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SUBSIDIZING THE STORK: NEW EVIDENCE ON TAX INCENTIVES AND FERTILITY

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ABSTRACT

Variation in tax policy presents an opportunity to estimate the responsiveness of fertility to prices. This paper exploits the introduction of a pro-natalist transfer policy in the Canadian province of Quebec that paid up to C$8,000 to families having a child. I implement a quasi-experimental strategy by forming treatment and control groups defined by time, jurisdiction, and family type. This permits a triple-difference estimator to be implemented — both on the program's introduction and cancellation. Furthermore, the incentive was available broadly, rather than to a narrow subset of the population as studied in the literature on AFDC and fertility. This provides a unique opportunity to investigate heterogeneous responses. I find a strong effect of the policy on fertility, and some evidence of a heterogeneous response that may help reconcile these results with the AFDC literature.

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1 Introduction

Families with children receive special treatment under the tax and transfer provisions of twenty-six of the twenty-nine OECD countries (OECD (2000)). These policies may be motivated by a concern for equity: the presence of children alters their parents' ability to pay, and so merits recognition in the tax liability assigned to the family.[1] In addition to equity considerations, family fiscal policy has efficiency consequences if fertility depends on the cost of children.[2] Economic models of fertility following Becker (1960) have studied the influence of the cost of children on fertility decisions. In turn, empirical researchers have shown great interest in trying to uncover evidence of a relationship between prices and fertility. The endogeneity of key variables has frustrated this effort.[3] Hotz et al. (1997) conclude their survey on the economics of fertility by stating that "the crucial challenge is to find plausibly exogenous variation in proxies for the price and income concepts appearing in the theories." Tax policy may present a solution to this problem. If families with children are treated differently by tax and transfer policies than families without children, then the tax system introduces variation in the after-tax price of children. If this variation is unrelated to individuals' choices, then it can be used to test for evidence of a relationship between fertility and prices.

Many researchers have studied the impact of fiscal incentives on fertility. In one strand of the literature, researchers regress an aggregate time series of fertility on policy variables and control variables.[4] Three distinct problems arise in these aggregate time-series studies. First, the identification of policy effects from these regressions relies solely on time-series variation. This leaves the identification vulnerable to trends in unobserved variables. Specifically, if different cohorts of mothers have different unobservable characteristics that are important for their child-bearing decisions, then time-series variation in general is not sufficient to

[1] See, for example, Pechman (1983) or Davies (1990) for the development of these arguments.

[2] The cost of a child comprises both the direct cost of the child's consumption and the opportunity cost of the parents' time used in raising the child. Nerlove et al. (1984) and Batina (1986) set out optimal taxation frameworks in which the optimal child subsidy and income tax rates depend on the elasticity of the demand for children, and how this elasticity varies with income.

[3] Women may have unobserved proclivities for different family sizes. If differences in these proclivities lead to different human capital accumulation and marital decisions, then the opportunity cost of time out of the labor market will be jointly determined with fertility. See, for example, Rosenzweig and Wolpin (1980).

[4] Examples include Whittington et al. (1990), Hyatt and Milne (1991), Zhang et al. (1994), and Gauthier and Hatzius (1997).

identify fertility effects of policy. Second, the assumptions about the timing of the response to policy are arbitrary. Reactions to changes in fertility policy will be delayed by a nine-month gestational lag, as well as any time necessary for the diffusion of information about the change in policy. This makes it unclear which year's policy influences which year's fertility. Finally, many of these time-series studies suffer from the common problem of short series and the resulting small sample size. This reduces the credibility of asymptotic inferences.

Another large set of studies uses microdata to study the effects of policy on fertility. Whittington (1992) and Whittington (1993) find a fertility-enhancing effect of the dependent exemption in the PSID. However, these studies are hampered by small sample sizes and lack of substantial variation. The bulk of the recent literature, however, focuses on the incentive effects of payments through Aid to Families with Dependent Children (AFDC) on female headship and fertility decisions.[5] The surveys of this literature in Moffit (1998) and Hoynes (1997b) both make a distinction between the findings of studies including state fixed effects and those that do not. On the question of female headship, Moffitt (1994) and Hoynes (1997a) provide evidence that the inclusion of state-level fixed effects wipes out the explanatory power of welfare policy. If some unmeasured state-varying factor influences both female headship and the determination of state AFDC rates, then excluding state fixed effects from the regression will attribute to the policy what should be attributed to the excluded variables. This leads Hoynes (1997b) to conclude that there is no compelling evidence of a response to policy. For fertility, the Hoynes (1997b) survey reaches a similar conclusion. Moffit (1998), on the other hand, interprets the evidence as being in favor of a relationship, although without robustness. Harvey et al. (2000) survey the recent experimental literature on welfare. They conclude that the "evaluations have produced inconsistent results" on the relationship between family size and welfare benefits.

More recently, Rosenzweig (1999) brings a different approach to the estimation of AFDC effects on behavior. In his paper, the marital and child-bearing decisions of the woman are modelled jointly, and estimated as a multinomial logit. This differs from other models that

[5]AFDC was a transfer program for single parents with low income. Hoynes (1997b) describes the features of AFDC in more detail. There is also some work on welfare and behavior in Canada. Allen (1993) finds some effect of welfare on fertility in a 1986 cross section of microdata. Dooley et al. (2000) study welfare benefits and female headship in Canada using provincial variation through time, finding no evidence of a relationship.

consider these decisions separately or sequentially. He uses differences in average welfare benefit levels across cohorts within states to identify the effect of the benefits. Rosenzweig finds a significant impact of AFDC in the decision of young women to be single mothers, even with the inclusion of state-level fixed effects.

In this paper, I exploit the introduction of a pro-natalist tax policy in the Canadian province of Quebec. The Allowance for Newborn Children paid up to C$8,000 to families following the birth of a child. I implement a quasi-experimental empirical strategy using microdata derived from the public-use files of the Canadian Census. The structure of the Allowance for Newborn Children allows for the formation of treatment and control groups defined by time, jurisdiction, and family type. This strategy overcomes the problems in the time-series literature described above, and offers two improvements on findings from the AFDC literature. First, the structure of the program allows for a triple difference estimator that is robust to linear time-varying jurisdictional effects. This strengthens the credibility of causal inferences. In contrast, Rosenzweig (1999) relies on state effects being constant to identify the influence of AFDC. If changes through time in fertility patterns within states have some influence on the decision to change AFDC rates, then estimates that rely on across cohort variation will be biased. Second, because the program was available to all families, the results are more general than those looking at AFDC payments alone. This permits a broader examination of heterogeneity in the response to the program. Critically, this provides an opportunity to find a potential reconciliation of the results presented here with the AFDC literature.

Several interesting findings emerge. First, the estimates suggest a strong, positive, and robust impact of the policy on fertility. In the model containing the full set of control variables, the fertility of those eligible for the new program is estimated to have increased by 12 per cent on average, and by 25 per cent for those eligible for the maximum benefit. Second, I estimate the responsiveness of fertility to an extra $1,000 in benefits, finding an increase of 16.9 percent. Finally, I find the response to the policy to be heterogeneous. Subsamples of women similar to those used in AFDC studies show no statistically significant response to the incentives, while families with higher income show a stronger response.

The paper proceeds as follows. First, I present a simple economic model of fertility to develop the theoretical framework for the estimation that follows. I then provide details on the relevant institutions and describe the empirical strategy used in the analysis. Next, I document trends in aggregate fertility using data derived from vital statistics, and then proceed to a rigorous empirical examination using different microdata sources, including several checks for robustness of the result as well as an examination of heterogeneity in the reaction to the program. The next section estimates the responsiveness of fertility to the dollar value of benefits. This is followed by a reconciliation of these results with the AFDC literature. Finally, a brief discussion closes the paper.

2 The Model

Becker's (1960) seminal article on the economics of fertility posits that parents make decisions about children as they do other consumer goods — maximizing utility subject to prices and a budget constraint. Willis (1973) synthesizes this approach with the theory of time allocation developed in Becker (1965) to formalize the relationships between labor supply and fertility. In his model, the presence of young children leads women to take time out of the labor market. Women facing a higher opportunity cost of being absent from the labor market face a higher price for children, and so will have fewer children.[6] Below, I present a simple static model of fertility in the presence of a per-unit transfer to families with children. This model predicts that family size is increasing in the amount of child subsidy, which is the basic result to be taken to the data.

This model is based on Becker's (1991) model of fertility. A family utility function is defined over the consumption of two goods, the number of children Q, and a composite good Z. The prices of the goods are p_q for children, and 1 for the composite good, which is taken as the numeraire. The family has income of I. The family receives a per-child subsidy of t, meaning that the price faced by the family for the consumption of children is $p_q - t$. The problem solved by the family is to maximize utility subject to the budget constraint:

$$\{Q,Z\}max \quad U = U\left(Q,Z\right)$$

$$s.t. \quad \left(p_q - t\right)Q + Z = I$$

[6]The development of both the theoretical and empirical literature is surveyed by Hotz et al. (1997).

The first-order conditions for the problem can be combined to give the standard condition relating the marginal rate of substitution to relative prices.

$$\frac{U_Q}{U_Z} = p_q - t$$

This solution implicitly defines a demand function for Q which depends on p_q, t, and I.

$$Q^* = Q^* \left(p_q, t, I\right)$$

Holding income constant, an increase in the net price of children $(p_q - t)$ leads to substitution away from children to more consumption of the composite good. The demand for children will be decreasing in the net price (increasing in the subsidy) so long as the income effect is not too negative (i.e. children are not Giffen goods):

$$\frac{dQ^*}{dt} > 0.$$

Becker-type models of fertility are controversial among demographers. Olsen (1994) provides a discussion of the distinctions between this type of model and standard demographic analysis, which places parents as actors within a system of exogenously given biological processes, reproductive technology, and cultural influences. These models predict no change in fertility decisions in reaction to exogenous changes in prices or incomes. So, evidence in favor of a fertility reaction to price changes can be taken as supporting the prediction that prices do matter against the alternative that prices are not important.

3 Empirical Strategy

I employ a quasi-experimental estimation strategy to explore the effects of tax policy on fertility. In this section, I first give some background on the Allowance for Newborn Children. This is followed by a discussion of the identifying assumptions used in the estimation strategy.

3.1 The Allowance for Newborn Children

Demography plays a unique role in the history of Quebec.[7] Following the ceding of New France to the British in 1763, the flow of new French colonists ended. Very high birth rates

[7]There is an historical precedent for the Allowance for Newborn Children. In 1669, King Louis XIV of France ordered that an annual stipend of 300 livres be paid to families with ten or more children (Langlois (1993)).

among French-Canadians allowed their numbers to grow from the original ten thousand colonists to over one million by the time of the Canadian Census of 1871 (Langlois (1993)). In 1959, fertility in Quebec fell below the Canadian average for the first time.[8] This trend heightened concern about the preservation of French-Canadian culture and political influence.[9] These historical concerns contribute greatly to an explanation for the introduction of the explicitly pro-natalist Allowance for Newborn Children.[10]

The Allowance for Newborn Children (ANC) paid non-taxable benefits when a child joined a family between May 1, 1988 and September 30, 1997.[11] All citizens and permanent residents of Quebec were eligible for this provincial program. The size of the ANC payment depended on the parity (birth rank) of the child within the family. Initially in 1988, a first or second child entitled the family to a one-time \$500 transfer. For a child of third or higher parity, the government paid a series of eight quarterly payments of \$375, totaling \$3,000. Over the next 4 years, the benefit amounts increased. From 1992, the birth of a first or second child brought a \$500 immediate payment. Second children also entitled the family to a second \$500 payment on the child's first birthday, and a third or higher parity child brought twenty quarterly payments of \$400, totaling \$8,000. The ANC was cancelled in 1997.[12]

The introduction of the ANC was announced in the Quebec provincial budget on May 12, 1988. In the months preceding the budget, both the main opposition party and the governing party included in their fiscal proposals some changes to Quebec's family policies (Montreal Gazette (1988ab)). However, the provincial government released no hints about the structure of the ANC prior to the budget speech. The day following the release of the budget, the ANC was front page news in both English and French newspapers in Quebec (Montreal Gazette (1988c), La Presse (1988)). This suggests that the ANC is unlikely to have been anticipated, but that information about its surprise introduction was plausibly wide-spread.

[8] Historical fertility rates for Quebec and Canada are presented and discussed in more detail in Section 4.

[9] See, for example, Gosselin (1968). Similar concerns about the "danger of submersion" into the English-speaking population are expressed in Langlois (1933, p. 142).

[10] If so, this raises the possibility that both the policy and any changes in fertility share a common origin — changes within Quebec society. I return to this point in the discussion of identification that follows.

[11] Children born to the mother, as well as children under age five joining a family through adoption, were eligible for the transfer. The benefit did not depend on the mother's marital status.

[12] Children born after September 30, 1997 were not entitled to the benefit, although those born on or before that date continued to receive the full stream of payments as scheduled until 2002.

This enhances the credibility of setting this episode in an experimental framework.

The ANC was cancelled for children born after September 30, 1997. The cancellation was announced well in advance, and again was well-publicized. As quoted in the Montreal Gazette (1996), the government justified the cancellation by saying they thought the ANC didn't work.[13] As a candidate for a quasi-experimental analysis, the cancellation is less than ideal. A large expansion of public subsidies for daycare was announced at the same time as the cancellation of the ANC.[14] If daycare incentives had impact on fertility decisions, then it is not clear that the absence of the ANC would lead to a fall in fertility. This potentially contaminates the experimental environment.

Was the subsidy provided by the ANC large or small? To gain insight into this question, I employ equivalence scales estimated by Phipps (1998). These scales measure the cost of children by the extra income necessary to return the household to its pre-child level of utility. So, this measure excludes the opportunity cost generated by any decrease in family labor supply. I apply these scales to an average level of family income and obtain costs of $\$7,935$ for a first child, $\$6,348$ for a second child, and $\$5,324$ for a third child.[15] Evaluated over the first five years of a child's life, this implies that the ANC represented a percentage subsidy to the direct costs of 1.3 per cent for a first child, 3.2 per cent for a second child, and 30.1 per cent for a third child.

3.2 Identification

Typically, quasi-experimental estimators compare the behavior of a treatment group and a control group through a period in which an exogenous change affects the economic environment of the treatment group.[16] Here, Quebec women act as the treatment group, with the women in the rest of Canada outside Quebec acting as the control group. The introduction of the ANC provides the exogenous change. The difference in the fertility of women in Quebec

[13] The raw number of children born in Quebec in 1996 was almost unchanged from 1988 at about 85,000, a fact which might underlie the government's claim. When the number of babies is appropriately normalized for the number and ages of women, a different answer emerges. This is taken up further in Section 4.

[14] See Baril et al. (2000) for a description and analysis of the pre-1997 and post-1997 Quebec family benefit programs.

[15] The average total family income among married couples in the Census data set for 1996 is $51,191. (The construction of this data set is described below in Section 5.1.) The equivalence scales estimated by Phipps (1998) for a two parent family are 1.155 for one child, 1.279 for two children, and 1.383 for three children.

[16] See Meyer (1995) for a fuller description of this estimation strategy.

before and after the introduction of the ANC can be compared to the difference in fertility of women outside Quebec during the same period to form the standard difference-in-differences estimator. In the literature on AFDC and fertility, jurisdictional fixed effects weaken the estimates of the impact of AFDC, raising questions about identification from cross-sectional variation across jurisdictions. In contrast, the difference-in-differences estimator eliminates any additive jurisdictional fixed effects, and consequently does not rely on cross-sectional inter-jurisdictional variation for identification.

Heckman et al. (1999) describe the functional form assumptions necessary for the difference-in-differences estimator to produce an unbiased estimate of the impact of a program. Specifically, the impact of the program, jurisdictional fixed effects, and period effects must be additively separable in order for a differencing strategy to be unbiased. Furthermore, the error terms must also be additively separable and their expected difference across groups equal to zero. The assumption on the error terms will be violated if, for example, some trend in a relevant unobserved characteristic affects the economic environment in one jurisdiction differently than the other. In this case, the influence of the unobserved trend on the outcome variable will be incorrectly attributed to the program.

I take three approaches to meeting the challenge presented by trends in other variables. First, I attempt to do the best job possible with observables. The regressions include several control variables for observable family characteristics that may influence fertility choices, as well as some provincial-level controls for aggregate trends that may differ across provinces. Conditioning on these variables improves the credibility of causal inferences, but is not sufficient in the presence of differing trends in unobservables. The second approach exploits the structure of the ANC to further refine the empirical strategy. Because families giving birth to higher parity children receive a larger allowance, their reaction to the program should be stronger than the reaction of families contemplating the birth of a first child. This permits the construction of a third difference — women facing a first-rank birth can act as a control group for women considering a higher parity birth. This enhances the robustness of the identification strategy relative to the basic difference-in-differences strategy. Finally, I implement this triple-differencing strategy not only on the program's introduction, but also on its cancellation.

For families facing the birth of a first child, the incentives provided by the ANC may be stronger than the benefit paid for that child alone. This arises because the birth of a first child also gives the family an option to have a second child. In this way, the incentives for higher parity births may influence families facing lower parity births. The use of families facing a first birth as a control group for families facing a third or higher birth is still informative, however, so long as the treatment for the two groups is different.[17]

This identification strategy may be compromised if other policy changes occurred contemporaneous with the introduction of the Allowance for Newborn Children. Two major changes during this time period present themselves. First, abortions were removed from the Criminal Code of Canada following the striking down of Section 251 by the Supreme Court of Canada in 1991.[18] To the extent that this increased the availability of abortions, it may have influenced fertility. The rate of abortion per 100 live births, however, showed little change between 1986 and 1992.[19] Second, the Canada-Quebec Accord of 1991 gave to the province of Quebec constitutional power over immigration.[20] If this resulted in a change in the fertility behavior of immigrants selected by Quebec compared to those selected by the rest of Canada, then my estimates will attribute to the ANC what should be attributed to the change in immigration laws. To investigate this hypothesis, I reproduced the results appearing in Section 5 with a subsample that excluded immigrants. There was no significant change to the point estimates.

The unique role of demography in Quebec society raises the question of policy endogeneity. Besley and Case (2000) argue that the source of policy variation must be considered carefully. If some change in Quebec society lead to both the introduction of the program and the change in fertility, then estimates of the effect of the policy will be confounded. The empirical approach taken here addresses this important issue in two ways. First, even in the presence of a different attitude to fertility among Quebecers, the identification will be robust if this attitude is constant through this period. Any fixed Quebec-specific determinant of

[17] I ran regressions attempting to account for this option value by including a measure of the incentives for the births of all potential higher parity children. The higher parity incentives were weighted by the probability that the family would have a child of a given parity, conditional on the family's current structure. These regressions produced results similar to those reported.

[18] See the Supreme Court of Canada ruling *R. v. Morgentaler* (1991).

[19] See Statistics Canada (1994). The rate per 100 live births increased from 17.0 to 17.7 in all of Canada, and from 14.7 to 16.6 in Quebec. The rates per one thousand women exhibited a similar pattern.

[20] See Young (1998) for details.

fertility is controlled for in this empirical strategy by comparing the fertility of Quebecers before and after the introduction of the ANC. Second, if there was some change in unobservable determinants of fertility in Quebec contemporaneous with the introduction of the ANC, the triple-difference comparison of first births to higher-order births permits inferences about the effects of the policy. In other words, a social trend would have to have a differential impact on families of different sizes in order to hinder inferences. Furthermore, an argument relying on changes in social attitudes would not only have to explain the patterns of fertility after the introduction of the policy, but also after its cancellation.

Bertrand et al. (2001) express concern about the possibility of a differencing identification strategy to find effects where there are none. I do three things to alleviate these concerns. First, I look for pre-existing trends in fertility in each of the data sources analyzed here. Second, I look for effects in provinces where there was no incentive program. Finally, my analysis with Census data will implement their suggestion to collapse data into one control and one treatment period in order to avoid potential serial correlation of the policy variables. I also explored the possibility of another control group, being non-residents (such as refugee claimants) who were in Canada but not eligible for the ANC. However, the size of this group was very small, and the comparability of unobservable characteristics for this group with permanent residents is not likely to be adequate.

4 Evidence from Vital Statistics

This section examines aggregate measures of fertility taken from vital statistics.[21] The analysis aims to assess whether observed patterns of fertility are consistent with the ANC having influenced fertility. The measure for fertility used here is the total fertility rate, which takes the current cross-section of women and uses them to estimate the number of children a typical woman will have during her lifetime.[22] I first look at the historic path of the total

[21] Vital statistics are collected by provincial governments. Statistics Canada collects some vital statistics from the provincial offices to provide national aggregate statistics. Along with these national statistics, I use data collected from unpublished tables provided by the Ontario Office of the Registrar General, Institut de la Statistique du Québec, and Statistics Canada.

[22] The total fertility rate is calculated by taking the proportion of women π of each age a who bear a child in a given year. These ratios are summed across ages 15 to 49:

$$TFR = \sum_{a=15}^{49} \pi_a.$$

fertility rate in order to provide context for the experimental period. I then focus on the years from 1980 to 2000, comparing fertility across jurisdiction and by parity, before and after its introduction and cancellation. Finally, I present some aggregate evidence of fertility behavior by cohort in order to look at the dynamics of childbearing.

Figure 1 graphs the historic path of the total fertility rate of women in Quebec and Canada before the ANC from 1922 to 1991.[23] The fertility of women in Quebec exceeded the Canadian average prior to 1959. From 1959 to 1974, fertility dropped sharply across Canada, going from 3.94 to 1.88, while the decline in Quebec was slightly greater, going from 3.93 to 1.61. From 1975 to 1979, Quebec fertility increased relative to the Canadian average, then fell again through the 1980s. The 1970s relative increase in Quebec fertility coincides with reforms to the federal family allowance in 1974 and 1978.[24]

In order to focus more closely on the period encompassing the introduction of the ANC, I construct annual total fertility rates for Quebec and for the rest of Canada excluding Quebec.[25] For comparison, I also include the total fertility rate for the United States in each year. These data are graphed in Figure 2. From 1980 to 1987, the total fertility rates in Quebec and the rest of Canada diverged, reaching a maximum difference of 0.290 in 1987. The period after the introduction of the ANC shows a quick narrowing of the gap between the total fertility rates of Quebec and the rest of Canada. By 1991 this gap reached 0.082, and then remained fairly constant through the duration of the program. This provides some preliminary evidence consistent with the ANC having affected fertility.

Following the cancellation of the program in 1997, the total fertility rate in Quebec fell

(In practice, the total fertility rate is typically calculated using five-year age groups.) An alternative measure, the completed fertility rate, measures the total number of children borne by women of cohorts who have completed their fertile period. Since few women exposed to the ANC have completed their fertile period, this measure is not useful for the present question. Campbell (1983) addresses the construction of demographic measures. Hotz et al. (1997) provide a detailed discussion comparing period and completed fertility measures.

[23]The Canada total fertility rate does not include Newfoundland because data for Newfoundland is not available for the whole period.

[24]The federal family allowance, the structure of which varies by province, was expanded significantly in 1974. In Quebec, the federal entitlement depended on the number of children in the family, with third and fourth children receiving 133 and 158 per cent more than the amount payable to a first child. In 1979, the family allowance was partially replaced by an income-tested refundable tax credit. More detail is provided in Appendix D.

[25]The construction of these total fertility rates is discussed in Appendix A. Data for Quebec is available up to 2000. National data is available currently only to 1998.

from 1.601 in 1996 to 1.429 in 2000. In the rest of Canada, there was also a downward trend from 1996 to 1998, though not as sharp as in Quebec. While caution should be taken in the interpretation of so few data points, it appears that fertility in Quebec and the rest of Canada moved in directions consistent with the cancellation of the ANC having had an effect.

Figure 3 breaks down the total fertility rate by parity. These fertility rates are analogous to the total fertility rate, but concentrate on specific births. The magnitudes can be interpreted as the proportion of women who will have a birth of a specific parity during her lifetime, using the behavior of the current cross-section of women. First, at the top of the figure the fertility rates of women having their first child are graphed. The rate for women in Quebec lies below the rate for women in the rest of Canada for the pre-reform period. After the introduction of the ANC, the fertility rate of women in Quebec rises relative to women in the rest of Canada until 1991, when it overtakes the rate for the rest of Canada. For second children, the same pattern emerges: a persistent gap before the reform followed by a period of convergence from the introduction of the ANC until 1991, and then finally a period with little difference between the rates from 1991 to 1997. The bottom two lines in Figure 3 compare the fertility rate for the two regions for births of third or higher parity. The gap between the rates before the introduction of the ANC was substantial. The rate was 0.217 in Quebec compared to 0.374 in the rest of Canada for 1987, for example. After the introduction of the ANC, the fertility rate for third or higher births in Quebec increased rapidly. In 1995, the Quebec rate reached 0.305, which was 41% above the rate observed in 1987. Over the same period, the fertility rate in the rest of Canada displayed a steady, slow downward trend.

In the period following the cancellation of the ANC, the trends in the parity-specific fertility rates again correspond with the hypothesis that the ANC affected fertility. Between 1996 (the last full year of the program) and 2000, the fertility rate for third or higher births dropped from 0.303 to 0.248 — a drop of 18 per cent. In the rest of Canada between 1996 and 1998 there was a decrease of only three per cent.

Overall, this breakdown of the total fertility rate by parity provides two strong pieces of evidence. First, the ANC appears to have had an effect on fertility rates in Quebec, both on its introduction and its cancellation. Second, the movements in births of third or higher parity appear to be larger than those for births of first or second parity, consistent with the magnitude of the incentives.

Do these observed changes in fertility represent a permanent or a transitory shift in fertility behavior?[26] For example, if woman reacted to the ANC by having more children earlier, followed by fewer children later in life, then there would be no effect of the ANC on completed fertility. However, the measured total fertility rate would reflect this with a transitory upward shift.[27] When completed fertility rates for the cohorts exposed to the ANC become available, this hypothesis may be testable. Still, with currently available data, some evidence can be gathered on this question. If a cohort of women exposed to the ANC is observed to shift births to earlier ages, then this would provide evidence of the observed shift in the measured total fertility rate being transitory.

Table 1 reports the number of children born to each one thousand women in Quebec in different age ranges by cohort. The data are presented at five-year intervals between 1962 and 1997. The rates from 1992 and 1997 are shaded to indicate the presence of the ANC for those years. The top-left cell takes the women born between 1943 and 1947 for the year 1962, when members of this cohort were between the ages of 15 and 19. For these women, there were 29.83 births per thousand women in 1962. The top row then follows this cohort through to 1987, when they had 2.59 children per thousand. Looking down the first column allows a comparison of different cohorts as they reach the 15 to 19 age range.

This table is informative when read along either dimension. First, looking down each column, there is a downward trend in fertility in each age range among newer cohorts until the introduction of the ANC. For example, women born between 1943 and 1947 had 68.13 children per thousand in 1977 when aged 30 to 34. The cohort of women born ten years later had only 59.95. Following the introduction of the ANC, women in this age range show higher fertility, at 80.89 in 1992 and 79.61 in 1997. Looking across different rows, any intertemporal shifting of fertility can be seen. For example, the cohort of women born between 1963 and 1967 increased their fertility when exposed to the ANC between the ages of 25 and 29 relative

[26]Rosenzweig and Wolpin (1980) and Rosenzweig and Schultz (1985) explore life cycle fertility behavior. Dickert-Conlin and Chandra (1999) examine the role of taxes and the timing of birth within a pregnancy.

[27]Hotz et al. (1997) demonstrate how shifts in the timing of births are exaggerated when a period fertility measure such as the total fertility rate is used. Heckman and Walker (1990) estimate a model of the timing and spacing of births using Swedish data. Merrigan and St.Pierre (1998) use a similar methodology on Canadian data.

to earlier cohorts not exposed to the ANC. When this same cohort of women was between the ages of 30 and 34 in 1997, they had 79.61 children per thousand, which exceeded the fertility of older cohorts in that age range. So, increases in fertility observed in 1992 do not appear to be offset by later decreases in fertility in 1997 when the same cohort of women were older. This provides some evidence against a transitory reaction to the ANC.

To summarize this evidence, aggregate fertility rates in Quebec and the rest of Canada move in a direction consistent with the ANC having an impact on women's fertility decisions. This reaction appears for births of all parities, but most noticeably for births of children of third or higher parities. This is consistent with the incentive structure of the benefits under the ANC. Finally, the pattern of increased fertility in Quebec during the reform period appears persistently through all ages for the observed cohorts, which provides some preliminary evidence against a transitory reaction to the program. These inferences, however, may be contaminated by trends in other factors influencing fertility that differ between Quebec and the rest of Canada. The next section expands the analysis to a framework using microdata, in which controls for observable household characteristics and province-wide trends can be incorporated.

5 Evidence from Census Data

The primary data set employed for the analysis is selected from the Canadian 1991 and 1996 Census Public Use Microdata Files on Families.[28] Combined in this way, the data set is a repeated cross-section rather than a longitudinal sample.[29] The Census microdata files combine information on the family recorded on Census Day with income and labor force information from the previous calendar year. The 1991 file describes each family as of June 4, 1991 and provides income details for 1990. Similarly, the 1996 file describes the families as of May 14, 1996, and provides income details for the 1995 tax year.[30]

[28] I also explored the Family Expenditure Survey, the Survey of Consumer Finance, and the General Social Survey as possible data sources. In all cases, the sample size for women in Quebec of different family types was insufficient to provide credible inferences.

[29] Heckman et al. (1999) and Heckman and Robb (1985) show that under fairly general conditions repeated cross sections estimate the same parameter as panel data.

[30] Using the 1986 Census in place of the 1991 Census was explored as well. Implementing a difference-in-differences strategy over a longer period may contaminate the differences through trends in unobservables. In particular, the 1986 Census covers a period of substantial population outflow from Quebec, which may

Two obvious weaknesses of the Census data used here are the frequency of the data and the inability to examine the cancellation of the program. The Census is taken quinquennially, and the 2001 Census files are not yet available. Both of these weaknesses, however, can be addressed in part by examining data from the Labour Force Survey. I take up this analysis in Section 6. For the main analysis, however, the Census is preferable because of the depth of information about the demographic and income situation of each household.

For the analysis with the Census data in this section, I first outline the selection criteria used to choose the families included in the analysis. Next, I describe the construction of the variables used from those available in the Census. Finally, I present some descriptive statistics for the full sample, as well as subsamples consisting of families from Quebec and from the rest of Canada.

5.1 Data Set Construction

The 1991 and 1996 files report information on a sample of 345,351 and 342,231 families respectively. Each is roughly a three per cent sample of the population. To create the data set used in the analysis, I first select only families in which the female spouse or lone-parent female is between age 15 and 34. Women older than 34 are increasingly likely to have children who have left the household, which makes the family structure difficult to reconstruct. This left 160,901 families in the data set. Additionally, there are 20,749 families who moved between provinces in the five years prior to Census day. These families are removed to improve accuracy in assigning the province of residence at the time the family had their children.[31] In some cases, the reported number of children is censored, so the exact family structure could not be constructed. Three hundred and sixteen such families are identified and removed from the data set. Finally, 2,951 families in the remaining sample are non-residents, making them ineligible for the receipt of the ANC or other family tax benefits.

have affected fertility rates if those leaving had different fertility characteristics than those who stayed. (See Lachapelle (1987) for a discussion of the effects of this migration.) Regressions using the 1986 Census in place of the 1991 Census show similar results for the core difference-in-differences results, but weaker evidence for the triple-difference results.

[31] Mobile households are of course important if mobility was influenced by child benefit policy. Because the Census does not report the previous province of residence nor the year when the move took place, this issue is difficult to address with these data. In regressions with this sample of mobile households, no difference in behavior relative to non-mobile households is observed.

The final data set contains 136,885 observations.

The timing of the Censuses and the ANC is critical to the interpretation of the empirical results. The Census files do not provide the exact year of birth for each child, but do report the number of children in different age ranges. The first category is for children under the age of six. For the 1991 Census, a child born between June 5, 1985 and June 4, 1991 will appear as a child under the age of six. These dates define what I refer to as the 1991 Census window. Similarly, the 1996 Census window opens on May 15, 1990 and closes on May 14, 1996. The ANC was paid for children born between May 1, 1988 and September 30, 1997. The ANC window thus partially overlaps the 1991 Census window, but completely spans the 1996 Census window. Figure 4 displays the timing graphically.[32]

Because of gestation and information lags, it is difficult to know exactly when the first births potentially influenced by the ANC took place. The degree to which births observed in the 1991 Census were influenced by the ANC changes the interpretation of the results. If no births observed in the 1991 Census were influenced by the ANC, then the research design is standard — one pre-treatment period followed by one full treatment period. Because of the overlap, however, the use of these two Censuses results in a comparison of fertility in a period of partial exposure to the ANC (the 1991 Census window) with fertility in a period with complete exposure to the ANC (the 1996 Census window).[33]

The "windows" methodology is similar to that of Rosenzweig (1999), who uses as an incentive variable the average welfare rates faced by women over the years until turning 22. Rosenzweig argues that it is more reasonable to assume that women react to average differences in policy rather than postulate that fertility moves exactly contemporaneously with policy. Results using a smaller three-year window can be formed with the Labour Force Survey, which reports the age of the youngest child in a category for children under age three. Analysis on these data appears in section 6.

This experimental design requires knowledge of the family structure at the beginning of

[32]From the ages of the mother and children reported in the 1995 General Social Survey, I constructed yearly observations on the fertility behavior of each mother. Using this data set, I could exploit the year to year changes in the ANC to identify the policy effects. Regressions on this data set showed positive and significant effects of the ANC on fertility. However, reported household income in the GSS is unreliable. This and the small sample size limit the usefulness of this data set for a deeper analysis.

[33]In Appendix C, I report results from regressions using the dollar values of child benefits. This will account for the intensity of treatment received by women through each Census window.

the Census window six years prior to Census day, as well as the exact number of children born to the family over the Census window. The Census reports the number of children in different age ranges residing with the family on Census day. The category for children under age six is used to construct the binary variable *Had a child*, taking the value 1 when the family has at least one child under six, and 0 if no children under age six are present. From the other age categories, I construct three indicator variables to count the number of children age six or older in the family. The variables *Zero older children*, *One older child*, and *Two or more older children* take the value 1 when the corresponding number of children over six are present in the household, and 0 otherwise. These variables enable the reconstruction of the family structure at the beginning of the Census window. The number of older children is the number of children the family had as it entered the Census window. The variable *Had a child* captures whether or not the family responded to the incentives they faced, given the number of children already in the family as it entered the Census window.

The reconstruction of the family structure is inexact. Children present at the beginning of the Census window may not be with the family on Census day. Similarly, children present on Census day may not have been present during the Census window. These discrepancies may result from events such as the death of a child, divorce, remarriage, or the adoption of an older child. The 1991 Census provides an opportunity to evaluate the accuracy of this reconstruction, since the file in that year reports how many children had ever been born to the female. Of the 74,400 families in the 1991 sample, 92.9 per cent show no difference between the number of children ever born to the female and the number of children currently in the household.[34]

Several other family characteristics observable in the data set may influence fertility. Controls for the age, highest education level, mother tongue, and immigration status of both the woman and her spouse are created from the reported categories in the Census.[35] In addition, three controls for province-wide factors are created and attached to each family based on the province of residence. Controlling for the family's income presents several difficulties. A great amount of evidence documents a drop in female labor market activity upon

[34]The family reconstruction for the excluded women in the age range 35 to 44 was successful in only 76.4 per cent of the cases.

[35]Further detail on the construction of all variables is provided in Appendix A.

the birth of a child.[36] Furthermore, transfers from government through family allowances and unemployment insurance payments may rise with the birth of a child, creating a similar endogeneity problem through the tax and transfer system. To overcome these problems, I construct a measure of family income that includes only male labor market earnings and family non-labor income. The body of empirical evidence suggests that these components of income are not responsive to family size. Ideally, I would include the annual income for each year of the Census window. The Census, however, reports only the income for the year preceding the year of the Census (1995 for the 1996 Census; 1990 for the 1991 Census). Therefore, the family income variable I create acts as a proxy for the income received by the family during the Census window.

Table 2 presents some descriptive statistics for the sample. For each of 1991 and 1996, the mean values for variables are reported for all observations, for those residing in Quebec, and for those residing in the rest of Canada. If assignment to treatment were randomized, the expected value of all characteristics would be equal across the treatment and control groups.[37] Because treatment was assigned by geography rather than by randomization, it is important to examine the differences between the treatment and control groups. The number of observations fell from 1991 to 1996, reflecting the smaller share of the population in the 15 to 34 age range in the later Census. The proportion of women with a child under six rose from 0.428 in 1991 to 0.444 in 1996. The increase in Quebec, however, was greater — from 0.418 to 0.451 compared to an increase of 0.432 to 0.441 in the rest of Canada. These comparisons are given a more thorough examination in the next section.

Changes in other observable characteristics may explain some of the changes in fertility in Quebec and the rest of Canada. For example, families in the 1996 sample attained higher education levels than families in the 1991 sample. The proportion of women with a university degree increased by 48.8 per cent in Quebec and 27.1 per cent in the rest of Canada. If women with more education have a higher opportunity cost of an absence from the labor force, then controlling for this difference between Quebec and the rest of Canada may become important. The proportion of married women in the sample decreased from 0.713 in 1991 to 0.683 in

[36] See, for example, Angrist and Evans (1998), or Gunderson (1998) for Canadian evidence.

[37] Randomized experiments do not necessarily eliminate bias. Heckman and Smith (1995) argue that both experimental and non-experimental evaluations face the same challenge — making inferences about the intrinsically unobservable behavior of the treatment group had it not received treatment.

1996, but this drop occurs almost equally in Quebec and the rest of Canada. Average family incomes dropped sharply from $24,749 in the 1991 sample to $21,593 in the 1996 sample, although once again there is not a large difference between Quebec and the rest of Canada. The change in the average provincial GDP growth does not differ greatly between Quebec and the rest of Canada. The net migration rate doubles between 1991 and 1996 in both Quebec and the rest of Canada, reflecting the increase in immigration through this period. Average provincial education spending per student grew by eight per cent in the rest of Canada, but only by one per cent in Quebec. Because changes in GDP growth, migration, and education spending occur simultaneously with the ANC, including these variables as controls will remove any effect of these provincial-level shocks on fertility from the measured impact of the ANC.

5.2 Differences in Means

Table 3 presents a comparison of the means of the indicator variable *Had a child* across time, jurisdiction, and parity. The standard deviations appear below the corresponding means. The table first compares the means using the full sample, then breaks down the sample by parity. The first two columns report the means from the 1991 and the 1996 sample. The third column takes the difference between these means across time to calculate the trend in the means, while the fourth column takes the difference in the trend differences. The fifth column then reports the percentage increase in fertility in Quebec from 1991 to 1996. This is calculated by comparing the observed difference-in-differences to a counterfactual case in which the Quebec trend was equal to the rest of Canada trend. The difference-in-differences is divided by the sum of the 1991 Quebec mean and the 1996 rest of Canada trend. Finally, the last column takes the difference between the result for first and third children to form the triple-difference.

Panel A analyzes the full sample. In Quebec, the proportion of women with a child under six increased by 0.033 from 1991 to 1996. The trend in the rest of Canada was 0.009. The difference in these differences is a significant 2.4 percentage points, which represents a 5.5 per cent increase over the counterfactual assumption that Quebec fertility followed the same trend as the rest of Canada. Panels B through D repeat these calculations for subsamples of women having zero, one, and two or more other children respectively. This approach leads to the triple-difference strategy described earlier. In panel B, the percentage increase in the proportion of women with zero older children who had a child is 4.0 per cent. For those with one, and two or more older children, this rises to 9.7 per cent and 17.2 per cent. These percentage increases change monotonically with parity, which is consistent with the benefit structure of the ANC. A more formal test of the triple-difference result is presented in the sixth column of the table. The difference-in-differences for families with no other children is subtracted from the difference-in-differences for families with two or more other children. This tests whether the percentage point change in the probability of having a child is equal across parities. Because the base probabilities are very different, the same percentage point change represents a different percentage change in the probability of having a first child versus the probability of having a third child. The calculated triple-difference is 0.036 percentage points. The corresponding p-value from the test of the hypothesis that this triple-difference mean is different from zero is 0.076.

The differences in means present compelling initial evidence of the effect of the ANC on fertility. These statistics show that fertility increased in Quebec between 1991 and 1996, and that this increase was stronger for births of higher parity. While this is consistent with the ANC having an effect on fertility, this preliminary evidence is insufficient to suggest causation. For example, other variables important for a family's fertility decisions may vary systematically across time, place, and parity. A multivariate framework that features controls for observable characteristics therefore improves the credibility of causal inferences.

5.3 Basic Regressions

The sample statistics presented in Table 2 revealed several differences between Quebec and the rest of Canada for variables potentially affecting fertility. In this section, I report results from regressions controlling linearly for demographic and provincial variables. This improves on the simple mean differences of the previous section by removing from the estimated program effect the influence of other observable variables affecting fertility. I first run regressions looking for the existence of a differential fertility rate in Quebec in 1996. Following this, I explore how this response changes among families facing the birth of children of different parities. The estimates reveal that the statistical significance of the increase in fertility in Quebec persists with the inclusion of linear controls for observable characteristics.

The equation to be estimated takes the following form:

$$Had\ a\ child_i = \beta_0 + \beta_1 Quebec_i * 1996\ dummy_i + \beta_2 Quebec_i + \beta_3 1996\ dummy_i + \beta_4' X_i + e_i$$

All specifications share the same independent variable (*Had a child*), and include controls for 1996 and Quebec fixed effects, as well as a constant. This corresponds to a typical difference-in-differences empirical specification by controlling for both Quebec and temporal fixed effects. The variable of interest is the interaction between *Quebec* and *1996 dummy*. This interaction picks up any differential trends in fertility among residents of Quebec relative to those in the rest of Canada. The variables included in X_i vary by specification. All models are estimated as probits, with standard errors derived from the Huber-White robust estimator for the variance-covariance matrix. The reported estimates are marginal probabilities for each of the included independent variables. These estimates can be interpreted as the marginal change in the probability of having a child during the Census window for a change in the corresponding independent variable.

Table 4 presents regression results including different combinations of regressors. The first column displays the results from a regression including only *Quebec*, *1996 dummy*, and their interaction. Without other control variables, the interaction term provides a measure of the unconditional average difference in fertility in Quebec in 1996. The marginal probability implied by the estimated coefficient on the interaction term is 0.024. As expected, this is the same as the difference-in-differences estimate of the treatment effect reported in Table 3. Given that the proportion of women with a child under six in Quebec in 1991 was 0.418, and the estimated marginal probability from the 1996 trend variable is 0.009, the 0.024 estimate therefore implies a 5.6 per cent increase in the probability of having a child for women in Quebec in 1996.

The second column expands the set of regressors to include controls for several characteristics of the mother. With these variables included, the implied percentage increase in the probability of having a child is 7.8 per cent. These estimates suggest that the increase in fertility in Quebec in the previous specifications was not due to differences in family structure, age, immigrant status, mother tongue, or education level of the women in the sample. I control for the number of children at the beginning of the Census window with dummy variables. Also included are controls for the age, immigrant status, mother tongue, and education level of the woman. The marginal probability of 0.205 reported for *One older child* suggests that families who have already had one child have a 20.5 percentage point higher probability of having another child, relative to families with no older children. (The dummy variable *No older children* is the excluded variable.) Families with two or more children already, however, are less likely to have another child, as indicated by the negative marginal probability reported for the corresponding indicator variable. Taken together, this reveals an average preference for two child families.

The demographic controls reveal no surprises. The excluded age category is for ages 15 to 24. Relative to the excluded category, the estimates suggest that females age 25 to 34 are 18.7 percentage points more likely to have a child. I include a dummy for immigrant status as well as dummies for the mother tongue spoken by the woman. These variables may capture cultural elements that vary across native-born and immigrant women, and across women of different language groups. The significant coefficient on being anglophone or francophone suggests that, relative to allophones, both anglophones and francophones are less likely to give birth in the Census window. Finally, three dummy variables indicate the effect of different levels of female education on fertility. The estimates decline monotonically with education. For a women with a university degree, the estimated coefficient implies a 19.2 percentage point drop in the probability of having a child. Women with more education have better labor market prospects, so this pattern is consistent with the predictions of the Willis (1973) framework in which women with a higher opportunity cost of time choose to have fewer children.

Rosenzweig and Schultz (1985) and Rosenzweig (1999) have argued that human capital accumulation decisions are made jointly with fertility decisions. For example, if a young woman has little desire to bear children, then this may increase her propensity to make investments in human capital. In addition, this may increase her desire to get married. This suggests caution in interpreting the coefficients on these potentially endogenous variables. How might this effect the estimate of the program's impact on fertility? If women changed their human capital and marital decisions in response to the introduction of the ANC, then interpreting these variables separately from the *Quebec - 1996 dummy* interaction becomes difficult. However, because many of the women in this data set were older when the program was introduced, it seems plausible to assume their marital and education choices were fixed before they were exposed to the program.[38]

The third column adds further control variables for the male partners of the women in the sample. The estimated coefficient on the *Quebec - 1996 dummy* interaction increases to 3.9 percentage points with the male controls included. The estimated coefficients on the education variables show a distinctly opposite pattern for the males. If males do not take time out of the labor force upon the birth of a child, then male earning potential has an income effect on fertility. Therefore, these estimates suggest a positive income effect on fertility. Additional evidence on the income effect on fertility is found in the estimated coefficient on *Family income*, a measure which excludes the labor market earnings of the female. This coefficient is positive, suggesting that a ten thousand dollar increase in family income increases the probability of having a child by 1.75 percentage points. In the Becker and Lewis (1973) quality-quantity model, more income leads to a higher demand for both child quality and child quantity, which leaves the sign of the overall income effect theoretically ambiguous.[39] In these data, the estimates suggest that, on average, the direct effect of higher income on the quantity of children dominates the indirect effect through child quality.

The fourth column of Table 4 supplements the controls from column 3 with three additional provincial control variables, as well as provincial fixed effects. The interpretation of the *Quebec* and *1996 dummy* interaction as a program effect relies on the assumed absence of other provincial trends in variables affecting fertility. *Provincial GDP growth*, *Provincial migration rate*, and *Provincial education spending* attempt to control for province-level macroeconomic, demographic, or fiscal shocks that may confound the measurement of the effect of the ANC. While only one of these estimates is statistically significant in itself, the three are strongly significant when tested jointly, with a calculated chi-squared test statistic of 15.51 for the exclusion of these three variables. These controls have a large impact on the estimate of the *Quebec - 1996 dummy* interaction term, which rises from 3.9 to 5.3 percentage points.

In the discussion of identification in Section 3, the possibility of finding "false" treatment

[38]Regressions on the subsample of women between the ages of 25 and 34, for whom this assumption may be more reasonable, show similar results to the full sample.

[39]The increase in desired child quality induced by the increase in income leads to an increase in the expenditure per child. This increases the cost of a child, which leads to a decreases in the desired quantity. Thus, higher income has a positive direct effect on quantity, but a negative indirect effect on quantity through child quality.

effects was raised. To investigate this issue, I conducted a number of falsification checks by looking for fertility effects in provinces and in time periods when there was no ANC program. These results are presented in Appendix B. Overall, no other situations arise with fertility patterns similar to those experienced by Quebec during this period.

5.4 Results for Different Family Structures

The evidence presented in Table 4 shows a strong increase in fertility in Quebec following the introduction of the ANC. In order to provide more convincing evidence of a causal link, I present results that compare the fertility of families facing the birth of children of different parities. With the higher payment made to births of third or higher parity, a stronger response by these families is expected.

Table 5 reports the results of regressions on three subsamples comprised of families with zero, one, and two or more older children. These results appear in the first three columns of the table. These regressions use the empirical specification from Table 4 including the full set of control variables. For families who entered the Census window with no children, the estimated increase in the probability of having a child is 4.1 percentage points, which implies a 9.8 per cent increase in probability over the counterfactual assumption that Quebec followed the same trend as the rest of Canada. For second children, the percentage increase in probability is 13.1 per cent, and for third or higher parity children, the probability is estimated to increase by 24.7 per cent over its counterfactual level. All three estimates are statistically significant at conventional levels. This larger increase in the fertility of families facing the birth of a higher-parity child is consistent with the pattern of the incentives of the ANC.

Families facing the birth of a third child may differ systematically from other families in other observable ways. For example, women who already have at least two children are older and have higher family income. To see if it is these differences rather than the ANC that underlie the stronger response among families facing higher-parity births, I pool together all family types, but now interact the *Quebec* and *1996 dummy* variable with each of *Zero older children*, *One older child*, and *Two or more older children*. As well, I include interactions of *Quebec* with each family type, and interactions of *1996 dummy* with each family type. This controls for any Quebec-specific effects for children of different parities, and common trends in fertility for families with children of different parities. This specification frees different family types to have different responses to the program, while controlling for observable differences across family types. The resulting estimates are quite similar to those from the regressions on family-type subsamples. The implied percentage increase in the probability ranges from 10.7 per cent for families with zero older children to 25.0 per cent for families with two or more older children. This again follows the pattern predicted by the incentive structure of the ANC.

5.5 Results Using Dollar Value of ANC Benefits

This section discusses results from regressions that replace the *Quebec - 1996 dummy* interaction with the dollar values of ANC benefits received by families. Such a specification accounts for the intensity of treatment received by different families. The analysis is made difficult, however, by the frequency of receipt of payments. Estimates from the existing literature tend to use annual benefit flows rather than lump-sum payments. For this reason, to try and maintain comparability I report results from regressions using two measures of the benefit — the flow of benefits over the first year of the child's life and the flow of benefits over the first five years of the child's life. More detail on the calculations can be found in Appendix C and Appendix D.

Table 6 presents the coefficients from regressions using the same control variables as Table 4 column (d) along with the first-year and the five-year ANC benefit amounts. The first column contains the results for the first-year benefit regression. This regression provides a useful comparison with results from the literature which focus on annual benefits. The estimated coefficient on the benefit variable is 0.073. This coefficient implies that a $1,000 increase in the benefits received in the first year would increase the probability of having a child by 16.9 per cent. When this responsiveness is combined with the average benefit received by Quebecers, the benefit elasticity of fertility can be calculated. The elasticity here is 0.107, which is similar to the range of estimates in time-series studies.[40]

The second column of the table displays the five-year benefit results. This measure

[40] Gauthier and Hatzius (1997) find a long run benefit elasticity of 0.16 for family allowances across countries. Zhang et al. (1994) find elasticities of 0.05 to 0.11 for child benefits in Canada. Whittington et al. (1990) find elasticities between 0.127 and 0.248 for the personal exemption in the United States.

better captures the change in the family's financial position because of the differing number of periods over which payments were made for the ANC. Here, the estimate suggests that a $1,000 increase in the total five-year sum of the benefits would increase fertility by 2.6 per cent. This is only slightly less than one fifth of the first-year benefit result, which suggests that using the first-year benefits proxies satisfactorily for future benefit flows.

Families in Quebec and in the rest of Canada were eligible for many other benefits through the tax system in addition to the ANC. Appendix C explores the total tax benefits received by families with children, finding results very similar to those presented above using only the ANC.

6 Evidence from the Labour Force Survey

The Labour Force Survey (LFS) overcomes two weaknesses of the Census data — its frequency and the inability to examine the cancellation of the ANC. This section provides a brief supplementary analysis using the LFS to address each of these questions.[41]

The LFS is a monthly survey of around 50,000 households, similar in many respects to the U.S. Current Population Survey. It combines questions on labor market activities with demographic characteristics of the household.[42] Three key variables permit the construction of family structure. First, information on the marital status of the household is reported. Second, the number of members in the family is provided. Finally, the data include the age of the youngest child (if there is a child). The first category for the youngest child is for ages less than three, so the window used for analysis here is only three years, compared to the six year window used in the analysis of the Census.[43] Married families and lone-parent or unattached females are included in the sample if the female is between the ages of 15 and 34. The average sample size for each year is around 260,059, of which about 42,022 are from Quebec.

[41]The motivation for this section borrows from an Honours research paper by Andrea Wenham.

[42]The survey is a nationally representative sample of the population of the ten provinces aged 15 and higher. Residents of the territories, inmates of institutions, residents living on Indian Reserves, and military personnel are excluded. I use the sample weights provided.

[43]The marital status is taken from the variable reporting the type of economic family rather than the marital status variable, as the marital status variable appeared inconsistent through time. Families classified as "other family types" were excluded because of the difficulty in assigning family structure.

One weakness compared to the Census is that the LFS reports only the age of the youngest child, rather than the number of children in the under age three category. This means that families who had multiple children during the three year window will erroneously be assigned too large a family structure at the beginning of the window.[44] This will affect any inferences made about the parity-specific patterns of fertility in the LFS, as more families will be assumed to have faced the higher incentive levels than was actually the case. This will bias down the results for those with one and those with two or more children. As with the Census data, a variable *Had a child* is constructed that takes the value 1 if the family has a child age three or less, and 0 otherwise.

Figure 5 displays the mean of the LFS *Had a child* variable both for all families and for families who had two or more older children at the beginning of the window. Separate lines are drawn for residents of Quebec and those in the Rest of Canada. Note that this variable represents a three year moving average of fertility, rather than a true indicator of fertility for each year. For example, the 1996 value for *Had a child* will reflect children born in 1993 through 1996, and possibly conceived as far back as 1992. Again, a line is drawn in at 1988 and at 1997 to indicate the beginning and the end of the ANC incentives.

The trends in fertility evident in Figure 5 are broadly consistent with the patterns expected with the introduction and cancellation of the ANC. For the results with all families, there is a clear increase in fertility following 1988 which is sustained until 1997. Following 1997, there is a drop in both Quebec and the Rest of Canada, but the drop in Quebec is steeper. For families with two or more older children, there is also a strong increase following 1988, and a decrease after 1997. As a percentage, these increases are large — between 1987 and 1994 the rate in Quebec moved from 0.073 to 0.084 for a change of 15 per cent. Because of the error in the construction of the family structure noted above, however, this may be biased down.

[44] For example, take a family with five members, two of whom were born in the past three years. Because we only observe the presence of one child under three, the procedure I use assigns the family four members at the beginning of the window rather than the correct number of three. In the Census sample used in section 5, 21.3 per cent of families had more than one child under age six.

7 Reconciliation with AFDC Findings

Aggregate time series studies mostly find some responsiveness of fertility to tax incentives. In contrast, the American AFDC literature has found inconsistent results. In this section, I attempt to reconcile the strong fertility effects of the ANC found here with findings from the rest of the literature. I do this by selecting subsamples from my Census data set that resemble the samples used in other studies. This permits some insight into the differences between the results found here and those from other studies.

I focus on three recent papers that study AFDC payments and fertility.[45] First, Rosenzweig (1999) employs the National Longitudinal Survey of Youth (NLSY) on young women through the age range 14 to 22. I replicate this data set by selecting women who are under age 25. Second, Fairlie and London (1997) use a sample of single mothers with at least one child from the Survey of Income and Program Participation (SIPP). I replicate their data set by using the same selection criteria. Finally, Acs (1996) uses the NLSY on a sample of single women under age 23. I replicate this data set by selecting single women under age 25.

The results from these regressions appear in Table 7. The regression specification used is the same as Table 4 column (d). The point estimates from the first and third regression show a very small and statistically insignificant effect. The second specification shows a large effect, but it is imprecisely estimated and so it is also statistically indistinguishable from zero. These results suggest that, in general, women who are single and who are younger may be less responsive to the ANC than other women. These types of systematic differences between women likely to collect AFDC and all women may explain the different results found in AFDC studies and the ANC results presented above.

To look more closely at heterogeneity in the response to the ANC, I present in Table 8 results from regressions incorporating interactions of *Quebec* and *1996 dummy* with several characteristics.[46] Column (a) shows the coefficient on the interaction of *Quebec* and *1996 dummy* with *Married*. This interaction term is not significant, which suggests that any differences in the responsiveness of single and married women to the policy is not attributable

[45]Many other papers in the AFDC literature (for example, Hoynes (1997a)) focus on the female headship decision, which combines marital and fertility choices. The studies chosen here for replication focus more directly on the fertility decision.

[46]In each case separate interactions of the characteristic with both *Quebec* and *1996 dummy* are included in order to isolate the response of the policy from Quebec and period specific effects.

to their marital status, but to other characteristics that differ between the two groups of women.[47] Column (b) reports the results from a regression including an interaction of *Quebec* and *1996 dummy* with *Female age 25-34*. The coefficient is positive, but not significant. Again, this provides no evidence that age alone leads older women in the sample to be more responsive to the policy than younger women. The next column shows the results from a regression with interactions between *Quebec* and *1996 dummy* and the female education variables. The excluded category is women with less than high school education. Again, none of the coefficients is significant.

Column (d) displays the estimated coefficient for a regression that includes an interaction between *Quebec* and *1996 dummy* and *Family income.* The estimate of 0.078 implies that an increase in family income of $100,000 increases the policy responsiveness from 0.036 to 0.114 percentage points. This suggests a strong income effect in policy responsiveness. The final column in the table includes all the interaction terms from the first four specifications. This specification also shows a strong income effect in the responsiveness of policy. Women with access to less non-labor income are not as responsive to the ANC as women with more non-labor income. This effect persists on the subsample of women with positive non-labor income, suggesting that this result is not driven by difference between women with no non-labor income and those with positive non-labor income.[48]

In contrast, Rosenzweig (1999) finds that the responsiveness of fertility to AFDC benefits is much smaller among women who may have had access to more resources.[49] This is most likely due to a decreasing likelihood that AFDC benefits are an important part of expected income as the woman's resources grow. So, it is not clear whether Rosenzweig's finding reflects a decreasing expected benefit or a decreasing responsiveness to benefits.

There are many possible interpretations of the observed increase in responsiveness with income. For example, this could be evidence of unobserved heterogeneity in the responsive-

[47] It is conceivable that these results are driven not by differences in responsiveness across groups of women, but by differences in the incentives they faced under the parity-based structure of the ANC. I also ran regressions interacting the same set of characteristics with the ANC benefit amounts, rather than the *Quebec - 1996 dummy* interaction. These regressions account for the intensity of the incentive faced by different families, and showed similar results to the regressions using the simple *Quebec - 1996 dummy* interaction.

[48] I thank Hilary Hoynes for this suggestion.

[49] Rosenzweig selects subsamples based on the income of the young woman's parents. Those with parental income over ten thousand dollars were much less responsive to AFDC benefits.

ness of women to these incentives. If high income women differ in some unobserved way from low income women, then the higher responsiveness of high income women may be reflecting this unobserved characteristic. As well, the income measure used here may not be exogenous. If there is positive assortative matching among spouses, then the income measure may be related to wife's earnings capacity, and so be related to the cost of children. This would complicate the interpretation of any income effects using this measure of family income.

Another potential explanation can be drawn from the model developed by Becker and Tomes (1976). Their model implies a U-shaped path for the desired number of children as income rises.[50] This means that at low income levels, the overall income elasticity of demand for children is negative, whereas at high income levels it is positive. This produces a useful prediction that may help in understanding the effect of an exogenous change in the price of children. At low income levels, this model predicts that the substitution and the income effects work in opposite directions, while at high income levels the income effect will reinforce the substitution effect. This occurs in the model because low income women given more income prefer to spend more on the children they already have rather than increasing the size of the family. This may explain the weak price response among low income women.

This section has looked at the responsiveness of subsamples of women chosen to resemble the data sets constructed in the AFDC literature. Among these women, the hypothesis that the policy response is zero cannot be rejected. This is consistent with researchers who have found only insignificant effects of welfare on fertility. Furthermore, this suggests that the results from the AFDC literature do not generalize to all women. In regressions using interactions of the policy variable with different characteristics, the responsiveness of women increases with non-wife income.

[50] They generate this result by adding heritable endowments of child quality to the Becker and Lewis (1973) model. With heritable quality endowments, the income elasticity of the own-contribution to quality is relatively large at low levels of income, and declines as income rises. This means that, at low levels of income, the child quality income effect will dominate but at higher levels of income the child quantity income effect will dominate. So, at low levels of income the overall income effect is negative, but then becomes positive at higher levels of income.

8 Conclusion

This paper has presented new evidence on the relationship between tax incentives and fertility. There are two major findings. First, the responsiveness of fertility to a birth subsidy is estimated to be large — up to a 25 per cent increase in fertility for families eligible for the full amount. A C$1,000 increase in first-year benefits is estimated to increase the probability of having a child by 16.9 per cent. Second, there is evidence of heterogeneity in the response to the policy. This heterogeneity may help to reconcile the results with evidence on AFDC and fertility, and suggests that findings about AFDC and fertility do not generalize to all women.

This evidence supports the hypothesis that prices matter for family fertility decisions. This, in turn, carries implications for the interpretation of the optimal tax models of Nerlove et al. (1984) and Batina (1986). Their models suggest that the design of tax and transfer systems should take into account the response of fertility to tax measures. Specifically Nerlove et al. assume that the most disadvantaged individual has the most children, while the results in Batina's model hinge critically on assumptions about the differences in fertility elasticities across income groups. The estimates presented in this paper help the interpretation of the models by providing evidence on the signs and magnitudes of the relevant elasticities.

A Variable Definitions

Total Fertility Rate: For each year in a given jurisdiction the number of births for women in seven five-year age groups covering women from age 15 to 49 is divided by the population of women in the corresponding age group. These seven birth rates are summed, then multiplied by five to get the total fertility rate. The birth data come from Statistics Canada catalogues 84-204 and 84-210. The population data come from CANSIM series C894142 and C892552.

Had a child: Takes the value 1 if at least one child under age six in the family on Census day; otherwise equal to 0.

Zero older children: Takes the value 1 if no children age six or older in the family on Census day; otherwise equal to 0.

One older child: Takes the value 1 if one child age six or older in the family on Census day; otherwise equal to 0.

Two or more older children: Takes the value 1 if two or more children age six or older in the family on Census day; otherwise equal to 0.

Male / Female less than high school: Takes the value 1 if did not receive high school diploma; otherwise equal to 0. For single females, the male variable takes the value 0.

Male / Female high school: Takes the value 1 if received high school diploma, but no further education; otherwise equal to 0. For single females, the male variable takes the value 0.

Male / Female post high school: Takes the value 1 if pursued further education past high school, but did not receive university degree; otherwise equal to 0. For single females, the male variable takes the value 0.

Male / Female university degree: Takes the value 1 if received university degree; otherwise equal to 0. For single females, the male variable takes the value 0.

Married: Takes the value 1 if female is legally married or in common-law relationship; otherwise equal to 0.

Live in urban area: Takes the value 1 if family lives in a community of population 100,000 or greater; otherwise equal to 0.

Male / Female immigrant: Takes the value 1 if an immigrant; otherwise equal to 0. For single females, the male variable takes the value 0.

Male / Female allophone: Takes the value 1 if mother tongue is neither French nor English; 0 otherwise. For single females, the male variable takes the value 0.

Male / Female anglophone: Takes the value 1 if mother tongue is English; 0 otherwise. For single females, the male variable takes the value 0.

Male / Female francophone: Takes the value 1 if mother tongue is French; 0 otherwise. For single females, the male variable takes the value 0.

Family income: The sum of male wages and salaries, male self-employment income, male investment income, and female investment income; in 1995 Canadian dollars.

Provincial GDP growth: Constructed as the average rate of real provincial GDP growth over the six years in the Census window; data from CANSIM, various series.

Provincial migration rate: Constructed as the net number of inter-provincial migrants divided by provincial population, averaged over the six years in the Census window; data from CANSIM, various series.

Provincial education spending: Constructed as the total provincial government spending on elementary and secondary education divided by the population in the age range 0 to 17; data from CANSIM, various series; in 1995 Canadian dollars.

B Falsification Checks

This appendix reports results from regressions where no effect is expected in order to enhance the credibility of the causal link drawn from the evidence. The regressions reported in section 5 identify a differential trend in the fertility of women in Quebec versus the rest of Canada. As well, this trend is shown to be increasing in the parity of the next child to be born. The control variables included in the regressions account for the effects of observable characteristics on fertility, and leave any remaining trend to be explained by the existence of the ANC program. The credibility of this interpretation as causal becomes weaker to the extent that strong trends in fertility exist in other provinces where none are expected. For example, in a comparison of the fertility of families observed in the 1986 Census to those in the 1991 Census, no persistent differences between Quebec and the rest of Canada should be observed, since the ANC had no material effect on families during either of these periods. Similarly, a comparison of any particular province (other than Quebec) with the rest of the country should not produce significant program effects, since no families outside Quebec were eligible for the ANC. I next explore these falsification strategies to try and find an effect where there should be none.

Table 9 displays results from regressions using the strategies outlined above. The first column reports the estimates for regressions based on the full set of control variables, using the interaction of *Quebec* and the dummy for the later Census year as the variable of interest. In columns 2 through 4 I report the estimates from a pooled regression like that in Table 5. The results for the 1986 and 1991 Census comparison in panel A of the table show no statistically significant difference between the trends in fertility in Quebec versus the rest of Canada over this period. When the *Quebec* and Census year interaction is further interacted with the family types in a pooled regression, no obvious pattern in the estimates is evident. This suggests that, in the period preceding the introduction of the ANC, there were no strong differences in fertility trends in Quebec and the rest of Canada.

The balance of the table in panel B reports results from regressions comparing each of the ten jurisdictions outside Quebec in turn with the other nine. (In all cases, Quebec observations are deleted for these regressions.) In the first column, both Newfoundland and

Saskatchewan show significant declines in fertility from 1991 to 1996.[51] From this evidence, it seems that Quebec is not alone in experiencing a statistically significant shock to its fertility over these years. However, the pooled regression results for neither Newfoundland nor Saskatchewan in columns 2 through 4 show a consistent pattern of significant effects by family type. Thus, the results in Table 5 for Quebec are unique in exhibiting a consistent pattern of significant effects for different family types.

C Analysis Using Total Child Benefits

In this appendix I examine regressions that use benefit levels rather than dummy variables as the key explanatory variables. Regressions on benefit levels can be interpreted as a Local Average Treatment Effect (LATE) in the sense of Imbens and Angrist (1994).[52] Consider the determination of benefits as a 'first stage' regression, with family type, province of residence, and year as regressors. The estimated effect of this benefit on fertility in the 'second stage' could be interpreted as a LATE that measures the increment to fertility caused by the change in benefits resulting from moving from not being a resident of Quebec during the ANC period to being a resident of Quebec during the ANC period.

Below I present some descriptive statistics for total child benefits across jurisdictions, years, and family types. This is followed by the results of regressions on the dollar value of benefits, including results that attempt to account for the endogeneity of income-tested benefits to fertility.

C.1 Descriptive Statistics

In addition to the ANC, families receive several other tax benefits related to children. For example, a family residing in Quebec in 1989 with a new child may have received the ANC, the Allowance for Young Children, the Quebec and the Federal Family Allowance, as well as refundable and non-refundable child tax credits. By combining the impact of these fiscal measures, the total tax incentives to have a child for each family in the data set can be calculated. In this section, I present summary statistics for the magnitude of the fiscal

[51] Saskatchewan and Newfoundland had the largest out-migration rates among the provinces for this period. Different fertility behavior among migrants and non-migrants may have contributed to the drop in fertility in these provinces.

[52] Meyer (1995) makes a similar point about the causal interpretation of this type of parameter, but does not relate it to the LATE.

incentives followed by regression results using these variables to estimate the influence of tax incentives on fertility.

The main incentive variables used in the analysis are calculated over two time horizons, one year and five years. This distinction may be informative because some of the family benefits are paid continuously from the year of birth until the child becomes an adult, while others are one-time payments or of limited duration. Because the year of birth of a child within the Census window is unknown, the incentives facing each family to have another child are calculated for each year in the Census window. The one-year benefit is then formed as an average of these six benefit calculations. For benefits over a five year horizon, the annual fiscal flow over the first five years of the child's life is discounted by a three per cent rate of time preference and summed. This calculation is repeated for each of the six potential years of birth in Census window, and averaged. Further details on the methodology and the child benefit programs are included in Appendix C.

Table 10 displays the means and standard deviations of the incentive variables for subsamples consisting of residents of Quebec and the rest of Canada. Panel A of the table pools together all family types, with panels B through D breaking down the sample into subsets defined by the number of children in the family at the beginning of the Census window. All statistics are reported separately for data derived from the 1991 and 1996 Censuses, and all values are in 1995 Canadian dollars. The first column reports the statistics for the ANC for residents of Quebec. Across all family types, the average family would have received $191 from the ANC in the years prior to the 1991 Census, and $635 in the years before the 1996 Census. Women in the 1991 Census had some exposure to the ANC during the Census window, while women in the 1996 Census were exposed to the full force of the program. In the 1996 sample, families with no other children would have received on average $528 through the ANC. The benefit for families with one other child is identical because a child of second parity receives only one payment in the first year, with the second payment coming on the child's first birthday. The ANC benefit rises to $1,646 for families for whom the additional child would be of third or higher parity.[53]

The second column shows the sum of all the benefits payable to a family with a new child, but excluding the ANC. The third column reports the total benefit levels for each of the family types, which is the sum of the first two columns. The fourth column contains the same total benefit statistics for residents of the rest of Canada outside Quebec, who were

[53]The standard deviations for these benefits is each zero because all families of each type receive the identical benefit.

ineligible for the ANC. Between 1991 and 1996, there were many changes to federal child benefits.[54] The family allowance, refundable and non-refundable tax credits ended in 1992 and were replaced by a new income-tested child tax benefit. However, the total of the other benefits for families in Quebec shows little change on average from the 1991 to the 1996 sample. On average, the change is $60, which is only 3.6 per cent of the 1991 total. Thus, most of the variation in average benefits for Quebec residents across time is driven by the ANC. For residents of the rest of Canada, total benefits do not change much on average — only $9 between 1991 and 1996 — which suggests that the net mean impact of changes to federal family policy on incentives is negligible.

I again draw on the equivalence scales estimated by Phipps (1998) to assess the magnitude of these incentives. Using these scales in Section 3, I calculated the average annual cost of a first child to be $7935, a second child $6348, and a third child $5324. Taking the total one-year child benefits in the 1996 sample in Table 10, this implies that the child benefits represent a subsidy of 24.9 per cent, 34.2 per cent, and 80.4 per cent for first, second, and third children respectively in Quebec. In the rest of Canada, the subsidies as a percentage of the cost of children are 13.0, 17.4, and 27.0 per cent for first, second, and third children respectively. These calculations indicate that the subsidies in the tax system are large, and especially so for families in Quebec.

The last four columns of the table repeat the analysis with the five-year incentive measure. During the first five years of a child's life, the only benefit that pays different amounts at different ages is the ANC. Accordingly, the ANC totals differ relative to the other benefits in the five-year horizon calculations. For families having their second child, the five-year total is now higher than for families having their first child, since the five-year total also includes the second $500 payment made on the child's first birthday. For families residing in Quebec facing the birth of a third child, the discounted sum of the total benefits received over the first five years of the child's life is $19,363. This is more than double the total for Quebec families with a first child, or for any type of family in the rest of Canada.

C.2 Correcting for Endogeneity

The ANC was a non-taxable transfer, but many of the other child benefits depend on the level of family income. For example, the federal Child Tax Credit was reduced by a rate of five per cent for every dollar of family income over a certain threshold ($25,921 in 1993). This

[54]For further detail, see Appendix D.

raises the possibility that these benefits are endogenous to the decision to bear a child. This potential endogeneity arises because a higher benefit provides an incentive for a woman to have a child, but the birth of a child may also cause a decrease in the woman's labor market activity. Lower labor market earnings leads mechanically to an increase in her income-tested child benefits. This may lead to an upward bias in the estimate of the response of fertility to incentives.

A solution to this problem lies in finding an instrument that is correlated with child benefits, yet exogenous to the decision to bear a child. The changes in child benefits between 1991 and 1996 provide an opportunity to form such an instrument. The changes in government policy are plausibly exogenous to the decision of an individual woman to have a child. By exploiting the exogeneity of these reforms, I can construct an instrument that has predictive power for the level of benefits, yet is not related to individual fertility decisions.[55] The calculation is made as follows. I construct simulated instruments in the spirit of Currie and Gruber (1996) for cells defined by province, year, and number of older children.[56] I then assign these simulated benefits to the women in my data set. The simulated benefits should have predictive power for the actual level of benefits received by women, but by construction will be unrelated to their labor force decisions, thus avoiding the endogeneity that may bias estimates using their actual benefits.[57]

Table 11 reports the results from the regressions using the first-year and the five-year benefit entitlement of the family if it had another child (measured in \$1,000) as the policy variable of interest. The full set of control variables is included in the regression. The dependent variable for the regressions remains the same — the binary variable *Had a child*. I depart from the previous regressions by estimating the models as a linear probability model using OLS instead of as a probit. This facilitates the estimation of two-stage least squares (2SLS) models using the instrument.[58] For all regressions, the coefficient on the level of the benefit entitlement is reported, along with the corresponding percentage increase in the fertility rate implied by the estimate for a \$1,000 increase in annual child benefits. I provide an elasticity calculation along with the reported coefficients. The benefit elasticity is calculated as the percentage change in the probability of having a child divided by the

[55]This instrumental variables strategy is similar to that used by, for example, Currie and Gruber (1996) to estimate the effect of health insurance for children on health outcomes.

[56]For each simulated individual I assigned the sample average labor market earnings for the husband and the wife. The simulated individuals were assumed to be married.

[57]The F-statistic for the first stage regression is $11,435$. The t-statistic on the simulated instrument is 142.98.

[58]The fit of the probit model and the linear probability model with the data is quite similar.

percentage change in the child benefit at the mean.

Panel A of the table uses the first-year benefits incentive variable. The first and second columns of the table present the OLS and 2SLS estimates using the total child benefit entitlement, including all programs. The OLS estimate is 0.129, which implies a 29.7 per cent increase in fertility for an increase of $1,000 in total benefits. This is almost twice the magnitude of the estimate obtained using the ANC alone in table 6. The 2SLS estimate, however, is 0.077, which implies a 17.6 per cent increase in fertility for a $1,000 increase in annual benefits. The benefit elasticity is also lower in the 2SLS results, at 0.236. The lower panel of the table repeats the regressions for the five-year benefits incentive variable. The estimates are slightly less than one fifth of the results using first-year benefits, suggesting that the response does not depend on the timing of the receipt of benefits.

In summary, the total fiscal incentives to have children in Canada during this period were large, especially in Quebec. I find that accounting for the endogeneity of income-tested benefits to fertility is important, but that the impact of fiscal incentives on fertility is still large.

D Institutions and Methodologies for the Benefit Calculator

This appendix provides more detail about transfers to families with children, and then describes the methodology used for the incentive variable calculations.

D.1 Transfers to Families with Children in Canada

During the period spanned by the Census window for the 1991 and the 1996 Censuses, Canadian families were potentially eligible for eleven distinct fiscal measures through the tax and transfer system. Each is described below. Further detail on these measures can be found in Canadian Tax Foundation (various years), Québec (1992), and HRDC (1999).

D.1.1 The Quebec Allowance for Newborn Children

The Allowance for Newborn Children was introduced on May 1st, 1988 and was cancelled on October 1, 1997. This non-taxable benefit was paid upon the birth of a child, or upon the adoption of a child under age five according to the rank of the child among the children under age 18 currently residing with the family. The initial rates were $500 immediately for a first or second child, and eight quarterly $375 payments for each child of rank three or higher. In May 1989, the rates changed so that a second child received a second $500 payment on his or her first birthday. For births of children of rank three or more, the $375 quarterly payments now continued for twelve quarters. As of May 1990, the $375 payments for children of rank three or more was extended to a length of 16 quarters. As of May 1991, the $375 payments for children of rank three or more was extended to a length of 20 quarters. As of May 1992, the 20 quarterly payments for children of rank three or more were increased to $400 per quarter.

D.1.2 Quebec Dependent Deduction / Credit

Through agreements with the Federal Government, Quebec sets its own base for taxation. In 1986 and 1987 a deduction for dependents under 21 could be claimed, which differed by the rank of the child. From 1988, these deductions were transformed into non-refundable credits. A person living alone, a married person, and a person heading a single-parent family receive additional credits as well. In 1995, the dependent child credit was $520 for the first child and $450 for each subsequent child. The person living alone credit was $210, the married person credit was $1,180, and the single parent family credit was $1,300.

D.1.3 Quebec Family Allowance

In Quebec, families received a family allowance from the provincial government during the period 1974 to 1997. This family allowance was paid monthly, and differed according to the rank of the child. It was not treated as taxable income. In 1995, the Quebec Family Allowance paid $130 annually for first children, $174 for second children, $218 for third children, and $261 for children of fourth or higher rank.

D.1.4 Quebec Availability Allowance

From 1981 to 1988, Quebec mothers were eligible for a transfer for children under age six if the mother was out of the labor force. The Availability Allowance differed by the rank of the child. When it was cancelled, it was replaced by the Quebec Allowance for Young Children. In its final year, the Availability Allowance paid $100 for one child under six, $200 for a second child under six, and $500 for a third child under six.

D.1.5 Quebec Allowance for Young Children

The Allowance for Young Children made monthly payments to families with children under age six according to the rank of each child. This benefit was paid from 1989 to 1997. In 1995, a family with one child under six received an annual payment of $117. For a second child under six, the family received an additional $234, and for a third an additional $585.

D.1.6 The Federal Child Tax Credit

The Child Tax Credit was introduced in 1978 and was cancelled in 1992. The non-taxable benefit consisted of an annual flat amount per child, which was gradually reduced for family incomes over a certain threshold. In 1988, a supplementary benefit for children under seven was introduced. This benefit was replaced by the Federal Child Tax Benefit (described below) in 1993. In its final year in 1992, the Child Tax Credit paid $601 per child with a supplement of $213 for each child under seven. The threshold level of income was $25,921.

D.1.7 The Federal Dependent Deduction / Credit

Until 1987, a deduction from taxable income could be claimed for each dependent under eighteen in the family. Following the income tax reform taking effect in 1988, this deduction was transformed into a non-refundable tax credit. From 1990, the size of the credit was doubled for children of third rank or higher within the family. In 1993, this credit was folded into the new Child Tax Benefit. In 1992, the credit was $399 for the first two children and $798 for children of third and higher rank.

D.1.8 The Federal Sales Tax Credit

The Sales Tax Credit was introduced in 1986. The benefit consists of a flat rate for each parent, plus a flat amount per child. The benefit is reduced for family incomes above a threshold, but is treated as taxable income. A supplement for single adults and parents was introduced in 1991, and is phased in for incomes over a certain threshold. In 1995, the credit paid $199 per adult, $105 per child, and a supplement single-headed households was phased in at two per cent for incomes over $6,456, to a maximum of $105. The reduction rate for the benefit in 1995 was five per cent for incomes over $25,921.

D.1.9 The Federal Family Allowance

The Family Allowance was reformed substantially in 1974, and maintained the same structure until it was replaced by the Child Tax Benefit in 1993. The benefit took the form of a monthly, taxable benefit for each child under eighteen in the family. With two exceptions, the benefit was paid at a flat rate per child. In Alberta, the benefit depended on the age of the child. In Quebec, the benefit depended on the rank of the child within the family, with higher-rank children earning a larger benefit. From 1989, the federal Family Allowance was subject to a claw back of 15% of income over a certain threshold. In 1992, the Family Allowance paid benefits at an annual rate of $418. In Quebec, the benefit was $267 for first children, $399 for second, and $996 for children of third or higher rank. The clawback threshold was $53,215.

D.1.10 The Federal Child Tax Benefit

In 1993, the Child Tax Credit, federal dependent non-refundable credit, and the Family Allowance were replaced with the Child Tax Benefit. Similar to the Family Allowance, the Child Tax Benefit pays benefits according to the child's age in Alberta and rank in Quebec. The base Child Tax Benefit in 1995 paid an annual benefit of $1,020 in most of the country, but in Quebec the rates were $868 for the first child, $1,023 for the second, and $1,596 for a third or higher ranked child. A supplement for third and additional children ($75 in 1995) is paid. A second supplement for children under seven ($213 in 1995) is also paid. On top of this benefit, a working income supplement for families with children is paid for incomes surpassing one threshold, and then reduced for incomes over another threshold. For 1995, the working income supplement increased at eight per cent for incomes over $3,750 until reaching $500, then was decreased by ten per cent of income over $20,921. The total sum of this benefit is reduced for family income above a certain threshold ($25,921 in 1995). The reduction rate is 2.5 per cent of income over the threshold for only children, and five per cent for families with more than one child.

D.2 Methodology for the Benefit Calculations

The benefit calculator was constructed as follows. I start with the family structure at the beginning of the Census window. For each year, I calculate the child benefits owed to the family based on the number of children it had at the beginning of the window. This calculation is repeated with an additional child added to the family. The difference in these two calculations represents the extra child benefits payable to the family upon the birth of another child in that year. This calculation is repeated for the first five years of the child's life (discounting by 3% per year time preference) and summed to find the five-year benefits. The whole calculation is repeated for the six years in the Census window, with the final one-year and five-year benefit measures calculated as the average over the years in the Census window. Gross income was calculated as the sum of male and female salaries and wages, self-employment earnings, and investment income in the Census year, deflated by the Consumer Price Index back to the relevant year.

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Figure 1: Total Fertility Rates: Historical

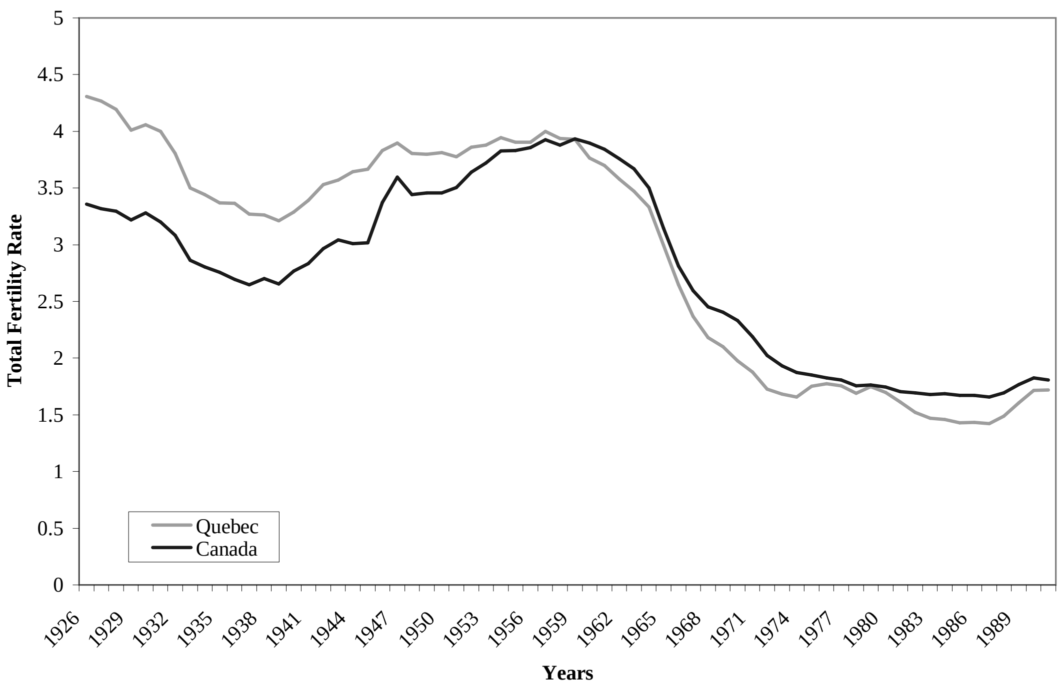

Figure 2: Total Fertility Rates: Quebec, Rest of Canada, and the United States

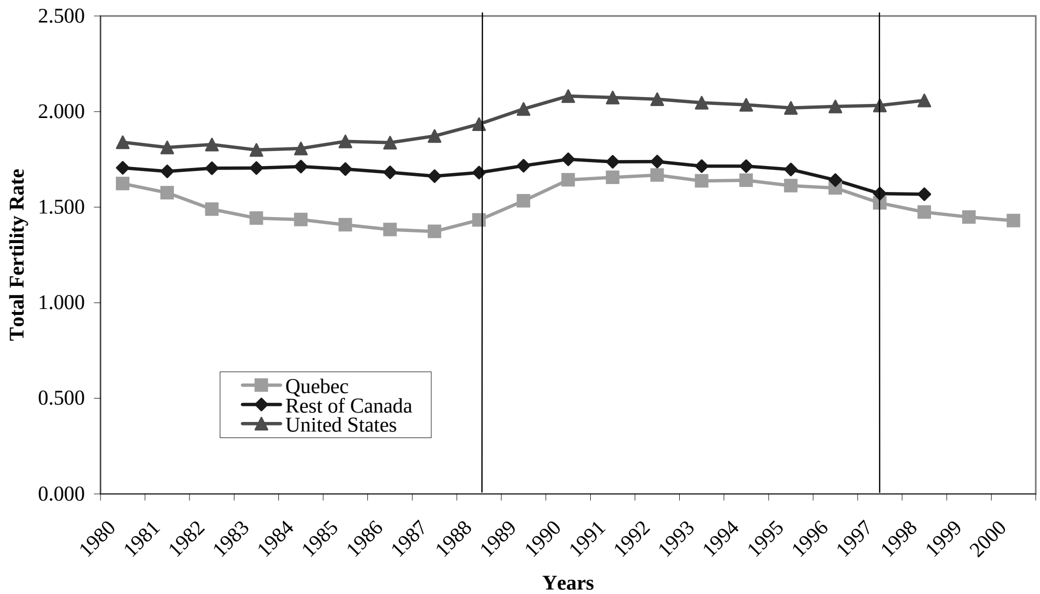

Figure 3: Fertility Rates: By Parity

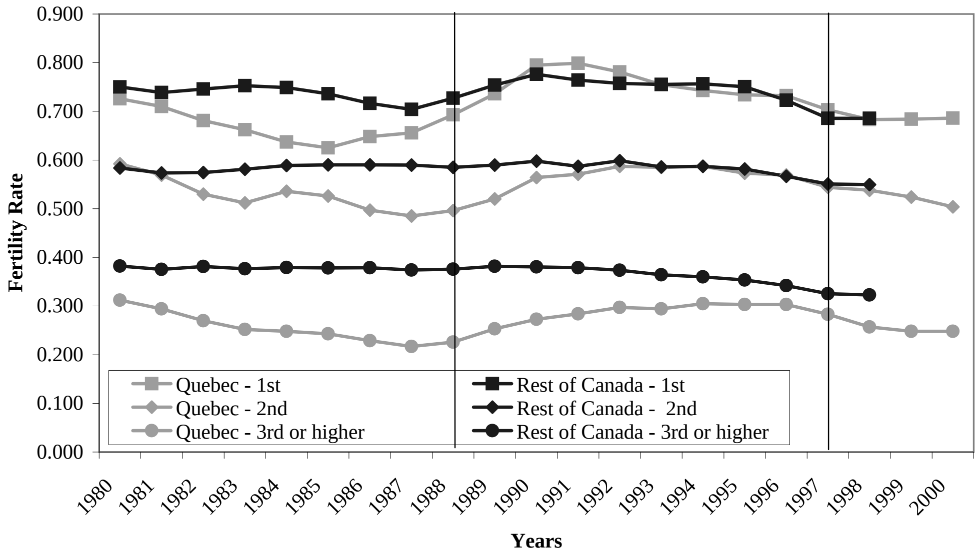

Figure 4: Timing

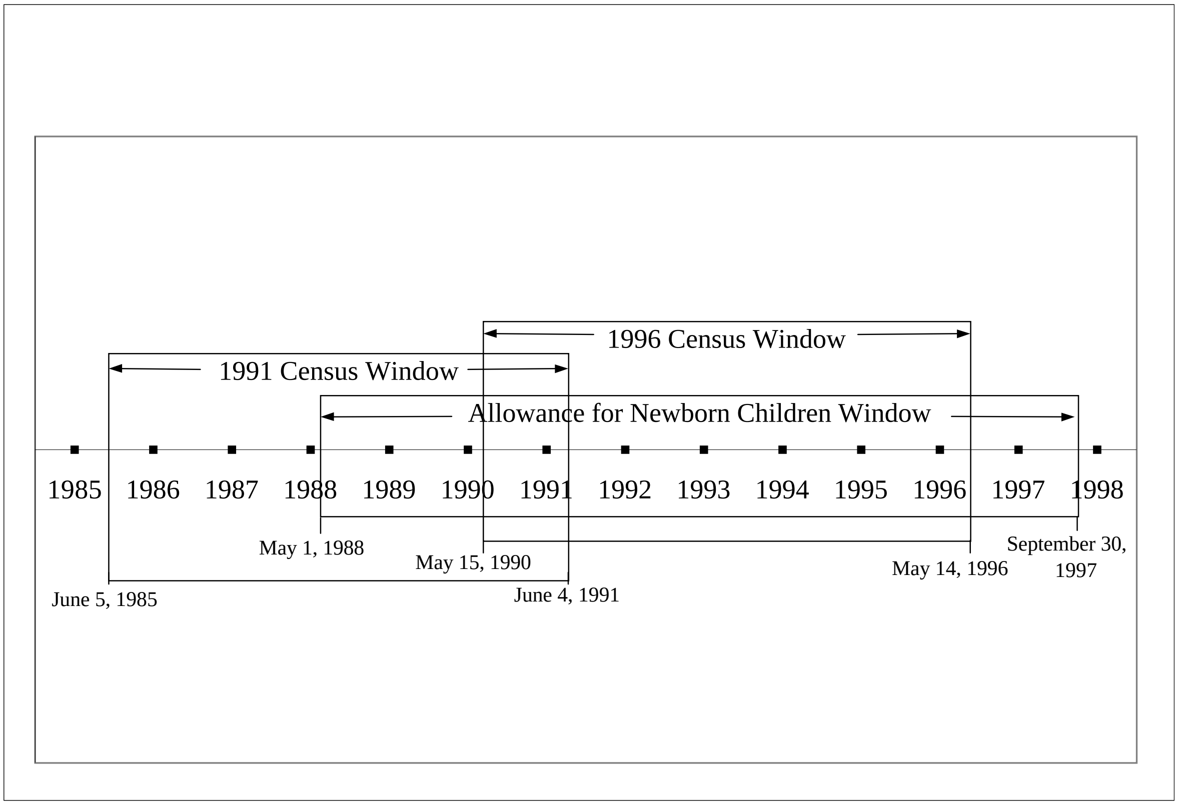

Figure 5: Proportion of families with child under age three in the Labour Force Survey

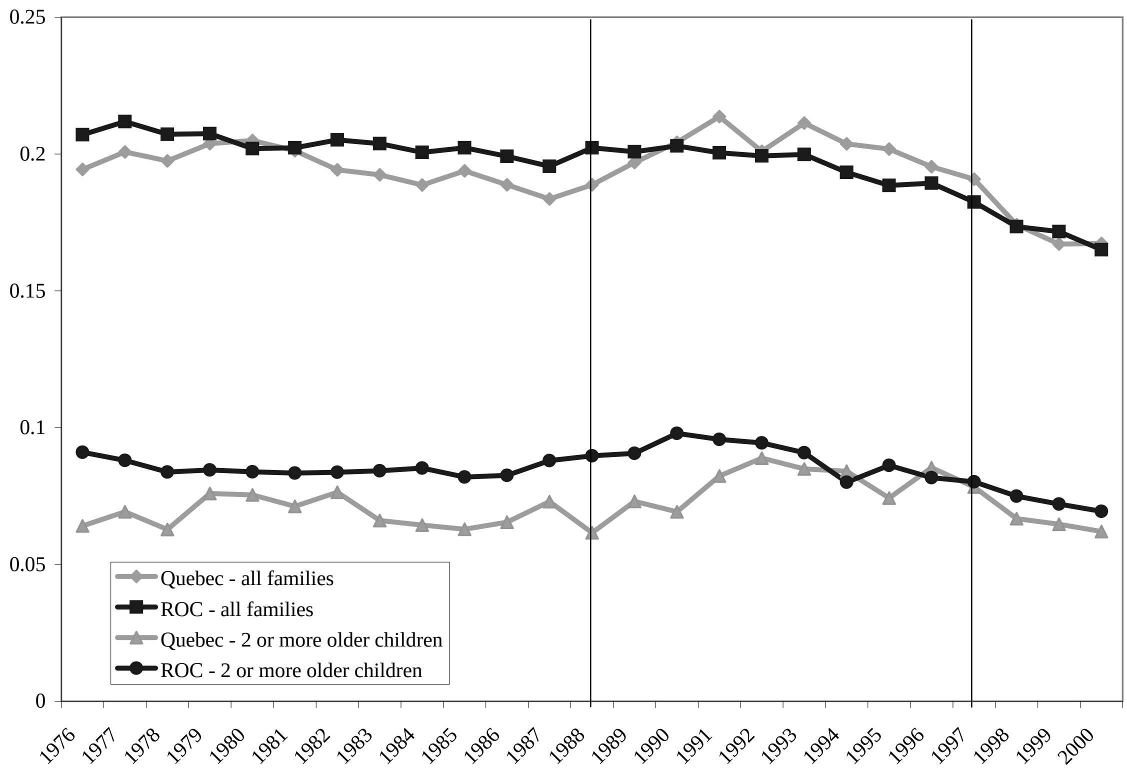

Table 1: Cohort Fertility Rates

Years of Birth	Age Groups					
	age 15-19	age 20-24	age 25-29	age 30-34	age 35-39	age 40-44
1943-1947	29.83	139.20	119.14	68.13	17.56	2.59
1948-1952	23.27	92.29	132.26	62.06	17.01	3.33
1953-1957	17.47	92.20	119.07	59.95	23.94	3.88
1958-1962	19.06	81.43	110.12	80.89	26.58	
1963-1967	15.05	69.07	129.71	79.61		
1968-1972	15.67	77.60	111.72			
1973-1977	17.89	66.95				
1978-1982	15.60					

Note: Reported is the average rate of births per one thousand women in Quebec. Years in which the ANC is active are shaded.

Table 2: Sample Characteristics

	1991			1996		
	All Observations	Quebec	Rest of Canada	All Observations	Quebec	Rest of Canada
Observations	74400	20285	54115	62485	16453	46302
Had a child	0.428	0.418	0.432	0.444	0.451	0.441
Zero older children	0.723	0.740	0.716	0.732	0.754	0.724
One older child	0.154	0.158	0.153	0.153	0.150	0.154
Two or more older children	0.123	0.102	0.131	0.115	0.096	0.122
Quebec	0.273	1.000	0.000	0.263	1.000	0.000
Rest of Canada	0.727	0.000	1.000	0.737	0.000	1.000
Female age 15-24	0.224	0.215	0.227	0.218	0.218	0.218
Female age 25-34	0.776	0.785	0.773	0.782	0.782	0.782
Male age 15-24	0.084	0.086	0.083	0.083	0.088	0.081
Male age 25-34	0.656	0.658	0.655	0.625	0.628	0.624
Male age 35-44	0.239	0.233	0.242	0.269	0.260	0.272
Male age 45+	0.021	0.022	0.020	0.024	0.024	0.023
Female less than high school	0.238	0.237	0.238	0.200	0.195	0.202
Female high school	0.184	0.183	0.184	0.155	0.154	0.155
Female post high school	0.455	0.463	0.453	0.489	0.485	0.491
Female university degree	0.172	0.160	0.177	0.229	0.238	0.225
Male less than high school	0.260	0.260	0.260	0.226	0.227	0.225
Male high school	0.153	0.163	0.149	0.148	0.148	0.148
Male post high school	0.459	0.451	0.462	0.484	0.473	0.488
Male university degree	0.128	0.126	0.128	0.143	0.153	0.139
Married	0.713	0.735	0.705	0.683	0.697	0.678
Live in urban area	0.598	0.626	0.588	0.602	0.649	0.585
Female immigrant	0.095	0.046	0.113	0.110	0.054	0.130
Male immigrant	0.119	0.064	0.140	0.127	0.068	0.148
Female allophone	0.096	0.055	0.111	0.111	0.070	0.125
Female anglophone	0.630	0.070	0.839	0.630	0.066	0.831
Female francophone	0.274	0.875	0.049	0.260	0.864	0.043
Male allophone	0.114	0.069	0.132	0.125	0.080	0.142
Male anglophone	0.605	0.063	0.817	0.611	0.066	0.811
Male francophone	0.281	0.869	0.052	0.264	0.854	0.047
Family income	24749	23242	25314	21593	20196	22092
Provincial GDP growth	3.22	2.85	3.36	1.25	0.91	1.37
Provincial net migration rate	0.34	0.17	0.40	0.64	0.35	0.74
Provincial education spending	6306	6142	6367	6689	6183	6870

Note: Reported are means over all observations in the relevant subsample. Male variables are averaged over families with a husband.

Table 3: Comparing Fertility by Time, Jurisdiction, and Parity

	Mean		Trend difference in means	Difference in	Percentage	Triple
	1991	1996	(2) - (1) =	differences	increase	difference
	(1)	(2)	(3)	(4)	(5)	(6)
A. All Parities						
Quebec	0.418	0.451	0.033			
	(0.003)	(0.004)	(0.005)			
n	20,285	16,453				
Rest of Canada	0.432	0.441	0.009	0.024	5.5%	
	(0.002)	(0.002)	(0.003)	(0.006)		
n	54,115	46,032				
B. Zero older children						
Quebec	0.393	0.418	0.025			
	(0.004)	(0.004)	(0.006)			
n	15,017	12,399				
Rest of Canada	0.398	0.407	0.009	0.016	4.0%	
	(0.002)	(0.003)	(0.003)	(0.007)		
n	38,754	33,338				
C. One older child						
Quebec	0.627	0.677	0.050			
	(0.009)	(0.009)	(0.013)			
n	3,207	2,475				
Rest of Canada	0.691	0.681	-0.010	0.060	9.7%	
	(0.005)	(0.006)	(0.008)	(0.015)		
n	8,262	7,088				
D. Two or more older children						
Quebec	0.278	0.353	0.075			
	(0.010)	(0.012)	(0.015)			
n	2,061	1,579				
Rest of Canada	0.321	0.344	0.023	0.052	17.2%	0.036
	(0.006)	(0.006)	(0.008)	(0.018)		(0.020)
n	7,099	5,606				

Notes: Reported in the first two columns are the means of the variable *Had a child*. Standard deviations appear below in parentheses. The percentage increase is calculated by dividing the difference-in-differences by the sum of the 1991 Quebec mean and the 1991 to 1996 rest of Canada trend.

Table 4: Regression Results

Dependent Variable: *Had a Child*

Independent Variables	(a)	(b)	(c)	(d)
Pseudo R-squared	0.0003	0.058	0.131	0.132
1996 dummy x Quebec	0.024 *	0.034 *	0.039 *	0.053 *
	(0.006)	(0.006)	(0.006)	(0.010)
1996 dummy	0.009 *	0.013 *	0.031 *	0.028 *
	(0.003)	(0.003)	(0.003)	(0.010)
Implied percentage increase in probability of having a child	5.6%	7.8%	8.7%	12.0%
Quebec	-0.014 *	-0.021 *	-0.005	0.023
	(0.004)	(0.006)	(0.007)	(0.024)
One older child	-	0.205 *	0.193 *	0.192 *
		(0.004)	(0.004)	(0.004)
Two or more older children	-	-0.163 *	-0.203 *	-0.205 *
		(0.004)	(0.004)	(0.004)
Female age 25-34	-	0.187 *	0.107 *	0.107 *
		(0.003)	(0.004)	(0.004)
Female immigrant	-	0.032 *	0.052 *	0.055 *
		(0.005)	(0.006)	(0.006)
Female francophone	-	-0.047 *	-0.037 *	-0.035 *
		(0.007)	(0.008)	(0.008)
Female anglophone	-	-0.049 *	-0.009	-0.007
		(0.005)	(0.006)	(0.006)
Female high school	-	-0.015 *	-0.055 *	-0.054 *
		(0.004)	(0.005)	(0.005)
Female post high school	-	-0.086 *	-0.118 *	-0.118 *
		(0.004)	(0.004)	(0.004)
Female university degree	-	-0.192 *	-0.235 *	-0.236 *
		(0.004)	(0.004)	(0.004)
Male age 25-34	-	-	0.148 *	0.148 *
			(0.007)	(0.007)
Male age 35-44	-	-	0.089 *	0.090 *
			(0.008)	(0.008)
Male age 45+	-	-	-0.114 *	-0.114 *
			(0.012)	(0.012)

Table continues on next page.

Table 4 (continued)

Independent Variables	(a)	(b)	(c)	(d)
Male immigrant	-	-	0.014 *	0.017 *
			(0.007)	(0.007)
Male francophone	-	-	-0.054 *	-0.051 *
			(0.008)	(0.008)
Male anglophone	-	-	-0.066 *	-0.0642 *
			(0.004)	(0.007)
Male high school	-	-	0.004	0.004
			(0.006)	(0.006)
Male post high school	-	-	0.015 *	0.016 *
			(0.004)	(0.004)
Male university degree	-	-	0.031 *	0.032 *
			(0.006)	(0.007)
Married	-	-	0.206 *	0.202 *
			(0.009)	(0.009)
lives in urban area	-	-	-0.068 *	-0.073 *
			(0.003)	(0.003)
Family income (C$10,000)	-	-	0.175 *	0.177 *
			(0.008)	(0.008)
Provincial GDP growth	-	-	-	0.005
				(0.008)
Provincial migration rate	-	-	-	-0.015
				(0.008)
Provincial education spending	-	-	-	0.037 *
				(0.018)

Notes: Reported coefficients are marginal probabilities from probit regressions using the full sample of 136,885 observations. A constant term was included but is not reported. Robust standard errors are reported below the corresponding estimates. Coefficients significant at the five per cent level are indicated with an asterisk. The implied percentage increase in the probability of having a child is calculated as described in the text.

Table 5: Impact of Allowance for Newborn Children on Different Family Types

Dependent Variable: *Had a Child*

	Older Children			
	Zero	One	Two or more	Pooled
Observations	99508	21032	16345	136885
Pseudo R-Squared	0.1361	0.083	0.028	0.132
Zero older children x Quebec x 1996 dummy	0.041 *	-	-	0.045 *
	(0.012)			(0.011)
Implied percentage increase in probability of having a child	9.8%	-	-	10.7%
One older child x Quebec x 1996 dummy	-	0.080 *	-	0.080 *
		(0.020)		(0.019)
Implied percentage increase in probability of having a child	-	13.1%	-	12.6%
Two or more older children x Quebec x 1996 dummy	-	-	0.082 *	0.082 *
			(0.028)	(0.022)
Implied percentage increase in probability of having a child	-	-	24.7%	25.0%
Quebec	0.009	0.036	0.080	0.035
	(0.028)	(0.049)	(0.059)	(0.024)
1996 dummy	0.027 *	-0.015	0.054 *	0.027 *
	(0.012)	(0.022)	(0.025)	(0.011)
One older child	-	-	-	0.209 *
				(0.007)
Two or more older children	-	-	-	-0.212 *
				(0.006)
One older child x Quebec	-	-	-	-0.054 *
				(0.012)
Two or more other children x Quebec	-	-	-	-0.026 *
				(0.014)
One other child x 1996 dummy	-	-	-	-0.013
				(0.010)
Two or more other children x 1996 dummy	-	-	-	0.023 *
				(0.011)
Other control variables	yes	yes	yes	yes

Notes: Reported coefficients are marginal probabilities from probit regressions on the relevant subsample. Control variables as in Table 4 specification (d) are included, but not reported. Robust standard errors are reported below the corresponding estimates. Coefficients significant at the five per cent level are indicated with an asterisk. The implied percentage increase in the probability of having a child is calculated as described in the text.

Table 6: Regressions Using the Dollar Value of Allowance for Newborn Children Benefits

Dependent Variable: *Had a Child*

	First-year Benefits ANC	Five-Year Benefits ANC
Coefficient on benefit	0.073 *	0.011 *
	(0.015)	(0.003)
Implied percentage increase in fertility rate for $1000 increase in benefits	16.9%	2.6%
Benefit elasticity	0.107	--

Notes: Control variables as in Table 4 specification (d) are included, but not reported. Coefficients significant at the five per cent level are indicated with an asterisk.

Table 7: Results Using Replications of AFDC Data Sets

Dependent Variable: *Had a Child*

	(a)	(b)	(c)
AFDC Study	Rosenzweig (1999)	Fairlie and London (1997)	Acs (1996)
Selection Criteria	Age 15-24	Single At least one child	Single Age 15-24
Observations	30271	7102	14292
Pseudo R-squared	0.131	0.044	0.114
Quebec x 1996 Dummy	0.003 (0.018)	0.077 (0.043)	0.004 (0.022)

Notes: Reported coefficients are marginal probabilities from probit regressions. Control variables as in Table 4 specification (d) are included, but not reported. Robust standard errors are reported below the corresponding estimates. Coefficients significant at the five per cent level are indicated with an asterisk.

Table 8: Heterogeneity in Response to Allowance for Newborn Children

Dependent Variable: *Had a Child*

	(a)	(b)	(c)	(d)	(e)
Quebec x 1996 dummy	0.034 *	0.036	0.074 *	0.036 *	0.061 *
	(0.015)	(0.017)	(0.017)	(0.012)	(0.017)
Interactions of Quebec x 1996 dummy with:					
Married	0.028				0.003
	(0.015)				(0.018)
Female age 25-34		0.025			0.017
		(0.016)			(0.017)
Female high school			-0.030		-0.040
			(0.021)		(0.021)
Female post high school			-0.027		-0.039 *
			(0.017)		(0.017)
Female university degree			-0.013		-0.035
			(0.022)		(0.022)
Family Income				0.078 *	0.074 *
				(0.028)	(0.036)

Notes: Reported coefficients are marginal probabilities from probit regressions. Control variables as in Table 4 specification (d) are included, but not reported. Also included are main effect interactions of each characteristic (*Married*, *Female age 25-34* etc.) with *Quebec* and with *1996 dummy*. Robust standard errors are reported below the corresponding estimates. Coefficients significant at the five per cent level are indicated with an asterisk.

Table 9: Falsification Regressions

Dependent Variable: *Had a Child*

	(a)	(b) Zero	(b) One	(b) Two or more
A. 1986 vs 1991				
Quebec x 1991 dummy	0.003	0.013	-0.001	-0.056 *
	(0.009)	(0.011)	(0.022)	(0.026)
B. 1991 vs 1996				
Newfoundland	-0.048 *	-0.045	-0.050	-0.056
	(0.020)	(0.024)	(0.041)	(0.051)
New Brunswick	-0.038	-0.040	-0.052	-0.012
	(0.033)	(0.035)	(0.048)	(0.059)
Nova Scotia	0.029	0.022	0.039	0.049
	(0.018)	(0.021)	(0.040)	(0.048)
Prince Edward Island	0.011	-0.019	-0.016	0.167
	(0.045)	(0.053)	(0.099)	(0.114)
Ontario	0.008	0.010	0.020	-0.018
	(0.014)	(0.014)	(0.021)	(0.023)
Manitoba	0.027	0.015	0.049	0.065
	(0.016)	(0.018)	(0.040)	(0.042)
Saskatchewan	-0.040 *	-0.287	-0.087 *	-0.043
	(0.016)	(0.019)	(0.038)	(0.037)
Alberta	0.010	0.015	-0.015	0.012
	(0.015)	(0.016)	(0.028)	(0.029)
British Columbia	0.001	-0.003	0.008	0.019
	(0.019)	(0.019)	(0.030)	(0.032)
Territories	0.014	-0.041	0.359 *	-0.050
	(0.054)	(0.062)	(0.107)	(0.117)

Notes: Reported coefficients are marginal probabilities from probit regressions on the relevant subsample. Control variables as in Table 4 specification (d) are included, but not reported. Robust standard errors are reported below the corresponding estimates. Coefficients significant at the five per cent level are indicated with an asterisk.

Table 10: Total Child Benefits

	First-year Benefits				Five-year Sum of Benefits			
	Quebec			Rest of Canada	Quebec			Rest of Canada
	ANC	Other Benefits	Total Benefits	Total Benefits	ANC	Other Benefits	Total Benefits	Total Benefits
A. All Parities								
1991	191	1651	1843	1101	305	7701	8006	5196
	(96)	(382)	(457)	(319)	(359)	(1805)	(2086)	(1507)
1996	635	1591	2226	1092	1217	7507	8723	5154
	(329)	(523)	(779)	(484)	(1866)	(2468)	(3957)	(2281)
B. Zero older children								
1991	159	1527	1686	1045	159	7111	7270	4932
	(0)	(249)	(249)	(312)	(0)	(1176)	(1176)	(1472)
1996	528	1448	1976	1031	528	6832	7360	4864
	(0)	(407)	(407)	(498)	(0)	(1921)	(1921)	(2348)
C. One older child								
1991	159	1704	1863	1212	308	7959	8267	5717
	(0)	(267)	(267)	(302)	(0)	(1258)	(1258)	(1422)
1996	528	1641	2169	1107	1029	7741	8770	5222
	(0)	(345)	(345)	(424)	(0)	(1628)	(1628)	(2002)
D. Two or more older children								
1991	478	2476	2954	1279	1361	11600	12961	6035
	(0)	(276)	(276)	(278)	(0)	(1302)	(1302)	(1313)
1996	1646	2637	4283	1439	6918	12437	19355	6789
	(0)	(327)	(327)	(276)	(0)	(1542)	(1542)	(1304)

Notes: Reported is the mean child benefit for each subsample. The standard deviation appears below in parentheses.

Table 11: Results for Benefit Regressions

Dependent Variable: *Had a Child*

	Total Benefits	
	OLS	2SLS
A. First Year Benefits		
Coefficient on benefit	0.129 *	0.077 *
	(0.004)	(0.016)
Implied percentage increase in fertility rate for $1000 increase in benefits	29.7%	17.6%
Benefit elasticity	0.399	0.236
B. Five Year Benefits		
Coefficient on benefit	0.027 *	0.011 *
	(0.001)	(0.003)
Implied percentage increase in fertility rate for $1000 increase in benefits	6.2%	2.5%

Notes: Control variables as in Table 4 specification (d) are included, but not reported. Coefficients significant at the five per cent level are indicated with an asterisk.