Design Matters: Causal Evidence on Cash Benefits and Fertility *

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Abstract

Children-related benefit is a common policy tool in many countries to reduce the costs of having children and raise fertility. Yet, how the design of benefits affects fertility responses remains less studied. This paper helps to fill this gap by leveraging the introduction of two benefits — a universal benefit and an earnings-related benefit — in the Canadian province of Quebec. Using Canadian administrative tax data and exploiting the variation of benefits across regions and time, I follow a difference-in-differences approach to uncover the fertility responses to the two benefits. The empirical analysis delivers two key results. First, a C$1,000 (2017 prices) spent on universal benefits raises fertility by 3.6% while the same amount spent on earnings-related benefits raises fertility by 2%. Importantly, the increase in fertility reflects an increase in the ultimate number of children rather than a re-timing of having children. Second, the large discrepancy in fertility responses is driven by the distributional feature of the two benefits. While universal benefits make larger payments to low-earnings women who are more responsive to financial incentives, the earnings-related benefits make larger payments to high-earnings women who are less responsive.

Keywords: Fertility, cash benefits, paid leave, distributional impact

JEL Classification: H31, J13, J18

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1 Introduction

Over the past decades, low fertility has become a new reality for over half of the world population. The average number of children per woman is below 2.1, a level to maintain a stable population, in almost all OECD countries. East Asia and parts of Europe have even reached "ultra-low" fertility rates of below 1.5 children per woman. The prolonged below-replacement fertility will rapidly change the demographic structure towards fewer working-age people and more older people. This change is likely to result in a shrinking labor force, putting enormous pressures on health care systems and public pension funds in the long term.

In light of the reality of low fertility, a growing number of countries have begun to provide cash transfers to families with children, often taking the form of family allowances, baby bonuses, or tax credits. Cash benefits can be further classified into two types — universal benefits and earnings-related benefits — depending on whether the benefits are linked to income. Both benefits reduce the costs of raising children, yet their distinct distributional features might lead to different fertility responses. Despite the widespread prevalence of benefits and the associated large expenditure, comparisons between universal benefits and earnings-related benefits have been rare, most likely for two reasons: a lack of policy variations that permits a comparison of two benefits in similar settings, and a lack of comprehensive data with detailed information on fertility as well as individual and family income that permits a distributional analysis of cash benefits.

To fill this gap, this paper compares the fertility effects and the cost-effectiveness of universal benefits and earning-related benefits by leveraging the introduction of two major benefits in Canada. The first benefit, Allowances for Newborn Babies (ANC), is a universal transfer implemented in

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1 Appendix Figure 1(a) plots the fertility rates across OECD countries.
2 If present demographic trends continue, between 1999 and 2050, Japan’s labor force will fall from 68 million to 46 million, Italy’s from 23 million to 14 million, and Germany’s from 41 million to 28 million (McDonald and Kippen 2001).
3 Between 2005 and 2015, the number of countries with policies to raise fertility has increased from 20 percent to 28 percent (UN 2015). Often pronatalist rationale is not the only motivation for family policies; there are other goals such as improving women’s employment, alleviating child poverty, and reducing gender inequalities. Nevertheless, pro-natal motive increasingly becomes one the main drivers of the recent waves of family policy reforms (Olivetti and Petrongo 2017).
4 Two recent examples of universal benefits include the Poland’s “Family 500+” (Rodzina 500+) program which delivers a tax-free benefit of PLN 500 (about EUR 120) per month for the second and any consecutive children until they reach the age of 18 and the baby bonus in Spain which delivers a one-time fixed amount of benefits to any families with a newborn. Examples of earnings-related benefits include the parental leave benefits that exist in most developed countries replacing a certain proportion of earnings. Other examples include tax credits like Canada Child Benefits (CCB) in Canada, The Earned Income Tax Credit (EITC) in the US and the Working Families’ Tax Credit (WFTC) in the UK.
1988. It provides fixed transfers to all families with a newborn regardless of income. The second benefit, Quebec Parental Insurance Plan (QPIP), is an earnings-related transfer implemented in 2006. It increases the portion of earnings replaced by parental leave benefits, which ultimately translates into higher maternal compensations, especially for middle- and high-income women.

Studying the Canadian context is ideal as it addresses the challenges of both the lack of policy variation and the lack of data. First, both ANC and QPIP were introduced in the province of Quebec, and both were salient and large in size. This setting allows me to estimate the fertility responses to the two benefits separately in a difference-in-differences design, using Quebec as the treated group and the other provinces as the control group. Second, the Canadian Longitudinal Administrative Databank (LAD) covers 20% of Canadian tax filers with precise information on children’s birth date, earnings, and family structure since 1982. The longitudinal nature and the rich information on earnings allow me to credibly identify not only the overall fertility responses but also the heterogeneous fertility responses across women’s earnings, as well as the distributional properties of the two benefits. Credibly identifying these effects is crucial to understand why one type of benefit is more cost-effective than the other.

My analysis reveals two key results. First, both ANC and QPIP have led to significant increases in fertility. In the nine years following the policy change, ANC increases fertility by 17 percent, and QPIP increases fertility by 10 percent. Scaling the benefits to C$1,000 (2017 prices), I find that a C$1,000 spent in universal benefits is associated with a 3.6% increase in fertility while the same amount spent in earnings-related benefits raises fertility by 2%. Moreover, by exploiting the longitudinal nature of data and tracking a few cohorts over their lifetime, I provide clear evidence that both benefits result in a persistent increase in fertility, representing an increase in the ultimate number of children rather than a re-timing of having children.

Second, to investigate the reasons behind the differential fertility effects of the two benefits, I analyze the distributional feature of the two benefits, as well as the heterogeneous responses across income groups. I find that ANC makes larger payments to women with lower earnings since the benefit value depends on the current number of children, and low-earnings women tend to have more children at an earlier age. This makes ANC a progressive transfer in nature. In contrast, QPIP makes larger transfer payments to women with higher earnings since the program gave a higher income replacement up to a higher threshold, making it a regressive transfer. Further, the
heterogeneous analysis across income reveals that low-earnings women are more responsive than their high-earnings counterparts to the same dollar amount of benefits. Thus, the distributional feature of the two programs, coupled with the heterogeneous fertility responses, explains why universal benefits outperform earnings-related benefits at encouraging births.

My findings relate to the literature on financial incentives and fertility. Previous studies have found a large discrepancy in fertility responses, with little consensus on why the magnitude varies so much across studies. Exploiting the variation in benefit generosity across regions and time, earlier studies find mixed evidence with modest effects at best, and the results are sensitive to methodology and specifications \cite{Gauthier2007}. A more recent literature, exploiting natural experiments from different countries, demonstrates that both universal benefits (e.g., \cite{Milligan2005}, \cite{Gonzalez2013}, \cite{Cohen2013}, and \cite{Riphahn2017}) and earnings-related benefits (e.g., \cite{Lalive2009}, \cite{Malkova2018}, and \cite{Raute2019}) have positive effects on fertility.

Nevertheless, comparing the fertility effects of these policy options across studies remains a challenge due to three reasons. First, previous papers tend to have different measurements of fertility. While some studies investigate the overall probability of birth (e.g., \cite{Milligan2005} and \cite{Malkova2018}), some examine higher-order births (e.g., \cite{Cohen2013} and \cite{Lalive2009}), others examine the total number of children when women reach the end of childbearing age \cite{Dahl2016}. Second, previous papers tend to have different time horizons due to data limitations or the duration of policies. While most studies investigate short- to medium-term fertility responses within two to five years after policies (e.g., \cite{Gonzalez2013}, \cite{Cohen2013}, and \cite{Raute2019}), a few investigate the long-term effects up to ten years after policies (e.g., \cite{Lalive2009} and \cite{Malkova2018}). Third, policies are embedded in broader economic and cultural contexts. For example, countries

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5Using US aggregate time-series data, \cite{Whittington1990} was the first paper to estimate the responsiveness of fertility to tax benefit seriously. It finds sizeable positive fertility responses. However, \cite{Crump2011} revisit the same tax policy with updated data and more flexible specifications and found no effects. Similarly, while \cite{Baughman2003} find that the expansion of earned income tax credit (EITC) has small positive impacts on first births, \cite{Baughman2009} find EITC produced even small reductions in higher-order fertility among white women. In Canada, \cite{Zhang1994} find that the exemption, family allowances, and child tax credit have significant and positive effects on fertility, while maternity leave does not have a significant impact. \cite{Brewer2012} find the introduction of the Working Families Tax Credit (WFTC) in the UK increases birth among coupled women.

6Olivetti and Petrongolo \cite{Olivetti2017} provides a survey of this literature.
vary a lot in female labor force participation, age-wage profile, and childcare provision as well as culture (Fernandez and Fogli, 2009). This variation implies that even the same benefits might induce different fertility responses in different economic and cultural contexts. I contribute to this literature by directly comparing the fertility effects and cost-effectiveness of universal and earnings-related benefits within the same setting. My analysis shows that the benefits’ distributional features lead to differential fertility responses, and that universal cash benefits are more cost-effective than earnings-related benefits in raising fertility rates. Evaluating the two benefits within the same setting ensures that the observed difference in fertility responses is likely attributable to the policy design rather than other factors.

Another issue faced by the literature is to decide whether cash benefits cause an inter-temporal shifting of having children or a change in the ultimate number of children. Imagine a case where a pro-natalist policy encourages women to have more children in the short run, followed by a reduction of childbearing in later life. In that case, the policy is ineffective at encouraging birth and thus become a waste of public resources. As pointed out by Adda et al. (2017), the existing literature provides relatively scarce evidence on this issue, and existing studies find mixed results. For example, Lalive and Zweimüller (2009) investigate an extension of parental leave in Austria and find that despite a substantial re-timing of giving birth, the change in the ultimate number of children is still positive. On the other hand, Adda et al. (2017) use a life cycle model to simulate the effect of a cash transfer and find that while cash benefits induce women to have children sooner, they have little impact on the ultimate number of children. Along this dimension, I contribute to the literature by taking advantage of the longitudinal nature of LAD, tracking down a few cohorts of women, and following them through their lifetime. In this way, I demonstrate that both universal benefits and earnings-related benefits lead to an increase in the ultimate number of children rather than an inter-temporal shifting of giving birth.

The remainder of this paper is structured as follows. In section 2 I discuss the institutional background for Canada. Section 3 discusses the data source. Details of our econometric framework are given in section 4. The results are presented in section 5. Section 6 concludes.

\footnote{Two other examples from Canada (Parent and Wang, 2007) and Germany (Cygan-Rehml, 2016) have found similar results that the changes in financial incentives only affect the timing of birth, with little impact on the ultimate number of children.}
2 Institutional Background

2.1 Allowance for newborn Children (ANC)

From the mid-80s to the mid-90s, the government of Quebec decides to increase its financial support to families. The objective pursued was to “adequately compensate the costs associated with children” (Duclos et al., 2001). The allowances for newborns (ANC), introduced in the spring budget of 1988, was a non-taxable cash transfer to all legal residents of Quebec that had a newborn between May 1, 1988 and September 30, 1997. The benefit was universal, with no income tests. The size of the benefits depends only on the parity (birth rank) of the child within the family.

When the benefits were first introduced in 1988, a first or second child brings the family a one-time transfer of C$500. For third births or more, each family receives eight quarterly payments of $375, adding up to be C$3,000. The benefit values then grow continuously over the period. The amount and exact timing of these payments are shown in Figure 1 and Appendix Table 1. From 1992 until the end of the policy, parents of a third child received $8,000, which accounts for 30% of the direct cost of the first five years of a child’s life (Milligan, 2005).

One potential issue is that the public may react to the policy before the implementation. In that case, the estimates may be contaminated by the anticipation effects and fail to capture a full policy effect. However, in the case of ANC, the anticipation effect is not likely. ANC was officially announced in May 1988 and was implemented in May 1988. This timeline suggests that the policy is unlikely to have been anticipated. The abolishment, however, was announced well in advance and well-publicized (Milligan, 2005). Children born after the cancellation date of Sep 30, 1997 were not eligible for payments. With the termination of ANC, the provincial government instead implemented a large expansion of public subsidies for childcare to encourage mothers’ participation in the labor force. In addition, ANC was replaced with a new means-tested family allowance focusing on low-income families. Since the expansion of childcare and the introduction of means-tested tax credit happened at the same time as the cancellation of the ANC, it is hard to get a clean identification of the effects on the ANC cancellation. Therefore, the cancellation of ANC in 1997 is not examined in this paper.

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8In 1989, an additional $500 is paid for a second child. For a third child, the eight quarterly payments were increased to 12 quarterly payments in 1989, then to 16 quarterly payments in 1990, 20 quarterly payments in 1991, and finally to 20 quarterly payments of $400, adding up to C$8000.
Figure 1: Allowance for newborn Children (ANC) Benefits over Time

Notes: The figure shows the ANC benefits for families with 1, 2, and 3+ children over year, in current year Canadian dollar (no adjustment for inflation).

2.2 Quebec Parental Insurance Plan (QPIP)

Prior to 2006, the parental leave programs were incorporated within the Employment Insurance (EI) program in all Canadian provinces, as prescribed by the Employment Insurance Act of 1996 and its amendments in 2000. EI offers temporary financial assistance to unemployed Canadians, including maternity benefits that new mothers can take and stay off work with pay, as well as parental benefits that fathers and mothers can share. Starting January 1, 2006, Quebec opted out of the federal EI program on maternity and parental leave and introduced Quebec Parental Insurance Program (QPIP) as a replacement. Both programs are financed by a payroll tax.\footnote{Since January 1, 2006, Quebec employment insurance contributors receive a reduction in their employment insurance premiums. The federal government determines the reduction rate. In 2020, the reduction rate was 0.38\% for wage earnings and 1.4 times that for employers. Quebec employment insurance contributors pay a premium to QPIP. In 2020, the premium was 0.494\% for wage earners.}

QPIP was officially announced in the middle of 2005 and then implemented on January 1, 2006. Given that it takes around 40 weeks to conserve a baby, it is unlikely that people would have anticipated the policy change before 2006. To further support the claim that anticipation is...
not likely, I provide the Google Trend of “QPIP” in Canada in Appendix Figure 2. Google Trend measures the frequency that people search the keyword “RQAP” (French acronym of QPIP) using Google web search. It normalizes the highest frequency to 100. The figure shows that searches for QPIP were relatively few until September 2005, supporting the idea that details of QPIP were not well-publicized prior to 2006.

QPIP introduces a few changes in the parental benefits systems. First, the reform lowers the eligibility criteria. While EI requires a new parent to have 600 hours of insurable earnings within a year preceding the birth, QPIP requires only $2,000 instead. Working at the province’s minimum wage, a new parent would qualify for QPIP with less than 200 hours of work, more than two-thirds less than in the rest of Canada. Thus QPIP is easier to apply for lower-income parents with seasonal, temporary, or part-time work. Also, QPIP introduced five weeks of paternity leave for fathers, which is the first in Canada.

Moreover, QPIP is more generous and flexible. QPIP provides a choice between a basic plan and a special plan. The basic plan offers lower benefits and longer leave duration, whereas the special plan offers higher benefits and shorter leave duration. Notably, both plans provide higher income replacement than the EI program. Under QPIP, the income replacement rates range between 55 percent and 75 percent, depending on the specific plan. In contrast, EI provides a constant 55 percent of income replacement. On top of the higher replacement rate, QPIP also offers a higher ceiling of insurable earnings. In 2006 (the first year after the reform), QPIP covers maximum earnings of $57,000 whereas EI covers up to a maximum of $39,000 in the rest of Canada. The difference in maximum insurable earnings persists throughout the years. In 2017, QPIP covers up to $72,500, whereas EI covers up to $51,300 in the rest of Canada. The details of the program are shown in Appendix Table 2.

Figure 2 shows the federal EI (blue solid) and the Quebec QPIP (red short dash) schedules as a function of individual pre-birth earnings. Comparing the two schedules, the increase in replacement rate is represented by the higher slope, and the increase in maximum insurable earnings is represented by the higher ceiling. For Quebec residents, their expected benefits change from EI the implementation of QPIP was stalled as the federal and Quebec government would not agree on the funds. It was not until the middle of 2005 that news emerged that the two governments had reached an agreement (Patnaik, 2019).

11Under the EI system, one can take 15 weeks of maternity leave and 35 weeks of parental leave. Under the QPIP basic plan, parents can take up to 18, 32, and 5 weeks of maternity leave, parental leave, and paternity leave. Under the QPIP special plan, there are 15, 25, and 3 weeks of maternity, parental leave, and paternity leave.
Notes: This figure shows the federal EI and the Quebec QPIP schedules as a function of individual pre-birth earnings, as well as the difference between them indicated by the green long-dash line. Dollar values are in current year Canadian dollar (no adjustment for inflation).

to QPIP. I plot the increase by the green long-dash line, which is a non-linear schedule composing of three parts. For those with earnings less than C$39,000, the increase in benefits entirely comes from the increase of replacement rate from 55% to 70% (or 75% under the special plan). For those who earn more than C$39,000, the increase in benefits comes from both the increase in replacement rate and the increase in maximum insurable earnings. Those who earn more than C$57,000 have the largest raise in benefits. The maximum benefits payable to them under QPIP is almost twice as large as that under EI (up to $39,900, compared with $21,450). Overall, the introduction of QPIP tends to benefit high-income individuals, who would otherwise see a greater portion of their normal earnings uninsured.

2.3 Comparing ANC and QPIP

The key feature differentiating the two policies is that QPIP is tied to individuals’ previous earnings while ANC is universal. This means that the two programs have different distributional
Figure 3: Benefits Change and Earnings Distribution

(a) Change in Benefits

(b) Distribution

Notes: Panel (a) shows the change in benefits of ANC (blue) and QPIP (red dash) as a function of individual pre-birth earnings. Panel (b) shows the distribution of earnings for women aged 21-38 in the pre-policy periods. To enable comparison, I convert all $ into 2017 prices using Statistics Canada CPI index.

implications for individuals with different earnings — ANC provides the same benefits to all people while QPIP provides larger benefits to high-earnings individuals.
Figure 3 (panel a) shows the change in benefits for ANC and QPIP, respectively, converted to 2017 dollar. While the ANC benefits for the first and second child are modest, the ANC benefit for the 3rd child is generous. Using the composition of first, second and third child before 1988, I obtain the average expected ANC benefits which are roughly C$4,600 in 2017 dollars. The average ANC benefit intersects with QPIP schedule at C$31.2K. This means that individuals with annual earnings more than C$31.2K get more benefits from QPIP whereas those with less than C$31.2K earnings get more benefits from ANC.

Figure 3 (panel b) shows the distribution of earnings for women aged 21-38 in the pre-policy periods. The figure reveals that around 32.6% of women earn more than C$31.2K in the ANC pre-policy period, whereas 35.6% of women earn more than C$31.2K in the QPIP pre-policy period. The earnings distribution suggests that (1) the in the era of QPIP, women’s earnings increased only modestly as revealed by the fact the distribution moved slightly to the right; (2) despite the modest increase in earnings, the distribution is still positively skewed (to the right) and the majority of women earn less than C$31.2K. As a result, the majority of women benefit more from ANC.

The economic theory considers children as normal goods just as other durable consumption (Becker, 1960). Therefore, any reduction in the cost of raising children will translate into a decrease in the relative price, and thus cause an increase in the demand for children. Since both universal benefits and earnings-related benefits reduce the costs of raising children, both benefits are expected to raise fertility. Despite the consensus on the directional prediction, the size of the fertility effects induced by the two benefits has no clear-cut prediction. As illustrate by figure 3, ANC and QPIP have distinct distributional features, the ultimate fertility effects of the two benefits will depend on the heterogeneous responses across earnings groups.

3 Data and Descriptive Statistics

3.1 Samples and Descriptive Evidence

I use the tax return data from the Longitudinal Administrative Database (LAD). The LAD contains rich information about demographics, earnings, tax credits and allowances, transfers, and

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12 For ANC, we show the earnings distribution between 1985-1988; for QPIP, we show the earnings distribution between 2002-2005. All earnings are in terms of the 2017 Canadian dollar.
savings of 20 percent of individuals filing a Canadian income tax return between 1982 to 2017. The LAD offers three key advantages for the analysis. First, the LAD provides the birth dates of children starting from 1985, which I use to link back to parents’ IDs. This is crucial to the analysis since it tells me when an individual has a child and the birth rank of each child. The key outcome variable “birth” is constructed as a dummy variable indicating whether a woman gives birth in the current year, or equivalently, has a child under age one. Second, the longitudinal nature of LAD allows me to track individuals over their lifetime. Therefore, I could readily track a few cohorts over time and test empirically whether the fertility increase after the policies was then followed by a decrease in fertility in later life. Third, the LAD has detailed income variables such as earnings and total income at the individual and family levels, allowing me to identify the distributional properties of the benefits and the heterogeneous fertility responses to the benefits. Furthermore, the rich information on income, combined with the longitudinal nature of the data, allows me to study the heterogeneity based on pre-policy individual earnings, which is another improvement compared to most of the previous studies.

I use two samples to do the empirical analysis. The main sample is used for the standard difference-in-differences (DID) analysis, where I compare the probability of having a newborn in Quebec and ROC before and after the policies. To do this, I include women aged between 15 and 44 who are non-temporary residence in one of the ten Canadian provinces. Then I exclude the women who are observed for less than three consecutive years because earnings of the preceding years are key to determine the parental leave benefit amount. To make it easier to compare, I include four years of pre-policy periods and nine years of post-policy periods for both ANC and QPIP. As robustness checks, I include a longer period of time and use all women aged between 15 and 44.

The second sample is used to track the affected cohorts through their lifetime and uncover their

\[ \text{Milligan (2005) draws from Census data which was conducted every five years. Therefore, the key outcome variable is “had a child under age six”.} \]

\[ \text{Previous literature tend to use contemporary family income data excluding women’s income to proxy individuals’ economic status. However, this income measurement might be endogenous as contemporaneous family income are likely to be correlated to contemporaneous individual income.} \]

\[ \text{ANC was implemented in 1988 and abolished in 1997, and the date of birth variable is available only since 1985. So for ANC I include 4 years of pre-policy period, from 1985 to 1988, and 9 years of post-policy period, from 1989-1997. To make the two policies more comparable, I make sure that the measurement of the policy effects are within the same timespan. So I use 4 years of pre-policy periods and 9 years of post-policy periods for QPIP as well. Then for QPIP the pre-policy period is from 2002-2005 and post policy period is 2006-2014.} \]

\[ \text{For the years before 1985, we can infer whether women have a newborn by using the variable “age of the youngest child”. This variable, however, is less accurately measured in LAD. We use all the available years: 1982-1997 for ANC and 1998-2017 for QPIP in this robustness check.} \]
pre-policy earnings. Specifically, I include 15 cohorts of women for both ANC and QPIP. For ANC, I include the women born between 1950 and 1964, follow them from the year 1985 to the year 1997, and use the mean earnings between 1985 and 1988 to construct the pre-policy earnings quintile. Similarly, for QPIP, I include women born between 1967 and 1981, follow them from 2002 to 2014, and use the mean earnings between 2002 and 2005 to construct the pre-policy earnings quintile. \footnote{I choose these 1950-1964 for ANC and 1967-1981 for QPIP so that women were at least age 24 when the policies start and as such their earnings are rather stable since then.} Appendix Tables 3 and 4 illustrate the cohorts.

Figure 4: Trends in the Probabilities of Birth

(a) Main sample: ANC

(b) Main sample: QPIP

(c) Second Sample: ANC

(d) Second Sample: QPIP

Notes: This figure shows the trends in the probability of giving birth for the main sample (panel a and b) and the second sample (panel c and d) for Quebec and the rest of Canada (ROC) respectively. For both ANC and QPIP, I included four years of pre-policy periods and nine years of post-policy periods. Sources: Own calculation, based on LAD.
and the second sample. Panel (a) and (b) show the fertility trends for the main sample, and panel (c) and (d) show the fertility trends for the second sample. I graph the probability of having a newborn for women in Quebec relative to the women in the rest of Canada. Before the policies, the fertility in Quebec is lower than that in ROC, and they move roughly in parallel. After the policies, the probability of having a newborn increases sharply in Quebec, catching up quickly to that in ROC. This figure alone gives a preview of the results, suggesting that the policies may have strong impacts on fertility.

3.2 Expected Benefits

A crucial empirical challenge is to ensure that the expected benefits are exogenous. For program ANC, the policy rules stipulate that the amount of benefits depends on the current number of children. Yet, women’s current number of children might already have been affected by ANC in the years after the policy. To address this issue, I construct the counterfactual number of kids based on province, women’s age, year, and the number of children prior to ANC. Then I use the counterfactual number of children to construct the expected ANC benefits. Therefore, the expected ANC benefits constructed in this way are arguably immune to the fertility responses after the policy.

Similarly, the policy rules of QPIP stipulate that the benefit is a deterministic function of individuals’ previous year’s earnings. Yet, women might adjust their labor supply in order to take advantage of the higher benefits provided by QPIP. As such, an individual’s previous year’s earnings might be endogenous in the years after QPIP. To address this concern, I construct the expected benefit variable based on earnings two years before. Specifically, we set $\text{Benefit}_{ijt} = \min(55\% \times \text{Earnings}_{ijt-2}, \text{YMPE}_t)$ for ROC and Quebec in the pre-reform periods and $\text{Benefit}_{ijt} = \min(70\% \times \text{Earnings}_{ijt-2}, \text{YMPE}_t)$ for Quebec in the post-reform period. Therefore, the QPIP benefits constructed in this way are likely immune to the labour supply adjustment after the policy. Appendix Figure 3 shows the evolution of expected benefits.

3.3 Summary Statistics

Table 1 presents summary statistics for women in Quebec and in the rest of Canada (ROC), separately for the pre- and post-policy periods. Column (5) reports the simple difference-in-differences between the sample means. Panel A shows the sample periods of ANC and panel B shows the
### Table 1: Summary Statistics

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<th>ROC After (2)</th>
<th>Quebec Before (3)</th>
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</tr>
<tr>
<td><strong>B. QPIP Main Sample</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>32.899</td>
<td>32.454</td>
<td>32.991</td>
<td>32.334</td>
<td>-0.212</td>
</tr>
<tr>
<td>Marry</td>
<td>0.592</td>
<td>0.577</td>
<td>0.606</td>
<td>0.596</td>
<td>0.005</td>
</tr>
<tr>
<td>Immigrant</td>
<td>0.139</td>
<td>0.181</td>
<td>0.071</td>
<td>0.11</td>
<td>-0.003</td>
</tr>
<tr>
<td>Earnings</td>
<td>25700</td>
<td>27900</td>
<td>24100</td>
<td>26300</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>(26700)</td>
<td>(28900)</td>
<td>(23700)</td>
<td>(25400)</td>
<td></td>
</tr>
<tr>
<td>Family Income</td>
<td>89200</td>
<td>97700</td>
<td>77200</td>
<td>84500</td>
<td>-1200</td>
</tr>
<tr>
<td></td>
<td>(73000)</td>
<td>(80200)</td>
<td>(61600)</td>
<td>(67300)</td>
<td></td>
</tr>
<tr>
<td>Benefits</td>
<td>10100</td>
<td>10700</td>
<td>9800</td>
<td>15600</td>
<td>5200</td>
</tr>
<tr>
<td>Birth</td>
<td>0.054</td>
<td>0.061</td>
<td>0.051</td>
<td>0.064</td>
<td>0.006</td>
</tr>
<tr>
<td>Birth 1st</td>
<td>0.023</td>
<td>0.025</td>
<td>0.024</td>
<td>0.028</td>
<td>0.002</td>
</tr>
<tr>
<td>Birth 2nd</td>
<td>0.021</td>
<td>0.024</td>
<td>0.019</td>
<td>0.025</td>
<td>0.003</td>
</tr>
<tr>
<td>Birth 3rd</td>
<td>0.01</td>
<td>0.012</td>
<td>0.008</td>
<td>0.011</td>
<td>0.001</td>
</tr>
<tr>
<td>Observations</td>
<td>3,074,535</td>
<td>6,785,250</td>
<td>987,110</td>
<td>2,125,505</td>
<td></td>
</tr>
</tbody>
</table>

Notes: The table reports summary statistics of the main sample, separately for ROC and Quebec, before and after the policy. For the ANC sample, “before” refers to years 1985-1988 and “After” refers to years 1989-1997. For the QPIP sample, “before” refers to years 2002-2005 and “After” refers to years 2006-2014. For columns (1)-(4), standard deviations for non-dummy variables are in in brackets. Column (5) reports raw differences in differences. Dollar values are rounded to the nearest $100 to comply with Statistics Canada policy.

Sample periods of QPIP. The table reveals that Quebec in some ways are observably different from the rest of Canada. For example, Quebec has on average much lower fraction of immigrants, lower individual earnings as well as family income. Fortunately, the difference of earnings and family income between Quebec and ROC has not changed much during both policy periods, as shown in column (5). Hence, the differences in levels do not invalidate the difference-in-differences (DD) identification strategy. Nevertheless, I estimate the main DD specification with these controls.
In particular, I include province specific immigration trends and province specific age trends to 
account for the demographic changes in different provinces. The estimation shows that including 
these controls do not change my baseline results.

4 Empirical Strategy

4.1 Identifying the intention-to-treat (ITT) effects on fertility

I use a standard difference-in-differences (DID) identification strategy that builds on provincial 
and time variations in benefits levels. The treatment and control groups consist of women in Quebec 
and the ROC, respectively. I start the my analysis by estimating the overall fertility responses using 
the following equation:

\[ \text{Birth}_{ijt} = \beta_0 + \beta_1 (\text{Quebec}_j \times \text{Post}_t) + \mathbf{X}_{ijt}' \beta_2 + \lambda_j + \rho_t + \Lambda_j \times \text{Age}_i + \epsilon_{ijt}, \]  

where the outcome variable Birth_{ijt} is an indicator, taking on value one if individual i in province 
j had a newborn in the year t; Quebec_j equals one if an individual lives in Quebec and zero 
otherwise; Post_t equals one in if the year t is after the policy. \( \mathbf{X}_{i,j,t} \) is a vector of individual 
covariates including age, immigrant status, marry, and prior year income. The inclusion of these 
covariates vary by specifications. The province fixed effects, \( \lambda_j \), absorb all time-invariant province-
level characteristics such as the distinct culture and ethnic characteristics of Quebec. The year 
fixed effects, \( \rho_t \), absorb all the time-varying factors that affect the Canadian economy as a whole 
such as the recession in early 1990s and the financial crisis in 2008. Moreover, there is a concern 
that women have been keep delaying childbearing age and this delay might have happened at 
differential rates in different provinces. To mitigate this concern, I include the interaction term 
between province and individual age (\( \Lambda_j \times \text{Age}_i \)). Including this interaction term allows for the 
demographic structure to vary across provinces.

The coefficient of primary interest, \( \beta_1 \), captures the average causal effect of the total benefits 
on the probability of motherhood. This equation estimates the reduced form or intention-to-treat 
(ITT) effects of policies. Conditional on the set of covariates, \( \beta_1 \) captures the Quebec specific 
changes in fertility after the policy, relative to the ROC.
This identification strategy critically hinges on the parallel-trend assumption: in the absence of the benefits, women in Quebec and in ROC should have followed parallel trends in the probability of motherhood. While this assumption is not testable, I provide some suggestive evidence that lends credence to this assumption. First, Figure 4 provides graphical evidence that the difference in fertility between Quebec and ROC stays fairly constant before the policies start. Second, I test policy effects over years, allowing $\beta_1$ to vary by year using the year before policy as the baseline. Specifically, I run the following specification:

$$
\text{Birth}_{ijt} = \beta_0 + \sum_{t \neq 1988, t \neq 2005} \beta_{1,\gamma}(\text{Quebec}_j \times I(t = \gamma)) + X'_{ijt}\beta_2 + \lambda_j + \rho_t + \Lambda_j \times \text{Age}_i + \epsilon_{ijt},
$$

Session 5 Figure 5 presents results from estimates of equation 2. It reveals no systematic differences in pre-trends across Quebec and ROC, providing further evidence on the validity of the parallel trend assumption.

The remaining issue relates to the estimation of standard errors. Bertrand et al. (2004) raises concerns about the correlation of the regressors within clusters in the DID estimation. Accordingly, the cluster-robust standard errors are estimated to generalize the Huber-White sandwich estimates to the clustered setting to account for possible heteroscedasticity and within non-treated group dependence of standard errors. In this paper, standard errors are clustered at the level of provinces and women’s year of birth, allowing for an arbitrary correlation structure for a cohort of women within a province. As a robustness check, I also estimate the standard errors using a wild bootstrap procedure proposed by MacKinnon and Webb (2017).

### 4.2 Identifying the fertility responses per thousand dollar

The DID estimators $\beta_1$ of Equation 1 can be interpreted as intention-to-treat (ITT) effects, directly capturing the full reform impacts on fertility. However, since this parameter averages the reform effects over all women in Quebec, it fails to reflect the benefits intensity. To compare the two benefits, I need to further estimate the treatment intensity and scale the ITT with it on a per dollar basis.

To do this, I estimate a two-stage least square (2SLS) model. In the first stage, I estimate
the reform-induced benefit changes where the benefits are predicted by interactions of Quebec and Post:

\[
\text{Benefits}_{ijt} = \alpha_0 + \alpha_1(\text{Quebec}_j \times \text{Post}_t) + X_{ijt}'\alpha_2 + \lambda_j + \rho_t + \Lambda_j \times \text{Age}_i + \epsilon_{ijt},
\]

(3)

In the second stage, I use the predicted benefits and get the 2SLS estimates of fertility responses per CA$1,000 (in 2017 prices):

\[
\text{Birth}_{ijt} = \gamma_0 + \gamma_1\text{Benefits} + X_{ijt}'\gamma_2 + \lambda_j + \rho_t + \Lambda_j \times \text{Age}_i + \epsilon_{ijt},
\]

(4)

Hence, the \(\gamma_1\) from equation 4 can be expressed as the ratio of reduced form estimates from equation 1 and the first stage coefficients from equation 3 \(\beta_1/\alpha_1\). As Angrist and Imbens (1995) puts it, the parameter \(\gamma_1\) represents the average causal responses, capturing a weighted average of causal responses to a unit change in treatment.\(^{18}\)

5 Results

5.1 Intention-to-Treat (ITT) Effects on Overall Fertility

Table 2 presents the difference-in-differences estimates from equation 1 for the main sample.\(^{19}\) Panel A shows the policy effect of ANC and Panel B shows the policy effect of QPIP. I start with the most parsimonious specification in column 1, controlling only province and year fixed effects. In column 2, I additionally include the interaction term of province fixed effect and women’s age because there is a general trend in the past three decades that women have been continuing putting off childbearing to later age. Including provincial specific age structure allows me to account for the possibility that this trend of delaying childbearing may occur at differential rates in different provinces. In column 3, I further add provincial fixed effects interacting with individuals’ immigrant status to account for the possibility that provinces might have differential trends in accepting immigrants whose fertility behaviours could be dramatically different from non-immigrants. Estimates from column 1 to column 3 show almost identical results, suggesting that the increase in fertility in Quebec is not due to the demographic change in age structure or immigrant structure.

The preferred estimate is column 2. The coefficients reveal strong and statistically significant

\(^{18}\)The main theoretical result of Angrist and Imbens (1995) is that under the assumption of Independence and
Table 2: Effects on Probability of Birth

<table>
<thead>
<tr>
<th>Outcome: Birth</th>
<th>Cluster Robust S.E.</th>
<th>Wild-Bootstrap</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
</tbody>
</table>

**Panel A. Policy effects of ANC (Pre-policy Mean=0.068)**

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post × Quebec</td>
<td>0.0112***</td>
<td>0.0116***</td>
<td>0.0119***</td>
<td>0.0117***</td>
<td>0.0105***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0013)</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.0011)</td>
<td></td>
</tr>
<tr>
<td>P-value</td>
<td>0.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.000</td>
</tr>
<tr>
<td>Implied % change</td>
<td>16.45%</td>
<td>17.08%</td>
<td>17.5%</td>
<td>17.22%</td>
<td>15.48%</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>N=13,197,720</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Panel B. Policy effects of QPIP (Pre-policy Mean=0.0510)**

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post × Quebec</td>
<td>0.0058***</td>
<td>0.0056***</td>
<td>0.0051***</td>
<td>0.0046***</td>
<td>0.0046***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0014)</td>
<td>(0.0013)</td>
<td>(0.0013)</td>
<td>(0.0012)</td>
<td>(0.0012)</td>
<td></td>
</tr>
<tr>
<td>P-value</td>
<td>0.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.07</td>
</tr>
<tr>
<td>Implied % change</td>
<td>11.41%</td>
<td>10.92%</td>
<td>9.92%</td>
<td>9.07%</td>
<td>8.95%</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>N=13,464,550</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Covariates**

<table>
<thead>
<tr>
<th></th>
<th>Y</th>
<th>Y</th>
<th>Y</th>
<th>Y</th>
<th>Y</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Year FE, Province FE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prov × Mothers’ Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Province × Immigrant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provincial aggregate controls</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Individual income, marry</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Y</td>
</tr>
</tbody>
</table>

Notes: Each column is from a separate DD regression for a linear probability model for women aged 15-44. I include those women observed for at least three consecutive years. Panel A shows the policy effect of ANC, covering years 1985-1997 (pre-policy 1985-1988; post-policy 1989-1997). Panel B shows the policy effect of QPIP, covering years 2002-2014 (pre-policy 2002-2005; post-policy 2006-2014). All models include fixed effects for province and year. Column 2 adds the province specific age structure. Column 3 adds the province specific immigrant structure. Column 4 adds provincial controls such as log(GDP), unemployment rate, household saving rates, and urbanized rate. Column 5 adds individual characteristics individuals’ previous years’ earnings and marital status.

The pre-policy means are the mean of birth in the pre-policy years: 1985-1988 for ANC and 2002-2005 for QPIP. Standard errors are adjusted for clustering on the cohort-province level for column 1-5. Column 6 presents the P-value using wild-bootstrap method, clustering at province level.

***, **, * denotes statistical significance at the 1%, 5%, and 10% level, respectively.
effects of cash benefits on fertility. Panel A shows that after ANC Quebec’s women have 0.0116 higher probability of having a child. Given that the probability of having a child in Quebec before ANC is 0.068, this implies a 17 percent increase in fertility. Similarly, panel B shows that QPIP leads to a 0.0056 higher probability of having a child, implying 11 percent increase over the pre-policy mean.

A potential threat to internal validity could arise if other economic conditions affecting fertility also change in the same time of policy change. To address this issue, I further expand the set of controls by adding province level GDP, household income, unemployment rate and urbanize rate in column 4. These additional variables account for provincial level macroeconomic shocks that may confound the treatment effects of policies. In column 5, I add in women’s individual characteristics such as marital status and previous year’s earnings. Comparing columns 1 through column 5 reveals that adding more flexible controls does not have a measurable influence on the treatment effects, suggesting that the increase in fertility in Quebec is not explained by the change in economic conditions or individual characteristics.

Column 1 to 5 are estimates using robust standard error, clustering at province specific cohort level, allowing for serial correlation within a province-cohort. As a robustness check, the last column shows the estimate of specification 1 using wild bootstrap method for inference. The p-value is 0 for ANC and 0.07 for QPIP, suggesting that the results are robust across alternative inference methods.

A potential challenge to the difference-in-differences strategy is that differential changes between Quebec and rest of Canada may be driven by preexisting differences in the time trends. To check for the parallel trend assumption and to see how fertility effects evolve through the post-policy period, I allow \( \beta_1 \) to vary across Quebec and rest of Canada and estimate the fertility responses over years using equation 2 using the year before the policy (1988 for ANC and 2005 for QPIP) as baselines.

Figure 5 plots the coefficients of the interaction term Year \( \times \) Quebec from equation 2 representing the covariate-adjusted differences in fertility rates between Quebec and rest of Canada in a specific year compared to the difference in the baseline years (1988 for ANC and 2005 for QPIP). The solid
vertical line denotes the start of policies. The figure shows that the estimated coefficients fluctuate around zero in the pre-policy period before the policies were implemented, suggesting that there are no heterogeneous time trend in fertility prior to the policy. This analysis provides support for parallel pre-trends, suggesting that women in the rest of Canada are a reasonable comparison group for women in Quebec.

After the policies take place, the probability of motherhood immediately increase in both cases. For ANC, the fertility increase grows over time, reaches the peak in 1993 and stays fairly constant at the new level. For QPIP, the fertility effect stays fairly stable at the new level throughout the sample period. This is not surprising since the benefits of ANC increase gradually from 1988 to 1993 while QPIP is a one-time increase of benefits. This pattern is largely in line with the trends of benefits, shown in Appendix Figure 3.

Figure 5: The DID estimates of probability of birth over years

Notes: This figure plots the coefficients of the interaction term Year × Quebec from equation 2, representing the covariate-adjusted differences in fertility rates between Quebec and rest of Canada in a specific year compared to the difference in the baseline years (1988 for ANC and 2005 for QPIP). The solid vertical line denotes the start of policies. The bars denote 95 percent confidence interval.

As a robustness check, Appendix Figure 4 shows the DD estimates of β1t for a longer period of time. For the years 1982-1984, the confidence interval is wider because I do not have the variable “date of birth” for children before 1985. I infer whether someone has a newborn based on the variable “age of the youngest child”, which is less accurate. Despite the wider confidence interval, the patterns are very similar to Figure 5, suggesting that the DD estimates are robust with longer periods of time.
5.2 Heterogeneous Fertility Response by Parity

The previous section shows that both policies have positive significant effects on overall probability of birth. And yet, whether the increase in fertility is driven by intensive or extensive margins remains a question. Recent studies find that these two margins might not always move in the same direction since first time mothers might face different opportunity costs than women who are already mothers (e.g. [Aaronson et al. 2014] (Baudin et al. 2015)).

Figure 6: The DID estimates on probability of childless and higher-order births over years

(a) ANC: Childless

(b) QPIP: Childless

(c) ANC: Higher-order Birth

(d) QPIP:Higher-order Birth

Notes: This figure plots the coefficients of $\beta_{1t}$ in eq 2 with 95 percent confidence interval. Panel (a) and (b) present the policies effects on probability of childless and panel (c) and (d) plots the effects on probabilities of higher-order birth (2nd+).

To address this issue, I further create variables “1st birth”, “2nd birth”, “3rd birth”, as well as “childless”. Then I estimate equation 1 comparing the fertility rates of Quebec to those other provinces, along the extensive and intensive margins separately. Figure 6 shows the impacts of
the benefits over time. Again, I include four years of pre-policy period and nine-year of post-policy period, and the vertical lines indicate the time when policies begin. Panel (a) and (b) present the policies effects on probability of childless and panel (c) and (d) plots the effects on probabilities of higher-order birth (2nd+). The figure reveals that before policies were implemented, Quebec’s trends was generally in parallel to the other provinces, for both childless and higher-order birth. After ANC and QPIP took place, Quebec’s probability of childless started to decrease while Quebec’s probability of having a higher order birth started to increase, relative to other provinces.

Table 3: Effects on Probability of Birth by Parity

<table>
<thead>
<tr>
<th>Birth</th>
<th>1st Birth</th>
<th>2nd Birth</th>
<th>3rd Birth</th>
<th>Childless</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
</tr>
</tbody>
</table>

Panel A. Policy effects of ANC

<table>
<thead>
<tr>
<th>Post × Quebec</th>
<th>0.0116***</th>
<th>0.003***</th>
<th>0.0035***</th>
<th>0.0052***</th>
<th>-0.0094***</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-policy Mean</td>
<td>0.068</td>
<td>0.026</td>
<td>0.02</td>
<td>0.022</td>
<td>0.3802</td>
</tr>
<tr>
<td>Implied % change</td>
<td>17.08%</td>
<td>11.52%</td>
<td>17.28%</td>
<td>23.46%</td>
<td>-2.47%</td>
</tr>
</tbody>
</table>

Panel B. Policy effects of QPIP

<table>
<thead>
<tr>
<th>Post × Quebec</th>
<th>0.0056***</th>
<th>0.0019***</th>
<th>0.0023***</th>
<th>0.0014***</th>
<th>-0.0109***</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-policy Mean</td>
<td>0.051</td>
<td>0.024</td>
<td>0.019</td>
<td>0.008</td>
<td>0.4423</td>
</tr>
<tr>
<td>Implied % change</td>
<td>10.92%</td>
<td>7.93%</td>
<td>12.16%</td>
<td>16.91%</td>
<td>-2.51%</td>
</tr>
</tbody>
</table>

Covariates

<table>
<thead>
<tr>
<th>Year FE, Province FE</th>
<th>Y</th>
<th>Y</th>
<th>Y</th>
<th>Y</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prov × Mothers’ Age</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

Notes: Each column is from a separate DD regression for a linear probability model for women aged 15-44. Outcomes include overall birth, first birth, second birth, 3rd birth and childless. Panel A shows the policy effects of ANC, covering years 1985-1997 (pre-policy 1985-1988; post-policy 1989-1997). Panel B shows the policy effect of QPIP, covering years 2002-2014 (pre-policy 2002-2005; post-policy 2006-2014). All models include province fe, year fe, and the interaction of province and mothers’ age. The pre-policy means are the mean of the corresponding outcome in the baseline year: 1988 for ANC and 2005 for QPIP. *** , ** , * denotes statistical significance at the 1%, 5%, and 10% level, respectively. Standard errors are adjusted for clustering on the cohort-province level.

Table 3 presents the corresponding average treatment effects. Again, panel A shows the results for ANC and panel B shows the results for QPIP. Column 1 repeats the Table 2 for comparison purpose. Column 2-4 show that the benefits of ANC raises the probability of having a first, a second and a third birth by 11%, 17% and 23% respectively while QPIP raises the probability of having a first, a second and a third birth by 8%, 12%, and 17% respectively. Both benefits reduce the probability of childless by 2.5%. Contrasting the two benefits, it appears that both benefits
increase higher-order births significantly more than the first birth, and that ANC has a larger
effects on higher-order births in magnitude.

5.3 Are the policy effects transitory or persistent?

From a policy perspective, it is important to distinguish whether the policy impact is transitory
or persistent. If the benefits work only to make people have children earlier followed by reducing
fertility in their later life cycle, then the overall number of children could be left unchanged. For
example, Adda et al. (2017) simulates the effects of a cash benefits and found that it only works
to make women to have babies earlier, leaving the ultimate number of children unchanged. Adda
et al. (2017) also finds substantially discrepancy between short-run and long-run fertility responses.

Figure 7: Difference-in-differences estimates on probability of birth over lifetime

(a) ANC  (b) QPIP

Notes: I use the second sample to do the analysis in this figure. This figure plots the coefficients of $\beta_{1t}$ in
eq 2 for the young, the middle and the old cohorts respectively, with 95 percent confidence interval. The
horizontal axis is age. The older cohort was hit by the policy in their late 30s; the middle cohort was hit
by the policy in their early 30s; the young cohort was hit by the policy in their late 20s. Appendix Table
3 and Table 4 show the definition of old, middle and young cohorts.

To probe the possibility that the policy effects could be transitory, ideally one should follow a
single cohort throughout their life cycle. If the cohort of women increases fertility after the policy
but then compensates by reducing fertility in their later life cycle, then the policy encourages the
rescheduling of fertility rather than an increase in fertility. To test this, I turn to the second sample
to track 15 cohorts through their lifetime. I further divide our sample into young, middle, and old
cohorts so that each cohort group comprises five cohorts. The older cohort was hit by the policy
in their late 30s; the middle cohort was hit by the policy in their early 30s; the young cohort was
hit by the policy in their late 20s. Then I estimate the difference-in-difference specification over their lifetime, using the same cohorts from the rest of Canada as control groups. In other words, I compare the young to young, middle to middle, and old to old between Quebec and the rest of Canada, using one year before policy as the baseline year. Appendix Table 3 and Table 4 show the definition of old, middle and young cohorts.

Figure 7 shows the results. On the horizontal axis, I plot the mean age of each cohorts. It might not be surprising that the old cohorts show barely any responses to the policy since they do not have much time to adjust fertilities given that the policies come so late for them. Both young and middle cohorts show strong and positive responses. Importantly, fertility rates for young and middle cohorts rise up almost immediately after the policies and they never come down over the nine years of post-policy period. I further estimate the same DD regression by parity of birth (See Appendix Figure 5) and the patterns are similar. This analysis lends strong support that both ANC and QPIP produce persistent fertility responses rather than a transitory shift of timing.

5.4 Comparing ANC and QPIP: Fertility responses per $1,000

To compare the cost-effectiveness of the two benefits, I scale the treatment intensity on a per dollar basis. Following the 2SLS method introduced in Section 4, I estimate the expected benefits increase and scale the fertility effects on the change in benefits for the two benefits respectively.

Table 4 reports the results. I define the benefit as the benefits that a woman expect to get for giving a marginal birth, measured in C$1,000 (in 2017 prices). For ease of comparison, column (1) and (4) shows the overall fertility effects of benefits, which are the same as Table 2 column 2. Column (2) and (5) show that ANC benefits is roughly $4,600 and QPIP increases women’s expected benefits by around $5,400. Column (3) and (6) shows the 2SLS estimates from equation 4. The method enables me to scale the fertility responses to $1,000. The results are shown in column (3) and (6) where the coefficient value in (3) is the ratio (1) and (2) and the coefficient value in (6) is the ratio (4) and (5). Column (3) and (6) indicate that a C$1,000 increase in expected benefits raise the probability of motherhood by 0.0025 for ANC and 0.001 for QPIP. Evaluated against the pre-policy means, these estimates imply that a C$1,000 paid by ANC raises fertility by 3.7% while a C$1,000 paid by QPIP raises fertility by 2%. An equality test reveals a p-value of 0, indicating that the policy effects of the two benefits are significantly different.
Table 4: Estimates of fertility responses per per $1,000

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>A. Policy effects of ANC</th>
<th>B. Policy effects of QPIP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1) Birth</td>
<td>(2) Benefit</td>
</tr>
<tr>
<td>Quebec × Post</td>
<td>0.0116***</td>
<td>4.633***</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.281)</td>
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<tr>
<td>Pre-reform mean</td>
<td>0.0068</td>
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<tr>
<td>Implied % change</td>
<td>3.69%</td>
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<tr>
<td>First-stage F stat</td>
<td>272</td>
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<tr>
<td>Equality test (P-value)</td>
<td>0.004</td>
<td>0.071</td>
</tr>
</tbody>
</table>

Notes: Panel A shows the policy effect of ANC, covering years 1985-1997 (pre-policy 1985-1988; post-policy 1989-1997). Panel B shows the policy effect of QPIP, covering years 2002-2014 (pre-policy 1998-2005; post-policy 2006-2017). Column (1) and (4) are the same DD estimates from Table 2. Column (2) and (5) show the DD estimates for benefits change, expressed in 2017 C$1,000 dollar value. Column (3) and (5) show the 2SLS estimates of birth per C$1,000. The coefficient value in (3) is the ratio (1) and (2) and the coefficient value in (6) is the ratio (4) and (5). All models include fixed effects for province and year and province specific age structure. ***, **, * denotes statistical significance at the 1%, 5%, and 10% level, respectively. Standard errors are adjusted for clustering on the cohort-province level.

5.5 Why ANC leads to larger fertility responses than QPIP

To probe why the difference design of benefits lead to differential fertility responses, I estimate the fertility responses across earnings quintile. To do this analysis, I turn to the second samples as they track 15 cohorts through their lifetime so that I can use individual’s pre-policy earnings to construct the earnings quintiles. In particular, I estimate the DD specification in equation 1 and the 2SLS specification in equation 4 for each of the earnings quintile.

Figure 8 shows the results of the benefits across women's pre-policy earnings, in quintiles. Panel (a) shows the increase in benefits in response to the reform. Both ANC and QPIP raises the expected benefits, but the distributional properties are different. ANC benefits are determined by the current number of children, and women with lower earnings tend to have more children earlier. Therefore, the amount of ANC benefits tend to decrease with individual earnings: while women in the bottom quintile receive C$7.6K on average, women in the top quintile receive less than C$4K on average. On the other hand, QPIP benefits are tied to prior earnings, and the reform gives a

---

20Since women might adjust their earnings in response to the policies, the earnings after the policies might be endogeneous.
Notes: The figure plots estimates of $\beta$ for different earnings quintile. The bar denotes a 95 percent confidence interval. Panel (a) is the DD estimates from eq 1, panel (b) is the first-stage estimates from eq 3, panel (c) is the 2SLS reduced form estimates from eq 4, and panel (d) expresses the estimates in (c) in percentage change against pre-policy mean.

higher income replacement up to a higher threshold. Therefore, the amount of QPIP benefits tend to increase with individual earnings: while women in the bottom quintile receive less than C$3K, women in the top quintile receive around C$11K. The comparison makes clear that ANC makes larger transfers to women with lower earnings and QPIP makes larger transfers to women with higher earnings.

Panel (b) shows the overall fertility responses (ITT effects) across the pre-policy earnings quintile. Again, both ANC and QPIP significantly raise the probability of motherhood. For ANC, the fertility response tend to decrease sharply with earnings in the sense that low-earners respond
much more than the high-earners. As ANC pays higher benefits to the low-earners, the decreasing
trend is in line with the benefit incentives. On the other hand, the results for QPIP is somewhat
surprising. Panel (b) indicates that low-earners respond to QPIP slightly more than high-earners,
notwithstanding the fact that QPIP pays much higher benefits to the high-earners. Comparing the
the ITT effects of ANC and QPIP across earnings quintile seems to suggest that the large transfer
to the lower-earners ultimately translate into more fertility.

Panel (c) presents the results of the 2SLS estimates across earnings quintile. The figure shows
that the fertility responses per C$1,000 are strikingly similar in the two policies: while a C$1,000
increase in benefits causes the bottom quintile to increase probability of motherhood by 0.004-
0.005, it only causes a 0.001-0.002 increases in the top two quintiles. Panel (d) further translates
this increase against the mean probability of motherhood during the periods. The patterns are
similar to panel (c): a C$1,000 increase in benefits causes probability of motherhood to increase by
6-8 percent in the bottom quintile, 6 percent in the second quintile, 4 percent in the third quintile,
1-2 percent in the top two quintiles.

Figure 8 provides an explanation of why universal benefits like ANC is more cost-effective
than the earnings-related benefits like QPIP at promoting fertility. The heterogeneous fertility
responses indicate that high-earnings individuals are in general much less responsive to the same
amount of benefits than their lower-earnings counterparts. This might not be a surprising finding
considering that women’s opportunity cost of having a child depends on their earnings and that
higher-earnings women tend to have higher opportunity costs. The magnitude of the fertility effects
ultimately depends on the percentage of earnings-replacement provided by the benefits. Universal
benefits translate into higher income replacement for low-income people while the earnings-related
benefits translate into the roughly same income replacement for all individuals. That explains why
in panel (b) the universal benefits ANC shows a downwarding fertility responses along the earnings
quintiles while the earnings-related benefit QPIP shows a near-flat fertility responses along earnings
quintiles.
6 Discussion and Conclusion

Every economy that embarks on a road of modern economic growth experiences a decline in fertility (Aaronson et al., 2014). This pattern is observed first in the high-income countries, then is spread to the low-income countries (Guinnane, 2011). However, recent trends in fertility show that the decline might have gone too far. With the current fertility below 2.1 in the developed world and rapidly declining in the developing world, low fertility has become a severe concern many governments face.

In this paper, I study the fertility effects of cash benefits. Leveraging two cash benefits implemented in the Canadian province of Quebec, I follow a difference-in-differences approach to causally identify the fertility responses to the two benefits and find that a C$1,000 raises the birth probability by 3.7% for universal benefits and 2% for earnings-related benefits. I further demonstrate that the distributional feature and the heterogeneous responses along income are the main reasons for the discrepancy. Overall, my findings highlight the importance of distributional properties in the design of the pro-natalist policy. My findings suggest that fertility is highly elastic to the costs of having children. Following the method from (Malkova, 2018), I perform a back-of-envelope calculation of elasticities. That is, I derived the percentage change in fertility over the percentage change in the total costs of raising a child from 0 to 18 years old. The calculation shows that the price elasticity of a child is -8.7 for ANC and -4.8 for QPIP.

My estimates of elasticities are slightly higher than the elasticities found in previous studies. It is summarized by (Malkova, 2018) that in Austria this elasticity is -4.4 (Lalive and Zweimüller, 2009), in Spain it is -3.8 (González, 2013), and in Israel it is -0.54 (Cohen et al., 2013). Milligan (2005) studied the policy of ANC and estimates that the overall elasticity equal to -4.1. As Milligan (2005) compares the fertility effects between 1991 and 1996, capturing a partial policy effect, it is not surprising that my estimates for ANC are somewhat stronger than Milligan (2005)’s estimates.

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21How much does it cost to raise a child from cradle to 18 years old? I follow the measures by Milligan (2005) and obtain an average of C$6,987 annually in 1988 dollar. Assuming parents support children financially from cradle to 18 years old, this translates into a total of C$235,634 in 2017 dollar. Milligan (2005) estimates a direct cost of C$7,935 for a first child, C$6,348 for a second child and C$5,324 for a third child. I weight these costs by the proportion of first, second and third child and obtain the weighted average of total cost. Other sources of measurement generally gives a range of C$200,000 to C$250,000, which are highly consistent with my measurement. See "https://globalnews.ca/news/3172459/how-much-does-it-cost-to-raise-a-kid-in-canada/". My estimates indicate that the cost of raising children decreases by 1.95% for ANC and 2.29% for QPIP. Fertility increases by 17% for ANC and 11% for QPIP. So the elasticities would be 17%/1.95% for ANC and 11%/2.29% for QPIP.
From a policy perspective, this paper provides strong evidence that cash benefits are effective policy tools to raise fertility. Moreover, this paper highlights the importance of distributional features when designing such benefits. The takeaway message is that pro-natalist cash benefits are more effective when it pays more benefits to the low-earnings women.

Two important caveats are noteworthy when interpreting the results. First, ANC and QPIP benefits entail different policy goals. While ANC’s only goal is to encourage birth, QPIP’s primary rationale, like most other parental leave benefits, is facilitating women’s careers and families, promoting gender equality, and improving children’s health outcomes. When the policies are implemented, the public learns the policy goals and might perceive the two policies differently. As documented by Rees-Jones and Rozema (2019), taxes change behavior not only through changing prices but also through other channels such as the provision of information or media coverage. Similarly, in my study, the public perception of the two benefits might also contribute to the differential fertility responses.

Second, ANC and QPIP might lead to differential labor responses since ANC is unconditional and QPIP depends on women’s pre-birth earnings. As pointed out in Section , QPIP might induce women to increase their labour earnings to take advantage of the benefits. The labor earnings might further change the tax revenue in the future. While labour responses are not the focus of this paper, a lack of them prevents me from conducting a complete welfare analysis. In other words, while the universal benefits appear to be more effective at encouraging birth, it is not necessarily a better policy option considering the labor outcomes, health outcomes, and future tax benefits.
References


UN (2015). World population policies.


A Appendix

Online Appendix of:

Design Matters: Causal Evidence on Cash Benefits and Fertility

Qiongda Zhao

A.1 Additional Figures and Tables

Table 1: Benefit payments under the ANC

<table>
<thead>
<tr>
<th>Period</th>
<th>1st kid</th>
<th>2nd kid</th>
<th>3rd and higher order</th>
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<tr>
<td>May 1988 to April 1989</td>
<td>500</td>
<td>500</td>
<td>8 quarterly payments of 375 (=3000)</td>
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<tr>
<td>May 1989 to April 1990</td>
<td>500</td>
<td>2 annual payments of 500 (=1000)</td>
<td>12 quarterly payments of 375 (=4500)</td>
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<td>2 annual payments of 500 (=1000)</td>
<td>16 quarterly payments of 375 (=6000)</td>
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<td>20 quarterly payments of 375 (=7500)</td>
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<tr>
<td>May 1992 to Sep 1997</td>
<td>500</td>
<td>2 annual payments of 500 (=1000)</td>
<td>20 quarterly payments of 400 (=8000)</td>
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Table 2: Comparison of QPIP and EI

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<tr>
<th></th>
<th>Employment Insurance (EI)</th>
<th>QPIP (Basic Plan)</th>
<th>QPIP (Special Plan)</th>
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<td>Eligibility</td>
<td>600 hours employment</td>
<td>$2,000 of income</td>
<td>$2,000 of income</td>
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<tr>
<td>Replacement rate</td>
<td>55%</td>
<td>70% for 30 weeks, 55% for 25 weeks</td>
<td>75%</td>
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<tr>
<td>Insurable Income Cap</td>
<td>CAD 39,000</td>
<td>CAD 57,000</td>
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<td>Duration</td>
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<td>Maternity leave</td>
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### Table 3: ANC Second Sample

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### Table 4: QPIP Second Sample

|        | Old Cohorts |          |          |          |          |          | Middle Cohorts |          |          |          | Young Cohorts |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |
|--------|-------------|----------|----------|----------|----------|----------|---------------|----------|----------|----------|---------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 2002   | 35 34       | 33 32     | 31       | 30 29      | 28 27      | 26        | 25 24       | 23 22     | 21       |
| 2003   | 36 35       | 34 33     | 32       | 31 30      | 29 28      | 27        | 26 25       | 24 23     | 22       |
| 2004   | 37 36       | 35 34     | 33       | 32 31      | 30 29      | 28        | 27 26       | 25 24     | 23       |
| 2005   | 38 37       | 36 35     | 34       | 33 32      | 31 30      | 29        | 28 27       | 26 25     | 24       |
| 2006   | 39 38       | 37 36     | 35       | 34 33      | 32 31      | 30        | 29 28       | 27 26     | 25       |
| 2007   | 40 39       | 38 37     | 36       | 35 34      | 33 32      | 31        | 30 29       | 28 27     | 26       |
| 2008   | 41 40       | 39 38     | 37       | 36 35      | 34 33      | 32        | 31 30       | 29 28     | 27       |
| 2009   | 42 41       | 40 39     | 38       | 37 36      | 35 34      | 33        | 32 31       | 30 29     | 28       |
| 2010   | 43 42       | 41 40     | 39       | 38 37      | 36 35      | 34        | 33 32       | 31 30     | 29       |
| 2011   | 44 43       | 42 41     | 40       | 39 38      | 37 36      | 35        | 34 33       | 32 31     | 30       |
| 2012   | 45 44       | 43 42     | 41       | 40 39      | 38 37      | 36        | 35 34       | 33 32     | 31       |
| 2013   | 46 45       | 44 43     | 42       | 41 40      | 39 38      | 37        | 36 35       | 34 33     | 32       |
| 2014   | 47 46       | 45 44     | 43       | 42 41      | 40 39      | 38        | 37 36       | 35 34     | 33       |
Both figures are taken from Oecd (2019). Panel (a) plots the number of children per woman aged 15–49, in 1970, 1995, and 2017. Panel (b) plots the total family spending as a percentage of GDP across OECD countries.
Figure 2: Google Trends for QPIP

Notes: Google trend measures the frequency people search the keyword “RQAP” using Google web search. It normalizes the highest frequency to 100. The data is downloaded from "https://trends.google.com/trends/explore?date=all&geo=CA&q=RQAP" and the figure is re-produced by author.
This figure shows the trends in the benefits for the main sample (panel a and b) and the second sample (panel c and d) for Quebec and the rest of Canada (ROC) respectively. For both ANC and QPIP, I included four years of pre-policy periods and nine years of post-policy periods. Sources: Own calculation, based on LAD.
Figure 4: Dynamic DD estimates on birth

(a) ANC

(b) QPIP

Notes: This figure plots the coefficients of $\beta_{1t}$ in eq[2] with 95 percent confidence interval.
Figure 5: Difference-in-differences estimates of birth by cohorts

(a) First Birth (ANC)

(b) First Birth (QPIP)

(c) Second Birth (ANC)

(d) Second Birth (QPIP)

(e) Third Birth (ANC)

(f) Third Birth (QPIP)

Notes: I use the second sample to do the analysis in this figure. This figure plots the coefficients of $\beta_{1t}$ in eq 2 for first, second and third birth respectively, with 95 percent confidence interval. Appendix Table 3 and Table 4 show the definition of old, middle and young cohorts.