differences within the framework of the one-period model since it yields no predictions concerning current variables. However, since the wife's lifetime participation is the correct criterion for allocating families to the two regimes under the one-period model, doubt must remain regarding the female time intensity of children until the current and lifetime results are reconciled.

FOOTNOTES

[1]The assumption that children are female-time intensive has been employed by Mincer, 1963; Willis, 1974; De Tray, 1974; Ben Porath, 1974; T. P. Schultz, 1974; Becker and Lewis, 1974; Hashimoto, 1974; Butz and Ward, 1979; Carliner, et al., 1980 and numerous other researchers.

[2]Note that this involves a special case of joint production, in which child inputs produce total quality: combinations of numbers of children and average "quality" per child. Becker and Tomes (1976) show that if the family is characterized by "child-neutral" preferences and there are constant and equal costs of investing in the quality of each child, then parents will equalize the quality of siblings.

[3]The assumption is often made that the time of husbands does not enter as an input in any home-produced commodities and is supplied inelastically to the market (see, e.g., Willis 1974; Butz and Ward 1979). However we wish to analyze the labour supply decisions of both spouses and incorporate the possibility of complementarity between the non-market times of husband and wife.

[4]The more general model with the utility function (1), which embodies quality-quantity interaction [Willis, 1974; Becker and Lewis, 1974] is analyzed in Appendix A. We indicate at various points in the text the implications of allowing quality to be endogenously determined.

[5]See Becker and Lewis (1974), Willis (1974) and the Appendix.

[6]The introduction of quality-quantity interaction qualifies this result since when both quality and quantity dimensions are being chosen a reduction in the cost of child commodities may lead to a large increase in quality and

a reduction in numbers. However if the elasticity of substitution between child numbers and Z equals or exceeds that between quality and Z (Becker and Lewis 1974 consider this a 'plausible case' p. 86) then this possibility is ruled out and a compensated increase in the marginal cost of children must reduce fertility (see Appendix A).

[7]Evidence has been cited in support of this proposition from women's labour supply regressions which included the number of children and typically found an inverse relationship [e.g., Willis 1974; De Tray 1974]. However, when fertility and labour supply are simultaneously determined, the coefficients from this type of regression do not indicate the time-intensity of children [see Rosenzweig and Wolpin, 1980].

[8]This assumes that the non-market time of each spouse is a normal commodity which will occur as long as the commodity which uses the spouse's time intensively is not strongly inferior.

[9]Note however that the present model refers to lifetime labour supply whereas conventional estimates of labour supply functions typically relate to periods shorter than the lifetime. Empirical results reported by Nakamura and Nakamura (1981) suggest that the labour supply schedule of married women both in the U.S. and Canada is backward bending.

[10]Since there are three factor inputs if one commodity is factor intensive in a particular factor it is not necessarily unintensive in either of the other two factor inputs.

[11]Reversing the inference, under the maintained hypothesis that the non-market times of spouses are normal, a positive cross-wage elasticity implies either complementarity in consumption or production or both. Reliable estimates of the non-labour income and wage coefficients of the fertility equation would

indicate whether children were intensive or unintensive in the time of each spouse, indicating complementarity or substitutability in consumption.

[12]The two sets of fertility and husband's labour supply schedules could also differ because of departures from log-linearity, which is a maintained hypothesis. Note however that our model predicts differences between the fertility and husband's labour supply schedules for the two regimes which are systematically related to the coefficients of the wife's labour supply equation.

[13]The additional binding constraint on women who do not participate in the labour market therefore offers an alternative explanation to the quality-quantity interaction model in explaining why numbers of children may appear to be an inferior commodity. In the opposite case in which children are not female-time intensive the income elasticity of numbers of children in families with non-participating wives would exceed that for families with working wives.

[14]The exact criteria for inclusion in the sample were: (i) members of a husband/wife family; (ii) age of wife greater than 34 and less than 60; (iii) age of husband greater than 24 and less than 65; (iv) husband employed in the civilian labour force with wages and salaries being the major source of his income; (v) husband reported positive earnings in 1970 and positive usual hours and weeks worked in 1970; (vi) the major source of the wife's income was <u>not</u> from self-employment.

[15]The estimated wage-experience profiles are reported in Appendix B, note 2. Since the wages of women who work in the labour force are influenced by their intermittent labour force participation (see Mincer and Polachek, 1974), the <u>potential</u> wage rates of working women, of given characteristics were

predicted from wage regressions for single (never married) women whose labour force attachment is known to be more permanent and for whom potential experience (Age-schooling-6) may reasonably approximate actual experience. The constructed lifetime wage of women should therefore be purged of much of the causation from labour supply to wages (Hall, 1974; Ashenfelter, 1974).

[16]This fraction of lifetime non-labour force participants is sizeable in relation to recent estimates that only 5% of U.S. women in a similar age range had never worked (Heckman and Willis 1979, Table 4). This difference reflects historically lower labour force participation rates for women in Canada.

There are also marked differences within the Canadian population. The probability that the wife never worked is markedly higher in Quebec (36.7%) compared to the rest of Canada (14.1%), and for women with a French mother tongue (40.15%) compared to women with an English mother tongue (11.50%). We examine these differences in more detail below.

The available measure of lifetime labour force participation differs from an ideal measure in two ways. First, the theoretical model emphasizes the decision period since marriage. Thus an unknown fraction of lifetime labour force participants will have worked prior to marriage but not since. Secondly the data reflect only past and current decisions but not future possibilities. An unknown fraction of lifetime non-labour force participants will enter the labour force in future years. For these two reasons some families will be misclassified which will tend to bias the coefficients for the two subsamples towards equality.

[17] The data do not identify the spouse for whom the present marriage is a second or higher order marriage. The predicted effect of SECMAR on fertility is ambiguous a priori. On the one hand the children of others may be viewed as being of lower 'quality' than own children by one spouse which may raise the total fertility of a remarried spouse. However, on the other hand the period between separation/divorce and remarriage and the deterrent effect of children from previous marriages on the probability of remarriage (Becker, Landes and Michael, 1977) would tend to reduce the fertility of remarried individuals.

[18] This result is consistent with the findings of Carliner, et al. (1980), but differs from the results of Nakamura and Nakamura (1981) who find that use of the French language in the home reduces the probability that the wife participates. Note however that we and Carliner et al. (1980) use mother tongue rather than the language of the home. In a broader context language in the home should be viewed as endogenous due to language acquisition. The list of regressors used by the Nakamuras differs substantially from the list used in the present study.

[19] The wife's mother tongue other than English or French (OTHLANGSP) may reflect the immigrant status of the wife more accurately than the immigrant status of the husband (IMMIG). In Tables 1-3 when significant, these two variables enter with the same signs.

[20] For example when equation (3) is estimated excluding the λ_A variable the husband's wage (LTWAGE*) enters with a coefficient of +0.062 (t=1.181) and the wife's wage (LTWAGESP*) enters with a coefficient of -0.176 (t=6.119), which suggests children are female-time intensive. However these coefficients reflect the movement across the distribution of unobserved characteristics as individuals enter the labour force in response to differences in wage rates and other variables.

[21] As noted by Olsen (1980) there is a general problem of identifiability when the variables entering the selection rule and the censored regression are identical since identification then relies on the non-linearity of conditional (or sample inclusion) mean of the disturbance and the assumed linearity in the relation to be estimated of the relation itself. This non-linearity depends on the disturbance. However, even if it is known that normality holds, the selection model with a linear relation is indistinguishable from a non-selection model where the relation takes on the particular non-linear form of the sum of the linear relation and the non-linear conditional mean of the disturbance.

[22] Several of these results contrast with the results reported by Carliner, _et al_. (1980). Carliner _et al_. found that only Newfoundland exhibited a fertility pattern differing significantly from other provinces and found no significant differences by language. In contrast we find more significant differences in fertility patterns between provinces/regions and language groups. Part of this difference reflects the larger sample size employed here. However most of the language difference is reflected in the husband's mother tongue, whereas Carliner, _et al_. include only the wife's mother tongue.

The _gross_ correlation between language and family size or residence in Quebec and family size reflects a series of offsetting factors. Quebec residence _per se_ is associated with lower fertility, whereas a French mother tongue or Roman Catholic religion increases fertility.

[23] The regressions for the subsamples correct for the self-selection of families into regimes with the inclusion of the λ_A and λ_B variables.

[24] Individuals with a relative preference for goods versus leisure (or equivalently goods-intensive versus time-intensive commodities) would tend to work more hours prior to retirement and accumulate larger stocks of assets (leading to higher non-labour income) in order to finance greater expenditures during retirement (see Greenberg and Kosters, 1973).

[25] One suggestion in the literature is that the inverse relationship between wife's wage and fertility reflects causation from fertility and concomitant labour force withdrawal to the depreciation of market skills and consequent lower wages [e.g. see Hall (1974) and Ashenfelter (1974)]. Our construction of lifetime wage rates for ever working women attempts to minimize such reverse causation.

REFERENCES

Ashenfelter, O. (1974) "Comment" in T. W. Schultz, ed., pp. 117-119.

Becker, G. S. (1965) "A Theory of the Allocation of Time" Economic Journal 75, pp. 493-517.

Becker, G. S. (1974) "On the Relevance of the New Economics of the Family" American Economic Review 64 (2), pp. 317-319.

Becker, G. S. (1981) A Treatise on the Family Harvard University Press, Boston Mass.

Becker, G. S. and H. G. Lewis (1974) "On the Interaction Between the Quantity and Quality of Children" in T. W. Schultz, ed.

Becker, G. S. and N. Tomes (1976) "Child Endowments and the Quantity and Quality of Children" Journal of Political Economy 84 (4), Part 2, pp. S143-162.

Becker, G. S., E. Landes and R. T. Michael (1977) "An Economic Analysis of Marital Instability" Journal of Political Economy 85 (6), pp. 1141-1188.

Ben Porath, Y. (1974) "Economic Analysis of Fertility in Israel: Point and Counterpoint" in T. W. Schultz, ed., pp. 189-220.

Butz, W. P. and M. P. Ward (1979) "The Emergence of Countercyclical Fertility" American Economic Review 69 (3), pp. 318-328.

Cain, G. and M. D. Dooley (1976) "Estimation of a Model of Labor Supply, Fertility and Wages of Married Women" Journal of Political Economy 84 (4), Part 2, pp. S179-S201.

Carliner, G. et al. (1980) "Female Labour Supply and Fertility in Canada" Canadian Journal of Economics 13 (1), pp. 46-64.

De Tray, D. N. (1974) "Child Quality and the Demand for Children" in T. W. Schultz, ed., pp. 91-116.

Fleischer, B. M. and G. F. Rhodes, Jr. (1979) "Fertility, Women's Wage Rates and Labor Supply" American Economic Review 69 (1), pp. 14-24.

Greenberg, D. H. and M. Kosters (1973) "Income Guarantees and the Working Poor: The Effect of Income-Maintenance Programs on the Hours of Work of Male Family Heads" in G. G. Cain and H. W. Watts, eds. Income Maintenance and Labor Supply, New York, Academic Press.

Hall, R. E. (1974) "Comment" in T. W. Schultz, ed., pp. 489-490.

Hashimoto, M. (1974) "Economics of Postwar Fertility in Japan: Differentials and Trends" in T. W. Schultz, ed., pp. 225-249.

Heckman, J. J. (1976) "The Common Structure of Statistical Models of Truncation, Sample Selection and Limited Dependent Variables and a Simple Estimator for Such Models" Annals of Economic and Social Measurement 5 (4), pp. 475-492.

Heckman, J. J. (1978) "A Partial Survey of Recent Research on the Labor Supply of Women" American Economic Review (Papers and Proceedings) 68 (2), pp. 200-207.

Heckman, J. J. (1979) "Sample Selection as a Specification Error" Econometrica 47 (1), pp. 153-161.

Heckman, J. J. and R. J. Willis (1979) "Reply to Mincer and Ofek" Journal of Political Economy 87 (1), pp. 203-211.

Kneisner, T. J. (1976) "An Indirect Test of Complementarity in the Family Labor Supply Model" Econometrica 44 (4), pp. 651-669.

Lewis, H. G. (1975) "Economics of Time and Labor Supply" American Economic Review 65 (2), pp. 29-34.

Mazany, L. (1980) "A Model of the Joint Determination of Labour Force Participation and Fertility Decisions of Married Women" mimeo, University of British Columbia.

Michael, R. T. and G. S. Becker (1973) "On the New Theory of Consumer Behavior" Swedish Journal of Economics 75, pp. 378-395.

Mincer, J. (1963) "Market Prices, Opportunity Costs, and Income Effects" in C. Christ, et al. eds., Measurement in Economics, Stanford, Stanford University Press, pp. 67-82.

Mincer, J. and S. Polachek (1974) "Family Investments in Human Capital: Earnings of Women" in T. W. Schultz, ed.

Nakamura, A. and M. Nakamura (1981) "A Comparison of the Labor Force Behavior of Married Women in the U.S. and Canada" Econometrica 49 (2), pp. 451-489.

Olsen, R. J. (1980), "A Least Squares Correction for Selectivity Bias," Econometrica, 48 (4), pp. 1815-1820.

Pollak, R. A. and M. L. Wachter (1975) "The Relevance of the Household Production Function and its Implications for the Allocation of Time" Journal of Political Economy 83 (2), pp. 255-277.

Poirier, D. J. and P. A. Ruud (1981) "On the Appropriateness of Endogenous Switching," Journal of Econometrics 16(2), pp. 249-256.

Rao N. Baskara (1974) "An Overview of the Fertility Trends in Ontario and Quebec," Canadian Studies in Population, vol. 1, pp.

Rosenzweig, M. and R. Evenson (1977) "Fertility, Schooling and the Economic Contribution of Children in Rural India: An Econometric Analysis" Econometrica 45, pp. 1065-1079.

Rosenzweig, M. and K. Wolpin (1980) "Life-Cycle Labor Supply and Fertility: Causal Inferences from Household Models" Journal of Political Economy 88 (2), pp. 328-348.

Schultz, T. W., ed. (1974) Economics of the Family, Chicago, University of Chicago Press.

Schultz, T. W. (1974b) "Fertility and Economic Values" in T. W. Schultz ed., pp. 3-22.

Willis, R. J. (1974) "A New Approach to the Economic Theory of Fertility Behavior" in T. W. Schultz, ed., pp. 25-75.

APPENDIX A

In this Appendix we consider the implications of the interaction of Quality and Quantity dimensions of choice regarding children for the theoretical predictions of the model. Maximizing the utility function (1) subject to (2), (3), (5i) and (6) yields first-order conditions of the form:

$$\text{(A1)} \qquad \frac{U_N}{\Psi} = \frac{p_x Q}{f_x} \equiv \pi_c Q = \pi_n; \; \frac{U_Q}{\Psi} = \frac{p_x N}{f_x} \equiv \pi_c N = \pi_Q.$$

The marginal cost of numbers (π_n) is proportional to the level of child quality chosen and conversely the marginal cost of quality (π_Q) is proportional to the level of family size (N).

Following Becker and Lewis (1973) define the level of "family resources": R as

$$\text{(A2)} \qquad R \equiv \pi_N N + \pi_Q Q + \pi_Z Z = F + \pi_C C.$$

The demand functions for numbers, quality and consumption in terms of real family resources and relative marginal costs are:

$$\text{(A3)} \quad \begin{cases} d\ell nN = \eta_n \, d\ell nR_r - (1 - S)\,\bar{\sigma}_N \, d\ell n\pi_N + S\sigma_{NQ} \, d\ell n\pi_Q + S_Z\sigma_{NZ} d\ell n\pi_Z \\ d\ell nQ = \eta_q \, d\ell nR_r + S\sigma_{NQ} d\ell n\pi_N - (1 - S)\bar{\sigma}_Q d\ell n\pi_Q + S_Z\sigma_{QZ} d\ell n\pi_Z \\ d\ell nZ = \eta_z d\ell nR_r + S\sigma_{NZ} d\ell n\pi_N + S\sigma_{QZ} d\ell n\pi_Q - (1 - S_Z)\bar{\sigma}_Z d\ell n\pi_Z \end{cases}$$

where R_r is family resources (R) deflated by an index of marginal costs, σ_{ij} is the Hicks-Allen partial elasticity of substitution between i and j in the utility function (1). We assume $\sigma_{ij} \geq 0$ all ij, $(1 - S_j)\bar{\sigma}_j \geq 0$ are the own-elasticites of substitution: $(1 - S)\bar{\sigma}_N \equiv S\sigma_{QN} + S_Z\sigma_{NZ}$; $(1 - S)\bar{\sigma}_Q \equiv S\sigma_{NQ} + S_Z\sigma_{QZ}$; $(1 - S_Z)\bar{\sigma}_Z \equiv S(\sigma_{NZ} + \sigma_{QZ})$, where $S = \pi_C C/R$. η_j is the "true" income elasticity of the jth commodity, holding marginal costs constant.

Solving the equations (A3) for changes in N, Q and Z in response to changes in real full income (F deflated by an index of π_Z and π_C) gives the following "observed" income elasticities:

(A4i) $D\bar{\eta}_n = (1-S)\{\eta_n(1-S\sigma_{nq}) - \eta_q(1-S)\bar{\sigma}_N\} \gtreqless 0$ as $\frac{\eta_n}{\eta_q} \gtreqless \frac{(1-S)\bar{\sigma}_N}{(1-S\sigma_{nq})}$

(A4ii) $D\bar{\eta}_q = (1-S)\{\eta_q(1-S\sigma_{nq}) - \eta_n(1-S)\bar{\sigma}_q\} \gtreqless 0$ as $\frac{\eta_q}{\eta_n} \gtreqless \frac{(1-S)\bar{\sigma}_q}{(1-S\sigma_{nq})}$

(A4iii) $D\bar{\eta}_c = (1-S)\{\eta_n[1-2S\sigma_{nq} - S_Z\sigma_{QZ}] + \eta_q[1-2S\sigma_{nq} - S_Z\sigma_{NZ}]\}$

(A4iv) $D[\bar{\eta}_q - \bar{\eta}_n] = (1-S)\{(1-2S\sigma_{nq})(\eta_q - \eta_n) + S_Z(\sigma_{QZ}\eta_n - \sigma_{NZ}\eta_q)\}$

(A4v) $D\bar{\eta}_z = D\eta_z + S[\sigma_{NZ}D\bar{\eta}_q + \sigma_{QZ}D\bar{\eta}_n]$

where $D \equiv (1-S\sigma_{nq})^2 - (1-S)^2\bar{\sigma}_N\bar{\sigma}_Q > 0$

In the special case in which N and Q are equally substitutable for Z (i.e., $\sigma_{NZ} = \sigma_{QZ} = \sigma_{jZ}$) expressions (A4iii)-(A4v) become:

(A4iii)′ $D\bar{\eta}_C = (1-S)(\eta_n + \eta_q)[1-2S\sigma_{nq} - S_Z\sigma_{jZ}] > 0$ if $(\eta_n + \eta_q) > 0$

(A4iv)′ $D[\bar{\eta}_q - \bar{\eta}_n] = (1-S)(1-2S\sigma_{nq} - S_Z\sigma_{jZ})(\eta_q - \eta_n) \gtreqless 0$ as $\eta_q \gtreqless \eta_n$

(A4v)′ $D\bar{\eta}_Z = (1-S)D\eta_Z + S\sigma_{jZ}(\eta_n + \eta_q)[1-2S\sigma_{nq} - S_Z\sigma_{jZ}] > 0$ if $\eta_j > 0$ all j

$D \equiv 1 - 2S\sigma_{nq} - S_Z\sigma_{jZ}[2S\sigma_{nq} + S_Z\sigma_{jZ}] > 0$ which requires $[2S\sigma_{nq} + S_Z\sigma_{jZ}] < 1$

i.e., the substitution elasticities (σ_{ij}) cannot on average exceed unity.

In general all the observed income elasticities $\bar{\eta}_j$ are ambiguous in sign, although a weighted average of observed income elasticities equals (1 - S). In particular if $\eta_q > \eta_n$ and $\sigma_{NZ} > \sigma_{QZ}$, which Becker and Lewis (1973) consider to be a plausible case, the observed income elasticity of numbers ($\bar{\eta}_n$) could be negative even though numbers of children are not inferior in terms of preferances (i.e., $\eta_n > 0$). We note also that under these conditions child commodities ($C = NQ$) could also be inferior in terms of the observed income elasticity (A4iii). If $\eta_q > \eta_n$ and $\sigma_{NZ} \leq \sigma_{QZ}$ this latter possibility is ruled out by the second order conditions.

In the special case in which N and Q are equally substitutable for Z (i.e. $\sigma_{NZ} = \sigma_{QZ}$) and $\eta_q > \eta_n$ the observed income elasticities for quality, child commodities (C) and consumption (Z) are predicted to be positive. The observed quality elasticity exceeds that of numbers and the latter elasticity may be negative.

The observed substitution effects resulting from a compensated change in relative prices (π_C/π_Z), holding real full income constant, are given by:

(A5i) $D\bar{\epsilon}^C_{N\pi_C} = S_Z\{(1-S)\bar{\sigma}_N\sigma_{QZ} - (1-S\sigma_{NQ})\sigma_{NZ}\} = S_Z\{S\sigma_{NQ}\sigma_{QZ} - \sigma_{NZ}[1-(1-S)\bar{\sigma}_Q]\}$

(A5ii) $D\bar{\epsilon}^C_{Q\pi_C} = S_Z\{(1-S)\bar{\sigma}_Q\sigma_{NZ} - (1-S\sigma_{NQ})\sigma_{QZ}\} = S_Z\{S\sigma_{NQ}\sigma_{NZ} - \sigma_{QZ}[1-(1-S)\bar{\sigma}_N]\}$

(A5iii) $D[\bar{\epsilon}^C_{N\pi_C} - \bar{\epsilon}^C_{Q\pi_C}] = -S_Z(\sigma_{NZ} - \sigma_{QZ})$

(A5iv) $D\bar{\epsilon}^C_{C\pi_C} = S_Z\{\sigma_{NZ}[2S\sigma_{NQ} + S_Z\sigma_{QZ} - 1] + \sigma_{QZ}[2S\sigma_{NQ} + S_Z\sigma_{NZ} - 1]\} = -DS_Z\sigma^* < 0$

(A5v) $D\bar{\epsilon}^C_{Z\pi_C} = -(1-S_Z)\{\sigma_{NZ}[2S\sigma_{NQ} + S_Z\sigma_{QZ} - 1] + \sigma_{QZ}[2S\sigma_{NQ} + S_Z\sigma_{NQ} - 1]\} = D(1-S_Z)\sigma^* > 0$

A compensated increase in the price of child commodities (π_C) is predicted to raise parental consumption and lower child commodities (C). However, the effect on N or Q alone is in general ambiguous. If $\sigma_{NZ} > \sigma_{QZ}$ then child numbers <u>must</u> fall in response to an increase in π_C. Q, however, may rise. Conversely if $\sigma_{NZ} < \sigma_{QZ}$.

In the special case in which Q and N are equally substitutable for Z

(A6i) $D\bar{\epsilon}^{C}_{N\pi_C} = D\bar{\epsilon}^{C}_{Q\pi_C} = S_Z\sigma_{jZ}[2S\sigma_{nq} + S_Z\sigma_{jZ} - 1] < 0$

(A6ii) $D\bar{\epsilon}^{C}_{C\pi_C} = 2S_Z\sigma_{jZ}[2S\sigma_{NQ} + S_Z\sigma_{jZ} - 1] < 0$

In this case a compensated rise in the price of child commodities <u>must</u> lower both child numbers and quality.

When quality/quantity interaction is incorporated in the analysis the fertility demand and labour supply schedules (equations (9), (11) and (12)) become:

$$(9)^* \quad d\ell nN = S_r\bar{\eta}_n d\ell nV + [S^m_L\bar{\eta}_n + \bar{\epsilon}^C_{N\pi_C}(k^m_c - k^m_Z)]d\ell nw_m + [S^f_L\bar{\eta}_n + \bar{\epsilon}^C_{N\pi_C}(k^f_c - k^f_Z)]d\ell nw_f$$

$$(11)^* \quad S^f_L d\ell mL_f = -S_V S_J\bar{\eta}_J d\ell nV - [S^m_L S_J\bar{\eta}_J + S_C S_Z\sigma^*(K^m_c - k^m_Z)(k^f_c - k^f_Z) + (k^f_c S_C k^m_c \mu_{mf}$$
$$+ k^f_Z S_Z k^m_Z \theta_{mf})]d\ell nw_m + [(k^f_c - k^f_Z)^2 S_Z S_C\sigma^* + k^f_c S_C(1 - k^f_c)\mu_f + k^f_Z S_Z(1 - k^f_Z)\theta_f$$
$$- S^f_L S_J\bar{\eta}_J]d\ell nw_f$$

$$(12)^* \quad S^m_L d\ell nL_m = -S_V S_k\bar{\eta}_k d\ell nV$$
$$+ [(k^m_c - k^m_Z)^2 S_Z S_C\sigma^* + k^m_c S_C(1 - k^m_c)\mu_m + k^m_Z S_Z(1 - k^m_Z)\theta_m - S^m_L S_k\bar{\eta}_k]d\ell nw_m$$
$$- [S^f_L S_k\bar{\eta}_k + S_C S_Z\sigma^*(k^m_c - k^m_Z)(k^f_c - k^f_Z) + (k^f_c S_C k^m_c \mu_{mf} + k^f_Z S_Z k^m_Z \theta_{mf})]d\ell nw_f$$

where the shares S_j are shares in family resources (R); $S_J\bar{\eta}_J = [k^f_c S_C\bar{\eta}_C + k^f_Z S_Z\bar{\eta}_Z]$, $S_k\bar{\eta}_k = [k^m_c S_C\bar{\eta}_C + k^m_Z S_Z\bar{\eta}_Z]$.

The above expressions assume that goods prices (P_x and P_y) are constant. Note that in the fertility demand equation $(9)^*$ the observed income and price elasticities of child numbers now enter. The labour supply schedules $(11)^*$ and $(12)^*$ depend on the observed income elasticities of child commodities ($\bar{\eta}_C$) and consumption ($\bar{\eta}_Z$) via $\bar{\eta}_J$ and $\bar{\eta}_K$ and the observed substitution elasticity between C and Z: $\sigma^* > 0$.

APPENDIX B: DEFINITIONS OF VARIABLES

Variable		MNEUMONIC	MEANS ALL	MEANS LTLFP	MEANS LTNLFP
Fertility (N)	Number of children ever born to wife[1]	NKIDS	3.249	3.248	3.252
Labour Supply of Wife (L_f)	Lifetime labour force participation (1 if wife ever worked, zero otherwise)	LTLFP	0.797	1.00	0.00
	Current labour force participation (1 if wife worked in 1970, zero otherwise)	LFP70	0.433	0.543	0.00
Labour Supply of Husband (L_m)	Lifetime hours of work (annual hours worked in 1970 x No. of years between completion of schooling and 65)	LTHRS	99,400.02	99,989.96	97,478.80
	Hours of work in 1970 (weeks worked in 1970 x usual hours per week)	ANNHRS	2,011.64	2,039.82	1,915.31
Schooling of Husband and Wife	Years of schooling of husband (wife) up to completion of high school	SCHHS	9.063 (9.440)	9.296 (9.810)	8.148 (7.984)
	Years of college completed by husband (wife) without degree	COLNoDeg	0.120 (0.085)	0.127 (0.097)	0.093 (0.036)
	Years of college completed by husband (wife) with degree	COLDeg	0.316 (0.086)	0.365 (0.103)	0.124 (0.018)
Wage Rates (w_m, w_f)	Lifetime wage of husband (wife-spouse) from wage-experience regressions[2] in ($0's)	LTWAGE (LTWAGESP)	4.580 (··)	4.586 (2.933)	4.136 (··)
	Current wage of husband (working wife-spouse) (annual earnings ÷ annual hours worked in 1970) (in $'s)	WAGE70 WAGE70SP)	4.588 (··)	3.971 (1.531)	3.470 (··)
Non-labour Income (V)	Lifetime non-labour income[3] (in $000's)	LTV	3.762	3.988	2.872
	Current non-labour income[4] (in $00's)	V70	3.865	4.082	3.010
	Region of Residence 1971: Newfoundland	NFL	2.01%	1.89%	2.47%
	Atlantic Provinces (Nova Scotia, New Brunswick)	ATL	5.98%	5.61%	7.40%
	Quebec	QUE	27.20%	21.57%	49.36%
	Ontario (reference group)				
	Prairie Provinces (Manitoba, Saskatchewan, Alberta)	PR	13.77	15.10%	8.54%
	British Columbia	BC	10.89	11.91%	6.87%
Urban/Rural	1971 residence in city/town pop. ≥ 30,000 (reference group)				
	1971 residence in town pop. < 30,000	Town	19.26%	18.41%	22.58%
	1971 rural non-farm residence	RNF	14.20%	12.96%	18.98%
	1971 farm residence	FARM	2.85%	2.81%	3.01%
Language	Mother tongue of head (spouse): English - reference group				
	French	FR (FRSP)	25.18% (25.46%)	18.84% (19.11%)	50.16% (50.47%)
	Other language	OTHLANG (OTHLANGSP)	17.41% (16.72%)	17.53% (16.72%)	16.94% (16.71%)
Religion	Religion of head (spouse): Roman Catholic	CATH (CATHSP)	42.25% (43.11%)	36.19% (37.08%)	60.10% (66.84%)
	Jewish	JEW (JEWSP)	1.49% (1.49%)	1.65% (1.64%)	0.85% (0.88%)
	Other (Protestant, no religion, etc.) - reference group				
Age	Age of husband (spouse)	AGE (AGESP)	47.90 (45.34)	47.54 (45.04)	49.32 (46.54)
	Age of husband (spouse) squared	AGESQ (AGESPSQ)			
Immigrant	Immigration status of head[5] (1 if born outside Canada, zero otherwise)	IMMIG	23.27%	24.52%	18.38%
Second Marriage	Present marriage is a second or higher order marriage for at least one spouse (coded 1 if number of years since date of first marriage of head not equal to years since date of first marriage of spouse, zero otherwise)	SECMAR	8.21%	8.78%	5.96%
			n=17405	n=13,880	n=3,525

Notes to Appendix B:

[1]Number of children - integer value 0-6, > 6 coded as 7.8433 based on calculations from the individual file of the 1971 Census. Since NKIDS is entered in natural log form $\ln(0)$ is coded as $-\ln(2)$ (i.e., the function $y = \ln(x)$ is linearized as $x \to o$).

[2]Lifetime wage variables for husbands and wives (who were lifetime labour force participants) were constructed from the wage-experience regressions:

A. Married Men, $16 \leq$ Age < 65 with positive earnings and annual hours in 1970

$$WAGE^{*} = \underset{}{0.235} + \underset{[37.370]}{0.0598\ SCHHS} + \underset{[3.678]}{0.0197\ COLNoDeg} + \underset{[36.799]}{0.0977\ COLDeg} + \underset{[34.911]}{0.0355\ EXPR}$$

$$\underset{[29.073]}{-0.00055\ EXPRSQ} - \underset{[3.953]}{0.0027\ EXPR \cdot IMMIG} + \underset{[10.662]}{0.4045\ IMMIG} - \underset{[11.695]}{0.0279\ SCH \cdot IMMIG}$$

$$\underset{[2.882]}{-0.0223\ FR} - \underset{[9.148]}{0.0995\ OTHLANG} \qquad R^2 = 0.123 \qquad n=34{,}283$$

(t statistics in parentheses, * denotes natural log)

B. The potential wage rates of working women, of given characteristics were predicted from wage regressions for single (never married) women whose labour force attachment is known to be more permanent (see footnote 15).

Single women, $16 \leq$ Age < 60 with positive earnings and annual hours in 1970

$$WAGE^{*} = -5.419 + \underset{[22.538]}{0.1096\ SCHHS} + \underset{[7.902]}{0.1130\ COLNoDeg} + \underset{[19.160]}{0.1569\ COLDeg} + \underset{[17.813]}{0.0455\ EXPR}$$

$$\underset{[11.422]}{-0.00073\ EXPRSQ} + \underset{[1.122]}{0.0207\ FR} + \underset{[4.821]}{0.4662\ IMMIG} - \underset{[5.163]}{0.0428\ SCH \cdot IMMIG}$$

$$R^2 = 0.222 \qquad n=5{,}919$$

where EXPR = (Age - Schooling - 6). The lifetime wage is then the discounted present value (using a 3% discount rate) of the predicted wage profile from the completion of schooling up to age 65 for husbands (LTWAGE) and age 60 for women (LTWAGESP). In each case the wage profiles were adjusted to take account of economic growth at a rate of 1.68% for husbands and 2.74% for wives (calculated from Butz and Ward, 1979).

[3]The constructed lifetime non-labour variable equals the present value (discounted at 3%) of receipts of non-labour income between the completion of schooling and age 65. It was assumed that non-labour income in each year would equal that reported in 1970 (V70) adjusted for economic growth at a rate of 2.21% p.a.

Notes to Appendix B (cont'd.)

[4]Current non-labour income equals total family income received from interest and dividends, other investment income, retirement pensions from previous employment and 'other income'. It excludes some sources of income which are conditioned by labour supply (e.g., unemployment insurance).

[5]For the purpose of constructing lifetime wage rates it was assumed that the immigration status of the wife was identical to that of the head. The Family File of the 1971 Canadian Census contains information only on the immigration status of the head (husband).