FERTILITY AND INCOME IN CANADA

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The main objectives of this study are to examine: i) the relationship between fertility and income using both time series and cross section data, ii) the extent of this relationship in Quebec and Ontario which have high proportions of Catholic and Protestant population respectively and iii) certain problems in the comparability of the time series and cross section as well as the micro and macro relationships.

Data and methodology:

The variables used in the time relationship are TFR (total fertility rate) and per capita personal disposable real income. Total fertility rates are from the Vital Statistics Reports and the income figures are from the National Accounts Reports. Personal income refers to the gross national income that accrues to the personal sector of the economy which is different from the government and the investment sectors. Time series analysis is restricted to the period 1926-64. Cross section data are from the census and they consist of the number of unmarried children less than age 25 and staying at home, and the earnings (wages & salaries) of families.

For the time series relationship fertility rates, lagged by one year, are regressed on income. The estimating equation is of the following form:

$$Y_i = a + bX_i + U_i \qquad \text{----- ----- ----- (1)}$$

where, Y_i = Total fertility rate for i^{th} year

X_i = Personal per capita real income for i^{th} year

U_i = error term

$i = 1,2 \ldots T$

and a & b are the estimated parameters.

Presence of autocorrelation in the residuals (U_i) was evaluated through the Durbin-Watson test and in all cases it was necessary to transform the data in order to reduce the extent of autocorrelation. Transformation of data was done as follows:

$$Y'_t = Y_t - r\,Y_{t-1} \qquad \text{----- ----- ----- (2)}$$

$$X'_t = X_t - r\,X_{t-1}$$

where, $r = \sum_{t=2}^{N} U_t\,U_{t-1} \Big/ \sum_{t=2}^{N} U^2_{t-1}$

The estimated parameters used in our discussion are from the regression equation fitted to the new series of values, X'_t & Y'_t and in all cases autocorrelation is not significant either at 5% or 1% level. We have tried to evaluate the presence of heteroscedasticity by using the approximate method of examining whether there is any systematic variation in the range of the residuals ordered according to income or time. We find that the range of the residuals does not show any systematic variation with time or the level of income. Due to fewer number of observations regression analysis could not be done for the cross section data.

Time series relationship:

In Canada, income started declining from 1928, reaching the lowest level in 1933. The period 1934 to 1964 is generally one of rising income. 1927-37 and 1959-65 are periods of declining fertility. During 1937 and 1959, the period of baby boom, fertility rose by about 49%.

Because of the nature of the trend in fertility and the possible effects of war, the period 1926-64 is divided into four sub-periods: 1926-39, 1940-45, 1946-57 and 1958-64. Since TFR is allowed to lag by one year, the corresponding subperiods are 1927-40, 1941-46, 1947-58 and 1959-65. We have fitted a single equation for the whole period using dummy variables in such a way as to estimate the parameters separately for each of the sub-periods.

Table 1. Estimated relationship between fertility and income, Canada

Period	Slope Coefficient	Correlation
1926-39	+1.342* (0.773)	+0.517
1940-45	+0.510 (1.153)	+0.138
1946-57	+2.318** (0.942)	+0.783
1958-64	-4.984** (1.526)	-0.759

* = Significant at .05
** = Significant at .01
Standard errors are given within brackets

One would normally expect that births would increase during favourable economic conditions and decrease during unfavourable economic conditions, thereby, resulting in a positive correlation between income and fertility. However, the estimated relationship (Table 1) is positive during 1926-57 and negative during 1958-64. We will examine this inconsistency in the direction of the relationship with the help of available data.

During the late 50's and the early 60's there was a moderation in the growth of Canadian economy (Economic Council of Canada, 1964: 7-53). This is indicated by the extent to which the actual growth rate falls short of the potential growth rate. The potential growth rate refers to 'a calculated measure of the total volume of production consistent with reasonably full and efficient use of the economic resources available to a nation' (Economic Council of Canada, 1964: 31). During 1957-63 actualgrowth in output consistently fell short of the potential growth.

Statistics on unemployment show similar slackening in economic activity. A growing economy requires that at least 97% of the labour force be employed. During 1946-54 unemployment rate

* The author gratefuly acknowledges the help received from Professors Karol J. Krotki, P. Krishnan, Frank Roseman, John Forster & Vic Matthews.

went beyond the 3% level only twice, while during 1954-64 it was always higher than 3%. During 1958-64 the average unemployment rate was about 6%.

Table 2. Annual average unemployment rates, Males, Selected age groups, Canada

Age groups	1950-53	1954-57	1958-61	1962-65
14-19	6.7	9.8	15.9	12.7
20-24	4.8	7.2	11.8	8.3
25-34	2.8	4.4	7.5	4.9
35-44	2.4	3.6	6.0	4.2
14 +	3.2	4.8	7.9	5.7

Source: Averages calculated from the annual unemployment rates in Sylvia Ostry, Unemployment in Canada

The extent of unemployment was quite high among the younger age groups. The duration of unemployment also increased. In 1958-65 an average of 33% of the total unemployed were seeking work for a duration of four months and above, as against only 24% during 1950-57.

Table 3. Proportion of owned dwellings, Canada

Year	Dwellings	
	owned	total
1941	56.6	100
1951	65.6	100
1961	66.0	100
1966	63.1	100

Source: Census of Canada, 1941, 51, 61 & 66

Table 4. Per cent changes in median income (constant dollars) of non-farm families by age of head, Canada

Period	Age of head		
	<25	25-34	35-44
1951-54	17.4	17.5	13.7
1954-57	5.1	10.0	7.9
1957-59	3.2	2.5	6.9
1959-61	-0.3	5.9	8.8

Source: Per cent changes calculated from data in Podoluk, J.R., Incomes of Canadians, 1968

Table 5. Average holding of 'total selected assets' by income groups among non-farm families and unattached individuals, Canada

Income ($)	Average holding of assets in dollars		
	1955	1958	1963
<1000	1187	3277	3081
1-1999	1332	4459	4465
2-2999	1277	5394	4657

Table 5. (cont'd)

Income ($)	1955	1958	1963
3-3999	1093	5947	5145
4-4999	1910	8461	7171
5-6999	2281	10529	8906
			10763
7-9999	4598	14796	13240
10,000 +	12468	30373	25043

Source: DBS, Income, Liquid Assets and Indebtedness of Non-farm Families in Canada, for the years 1955, 1958 and 1963.

Note: i) For 1963 and for the income group 5000-6999, average holdings refer to income groups 5000-5999 and 6000-6999.

ii) Total selected assets are: a) current savings deposits with chartered banks, savings deposits in post office savings banks, insurance companies etc. b) government of Canada bonds, public utilities, municipal and provincial bonds, industrial and corporate bonds; c) mortgages and agreements of sale on residential and other types of property; d) loans to other persons and e) estimated market value of owner occupied homes (1955 figures do not include this item).

Data on family income, ownership of dwellings and asset holdings also indicate that the economic conditions as experienced by the families during the later post war years were relatively unfavourable. Though family income increased between 1951 and 1961, most of this increase was confined to the period 1951-57. If the rise in income is sufficient enough to keep pace with the rising aspirations among the people, one would normally expect an increase in the holding of assets like houses, government bonds etc. Ownership of dwellings increased substantially during the 40's, it was more or less stable in the 50's and decreased slightly during 1961-66. Similarly, the average holding of other types of assets declined sharply during 1958-63. This is so in most of the income classes.

Women who were at their prime reproductive ages in the late 50's and the early 60's generally spent the early part of their life during a period of economic prosperity. They might have had high expectations regarding their standard of living quite in keeping with their childhood experience. High expectations on the one hand and a relatively unfavourable economic climate on the other might have contributed at least partly to the decline in TFR since 1959. However, the evidence presented here in support of a positive relationship between fertility and income in Canada cannot be considered as conclusive. It would have been better if we had comparable data on the socio-economic characteristics of individual families for the pre war period as well. These data are hard to obtain. Secondly, better indicators will be needed to measure the economic burden of the families at

various points in time. It may be mentioned here that the behaviour of personal income during the post war recessions was different from that during the depression of the 30's. In recent times the share of transfer payments (e.g. unemployment compensation payments) in personal income increased considerably, thereby making personal income less sensitive to economic fluctuations. Perhaps, a single indicator or variable may not explain the variations in fertility for both the pre war and the post war periods. Further, the variations in TFR are due to the changes in the proportion married, completed family size and in the age pattern of childbearing and it is important to know how these components are related to the changes in the economic conditions.

Cross section relationship:

Cross section data available in the census consist of the number of wage earning families cross classified by the number of children (less than age 25, unmarried and staying at home at the time of enumeration), income (wages and salaries) of the family and the age of head. Wage earning families constitute approximately two-thirds of the total number of families and most of them are husband and wife families. Since data on the number of children living are available only for 1941 (not for 1951 and 1961) we had to use, for the sake of comparability, the number of unmarried children staying at home which will differ from the actual family size. However, when we take into consideration only those families where the age of head is less than 45, the difference between these two indicators of family size is negligible as can be seen from the 1941 census data. Secondly, from the 1941 data and from other evidence (Henripin, 1968: 282-83) we find that the direction of the income-fertility relationship is the same whether we use the number of children living or the number of unmarried children staying at home.

Table 6 shows the relationship between family size and income at specified age groups. The reduction in family size for all income groups in the 35-44 age group in 1951 as compared to 1941 can be attributed to the postponement of births also resulting in a smaller completed family size. That is, the 1907-11 and the 1912-16 birth cohorts who were in the 40-44 and 35-39 age groups in 1951 had to face economic difficulties at the time of their prime childbearing periods and consequently they had less time available for a possible recovery of births.

Using the differentials given in the table we can make a crude comparison of the extent and the direction of the relationship. During 1941-61 there seems to be a weakening of the negative relationship as well as a reversal to a positive relationship. For example, in 1961, the group less than age 25 shows a more consistent positive relationship. However, it is difficult to conclude that these cohorts will show the same positive relationship when their family size is completed. It may be that among the recent cohorts, earlier childbearing is more common in the higher income groups as compared to the lower income groups, thereby showing a positive relationship at a point in time. In the absence of data on the differences in the timing of births among the various income groups it is difficult to comment on a possible reversal from a negative to a positive relationship between completed family size and income.

Table 6. Average number of children (per 1000 families) according to income and age of head, wage earning families, Canada

1941			1951		
Income ($)	Age < 35	Age 35-44	Income ($)	Age < 35	Age 35-44
< 450	1506	2938	500	1494	2671
450-949	1305	2661	500-999	1598	2819
950-1449	1182	2417	1000-1449	1541	2695
1450-1949	1169	2190	1500-1999	1398	2464
1950-2949	1134	1969	2000-2499	1400	2305
2950-3949	1115	1810	2500-2999	1422	2225
3950-4949	1204	1850	3000-3999	1427	2098
4950 +	1369	1938	4000-5999	1455	1949
			6000 +	1614	2005
All income groups	1259	2413		1437	2306
Differentials	-9%	-34%		+8%	-25%

1961			
Income ($)	Age < 25	Age 25-34	Age 35-44
< 2000	947	2109	3111
2000-2999	882	1982	2854
3000-3999	896	1932	2747
4000-4999	943	1948	2654
5000-5999	954	1972	2606
6000-6999	957	1982	2554
7000-9999	1037	2042	2543
10,000 +	1114	2230	2679
All income groups	917	1971	2706
Differentials	+18%	+6%	-14%

Source: Census of Canada 1941, 1951 & 1961.

Differentials: Change in the average number of children in the highest income groups as compared to that in the lowest income group, expressed as per cent of the latter.

Quebec and Ontario:

The general trends in income in Ontario and Quebec are similar to those for the country as a whole. Throughout the period of study, the income level was lower in Quebec. In the case of fertility there are significant differences between these two provinces. During 1937-59, the period of baby boom, TFR in Ontario rose from 2161 to 3773 or by 75%. In Quebec on the other hand the increase was only 20%, i.e., from 3268 to 3928. During 1926-37 and 1959-65 the decline

in fertility was more rapid in Quebec. As a result of this differential rate of change, TFR in Quebec was 4% less than that of Ontario in 1965 though it was 58% higher in 1926.

Table 7. Estimated relationship between fertility and income, Ontario & Quebec

	Ontario	
Period	Slope	Correlation
1926-39	1.559** (0.796)	+0.614
1940-45	2.501* (1.517)	+0.440
1946-57	2.289** (0.915)	+0.639
1958-64	-4.525** (1.396)	-0.873
	Quebec	
Period	Slope	Correlation
1926-39	2.200** (0.795)	+0.543
1940-45	1.322 (1.962)	+0.384
1946-57	1.142 (1.030)	+0.509
1958-64	-4.948** (1.209)	-0.867

* = Significant at .05
** = Significant at .01
Standard errors are given within brackets

The negative relationship in both Ontario and Quebec during 1958-64 has to be interpreted in the light of the observations made earlier regarding the slackening of economic activity since the middle of 1950's. Unlike in Ontario, during 1940-57 the relationship is notsignificant in Quebec. It may be noted that at the start of the baby boom TFR was relatively high in Quebec. In 1937 the year of very low fertility, TFR in Ontario was 2161 while in Quebec it was 3268 or about one and a half times larger than the former. In other words, the historic transition from high to low fertility was achieved much earlier in Ontario than in Quebec. During 1940's along with the rise in income, Quebec experienced certain social changes, like the rapid increase in urbanization and enrollment in schools, the weakening of the hold of religion on education (Whyte, D.R., 1968) and the rise of the middle class more conscious of its right to economic security (Guindon, 1968). These social changes combined with the relatively high fertility might have reduced the chances of any substantial increase in fertility. Most of the increase in TFR which Quebec experienced can be attributed to the shift toward an younger age at childbearing. In the 30-34 age group the family size of the 1922-26 birth cohort was 83% complete as against 74% in the 1907-11 cohort. Similar changes can be observed in Ontario. However, unlike in Ontario, completed family size in Quebec did not show any marked increase. For example, in Quebec, compared to the 1907-11 cohorts, the 1917-21 and the 1922-26 cohorts enlarged their completed family size by 4% and 4.6% respectively. For Ontario, on the other hand, the corresponding figures are 19% and 30%.

The Cross section data show that in Ontario during 1941-61 there was a slight reversal from a negative to a positive relationship between income and family size at specified age groups. In Quebec on the other hand even though the negative relationship had weakened, there was no such reversal toward a positive relationship. Further research on fertility differentials by education, occupation, rural-urban residence etc. in the provinces may throw some light on the relationship between the stage reached by certain population in the demographic transition and the nature of the relationship between fertility and socio-economic factors.

Time series and cross section, micro and macro relationships:

There seems to be some "discrepancy" between the positive time series relationship on the one hand and the shift from a negative to a positive cross section relationship on the other. Previous studies on the relationship between fertility and income have, with a few exceptions, shown positive time series and negative cross section relationships. For our discussion here, cross section data will mean the distribution of families by income and the number of children, and the time series data refers to the mean income and family size of a population for a series of time points. In the former there is individual correspondence between income and family size while in the latter we do not know whether there is such a correspondence (i.e., whether those who increased their family size were the same who experienced an increase in income as well). If there is no individual correspondence in the time series (aggregate) relationship how do we explain the reproductive behavior of the individuals on an average? In a way the cross section-time series "discrepancy", interpretation of a macro relationship (or the consistency between the micro and the macro relationships) and the identification of the true relationship seem to be related to one another (Chipman, 1957). In the following paragraphs we intend to highlight some of these problems.

Specification bias:

Time series and cross section findings can differ with respect to the direction and magnitude of the relationship as a result of excluding a relevant independent variable. Let us assume that the true relationship is of the following form (using deviations from the mean):

$$Y = \beta_1 X_1 + \beta_2 X_2 \qquad \text{----- ----- ----- (3)}$$

where, Y = fertility (total fertility rate or family size),
X_1 = income
X_2 = education (number of years of schooling)

In the estimating equation let education be ommitted, then

$$Y = bX_1 \qquad \text{----- ----- ----- (4)}$$

Since Y is influenced by both X_1 and X_2,

$b = \beta_1 + \beta_2 \cdot \alpha$

where,

$$\alpha = \Sigma X_1 X_2 / \Sigma X_1^2$$

The bias in 'b' as a result of excluding X_2 is given by the terms other than β_1. β_2 is a measure of the effect of the left out variable on Y, and 'α' or the auxiliary coefficient refers to the covariation between the included and the excluded variables. In other words, in (4) income captures the influence of education (on fertility) and the extent of this influence is determined by the auxiliary coefficient. In (4) we have the unconditional effect (direct effect of income as well as the indirect effect of education through income) of income on fertility, while in (3), β_1 measures the conditional effect, i.e., the effect of income on fertility given that education is held constant.

The sign of 'b' depends on the algebraic size of the quantity $\beta_2 \cdot \alpha$. Let us suppose that fertility and education are negatively related, while fertility and income, income and education are positively related. And we fit equation (4) to both time series and cross section data. In this case the positive covariation between education (number of years of schooling) and income will be larger in the cross section than in the time series data. Because of this, the auxiliary coefficient will be larger in the cross section data. Given positive income effect ($+\beta_1$) and negative education effect ($-\beta_2$) a larger value of 'α' (in cross section) can result in 'b' having a negative sign in the cross section relationship and positive sign in the time series relationship. In general, the way in which certain variables are operationalized and the extent of variability in the variables (or indicators) can be such that the cross section and time series findings may not be consistent with respect to the magnitude and the direction of relationship.

There are certain situations where it is difficult to specify the theoretical relationship in the time series data. Let us take for example, the interrelationship among the opportunity cost of bearing and rearing children, husband's income, wife's ability and willingness to earn income and family size. It is difficult to specify this interrelationship in a time series equation. One may argue that these variables represent certain characteristics of the individuals which are not strictly comparable to the macro variables generally used in the time series equation. Theoretically, the variables that influence the individual family size are the same whether we analyse the data cross sectionally or over time. The problem here is one of identifying the theoretical relationship given certain type of data. Consequently there are some difficulties when we try to interpret the statistical relationship in order to explain and predict the reproductive response. Instances are not rare when cross section equations are used to predict changes in fertility over time. Similarly, from time series relationship inferences are drawn about differential fertility among couples with varying levels of income. Let us briefly examine these aspects.

It is reasonable to assume that the relationship between, say, income and family size is determined by the individual decision making units. Through cross section and time series equations we seek to understand what this individual relationship (on an average) is like. Each couple or family has a tendency to change (increase) their family size given certain change (increase) in their income. This relative change in family size and income can be called individual elasticity which is equal to or greater than zero. Now, the distribution of family size (according to income) at a point in time can be considered as a function of the initial distribution of income among the couples, individual elasticity of demand for children and the rate of increase in income in the past. If the poor have higher elasticity than the rich, an unit increase in income will result, at a point in time, in a larger family size for the poor as compared to the rich. The continuation of this negative cross sectional relationship at successive points in time will depend on the extent of the difference in elasticity (between the rich and the poor) and in the rate of increase in income. However, mean income and family size may both increase over time. This positive time series relationship per se does not indicate whether the elasticity is higher or lower among the poor as compared to the rich. This is because of the lack of individual correspondence between changes in income and family size. For the same reason, given the positive time series relationship, it is not necessary that the poor and the rich should have small and large family size respectively.

Aggregation bias:

The lack of individual correspondence in the time series relationship poses some problems in interpreting the relationship. The question is whether the degree of the relationship estimated from the time series data can be interpreted as the response of the couples (on an average) to an increase in income. That is, whether the macro (time series) slope is equal to the mean of the micro slopes or individual elasticities. Aggregation of individual or micro functions is different from a function fitted to aggregate variables. In time series equation only aggregate variables are used. It has been shown elsewhere (Allen, 1956, 694-722; Brown, 1965: 145-161) that given unequal micro slopes (elasticities differ among the couples) the macro slope 'b' can be equal to the mean of the micro slopes ($b_i \cdot 1/N$) only when the income distribution is constant during the period. In the case of systematic changes in income (i.e., those couples with atypical elasticity experience violent changes in income) the macro slope is equal to the mean of the micro slopes plus some bias which is called aggregation bias. As a result of this bias the macro slope can underestimate or overestimate the mean of the micro slopes. If a section of the population has a high rate of growth in their income, the macro slope is more likely to reflect the fertility experience of this particular group. So far we have assumed

that the differences in the elasticities (between the rich and the poor) are constant over time. If they change, which is quite likely, there is the additional problem of identifying the 'changing structure'.

We do not argue that the cross section studies are superior to the time series or vice versa. The point is that the type of data used and the way in which the variables are measured and classified have certain implications for explaining and predicting the reproductive behavior. And our discussion of income-fertility relationship has to be viewed in the light of these problems.

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