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A look at the impact of recent family policies on the fertility rate in Quebec

By

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Abstract

This essay explores the effect of modifications in family policies during the recent years on Quebecers' fertility behaviors. Particularly, it aims to determine how the abolition of the Allowance for Newborn Children and the subsequent introduction of subsidized daycare as well as the introduction of the Quebec Parental Insurance Plan affected the fertility rate. It also aims at going a little further in understanding how public policies affect the fertility behavior by assessing how the introductions of those policies affect the spacing between births.

To realise this study, the Survey of Labour and Income dynamics was used. Its extensive set of socioeconomic, demography and household related variables allowed us to build logistic random-effects and population effects models.

The results were inconclusive as no clear evidences of a relationship between the introduction of the policies aforementioned and a variation in the fertility rate or time lapse between births were found.

Acknowledgement

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1. Introduction:

Once a leader in terms of fertility rate amongst Canadian provinces, Quebec has fallen over the decades to reach the bottom of the list. A low fertility rate is problematic especially with the incoming population aging that will further contribute to the increase of the dependency rate[1].

This led policy makers to think of ways to incite the population to have more children. Policies changed over the years and it is primordial to know to what extend they were effective.

This paper therefore aims at better understanding how recent "family policies" affected the behavior of individuals. Firstly, we want to evaluate the effect of those policies on the fertility rate. Secondly, we seek to determine whether the policies changed the length of time parents wait between their first and second child.

The years considered in this study are 1993 to 2008. There were two substantial changes in family policies during those years. The first is the abolishment of the Allowance for Newborn Children (ANC) and the simultaneous introduction of subsidized daycares across the province. The net effect of those changes on the fertility rate is unclear as both policies aimed to increase births. Further investigation would therefore be necessary to assess the effect of this change.

[1] See Annex

The second is the introduction of the Quebec Parental Insurance Plan (QPIP) in 2006 which replaced the Employment Insurance plan in Quebec. This new parental leave plan is seen as more generous. It was immediately followed by a steep increase in fertility rate in Quebec which led many to believe that it was due to the introduction of the policy[2]. This essay therefore aims to evaluate to what extend it was the case.

This paper is organized as follows. A review of the literature on the effect of family policy will first be presented. This section will cover the rational of whether or not public policies can impact fertility as well. Empirical papers on the effect of various public policies on fertility will also be presented. This section will be followed by a presentation of the recent family policy in Quebec that could have impacted the fertility rate. A presentation of the dataset and descriptive statistics will then follow. This will then lead to a presentation of the methodology. Finally, the results will be presented followed by the conclusion of this paper.

2. Literature review:

Becker (1960) is the first to have published literature analysing the link between income and demand for children. Particularly, in his paper, he aims to demonstrate that the demand for consumer durables is a useful framework in analyzing the demand for children. He introduced the concept of "child quality" in the sense that individuals whose income increases will desire to increase their spending in children and will be able

[2] http://www.rqap.gouv.qc.ca/publications/pdf/RQAP_comm_23-jan-07.pdf

to do so by having more children or by spending more income on the quality of children i.e. private schools or activities.

However, in order to test models of fertility, we have to consider if whether or not, family policies and thus, financial incentives really do have an effect on fertility rate. Couples could effectively choose the number of children that they want without carefully considering their cost. In the same way, financial incentive from public policies could be deemed too weak to affect the individuals' behavior.

Gauthier (2007) explores such concerns by making a review of previous papers focusing on policies directly targeted at families with children. The policies reviewed are such as direct and indirect cash transfers for families with children, maternity and parental leave benefits and childcare facilities and related subsidy programs. Starting from Becker's model explained above, 5 assumptions are made in order to link policies and demographic behaviors and explains why policies sometimes do not lead to the desired result.

The first is that an increase in income is expected to result in an increase in the demand for children. As discussed by Becker (1960), an increase in income may lead to more children or children of higher quality i.e. children with a better education. This implies that a transfer to parents of newborn could not always lead to more children.

The second assumption is that individuals have perfect information, meaning that they know exactly the cost and benefits of various alternatives. However, according to Goldthorpe (2000), individuals only have imperfect information on the real cost and

benefits of children. Therefore, it could be that individuals make their decisions whether or not to have children based on the perceived cost of children instead. The perceived cost may not necessarily correspond to the true cost of children. This could lead to uncertain results for policies. For example, it may increase the impact of cash benefits if individuals are underestimating the real cost of children, or it may instead decrease the impact of cash benefits if individuals are overestimating the real cost of children.

The third assumption is that the decision of child bearing is an economically rational decision. Again, as put forward by Goldthorp (2000), this assumption can be questioned as individuals would instead consider actions being "appropriate" or "adequate" given their goals. They would therefore consider a policy in terms of if whether it allows them to reach their goal rather than considering the exact economic value of the policy. This introduces some noise in the way policies affect the behavior of individuals thus affecting policies impact.

The next assumption is that policies can impact fertility by reducing the cost of children or by increasing income while preferences for children remain fixed. However, one could argue that policies promoting fertility can do so not only by changing the cost incurred by the parents but also by changing how much they value a child. For example, as put forward by Gauthier (2000), family policies may be influencing fertility by valorizing children, and thus by influencing individuals' preferences for children. In the same way, parental leave policies may not only lower the opportunity cost of children but may also

be influencing fertility by making it more socially and professionally acceptable to take time off after the birth of an infant.

The fifth assumption of the economic model of fertility is that preferences over children are homogeneous amongst household members. This implies that the heterogeneity of preferences could have implications on the effect of policies on fertility in allowing partners to have different preferences for children and thus, different perceived benefit and cost from having children.

The author then reviews empirical papers linking fertility and public policies. There are two categories of policies that are review in which we are interested. The first category is cash benefit policies. The general findings obtained from papers reviewed are that this type of policies tends to be linked with an increase in fertility; although the effect is often relatively small. Moreover, the results from papers using macro-data tend to be that these policies have an impact of the tempo of birth rather than on the quantum meaning it will affect the timing of births but not how many children individuals have.

The second category is work-related policies. The general finding concerning the parental leave policies are mixed. Some papers found positive effects of increasing the parental leave on fertility finding that an increase in maternity leave benefits of 1% could lead to an increase in fertility rate between 0.09% and 0.26%. However, other papers did not find any evidence that increasing maternity leave benefits would lead to an increase in fertility rate.

Rindfuss et. al studied the effect of child care availability on fertility rate. More precisely, they aimed at testing what call the "child-care and fertility hypothesis" which is the hypothesis that "as child care becomes more widely available, affordable, and acceptable, the antinatalist effects of increased female educational attainment and work opportunities decrease". They used Norvegian data covering the 1973–1998 period. Using a discrete-time hazard model, they estimate the determinants of the timing of births for the first birth as well as subsequent births. This allow them to use these statistical results in a simulation model in order to estimate the effect of different child-care availability scenarios on the total number of children born to women by age 35. Their general result is that an increase in availability of child care leads to an increase. completed fertility. Furthermore, this result was valid for all parities.

Several papers were published using the Allowance for Newborn Children as a quasi-natural experiment to explore the relationship between public transfers and fertility rate. Two will be presented.

Duclos, Lefebvre and Merrigan (2003) aimed to find evidence of a positive effect of public transfers on fertility rate by using the introduction of the ANC in Quebec. To obtain their results, they use a difference-in-difference methodology to estimate differences in the probability of giving birth to first, second and third order birth. They use data on Vital Statistic from all Canadian provinces as well as data from the Survey of Consumer Finance. Their findings are that financial incentives did have an effect on the probability of giving birth especially to a birth of third rank in the case of the ANC.

The second paper is by Milligan (2004). Similar to the 2002 paper review above, the author uses the introduction of the Allowance for Newborn Children as a quasi-experimental empirical strategy using vital statistics and microdata derived from the public-use files of the Canadian Census to verify if monetary incentive can affect the fertility rate. The author first proceeds by looking for evidence from the vital statistics for years 1980 to 1997. He regresses the total fertility rate as well as the fertility rate for first to third parities on dummy variable for the years, a dummy for Quebec as well as an interaction term between Quebec and an indicator for the years following the introduction of the ANC. This last variable accounts for the difference in the time trend of fertility in Quebec versus the rest of Canada. The results from this regression bring evidence that the policy increased fertility in correspondence with the policy incentive.

The author then uses the census from 1992 and 1996 to evaluate the effect of going from a partial implementation of the ANC to a full implementation. The author once again uses a difference-in-difference setting to determine the effect of the policy. The model has two periods and includes an array of control variables contained in the census. The models are estimated as probit. The results obtained bring evidence that the ANC program had a positive impact on the number of birth.

No researches were done on the relationship between enhanced parental leave and fertility rate using Quebec's Parental Insurance Plan to the author's knowledge. We will therefore present a paper by Lalive and Zweimüller[3] to discuss what effect this policy could have had in Quebec. In their research, the authors use two reforms of the Austrian

[3] Lalive, R., and Zweimüller (2009)

Parental Leave system that occurred in 1990 and 1996 respectively. The first reform extended the duration of the parental leave while the second partially counterbalanced the former. The findings of the authors are that the extension of the parental leave increased the fertility rate in the short run as well as in the long run. Moreover, there are differential fertility responses for women depending on her income indicating that both cash transfers and job protection matters. Finally, the second reform that partially cancelled the first had no effect on the fertility rate but affected the timing of births; they found that the reduction in PL length had for effect of reducing the space between first and second births.

3. Institutional background: Family policies in Quebec

This section examines the principal policies that could have influenced the fertility rate in Quebec in the years considered for this paper. The first policy we consider is the Allowance for Newborn Children. This pro-nativist policy was introduced in 1988 and consisted of non-taxable benefit that were given to family when a child was born and for which all citizen and permanent citizen were eligible. The amount given to the parents was conditional on the rank of the infant within the family. From 1992 to 1997 when the program was abolished, the payment were of $500 for the birth of a first child, $500 at birth followed by $500 on the day of the first birthday of the child for the second child and finally, the payment for a third or of higher order child was 20 quarterly payments of $400 for a total of $8000.

The ANC was eliminated along with another policy called the allowance for young children that paid benefit to every family with a child under 6 years old when the *Act respecting family benefits* took effect. The new family allowance was mainly for low-income families.

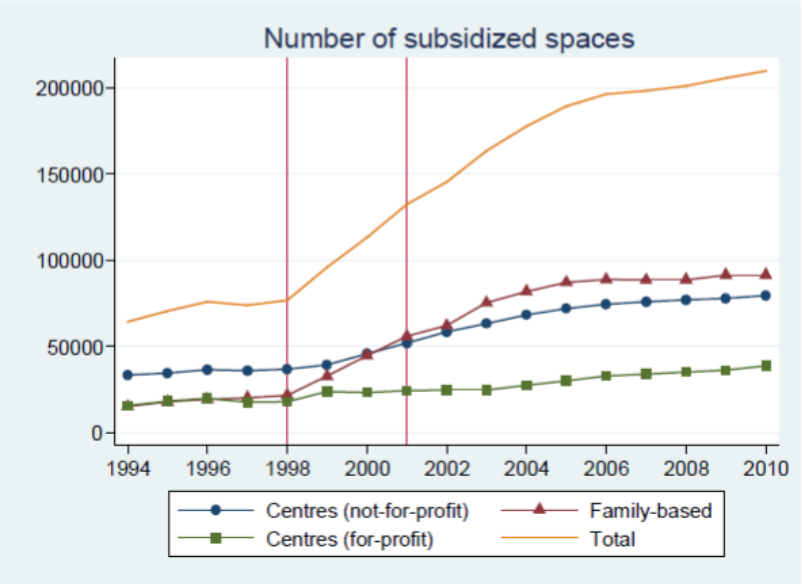
A major policy that was introduced in Quebec that same year is the subsidized daycare policy. This policy had two main objectives[4]. The first one is the one of interest for this paper and was to allow parents to conciliate their worker as well as their parents' obligations by providing them with affordable daycare allowing them not having to choose between their career and their family. The second objective was to provide an optimal development environment for every child thus balancing the chance of success for the children of all horizons.

Furthermore, although this policy is often viewed as a policy that was introduced to help women integrate the workplace. However, it can also be considered as a pronatalist policy as, by facilitating the work-family conciliation, some person that would not have had children to pursue their career could now decide otherwise.

The policy consisted of offering spaces in not for profit daycare at a reduced rate of 5 dollars to children under 5 years old. All families were eligible. The rate was increased to 7 dollars in 2004.

[4] http://www.cirano.qc.ca/icirano/public/pdf/20101202_P-Lefebvre_ppt.pdf

Figure 1 : Number of subsidized daycare places, Quebec, 1994-2010



Source : (Merrigan, Lebfevre, Roy-Desrosier 2010)

The family benefits program was then replaced by the refundable tax credit for child assistance known as child assistance in January 2005. It included the supplement for handicapped children and all children under 18 were eligible. Child assistance amounts varied from family to family and were calculated each year based on family income, conjugal status and the number of children under 18 in the family.

The next major policy that could influence fertility and that was adopted in the years we are interested in is the Quebec Parental Insurance Plan. This policy was introduced after the Quebec and Canadian government reached an agreement allowing Quebec to opt out of the employment insurance plan. This lowered the deductions for EI for Quebec residents but led to the introduction of a new deduction for QPIP. This policy came into effect on January 1st 2006 and was available to every new parent who is either working or self-employed. The principal differences in this new policy were the increased rate of

benefit offered and that two options are offered to parents to better conciliate work and family. The first is 18 weeks of leave with a benefit worth 70% of the usual weekly income. The second is 15 weeks of leave with a benefit worth 75% of the usual weekly income. Furthermore, it introduced a paternity leave that cannot be transferred to the mother. Once again, two options were offered. The first one is a 5 weeks leave with a benefit of 70% of the usual weekly income and the second is a 3 weeks leave with a benefit of 75% of the usual weekly income. In the other provinces, there were no paternity leave and the benefit given was equivalent to 55% of the usual weekly income. This information is summarized in Table 1.

Table 1 : Comparison of Quebec Parental Insurance Plan and Employment Insurance (2007).

	Quebec Parental Insurance Plan				Employment Insurance	
Type of plan	Base plan		Special plan		Maternity, parental and adoption plan	
	Maximum number of weeks	%	Maximum number of weeks	%	Maximum number of weeks	%
Maternity	18	70%	15	75%	15	55%
Paternity	5	70%	3	75%	0	N/A
Parental	7 25 (total = 32 weeks)	70% 55%	25	75%	35	55%
Adoption	12 25 (total =32 weeks)	70% 55%	28	75%	35	55%
Majoration for low income family	Up to 80 % of average weekly income				Up to 80 % of average weekly income	

Source: QPIP

Moreover, other aspects of the plans differ. Both programs require the workers to have contributed to a certain level to be eligible to receive benefit. The QPIP does not require a

minimum number of hours worked to be eligible for the policy while the EI requires that the individual had worked at least 600 hours. However, the Quebec plan requires the individual to have earned at least $2000 to be eligible for the benefit while the EI plan does not require any minimum earned income. Since it requires a minimum number of hours, the effective minimum earned income required to be able to benefit from the EI would be 600 hours at the person's hourly wage. For comparison, taking the minimum wage of $8 an hour effective in Quebec on May 1st 2007, this would be equivalent to an income of $4800. Another difference between the two programs is the maximum insurable income. The QPIP sets its maximum insurable income equal to the maximum insurable income set by the *Commission de la santé et de la sécurité du travail.* This maximum is higher than the maximum insurable income set by the EI. Furthermore, all workers in Quebec are eligible, including self-employed workers, while the self-employed workers are not covered by the EI. Lastly, there is no waiting period to receive benefits from the QPIP while recipient in the ROC must wait 2 weeks to receive their benefits. This information is summarized in Table 2.

Table 2 : Comparison between Quebec Parental Insurance Plan and Employment Insurance (2007).

	Quebec Parental Insurance Plan	Employment Insurance
Minimum number of hours required	None	600 hours
Minimum income	2 000 $	4 800 $ (1)
Maximum insurable income	59 000 $	40 000 $
Self-employed worker	Eligible	Non-eligible
Percentage of income replacement	55 %, 70 % or 75 % (2)	55%
Waiting period	None	2 weeks
(1) There is no minimum income in the Federal plan which instead uses the notion of "minimal number of hours required". This number equivalent to 600 hours at the Quebec minimum wage of $8 per hour in effect as of May 1st 2007.		
(2) According to plan chosen		

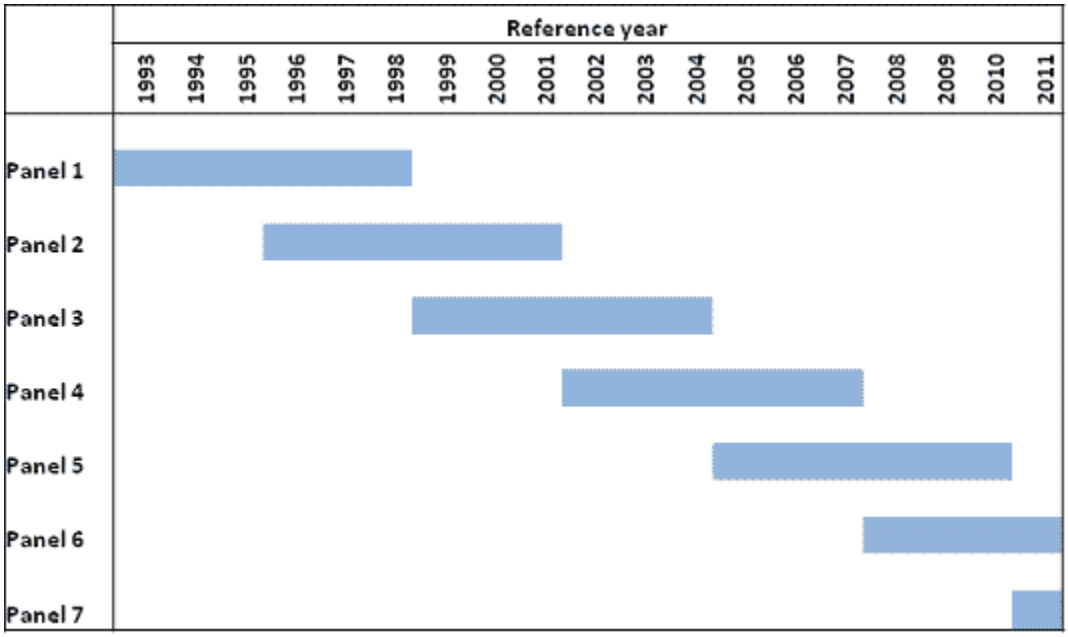
Source: QPIP

4. Dataset:

The data in this paper comes primarily from the Survey of Income Dynamics (SLID). This dataset was introduced in 1993 and replaced the Survey of Consumer Finances.

The samples for SLID are selected from the monthly Labour Force Survey (LFS). The sampling methodology is thus the same as the LFS and is drawn from an area frame and is based on a stratified, multi-stage design that uses probability sampling. Each sampled household in the dataset are interviewed over a six-year period. The cross-sectional aspect of the SLID sample is composed of two panels. Each panel consists of two LFS rotation groups and contains about 17,000 households. Panel are surveyed for a period of six consecutive years. Moreover, new panels are introduced every three years such that two panels always overlap.

Figure 2 : Overlapping design of SLID sample



Source : Statcan

It is an interesting dataset for the present paper as it contains longitudinal data on individuals such as socioeconomics, educational as well as demographic and information on the household composition. This provides information on the fertility of women in the sample, as well as allowing controlling for factors that might influence their choice regarding giving birth. The data from panel 1 to panel 6 were selected which cover from the year 1993 to 2011.

4.1 Descriptive statistics:

This section will present the chosen variables to be included in the models estimated. The variables were weighted using the longitudinal weights included in the SLID to construct the descriptive statistics. The respondents considered are Canadian women aged 15 to

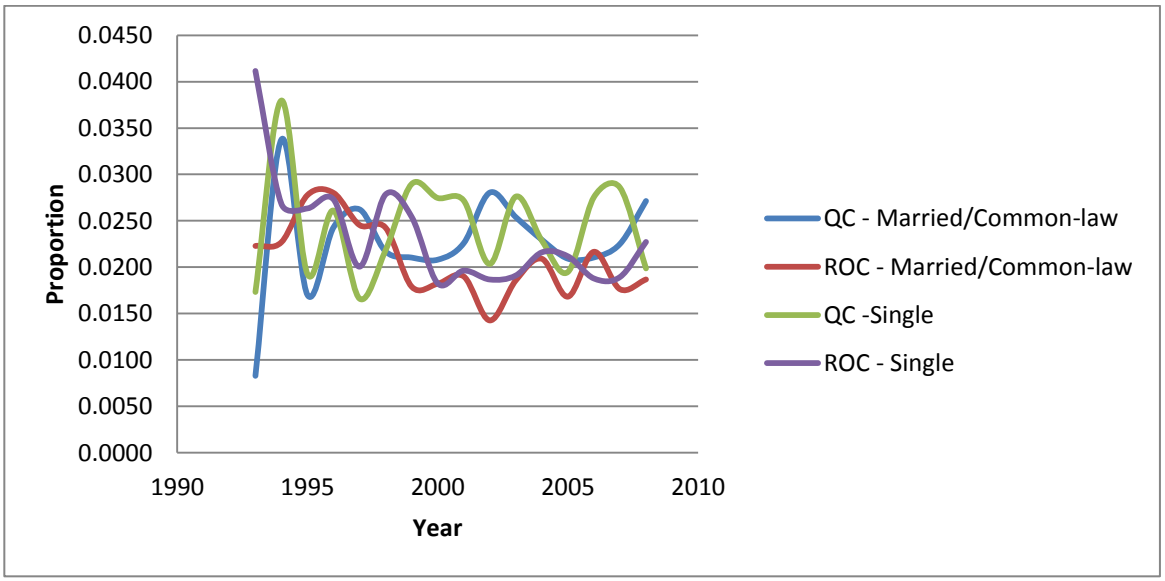
49. They are separated in two groups; respondents living in Quebec and respondents living outside Quebec (living in the Rest of Canada (ROC)).

A measure of the household after-tax income in adjusted for the family size in $10000 and in constant dollars of 2002 was included. If we consider a child as a “normal good”, an income increase should be associated with an increase in the number of children born. However, as noted earlier, this might not be the case if the parents choose instead to invest in the child’s “quality”.

A measure of the labour force status of the women is also included. The expected effect of a respondent working in comparison with being unemployed on her probability of having a child is negative. This is due to the superior opportunity cost of having a child due to having to stop working because of the pregnancy.

The next variable included in the models is the marital status. We expect respondents that are married or in a common-law union to have a greater probability of giving birth as their union can be seen as a sign of stability in their relationship with their partner.

Figure 3 : Proportion of respondents that gave birth by marital status, Quebec and Rest of Canada, 1993-2008



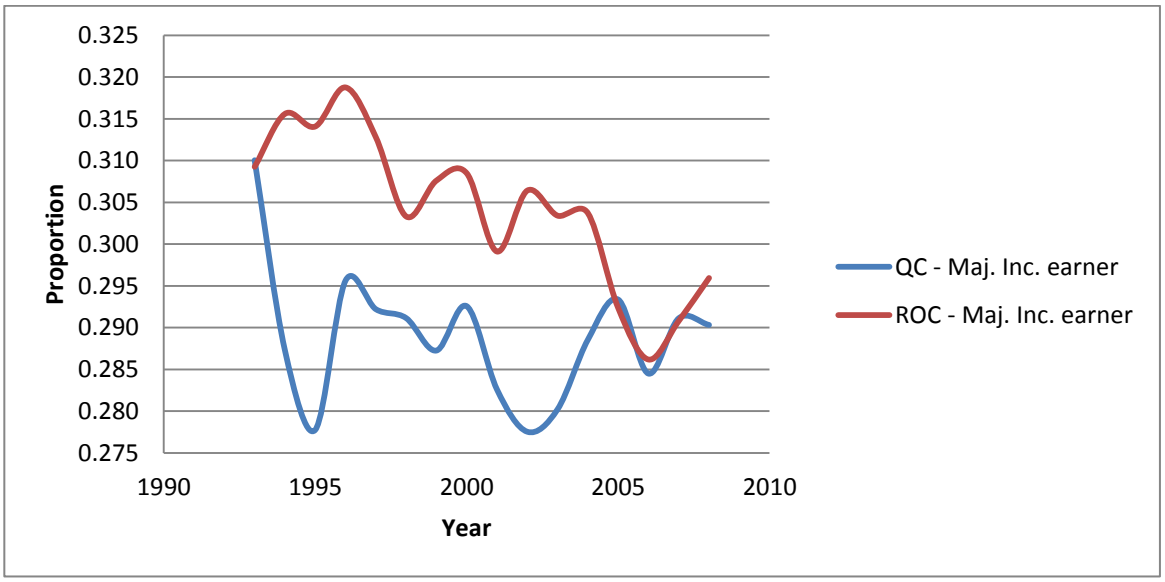
* Women aged 15-49

Source: SLID and author's calculation

Figure 3 seems to indicate that the proportion of married or in a common-law union women giving birth is similar to proportion of single women that gave birth. The proportion of single women that gave birth sometimes even surpassed the proportion of married women that gave birth within groups.

There is also a dichotomous variable taking the value of one if the respondent is the principal income earner in the household. The respondents will be the major income earner if she earns more than her partner but can also be reported as the major income earner if she is not in a relationship. The reason behind the inclusion of this variable is similar to the labour force variable. We expect that a respondent that is the major income earner in the household will have a lower probability of giving birth than a respondent that is not because the opportunity cost of leaving work is greater.

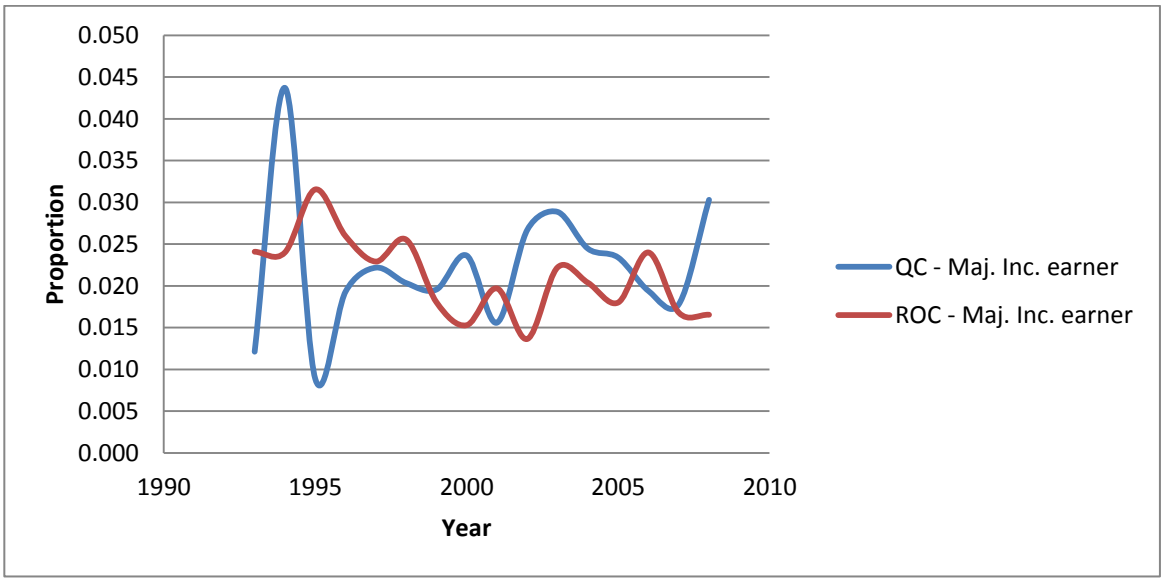
Figure 4 : Proportion of respondents that are the major income earner in the household, Quebec and Rest of Canada, 1993-2008



* Women aged 15-49
Source: SLID and author's calculation

From figure 4, we can see that in 1993, respondents from both groups were the major income earner of their household. The proportion of respondents that were the major income earner in the household was greater in the Rest of Canada over the years up until 2005 when the gap between the groups narrowed sharply.

Figure 5 : Proportion of respondent that gave birth when major income earner, Quebec and Rest of Canada, 1993-2008

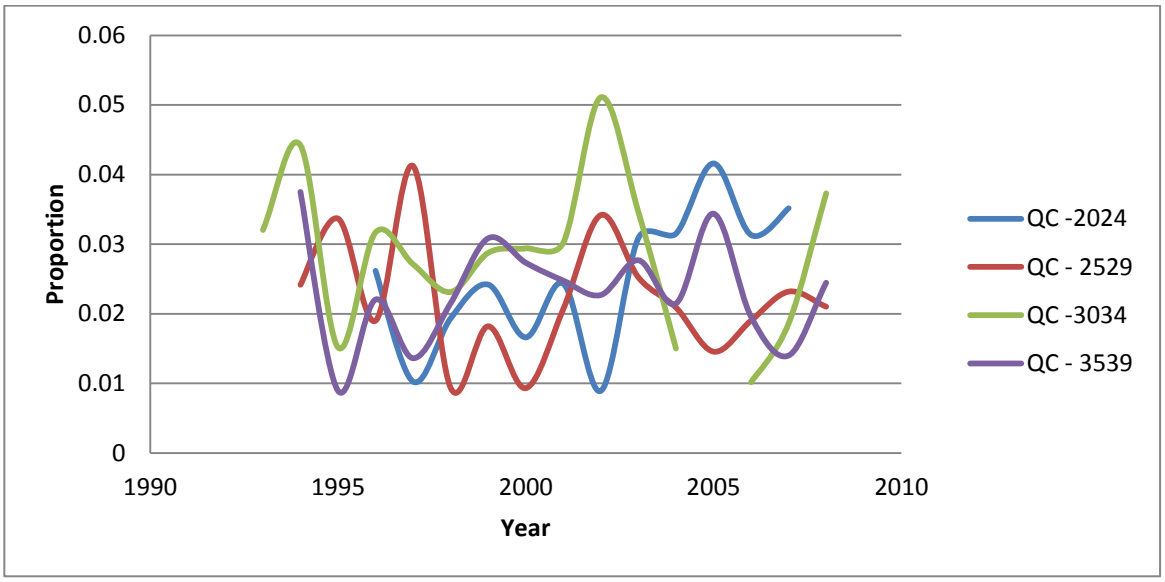


* Women aged 15-49
Source: SLID and author's calculation

Figure 5 shows that the proportion of respondents that gave birth, although it fluctuates greatly, is relatively similar in both groups.

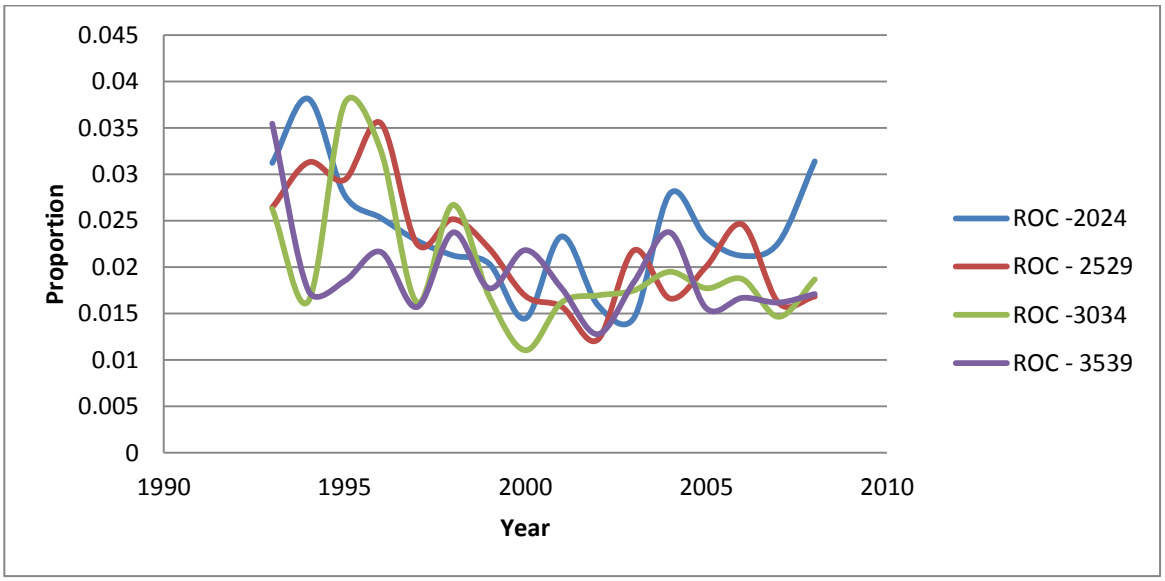
A measure of the age of the women is also included as different age categories. The age of the respondents will affect the probability of giving birth as couples will normally choose to start a family when they feel that they have the right partner as well as they feel they have reached financial security. Thus we expect the probability to be greatest for respondents in the age category 30 to 34 years old.

Figure 6 : Proportion of respondents that gave birth by age group, Quebec, 1993-2008



* Women aged 20-39.
Some years cannot be displayed as there were too little respondents.
Source: SLID and author's calculation

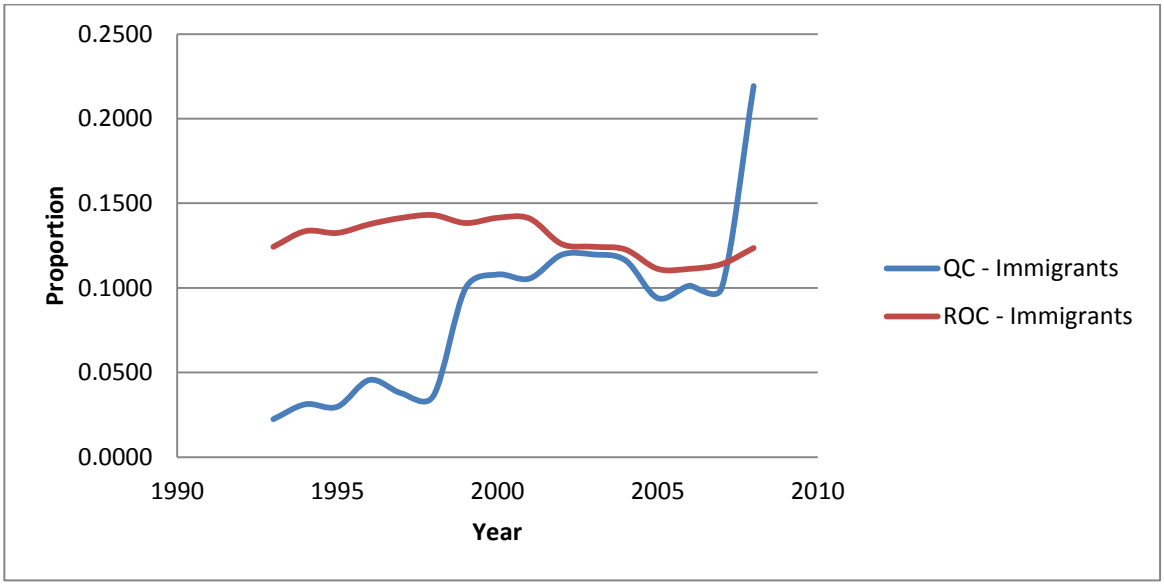
Figure 7 : Proportion of respondents that gave birth by age group, Rest of Canada, 1993-2008



* Women aged 20-39
Source: SLID and author's calculation

The immigrant status of the respondents is also included. This variable is commonly included in the literature[5]. Respondents that are immigrant are expected to have a greater probability of giving birth.

Figure 8 : Proportion of immigrant respondents, Quebec and Rest of Canada, 1993-2008



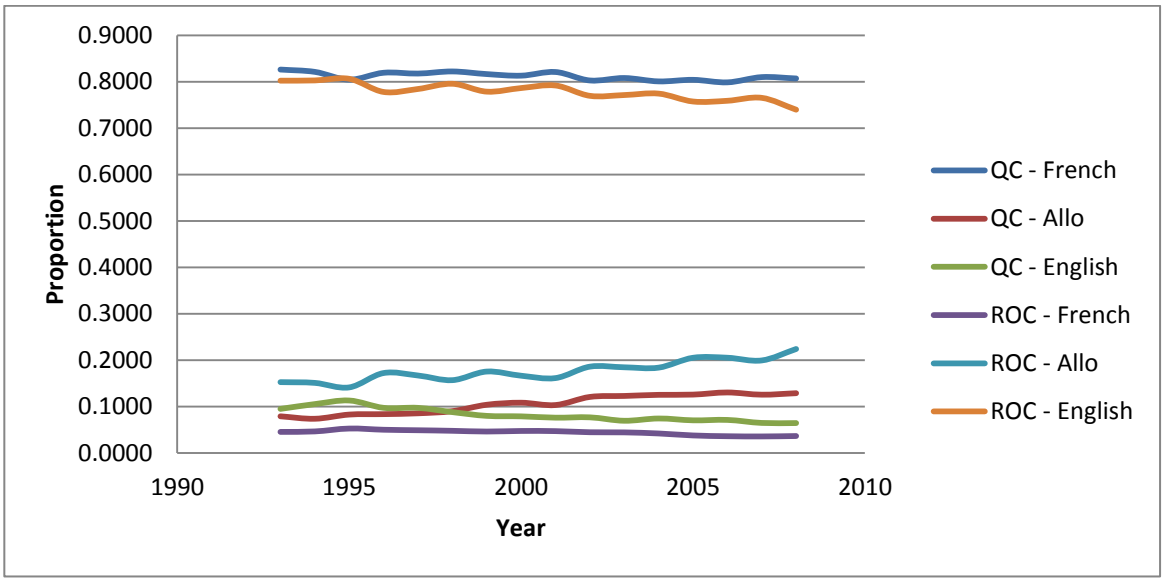
*Women aged 15-49
Source: SLID and author's calculation

From Figure 8, we observe that the proportion of immigrant respondents from the Rest of Canada stayed relatively constant offer the years considered. On the other side, the proportion of immigrant respondent living in Quebec increases sharply over the years to end up surpassing the proportion in the ROC.

Two language variables are also included in the form of binary variables that will take the value of one if the respondent's mother language is French and if the respondent's mother language is other than English or French (allophone).

[5] Milligan (2004)

Figure 9 : Proportion of respondents per mother languages, Quebec and Rest of Canada, 1993-2008



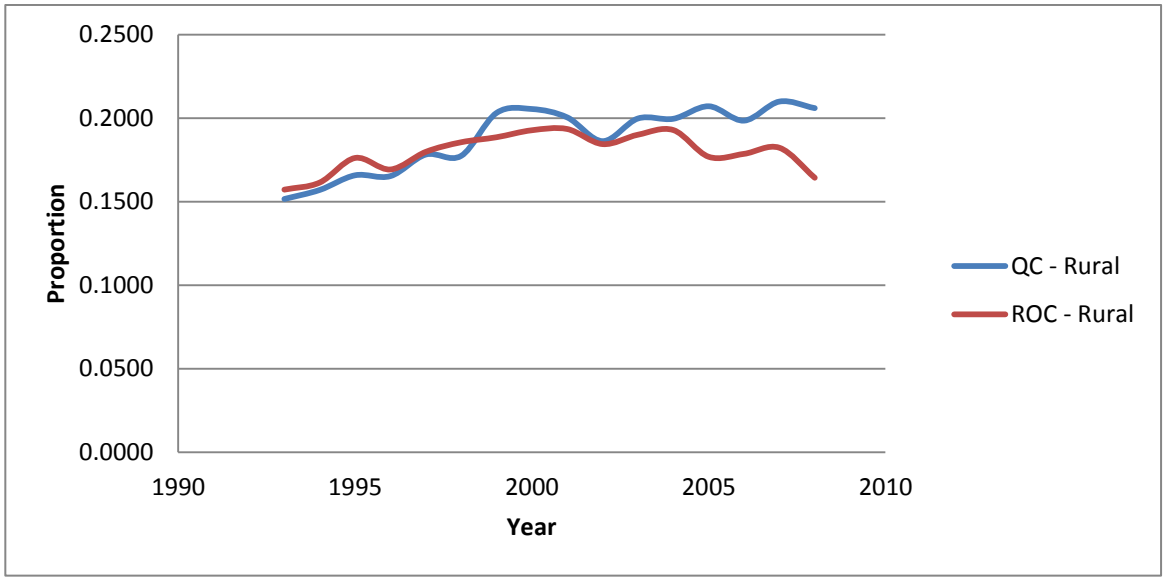
* Women aged 15-49

Source: SLID and author's calculation

Unsurprisingly, a great proportion of respondents reported French as their mother language in Quebec and English in the ROC. The proportion of respondents having identified another language as their mother language in both places is fairly low in comparison.

An additional dichotomous variable was included for the type of area where the respondents lives in whether urban or rural. We expect the effect of living in a rural area on the probability of giving birth to be positive.

Figure 10 : Proportion of respondents that live in rural area, Quebec and Rest of Canada, 1993-2008

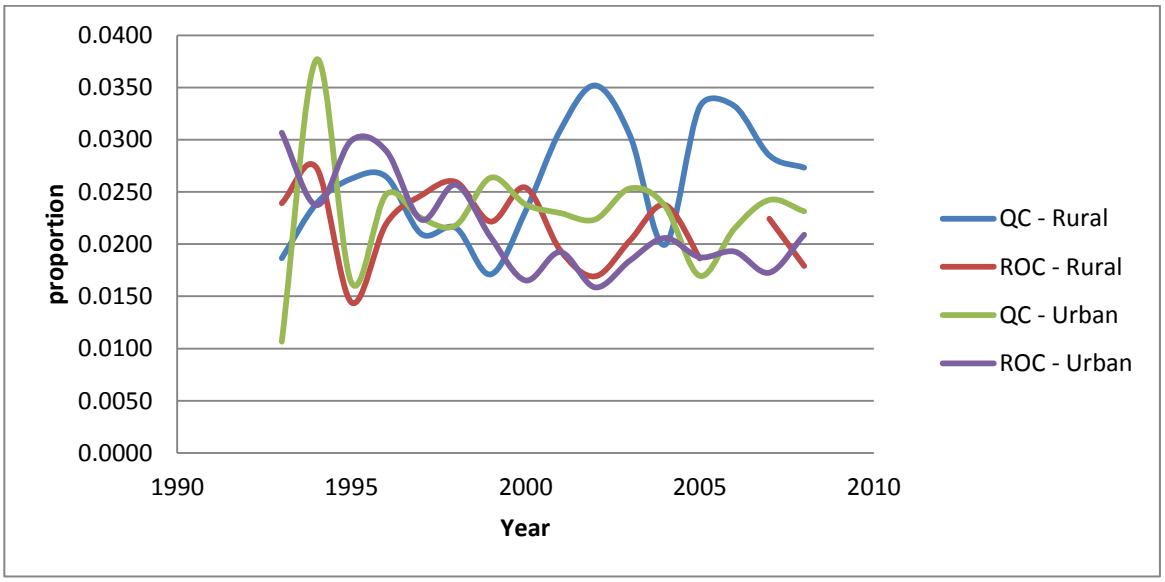


* Women aged 15-49

Source: SLID and author's calculation

Figure shows 9 that the proportion of respondents living in a rural area is quite similar in both Quebec and the ROC. Furthermore, the proportion is slightly increasing over the years in Quebec while it increases at first in the ROC and then declines over the last three years.

Figure 11 : Proportion of respondent that gave birth, by type of region, Quebec and Rest of Canada, 1993-2008



* Women aged 15-49
Some years cannot be displayed as there were too little respondents.
Source: SLID and author's calculation

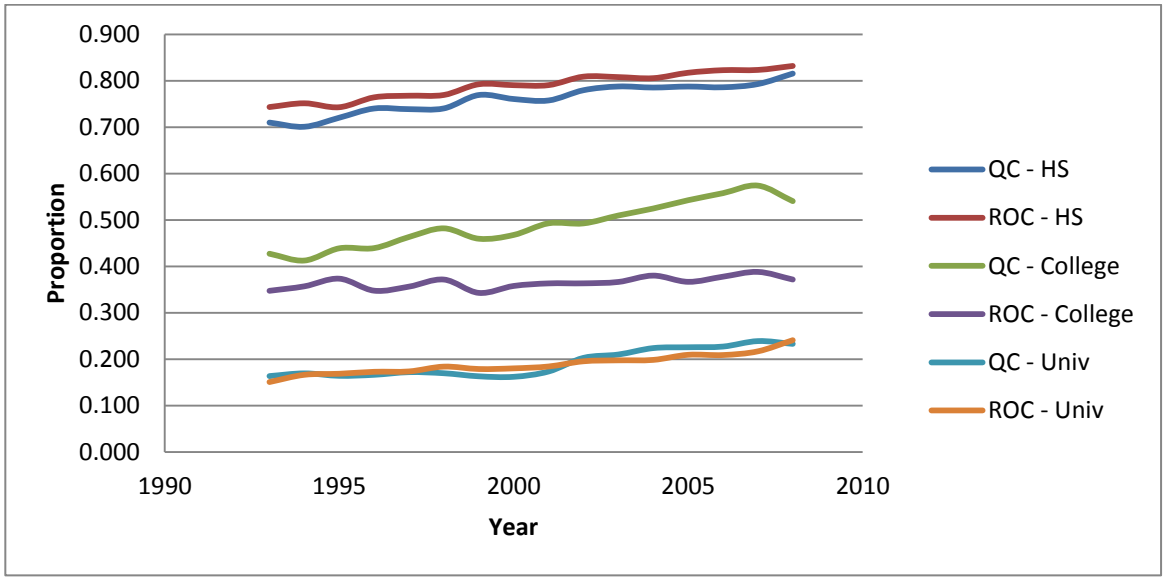
Now looking at the proportion of women that gave birth in both regions, we can observe that for both Quebec and the ROC, there are higher proportions of respondents that gave birth in the population living in rural area which correspond with the assumption made above.

There are three binary education variables that will take the value of one if the respondent have completed high school, if she has received a degree that is higher than high school but lower than a university degree and finally if she has received a university degree. We expect the probability of having a child to decrease as the education degree level increases. This is due to higher education being associated with better jobs i.e. jobs with better benefits, more pleasant working conditions, and higher status[6]. Thus more

[6] Rindfuss et all. (2010)

educated women might focus more on their career and will suffer a greater opportunity cost by having children.

Figure 12 : Proportion of respondents by education level, Quebec and Rest of Canada, 1993-2008



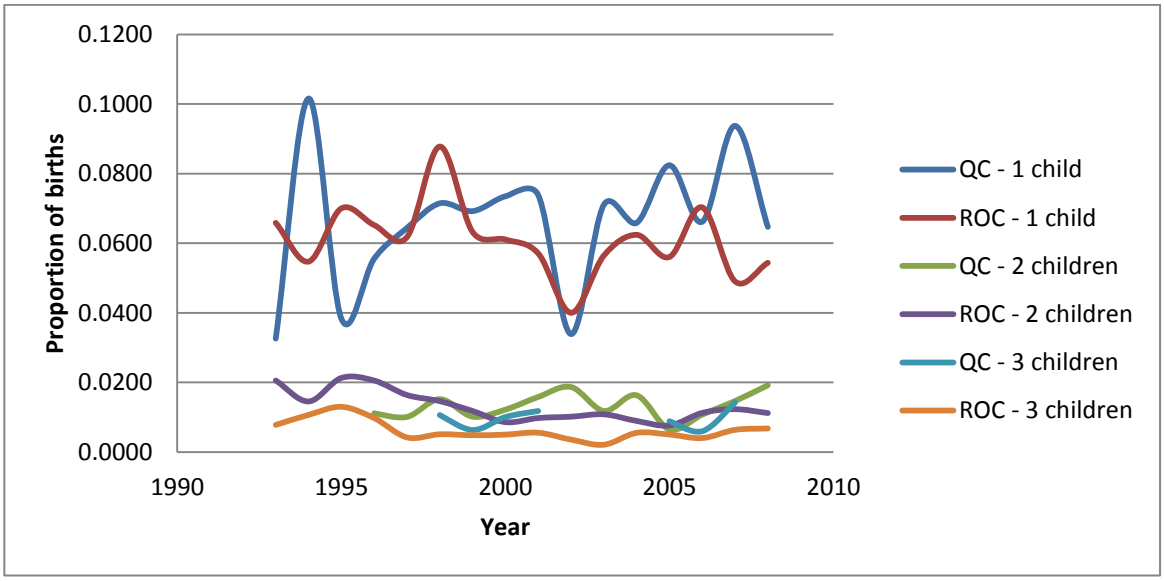
* Women aged 15-49
Source: SLID and author's calculation

The proportions of respondents having a high school degree as well as a university degree are very similar in both places. The proportion of respondents having a degree in between high school and university as measured by the college variable is higher in Quebec. This is probably due to the existence of CEGEP in Quebec inflating the proportion of respondents having had post-secondary education.

The household composition variables consist of the number of children already born to the respondent (parity) and a measure of the age category of the children already born to the respondents.

The parity variable controls for the respondents' preferences for the total number of children they desire. We expect the proportion of respondents that give birth to be higher for the women that have one child as most family desire to have two children[7].

Figure 13 : Proportion of woman that gave birth by parity, Quebec and Rest of Canada (1993-2008)



* Women aged 15-49
Some years cannot be displayed as there were too little respondents
Source: SLID and author's calculation

The measure the child's age are dichotomous variable indicating if there is a child in the household that is of pre-school age (0 to 5 years old), of school age (6 to 17 years old) or is a young adult (18 to 24 years old).

Finally, a binary variable for the birth of a child is added to the models that aim at determining the effect of the change in family policy on the fertility rate as the dependant variable. The information relative to the construction of the variable is included in the

[7] Rindfuss et all. (2010)

annex as the SLID flag variable for the birth of a child was not available for years prior to 2004.

The time lapse between birth variable represents the years between the first birth of a child and the second. The second birth is the one that happens during the years included in the dataset. It is constructed by taking the difference between the age of a respondent during the year that she gave birth with the age she reported as the year that she had her first child. Further information will be provided in the annex.

The models that aim at determining the effect of the change in family policy on the time lapse between births will have the latter as the dependent variable. Both models will thus have the same control and independent variable.

The details on how the variables were manipulated from the original dataset are included in the annexes.

5. Methodology:

This paper will use a model similar to the one used in the papers analysing comparable questions described earlier such as Milligan (2004). The probability of giving birth will thus be evaluated using non-linear models for panel data. The logit model was preferred over the probit model because it allows for the use of fixed effects in the context of panel data. However, the results obtained using the probit model will be available in the annexes for the sake of comparison. A difference-in-difference approach will be

undertaken to estimate the effect of the change in the fertility rate caused by the drastic change in family policy program in Quebec.

The following description of the difference-in-difference (DID) methodology is adapted from the explanation found in Chapter 5 of Angrist and Pischke's Mostly harmless econometrics[8].

This methodology consists of evaluating the equation for a treatment group and a control group before and after the introduction of the treatment (policy). In this case, the treatment group is the respondents living in Quebec and the control group will be the respondents living in outside of Quebec (The ROC).

Let's consider a general two period model:

$$Y_{ist} = \gamma_s + \lambda_t + \beta D_{st} + \varepsilon_{ist}$$

Where Y_{ist} is the outcome, γ_s is the state fixed effect, λ_t is the time fixed effect and D_{st} is the treatment and is equivalent to the interaction term $s_i * t$ where s_i is the state where the policy is implemented and t is the time at which it was implemented. Also, we assume that $E(\varepsilon_{ist}|s,t) = 0$

Thus, β will be the effect of the treatment on the outcome. This can be shown by the following equations.

[8] Angrist, J. and Pischke, s. (2008)

Assuming the treatment occurred in State 2 and in period 2 making State 1 the control state. We have:

$$E[Y_{ist}|s = 1, t = 2] = \gamma_1 + \lambda_2$$

$$E[Y_{ist}|s = 1, t = 1] = \gamma_1 + \lambda_1$$

$$[Y_{ist}|s = 2, t = 2] = \gamma_2 + \lambda_2 + \beta$$

$$[Y_{ist}|s = 2, t = 2] = \gamma_2 + \lambda_1$$

Thus, the difference within state and across time is given by:

$$E[Y_{ist}|s = 1, t = 2] - E[Y_{ist}|s = 1, t = 1] = \lambda_2 - \lambda_1$$

$$[Y_{ist}|s = 2, t = 2] - E[Y_{ist}|s = 2, t = 1] = \lambda_2 - \lambda_1 + \beta$$

Thus, the policy effect is given by:

$$[Y_{ist}|s = 2, t = 2] - E[Y_{ist}|s = 2, t = 1] -$$

$$E[Y_{ist}|s = 1, t = 2] - E[Y_{ist}|s = 1, t = 1] = \beta$$

This methodology can also be generalized to models including more states and more years.

In the case of this present paper, the DID methodology would consist of evaluating the difference in the probability of giving birth in Quebec and in the ROC before and after the implementation of new family policies. The equation will be of the form:

$$Y_{it} = \lambda_t + \gamma_s + \beta z_{gt} + \delta_{gt} X_{igt} + \varepsilon_{igt}$$

Where Y_{it} is the outcome which can be to give birth or not, λ_t is the year trend, γ_s is the province fixed effect, z_{gt} is the group/time period covariates (policy variable) and X_{igt} is the individual-specific covariates. The coefficient of interest in this case is β which represent the effect of the policies.

A potential problem is put forward by Bertrand et al. (2003). The DID setting could lead to a bad estimation of the standard error due to serial correlation. Three factors are known to lead the standard error to underestimate the true standard deviation. The length of the time series, the serial correlation of the most commonly used dependent variables and whether any procedures have been used to correct for it. We argue in our case, this problem should not affect our estimates as our panels are only 6 years long with an average length of about 3 years. Furthermore, cluster robust standard errors were used which should alleviate the problem.

5.1 Testing for the validity:

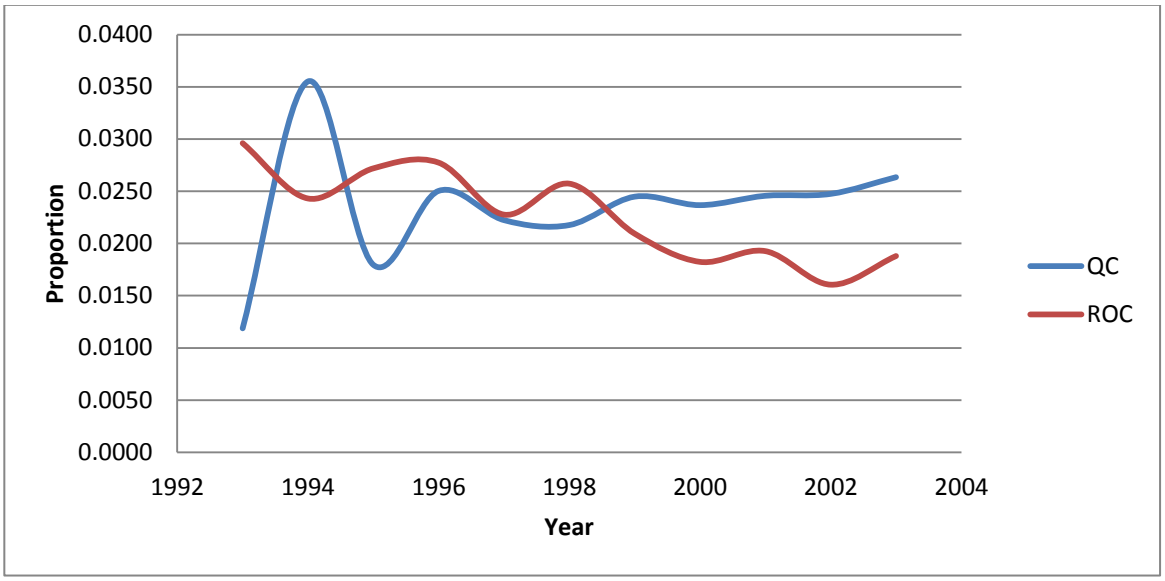
A key assumption for a DID strategy is that the outcome in treatment and control group would follow the same time trend in the absence of the treatment[9]. In this particular case, it means that without the 1997 change in family policy, the proportion of birth would have moved in a similar fashion both in Quebec and the Rest of Canada. The same would hold for the introduction of the enhanced parental leave policy in 2006. A second key assumption is that there are no contemporaneous shocks affecting the outcome in

[9] Meyer (2005)

the years considered in the analysis. In order for the second assumption to hold, we have to "combine" policies that were adopted (modified) around the same time. For this reason, we cannot analyse the effect of the introduction of the subsidized daycare alone; we have to take into consideration that the ANC was abolished the same year making the analysis about the general change in policy. Similarly, the same can be said about the introduction of the Quebec Parental Insurance Plan. A year prior to the enhancement of the parental leave policy, the Child Assistance Payment was introduced making it hard to differ between the two policies as they both affect the cost of a child causing an effect on the probability of having a child. Therefore, both policies will be analysed simultaneously. The same analysis will be performed on the time lapse between the first and the second birth.

The graphs of the dependent variables are now presented to illustrate how they behave prior to and after the introductions of the treatments.

Figure 14 : Proportion of respondents that gave birth, Quebec and Rest of Canada, 1993-2004

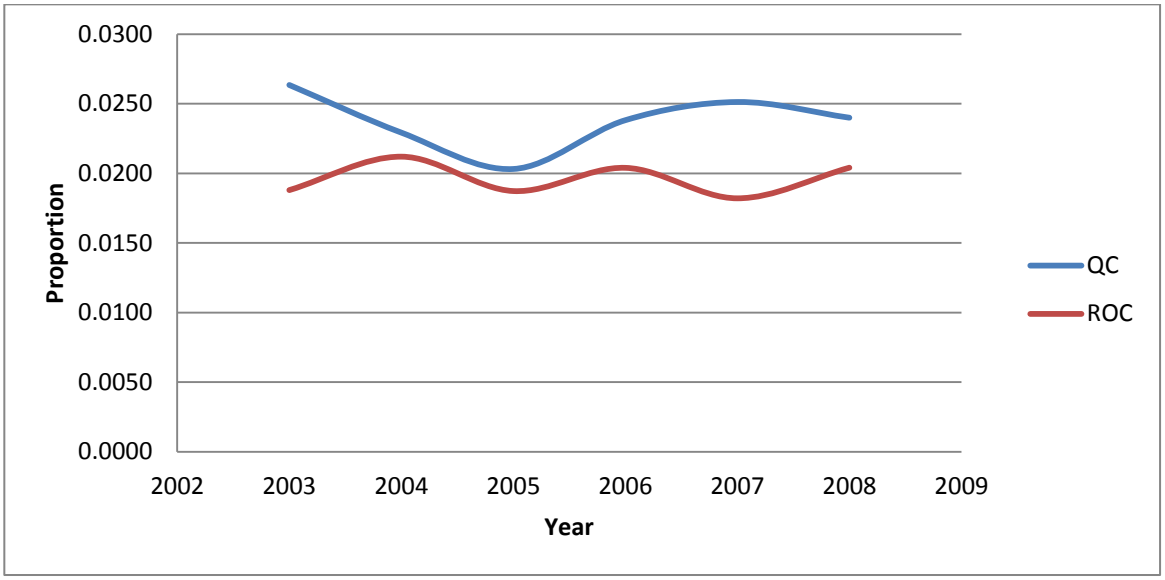


*Women aged 15-49
Average standard deviation is 0.15 and 0.149 for Quebec and ROC respectively.
Source: SLID and author's calculation

From figure 14, we notice that for Quebec, there was a sharp increase in the proportion of respondents that gave birth from 1993 to 1994 followed by a decrease for 1995. Recall that the ANC was implemented shortly before this time which means that this could be linked to the implementation of this policy. The fertility rate in Quebec then declines and follows a trend similar to the ROC's. Quebec fertility rate then seems to increase following the change in family policy. The proportion then increased again to stay at a constant level until 2003. For the ROC, there seems to be a small decline in the proportion of respondents that gave birth over the years, with a steeper decline after the years following the change in the policies. The analysis is not simple in this case as the policies change in Quebec was announced in advance. This fact might have affected the behavior of the respondents who would have wanted to benefit from the ANC prior to its

dismissal. However, we do not observe a sharp increase in the proportion of women that gave birth in the year preceding the change indicating that there might not have been a generalized change in behavior due to the incoming change in policy. Finally, the large standard deviation compared to the mean for each year lessens the reliability of the graphical analysis.

Figure 15 : Proportion of respondents that gave birth, Quebec and Rest of Canada, 2003-2008



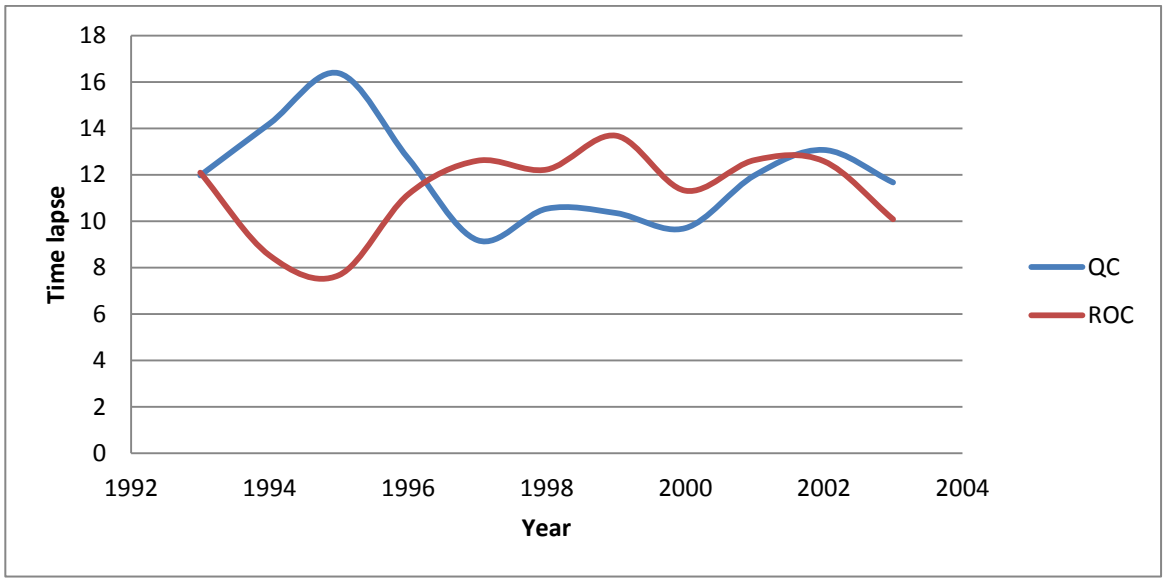
*Women aged 15-49
Average standard deviation is 0.152 and 0.139 for Quebec and ROC respectively.
Source: SLID and author's calculation

Figure 15 illustrates the proportion of respondents that gave birth for the years prior and following the introduction of the Child assistance payment policy. There seems to be a parallel trend observed prior to the introduction of the measures followed by an increase in the proportion of respondents that gave birth in Quebec while this proportion slightly declined around 2006. The difference in proportions seems to narrow at the end of the

decade. The graphical analysis seems to provide evidence that the policies had an effect on the probability of giving birth in Quebec. However, further analysis will be needed to properly determine this supposition. Finally, similar to the analysis made for the 1997 change, the standard error of the means presented in the graph are fairly high once again lessening the value of the analysis.

The same analysis can be made for the model looking at the time lapse between births.

Figure 16 : Time lapse between the first and second birth, Quebec and Rest of Canada, 1993-2003



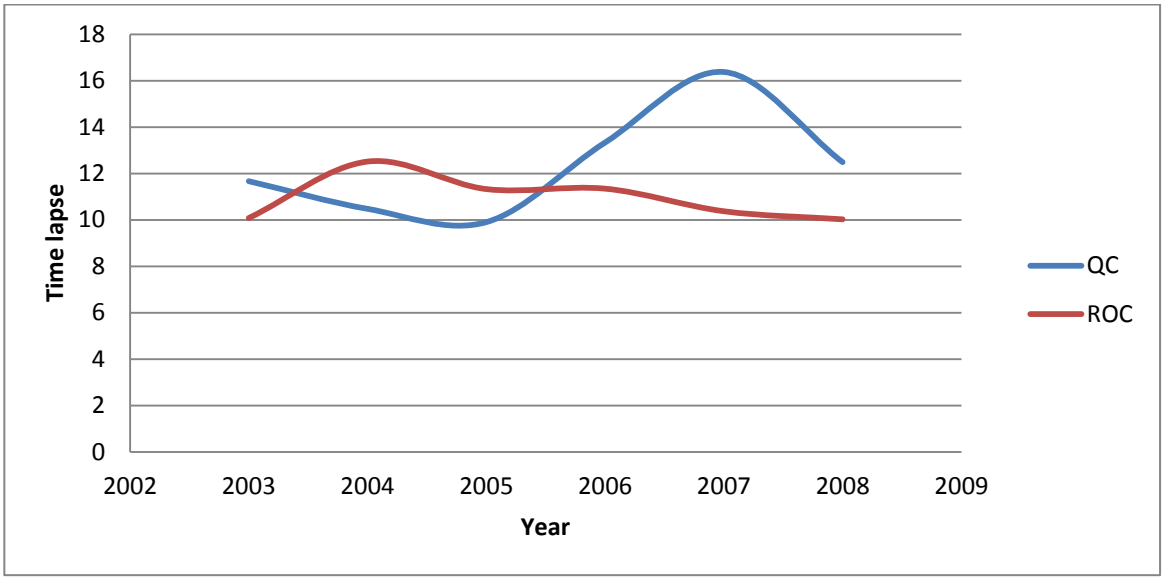
*Women aged 15-49
Average standard deviation is 6.8 and 11.32 for Quebec and ROC respectively
Source: SLID and author's calculation

Alike for the proportion of respondent that gave birth around the introduction of the subsidized daycare, the trend in the time lapse between birth in the first half of the 1990's seem to be different between Quebec and the Rest of Canada. The trends then

seem to get closer to following a similar trend for the rest of the years considered. Also, the standard errors are smaller in this case, making the analysis more reliable.

The second set of policies that were implemented in 2005 and 2006 will now be analysed.

Figure 17 : Time lapse between the first and second birth, Quebec and Rest of Canada, 2003-2008



*Women aged 15-49
Average standard deviation is 12.37 and 10.9 for Quebec and ROC respectively
Source: SLID and author's calculation

In this case, for the year prior to the introduction of the policies, there seems to be a parallel trend between Quebec and the Rest of Canada where the time lapse between the first and second birth seems to be declining at the same rate, then, after 2005, there is an increase in the time lapse between the first and second birth in Quebec as the mean time lapse slowly decrease over the years. The mean time lapse between births in Quebec than starts decreasing again. Alike the change in proportion of respondents giving birth after the 2005 and 2006 policies, the graphical analysis shows some evidence that the

policies might have had some effect on the behavior of the respondents. However, it can be noted that, although an effect is observed, the direction of the effect is not the one anticipated. Finally, the standard errors of the means are relatively large making the analysis less reliable.

5.2 Models:

The advantage of using a dataset that includes repeated information for many individuals is that it allows controlling for unobserved factors such as an individual's preference for children. Such effects are called fixed effects. In a fixed-effects model, we assume that the Y_{ij} have independent Bernoulli distributions with probabilities satisfying logit(π_{ij}) = $\alpha_i + x'_{ij}\beta$. Fixed effects logit are in fact conditional logit in the sense that groups were all observations are successes (or all are failures) do not contribute to the conditional likelihood. They only rely on *within variation*, that is, the variation within a group. In this case, the individual herself across time, as opposed to the between variation, which is the variation across groups, or across respondents in this case. This can lead to estimating the model in a small subset of the data and is the case for this paper where only the respondents that gave birth were selected.

Another model that is considered is the random effect model. For this model, we postulate the existence of an unobserved individual effect α_i such that given α_i the Y_{ij} are independent Bernoulli random variables with probability π_{ij} such that logit(π_{ij}) = $\alpha_i + x'_{ij}\beta$ In other words the conditional distribution of the outcomes given the random effects α_i is Bernoulli, with probability following a standard logistic regression model

with coefficients ai and β. Moreover, we treat α_i as an error term and assume a distribution, namely N(0, σ_α^2) The fixed effect α_i are assumed to be independent from the regressors which might be a strong assumption. The evaluation of this model will use both within and between variation.

The third model added is the population average model. It is usually compared with the random effect model. This model will evaluate the average effect of a variable on an average individual and thus, the interpretation of the variable is different. From a policy point of view, for example, one could argue that decisions should be based on the average effect.

Table 3 : Coefficient for the fixed effects, random effects and population average, 1993-2003

	FE	RE	PA
1994	0.2305	0.1158	0.0970
	(0.1782)	(0.1525)	(0.1306)
1995	0.4892	0.1963	0.1560
	(0.1997)	(0.1550)	(0.1317)
1996	0.7262	0.2228*	0.1858*
	(0.2163)	(0.1326)	(0.1128)
1997	0.8704***	-0.0051	-0.0312
	(0.2352)	(0.1380)	(0.1176)
1998	1.108***	0.0403	0.0298
	(0.2766)	(0.1412)	(0.1202)
1999	1.4217***	0.1156	0.0933
	(0.2747)	(0.1380)	(0.1171)
2000	1.5153***	-0.0248	-0.0280
	(0.3163)	(0.1421)	(0.1208)
2001	1.7793***	-0.0961	-0.0986
	(0.3205)	(0.1443)	(0.1223)
2002	1.7820***	-0.2835*	-0.2541**
	(0.3706)	(0.1492)	(0.1270)

2003	2.5179***	-0.0099	-0.0138
	(0.3984)	(0.145)	(0.1229)
Quebec	0.7105	0.0412	0.0268
	(2.3614)	(0.1449)	(0.1193)
Treatment	0.0091	0.3750***	0.3085***
	(0.2339)	(0.1391)	(0.1179)
Highschool	1.0308	-0.0277	-0.0218
	(3.6435)	(0.0757)	(0.0630)
College	-0.3185	0.0211	0.0213
	(0.3088)	(0.0612)	(0.0512)
University	0.1730	-0.2070**	-0.1743**
	(0.3053)	(0.0847)	(0.0708)
French	(omitted)	-0.2355**	-0.1890**
		(0.1097)	(0.0886)
Allophone	(omitted)	-0.0469	-0.0529
		(0.1106)	(0.0920)
Rural	0.0001	-0.0252	-0.0084
	(0.1613)	(0.067)	(0.0568)
Immigrant	-0.2534	-0.2306**	-0.2075***
	(0.3222)	(0.094)	(0.0805)
HH Revenue	-0.0311	-0.195***	-0.172***
	(0.0736)	(0.0513)	(0.0441)
Maj. Inc. earner	-0.0101	0.0803	0.0681
	(0.1493)	(0.0744)	(0.0627)
Preschool aged	-3.6735***	-2.1093***	-1.7753***
	(0.2151)	(0.0973)	(0.0844)
School aged	-4.0726***	-1.7068***	-1.3852***
	(0.3297)	(0.0958)	(0.0763)
Young adult	-16.494***	-4.2292***	-3.9196***
	(0.7659)	(1.0146)	(-1.03)
1 child	-0.4279***	1.0701***	0.9284***
	(0.1212)	(0.0653)	(0.0526)
2 children	-2.7158***	-0.7814***	-0.5991***
	(0.2390)	(0.0782)	(0.0693)
3 children or more	-5.0487***	-1.8931***	-1.6462***
	(0.4186)	(0.1078)	(0.1052)
aged 25-29	-0.1250	0.2546***	0.2046***
	(0.1814)	(0.0836)	(0.0706)
aged 30-34	-0.3587	0.6420***	0.5309***
	(0.2853)	(0.0866)	(0.0711)
aged 35-39	-0.4647	0.8232***	0.6753***
	(0.3590)	(0.0903)	(0.0735)

Work	-0.0358	0.0078	0.0181
	(0.1476)	(0.0750)	(0.0634)
Married/Com.-law	0.2788	0.6966***	0.5571***
	(0.1690)	(0.0779)	(0.0632)
Number of obs.	6957	97537	97537
Number of groups	1702	33718	33718

Robust standard error are reported in parenthesis
p-val $\leq$ 0.01: ***, 0.01<p-val $\leq$ 0.05 :**, 0.05<p-val $\leq$ 0.1 :*

Table 1 includes the coefficients of the three types of models considered. Something we can point out is that the coefficients of the random effect and population average model are very similar compared to the fixed effects model. Also, variables that have no variance within a group (individual) cannot be estimated in the fixed effects model as it only uses within-variation. This is the case with the French and allophone variables which are mother languages and thus, are time invariant. It should also be the case for the immigrant variable but some individuals appear to have reported being an immigrant in some years and not in other. We assume that the proportion of individual that did is small.

Table 4 : Coefficients of fixed effects, random effects and population-average models 2004-2008.

	FE	RE	PA
2005	0.2174	-0.0506	-0.0562
	(0.225)	(0.1260)	(0.1075)
2006	0.6637**	0.1264	0.0763
	(0.3169)	(0.1315)	(0.1116)
2007	0.8648**	0.0609	0.0065
	(0.3768)	(0.1357)	(0.1148)
2008	1.3045***	-0.0016	-0.0334
	(0.4381)	(0.1376)	(0.1169)
Quebec	2.8509	0.2857	0.2213
	(6.9460)	(0.2074)	(0.1769)

Treatment	0.2996	0.0125	-0.0117
	(0.290)	(0.1989)	(0.1688)
Highschool	1.1592	-0.2585**	-0.2043**
	5.6547)	(0.1231)	(0.1033)
College	0.9911**	-0.1220	-0.1058
	(0.4562)	(0.0954)	(0.0800)
University	0.6518	0.1196	0.1184
	(0.5339)	(0.1121)	(0.0949)
French	(omitted)	-0.0112	0.0096
		(0.1762)	(0.1491)
Allophone	(omitted)	0.5176***	0.4604***
		(0.1325)	(0.1112)
Rural	0.5839	0.2685***	0.2334***
	(0.5373)	(0.1033)	(0.0871)
Immigrant	0.6362	0.1994	0.1941*
	(0.6575)	(0.1274)	(0.1079)
HH Revenue	-0.0034	0.0266**	0.0238**
	(0.1730)	(0.0132)	(0.0096)
Maj. Inc. earner	-0.2496	-0.0135	-0.0026
	(0.2787)	(0.1189)	(0.1004)
Preschool aged	-6.8211**	-2.1868***	-1.8987***
	(2.8676)	(0.1597)	(0.1411)
School aged	-5.1512***	-1.2429***	-1.0087***
	(2.0068)	(0.1439)	(0.1176)
Young adult	-14.0448***	-	-
	(3.1387)		
1 child	-0.8796***	1.2061***	1.0103***
	(0.3118)	(0.1070)	(0.0862)
2 children	-3.4168***	-0.8108***	-0.6641***
	(0.4297)	(0.1184)	(0.1072)
3 children or more	-5.9835***	-1.4728***	-1.2787***
	(0.6885)	(0.1469)	(0.1388)
aged 25-29	0.1464	-0.1838	-0.1672
	(0.3893)	(0.1269)	(0.1088)
aged 30-34	0.8214	0.0257	0.0234
	(0.5167)	(0.1348)	(0.1131)
aged 35-39	1.6059**	0.3453***	0.2606***
	(0.7966)	(0.1332)	(0.1095)
Work	-0.0835	-0.1702	-0.1318
	(0.1971)	(0.1052)	(0.0889)
Married/Com.-law	0.4443	0.7914***	0.6567***
	(0.3684)	(0.1182)	(0.0953)

Number of obs.	1950	42704	42704
Number of groups	582	21386	21386

Robust standard error are reported in parenthesis
p-val $\leq$ 0.01: ***, 0.01<p-val $\leq$ 0.05 :**, 0.05<p-val $\leq$ 0.1 :*

The same observations made for table 1 can also be made for table 2. The random effects and population average model do not report any coefficient for the variable young adult because it predicts failure perfectly.

In order to choose which model to choose, several things are to be taken into consideration. The first thing we can look at is the within and between variations in the variables.

Table 5 : Between and within variation across individuals, Canada, 1993-2008

Variable		Mean	Std. Dev.	Variable		Mean	Std. Dev.
High school	overall	0.7690	0.4214	1 child	overall	0.1398	0.3468
	between		0.4257		between		0.3140
	within		0.0572		within		0.1740
College	overall	0.3912	0.4880	2 children	overall	0.2600	0.4386
	between		0.4742		between		0.4051
	within		0.1154		within		0.1985
University	overall	0.1686	0.3744	3 children	overall	0.2650	0.4413
	between		0.3638		between		0.4082
	within		0.0775		within		0.1946
French	overall	0.2213	0.4151	age1519	overall	0.0637	0.2442
	between		0.4136		between		0.2657
	within		0.0000		within		0.1382
Allophone	overall	0.0995	0.2993	age2024	overall	0.1342	0.3408
	between		0.3051		between		0.2943
	within		0.0000		within		0.1902
Rural	overall	0.2688	0.4433	age2529	overall	0.1202	0.3252
	between		0.4234		between		0.2762
	within		0.1461		within		0.1879
Immigrant	overall	0.1190	0.3238	age3034	overall	0.1429	0.3499
	between		0.3065		between		0.2925

	within		0.1379		within		0.2045
Income	overall	0.7319	1.2840	age3539	overall	0.1730	0.3782
	between		1.1502		between		0.3115
	within		0.6557		within		0.2263
Maj. Inc. earner	overall	0.3185	0.4659	age4044	overall	0.1878	0.3905
	between		0.4256		between		0.3222
	within		0.2071		within		0.2346
Pre-school	overall	0.2010	0.4008	age4549	overall	0.1783	0.3828
	between		0.3557		between		0.3790
	within		0.1880		within		0.1656
School age	overall	0.3765	0.4845	Work	overall	0.8184	0.3855
	between		0.4525		between		0.3265
	within		0.1832		within		0.2412
Young adult	overall	0.1111	0.3142	Married/Common-law	overall	0.6202	0.4853
	between		0.2871		between		0.4702
	within		0.1605		within		0.1676

Source: SLID and author's calculations

From table 3, we can see that the within variable variation is rather small in comparison with the between variation. This might be caused by the fact that the panels are relatively short with a maximum number of repeated observations of 6, leaving little room for variation in age for example. We can therefore speculate that the fixed effect estimators will not be very efficient as they rely on within variation.

However, it is common to perform a Hausman test in order to determine which model should be used.

Table 6 : Hausman test for the 1993-2003 models

	---- Coefficients ----				
	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))	
	fe	re	Difference	S.E.	Chi square
1994	0.2336	0.1160	0.1176	0.1280	0.108
1995	0.4989	0.1958	0.3031	0.1446	0.636
1996	0.7261	0.2193	0.5068	0.1708	1.504
1997	0.8523	-0.0023	0.8546	0.1827	3.998

1998	1.0779	0.0388	1.0391	0.2076	**5.201**
1999	1.3722	0.1121	1.2601	0.2439	**6.509**
2000	1.4466	-0.0254	1.4720	0.2628	**8.244**
2001	1.7025	-0.0960	1.7985	0.2839	**11.392**
2002	1.6911	-0.2806	1.9717	0.3298	**11.788**
2003	2.4154	-0.0091	2.4245	0.3481	**16.885**
Quebec	0.6922	0.0512	0.6410	0.7989	0.514
Treatment	0.0396	0.3730	-0.3334	0.2116	0.525
Highschool	0.9164	-0.0083	0.9248	0.9502	0.900
College	-0.3487	0.0269	-0.3755	0.2574	0.548
University	0.1885	-0.1924	0.3809	0.2799	0.518
Rural	-0.0420	-0.0288	-0.0133	0.1725	0.001
Immigrant	-0.2595	-0.2288	-0.0307	0.2293	0.004
HH Revenue	-0.0279	-0.1872	0.1593	0.0671	0.378
Maj. Inc. earner	-0.0044	0.0662	-0.0706	0.1441	0.035
Preschool aged	-3.6888	-2.0777	-1.6111	0.2197	**11.815**
School aged	-4.0700	-1.7110	-2.3590	0.3112	**17.884**
child1	-0.4239	1.0707	-1.4946	0.0803	**27.832**
child2	-2.6936	-0.7776	-1.9160	0.1408	**26.065**
child3	-4.9954	-1.8872	-3.1082	0.2385	**40.508**
aged 25-29	-0.0987	0.2543	-0.3530	0.1630	0.764
aged 30-34	-0.3048	0.6358	-0.9406	0.2767	3.198
aged 35-39	-0.4058	0.7531	-1.1589	0.3684	3.646
Work	-0.0280	0.0092	-0.0372	0.1033	0.013
Married/Com.-law	0.2704	0.6789	-0.4085	0.1571	1.063

b = consistent under Ho and Ha; obtained from xtlogit
B = inconsistent under Ha, efficient under Ho; obtained from xtlogit

Test: Ho: difference in coefficients not systematic

chi2(29) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 480.68
Prob>chi2 = 0.0000

Source: SLID and author's calculations

Table 7 : Hausman test for the 2004-2008 models

---- Coefficients ----					
	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))	
	fe	re	Difference	S.E.	Chi square

2005	0.1999	-0.0494	0.2493	0.1824	0.341
2006	0.6364	0.1252	0.5112	0.2260	1.156
2007	0.8294	0.0582	0.7712	0.2651	2.244
2008	1.2742	-0.0043	1.2785	0.3306	**4.944**
Quebec	2.8566	0.2911	2.5656	7.1554	0.920
Treatment	0.3164	0.0077	0.3087	0.2573	0.370
Highschool	0.8520	-0.2378	1.0898	1.0540	1.127
College	0.8648	-0.1182	0.9830	0.5242	1.843
University	0.6615	0.1355	0.5259	0.4876	0.567
Rural	0.5663	0.2592	0.3071	0.4002	0.236
Immigrant	0.7015	0.2017	0.4997	0.4921	0.507
HH Revenue	-0.0038	0.0269	-0.0307	0.0250	0.038
Maj. Inc. earner	-0.2665	-0.0253	-0.2412	0.2922	0.199
Preschool aged	-6.8303	-2.1514	-4.6790	0.9182	**23.842**
School aged	-5.1485	-1.2461	-3.9025	0.9389	**16.219**
child1	-0.9030	1.1922	-2.0952	0.1865	**23.540**
child2	-3.4539	-0.8103	-2.6436	0.3242	**21.557**
child3	-5.9936	-1.4656	-4.5280	0.5109	**40.128**
aged 25-29	0.1693	-0.1862	0.3555	0.3303	0.383
aged 30-34	0.8755	0.0217	0.8538	0.5447	1.338
aged 35-39	1.6037	0.2802	1.3235	0.7665	2.285
Work	-0.0829	-0.1605	0.0776	0.1717	0.035
Married/Com.-law	0.4579	0.7749	-0.3170	0.3357	0.299

b = consistent under Ho and Ha; obtained from xtlogit
B = inconsistent under Ha, efficient under Ho; obtained from xtlogit

Test: Ho: difference in coefficients not systematic

chi2(23) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 159.81
Prob>chi2 = 0.0000

Source: SLID and author's calculations

From table 6 and 7, we can see that the Hausman tests inform us that the fixed effect model should be preferred to the random effect model. It does so by comparing the difference between the coefficients of the models and divides their square by the

difference in their variance in order to obtain a chi square statistic which is then compared to a critical value chosen accordingly with the number of degrees of freedom.

However, it would be useful to look deeper into the comparison. The Hausman test uses all the variables included to construct the chi square statistic. It is possible to look at each variable individually. The chi square statistic to compare two coefficients is given by $(\widehat{\beta_{FE}} - \widehat{\beta_{RE}})^2/(var(\widehat{\beta_{FE}}) - var(\widehat{\beta_{RE}}))$. The chi square critical value for a test at a 5% significance level with 1 degree of freedom is 3.841. The last column of the two Hausman table give the chi square statistic for the individual variables. We can see that the difference is only significant for a few variables for which it is very large which might explain why the Hausman test indicates that the random effect model is more adequate. It should also be pointed out that as the fixed effect model only uses the observation for which the event occurred, the estimations are obtained with much less observation which might make them imprecise. This information diminishes the accuracy of the Hausman test in this situation.

Thus after consideration, the random effects model is preferred over the fixed effects model. The population average model will also be presented for comparison.

6. Results[10]:

The results from the estimations will be presented in this section. It is important to remind the reader that, as the statistical software commands used to obtain the estimates did not allow for the use of weights, the result presented here is representative of the current sample.

Moreover, it should be emphasized that the object of this model is not to assess the effect of the introduction of subsidized daycare on fertility rate but the effect of the change in the type of family policy on fertility rate. As noted by Milligan (2004), this setting is not ideal to assess the effect of a subsidized daycare policy alone. This model aims to find evidence that the subsidized daycare had a soothing effect on the decline in the fertility rate due to the removal of the ANC benefit policy and thus, providing evidence that subsidized daycare are a good policy to derail policy decline. It will however be impossible to extrapolate the result to another state. A second policy that was adopted on the time frame studied is the enhanced parental leave in Quebec. The same strategy will be employed to assess the effect of easing the work-family trade-off on the fertility rate.

[10] The base individual is a 20 to 24 years old single Anglophone woman born in Canada with that hasn't worked in the past year, has no education degree and has no children or any children living at home.

6.1 Results for probability of birth models:

Table 8 : Marginal effects for random effect and population effect model: 1993-2003

	RE	RE	PA	PA
1994	0.0010	0.0004	0.0020	0.0011
	(0.001)	(0.0005)	(0.003)	(0.0015)
1995	0.0016	0.0007	0.0030	0.0018
	(0.0015)	(0.0005)	(0.003)	(0.0016)
1996	0.0016	0.0008	0.0030	0.0023*
	(0.0012)	(0.0004)	(0.003)	(0.0013)
1997	-0.0007	0.0000	-0.0020	-0.0003
	(0.0012)	(0.0004)	(0.003)	(0.0013)
1998	0.0001	0.0001	0.0000	0.0003
	(0.0012)	(0.0004)	(0.003)	(0.0013)
1999	0.0003	0.0004	0.0010	0.0011
	(0.0012)	(0.0005)	(0.003)	(0.0013)
2000	-0.0008	-0.0001	-0.0020	-0.0003
	(0.0012)	(0.0004)	(0.003)	(0.0013)
2001	-0.0013	-0.0003	-0.0030	-0.0010
	(0.0012)	(0.0004)	(0.003)	(0.0013)
2002	-0.0026**	-0.0008*	-0.006**	-0.0025*
	(0.0012)	(0.0004)	(0.003)	(0.0013)
2003	-0.0006	0.0000	-0.0010	-0.0002
	(0.0012)	(0.0005)	(0.003)	(0.0014)
Quebec	-0.0003	0.0001	-0.0010	0.0003
	(0.001)	(0.0005)	(0.002)	(0.0013)
Treatment	**0.0027****	**0.0012***	**0.006****	**0.0034*****
	(0.0012	**(0.0005)**	**(0.002)**	**(0.0013)**
Highschool		-0.0001		-0.0002
		(0.0002)		(0.0007)
College		0.0001		0.0002
		(0.0002)		(0.0006)
University		-0.0007**		-0.0019**
		(0.0003)		(0.0008)
French		-0.0008**		-0.0021**
		(0.0004)		(0.0010)
Allophone		-0.0001		-0.0006
		(0.0004)		(0.0010)
Rural		-0.0001		-0.0001
		(0.0002)		(0.0006)
Immigrant		-0.0007**		-0.0023***

		(0.0003)		(0.0009)
HH Revenue		-0.0006***		-0.0019***
		(0.0002)		(0.0005)
Maj. Inc. earner		0.0003		0.0008
		(0.0002)		(0.0007)
Preschool aged		-0.0067***		-0.0197***
		(0.0006)		(0.0010)
School aged		-0.0054***		-0.0154***
		(0.0005)		(0.0009)
Young adult		-0.0135***		-0.0434***
		(0.0033)		(0.0108)
1 child		0.0034***		0.0103***
		(0.0004)		(0.0007)
2 children		-0.0025***		-0.0067***
		(0.0003)		(0.0008)
3 children or more		-0.0060***		-0.0183***
		(0.0006)		(0.0010)
aged 25-29		0.0008***		0.0023***
		(0.0003)		(0.0008)
aged 30-34		0.0020***		0.0059***
		(0.0003)		(0.0008)
aged 35-39		0.0026***		0.0075***
		(0.0003)		(0.0008)
Work		0.0000		0.0002
		(0.0002)		(0.0007)
Married/Com.-law		0.0022***		0.0062***
		(0.0003)		(0.0007)
Number of obs	97537	97537	97537	97537
	33718	33718	33718	33718

Robust standard error are reported in parenthesis
p-val $\leq$ 0.01: ***, 0.01<p-val $\leq$ 0.05 :**, 0.05<p-val $\leq$ 0.1 :*

Table 8 presents the results for the models estimating the effect on the probability of giving birth of the 1997 change in family policy in Quebec. The first and third columns respectively present the random effect and the population average models that did not include any covariates. We can see that although the effect of the treatment was statistically positive at the 5% level in both cases, the effect coming from the introduction of new policies was weak. The marginal effect from the random effect model indicates

that the change in policies increased the respondents' probability of giving birth by 0.27%. The population-average model indicates that this same probability increased by 0.6%.

Now, by looking at the results from the models including the covariates, we can notice that, while still being statistically significant at the 10% and 1% level respectively, the marginal effect of the treatment variable has shrunk by half in both the random effect and population average model. The change in family policies had for effect of increasing the probability of giving birth by 0.12% and 0.34% respectively. It should however be noted that, as the parallel trend condition was not clearly met, this result should be taken with caution.

Almost all of the statistically significant marginal effects have the expected sign. One thing worth mentioning is that the marginal effect on the variable "one child" is positive while the signs on the variables "two children" and "three children and more" are negative, showing evidence of the hypothesis that individuals have a preference for 2 children family. Finally, both the immigrant variable and the revenue variable are statistically significant and have negative signs which, especially in the case of immigrant, are surprising. However, the coefficients are very low.

Let's now look at the results from the model including the effect of the second set of family policies change.

Table 9 : Marginal effects for random effect and population effect model: 2004-2008

	RE	RE	PA	PA
2005	-0.001	-0.0001	-0.0017	-0.0006
	(0.0008)	(0.0004)	(.0020)	(0.0012)
2006	0.000	0.0004	0.0010	0.0009
	(0.0009)	(0.0004)	(.0023)	(0.0013)
2007	0.000	0.0002	-0.0004	0.0010
	(0.0001)	(0.0004)	(.0022)	(0.0013)
2008	-0.0003	-0.0000	-0.001	-0.0004
	(0.0001)	(0.0004)	(.0022)	(0.0013)
Quebec	0.0018*	0.0008	0.0044	0.0025
	(0.001)	(0.0006)	(.0025)	(0.0020)
Treatment	**0.000**	**0.0000**	**-0.0013**	**-0.0001**
	(0.0013)	**(0.0006)**	**(.0032)**	**(0.0019)**
Highschool		-0.0008		-0.0023**
		(0.0004)		(0.0012)
College		-0.0004		-0.0012
		(0.0003)		(0.0009)
University		0.0004		0.0013
		(0.0003)		(0.0011)
French		-0.0000		0.0001
		(0.0005)		(0.0017)
Allophone		0.0015***		0.0051***
		(0.0004)		(0.0012)
Rural		0.0008**		0.0026***
		(0.0003)		(0.0010)
Immigrant		0.0006		0.0022*
		(0.0004)		(0.0012)
HH Revenue		0.0001*		0.0003**
		(0.0000)		(0.0001)
Maj. Inc. earner		-0.0000		-0.0000
		(0.0003)		(0.0011)
Preschool aged		-0.0064***		-0.0210
		(0.0009)		(0.0014)
School aged		-0.0037***		-0.0112
		(0.0006)		(0.0013)
Young adult		-		-
1 child		0.0035***		0.0112
		(0.0006)		(0.0011)
2 children		-0.0024***		-0.0074
		(0.0005)		(0.0012)

3 children or more		-0.0043***		-0.0142
		(0.0007)		(0.0014)
aged 25-29		-0.0005		-0.0019
		(0.0004)		(0.0012)
aged 30-34		0.0001		0.0003
		(0.0004)		(0.0013)
aged 35-39		0.0010		0.0029**
		(0.0004)		(0.0012)
Work		-0.0005		-0.0015
		(0.0003)		(0.001)
Married/Com.-law		0.002***		0.0073***
		(0.0004)		(0.0011)
Number of obs	43232	42704	43232	42704
	21623	21386	21623	21386

Robust standard error are reported in parenthesis
p-val $\leq$ 0.01: ***, 0.01<p-val $\leq$ 0.05 :**, 0.05<p-val $\leq$ 0.1 :*
The variable Young adult was omitted because it perfectly predicted failure

This time, both the random effect and population models, with and without covariates do not allow the rejection of the null hypothesis that the treatment had an effect on the probability of giving birth for a woman. Furthermore, fewer variables have a statistically significant effect although those that do have the expected sign.

The next subsection will present the models that aim at determining the effect of the policies on the time lapse between the first and second births.

6.2 Results for time lapse between birth models:

Table 10 : Coefficients for random effect and population effect model: 1993-2003

	RE	PA
1994	0.7251***	0.3887***
	(0.0669)	(0.0845)
1995	1.4922***	0.9061***
	(0.1024)	(0.1174)
1996	2.1101***	1.1550***
	(0.1348)	(0.1443)
1997	2.7766***	1.5469***
	(0.1492)	(0.1540)
1998	3.3693***	1.8492***
	(0.1607)	(0.1645)
1999	3.6569***	1.7796***
	(0.1836)	(0.1789)
2000	4.2599***	2.0991***
	(0.1933)	(0.1850)
2001	4.9067***	2.4710***
	(0.2029)	(0.1810)
2002	5.3174***	2.4021***
	(0.2144)	(0.1979)
2003	5.9905***	2.7477***
	(0.2257)	(0.2064)
Quebec	-0.5186**	-0.4807*
	(0.2326)	(0.2729)
Treatment	**0.1413**	**0.1141**
	(0.1478)	**(0.1688)**
Highschool	-0.5121***	-0.2919
	(0.1768)	(0.1728)
College	0.2699*	0.1023
	(0.1412)	(0.1278)
University	0.1187	0.0447
	(0.1682)	(0.1728)
French	0.0635	0.1314
	(0.2485)	(0.2578)
Allophone	-0.134	-0.0996
	(0.2738)	(0.2515)
Rural	0.1316	0.0542
	(0.1002)	(0.1114)
Immigrant	-0.3624	-0.1997

	(0.2348)	(0.1927)
HH Revenue	-0.0276	0.0257
	(0.0325)	(0.0479)
Maj. Inc. earner	-0.0291	-0.0717
	(0.0785)	(0.0897)
Preschool aged	-0.013	-0.1435
	(0.0940)	(0.0956)
School aged	0.3372***	0.2964***
	(0.0852)	(0.0975)
Young adult	0.4348**	0.7562***
	(0.1937)	(0.2139)
aged 25-29	1.2340***	1.8314***
	(0.0701)	(0.0796)
aged 30-34	2.5409***	4.0362***
	(0.1026)	(0.1086)
aged 35-39	3.9855***	6.5447***
	(0.1345)	(0.1380)
Work	-0.0719	-0.0768
	(0.0671)	(0.0795)
Married/Com.-law	0.3672***	0.4918***
	(0.1108)	(0.1168)
Number of obs	8926	8926
Number of groups	4289	4289

Robust standard error are reported in parenthesis
p-val $\leq$ 0.01: ***, 0.01$<$p-val $\leq$ 0.05 :**, 0.05$<$p-val $\leq$ 0.1 :*

We can see from table 10 that there is no evidence the change in policies had an effect on the time lapse between the first and second children. Furthermore, the results seem to indicate that residents of Quebec have a smaller lapse of time between the birth of the first and second birth. Also, the time lapse increases with the age of the women. Also, respondents that are married or in a common-law partnership wait for 0.36 and 0.49 years respectively more than single respondents depending if we are using the random effect or the population average model.

Table 11 : Coefficients for random effect and population effect model: 2004-2008

	RE	PA
2004	2.4911***	0.4419***
	(0.4261)	(0.0593)
2005	3.1156***	0.7588***
	(0.4191)	(0.1130)
2006	3.8358***	1.1985***
	(0.4176)	(0.1449)
2007	4.5865***	1.6870***
	(0.4236)	(0.1520)
2008	5.0001***	1.8098***
	(0.4281)	(0.1686)
Quebec	0.2808	0.3220
	(0.3174)	(0.3473)
Treatment	**-0.2217**	**-0.2711**
	(0.1466)	**(0.1859)**
Highschool	0.4802	0.1965
	(0.5006)	(0.2813)
College	0.1768	0.1484
	(0.1446)	(0.1693)
University	0.0615	0.1003
	(0.1888)	(0.2068)
French	0.3571	0.2021
	(0.3428)	(0.3469)
Allophone	0.7618**	0.6327**
	(0.3115)	(0.2889)
Rural	0.0343	0.0631
	(0.1225)	(0.1487)
Immigrant	-0.1471	-0.0803
	(0.2635)	(0.2215)
HH Revenue	0.0143	0.005
	(0.0439)	(0.072)
Maj. Inc. earner	0.1288	0.1852
	(0.1309)	(0.1334)
Preschool aged	-0.0169	-0.0825
	(0.1272)	(0.1291)
School aged	0.4619***	0.5325***
	(0.1023)	(0.1340)
Young adult	0.6693**	0.8293**
	(0.2797)	(0.3637)
aged 25-29	1.2449***	1.8272***
	(0.1180)	(0.1281)

aged 30-34	2.7276***	4.2658***
	(0.1712)	(0.1674)
aged 35-39	3.9729***	6.4629***
	(0.1855)	(0.1898)
Work	0.0574	0.0181
	(0.0815)	(0.0931)
Married/Com.-law	0.1888	0.0213
	(0.1227)	(0.1470)
Number of obs.	4351	4351
Number of groups	2471	2471

Robust standard error are reported in parenthesis
p-val $\leq$ 0.01: ***, 0.01$<$p-val $\leq$ 0.05 :**, 0.05$<$p-val $\leq$ 0.1 :*

The results from the models including the second set of policies are similar to the results from the models including the 1997 modification in family policy. Once again, there is no evidence that the introduction of the enhanced parental leave policy and the child assistance benefit had any effect on the time lapse between the first and second birth among the respondents.

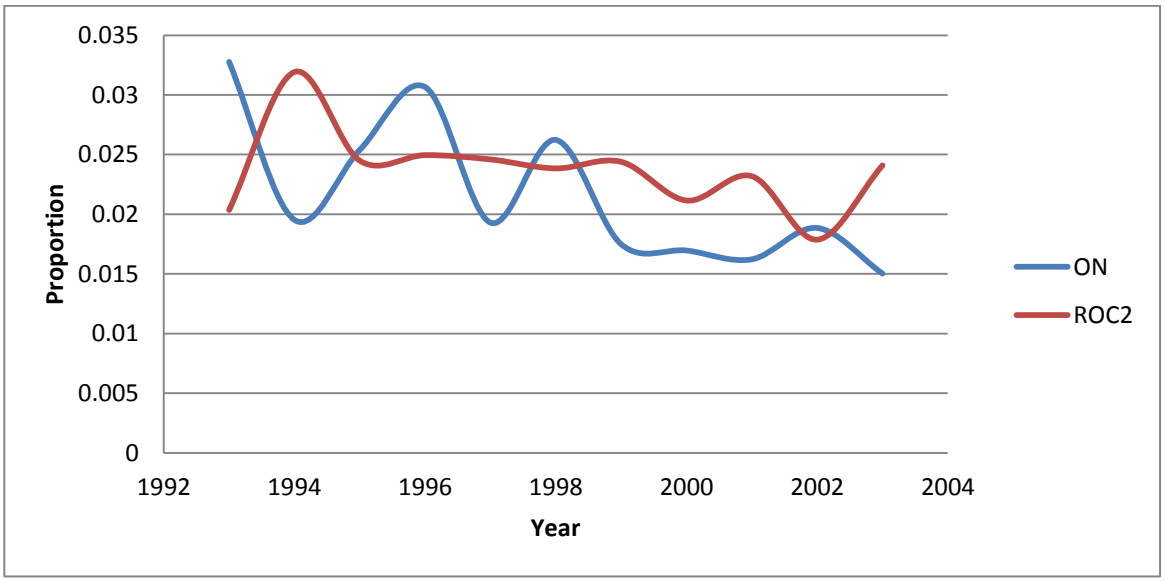
Additionally, in both the 1993-2003 and 2004-2008 models, it seems that the year dichotomous variables are highly statistically significant in both cases and that the effect is increasing with years. This might indicate that there are some problems with either the model or the data as all the effects seem to be captured by those. This last hypothesis is even further credible as the means presented in the summary statistics section indicates very high and unlikely numbers.

6.3 Robustness check:

To see if the analysis is robust, the analysis will be done a second time by taking another province instead of Quebec to see if the model will find some sort of effect. As the residents of the other province were not affected by the policies we should expect no effect following the introduction of the policies. If there are some effect on the fertility rate that are associated with the introduction of the policies, they might be caused confounding shocks rather than by the program. The province of Ontario was chosen to perform the placebo test because it is relatively similar to the province of Quebec. The control group will thus be called the Rest of Canada 2 which correspond to all remaining 9 provinces. Furthermore, there was no introduction of family policy as big as the ones introduced in Quebec. The Ontario government introduced the Ontario Child Benefit (OCB) policy in July of 2007. It was announced the same year it was introduced and consisted of a down payment of $250 per child that replaced all cash child-related benefits within Ontario's social assistance system except for those designed for housing needs of children. As the policy was introduced a few years after the ones in Quebec and that it was relatively small in comparison with the policies introduced in Quebec, we assume that the effect of this policy should not be picked up by the treatment variable in the model.

Starting with the 1997 change in policy, we get the following mean proportion of respondents that gave birth.

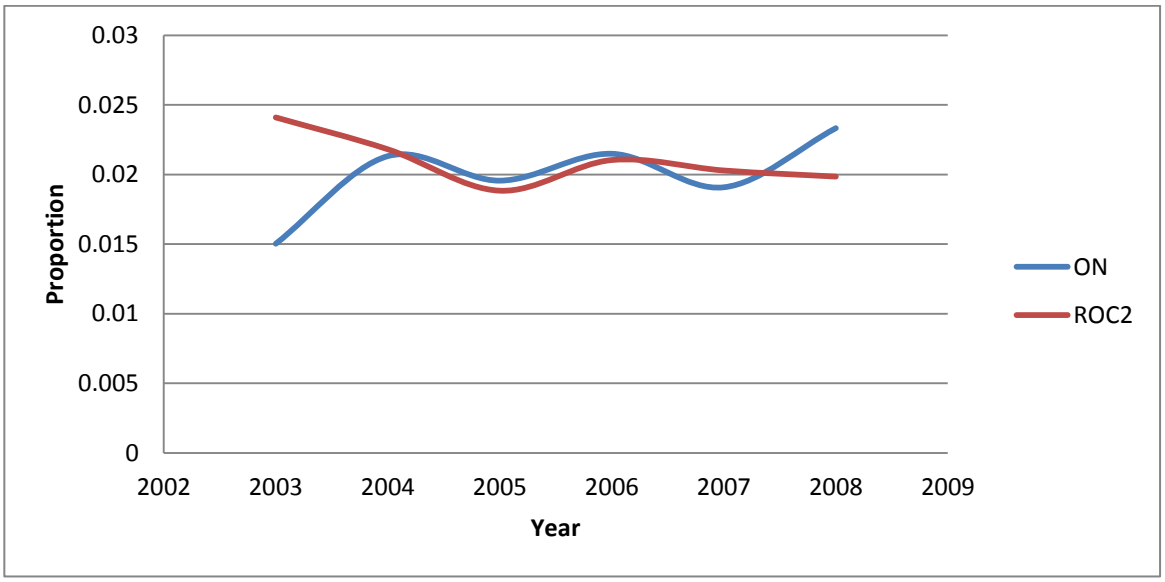
Figure 18 : Proportion of respondents that gave birth, Ontario and Rest of Canada 2, 1993-2003



* Women aged 15-49
Source: SLID and author's calculation

By looking at Figure 18, it looks like there are no common trends before the implementation of the 1997 policy although the proportion of women that gave birth in Ontario is declining in general as is the one in the ROC2. In then declines more steeply by the end of the 1990's.

Figure 19 : Proportion of respondents that gave birth, Ontario and Rest of Canada 2, 1993-2003



* Women aged 15-49
Source: SLID and author's calculation

Now by looking at the preceding graph for the years surrounding the second set of policies, it seems like there was no effect which is what was expected.

The results for Ontario will now be presented.

6.4 Results for Ontario

Table 12 : Marginal effect for random effect and population-average model,Ontario,1993-2003

	RE	PA
1994	0.0004	0.0011
	(0.0005)	(0.0014)
1995	0.0006	0.0017
	(0.0005)	(0.0014)
1996	0.0007*	0.0021
	(0.0004)	(0.0012)
1997	0.0000	-0.0003

	(0.0004)	(0.0012)
1998	0.0007	0.0021
	(0.0004)	(0.0013)
1999	0.0010**	.0029**
	(0.0004)	(0.0013)
2000	0.0005	0.0014
	(0.0004)	(0.0013)
2001	0.0003	0.0007
	(0.0004)	(0.0013)
2002	-0.0003	-0.0009
	(0.0004)	(0.0012)
2003	0.0006	0.0016
	(0.0004)	(0.0013)
Ontario	0.0010***	.0030***
	(0.0003)	(0.0009)
Treatment	**-0.0012*** **	**-.0036** **
	(0.0004)	**(0.0012)**
Highschool	-0.0001	-0.0003
	(0.0002)	(0.0007)
College	0.0001	0.0003
	(0.0002)	(0.0006)
University	-0.0007**	-.0019**
	(0.0003)	(0.0008)
French	0.0000	0.0001
	(0.0002)	(0.0007)
Allophone	-0.0001	-0.0004
	(0.0004)	(.0010)
Rural	-0.0001	-0.0001
	(0.0002)	(.0006)
Immigrant	-0.0008**	-.0024***
	(0.0003)	(.0009)
HH Revenue	-0.0006***	-0.0020
	(0.0002)	(0.0005)
Maj. Inc. earner	0.0003	0.0008
	(0.0002)	(.0007)
Preschool aged	-0.0068***	-.01977***
	(0.0006)	-0.0010
School aged	-0.0055***	-.0154***
	(0.0005)	(.0009)
Young adult	-0.0136***	-.0437***
	(0.0033)	(.0108)
1 child	0.0034***	.01034***
	(0.0004)	(.0007)

2 children	-0.0025***	-.0066***
	(0.0003)	(.0008)
3 children or more	-0.0061***	-.0183***
	(0.0006)	(.0011)
aged 25-29	0.0008)	.0022***
	(0.0003)	(.0008)
aged 30-34	0.0020***	.0058***
	(0.0003)	(.0008)
aged 35-39	0.0026***	.0074***
	(0.0003)	(.0008)
Work	0.0000	0.0002
	(0.0002)	(.0007)
Married/Com.-law	0.0022***	.0062***
	(0.0003)	(0.0007)
Number of obs	42704	42704
Number of groups	21386	21386

Robust standard error are reported in parenthesis
p-val $\leq$ 0.01: ***, 0.01<p-val $\leq$ 0.05 :**, 0.05<p-val $\leq$ 0.1 :*

The models indicate that after the introduction of the policy in Quebec there was a negative effect on the probability of giving birth in Ontario. However, as for the results from table 8, the proportion of respondents that gave birth did not quite follow parallel trends in the treatment and control groups meaning that we can't have a lot of confidence in the results presented and should be cautious in interpreting those results.

Table 13 :Marginal effect for random effect and population-average model, Ontario,2004-2008

	RE	PA
2005	-0.0001	-0.0006
	(0.0003)	(0.0011)
2006	0.0006	0.0014
	(0.0004)	(0.0013)
2007	0.0004	0.0006
	(0.0004)	(0.0013)
2008	0.0002	0.0001
	(0.00040)	(0.0013)

Ontario	0.0003	0.0009
	(0.0004)	(0.0013)
Treatment	-0.0006	-0.0020
	(0.0005)	(0.0017)
Highschool	-0.0008	-0.0023**
	(0.0004)	(0.0012)
College	-0.0003	-0.0010
	(0.0003)	(0.0009)
University	0.0004	0.0014
	(0.0003)	(0.0011)
French	0.0006	0.0019*
	(0.0004)	(0.0010)
Allophone	0.0016***	0.0054***
	(0.0005)	(0.0012)
Rural	0.000**	0.0025***
	(0.0003)	(0.0010)
Immigrant	0.0006	0.0022*
	(0.0004)	(0.0012)
HH Revenue	0.0000785*	0.0003**
	(0.0000)	(0.0001)
Maj. Inc. earner	0.0000	0.0000
	(0.0004)	(0.0011)
Preschool aged	-0.0064***	-0.0210***
	(0.0009)	(0.0014)
School aged	-0.0037***	-0.0112***
	(0.0006)	(0.0013)
Young adult	-	-
1 child	0.0036***	0.0112**
	(0.0006)	(0.0011)
2 children	-0.0024	-0.0074***
	(0.0005)	(0.0012)
3 children or more	-0.0043***	-0.0142***
	(0.0007)	(0.0014)
aged 25-29	-0.0005	-0.0018
	(0.0004)	(0.0012)
aged 30-34	0.0001	0.000
	(0.0004)	(0.0013)
aged 35-39	0.0010	0.0028
	(0.0004)	(0.0012)
Work	-0.0005	-0.0015
	(0.0003)	(0.0010)
Married/Com.-law	0.00234	0.0072***

	(0.0004)	(0.0011)
Number of obs	97537	97537
Number of groups	33178	33178

Robust standard error are reported in parenthesis
p-val $\leq$ 0.01: ***, 0.01$<$p-val $\leq$ 0.05 :**, 0.05$<$p-val $\leq$ 0.1 :*

The results from table 13 do not indicate that there was an effect on the probability of giving birth in Ontario following the change in policies in Quebec which was the expected result. This provides some confidence in the results obtained above for the 2005/2006 changes in Quebec family policies.

7. Limitation of the analysis

This analysis encountered several caveats making it difficult to reach valuables results out of the analysis. The first is that by trying to evaluate the effect on fertility resulting from the change in policy from the 1997 change in family policy, it is not possible to isolate the effect from the dismissal of the ANC and the introduction of the subsidized daycares. It is therefore impossible to extrapolate the effect seen in Quebec to another place as it is a unique case. We therefore could not have estimated the effect of implementing subsidized daycare on the fertility rate alone, cleaned from the effect of the ANC. The result from this can only be historical and although they are still useful, they cannot help future policy makers make better decision in the future. A similar problem, to a lesser extent, affected the result from the new parental leave policy as the Child Assistance Measure.

Furthermore, another problem affecting how the result from this paper can be extrapolate to other States is the fact that weights could not be used for the regression estimations. The sample used was therefore possibly not representative of the population making the result applicable to the sample only.

Finally, there was a small attrition problem within the dataset having for consequence that the average length that respondents stayed in the survey was about 3 years making it difficult to estimate fixed or random effect and to fully benefit from the longitudinal aspect of the survey.

8. Conclusion

This paper had two primary objectives. The first was to determine if the change in family policy that took place in 1997 with the abolishment of the ANC and the subsequent introduction of subsidized daycare as well as the 2006 introduction of enhance parental leave policy in Quebec had any effect on the probability of giving birth for Quebec's women and subsequently had an effect on the fertility rate. The second was to further explore how the introduction of those policies affected the fertility behavior of women by trying to determine how it affected the timing of births in the sense of the time lapse between births. The results obtained do not allow confirming that the change in policies had any significant effect on the probability of giving birth for women exposed to those policies. However, this paper brings some novelty as it is one of the few to use longitudinal data to study such an issue instead of census data for Quebec policies.

Furthermore, it proposes a model, although that no clear results where obtain, that allows to better understand how financial incentive and social policies affect the behavior of individuals toward their fertility decisions.

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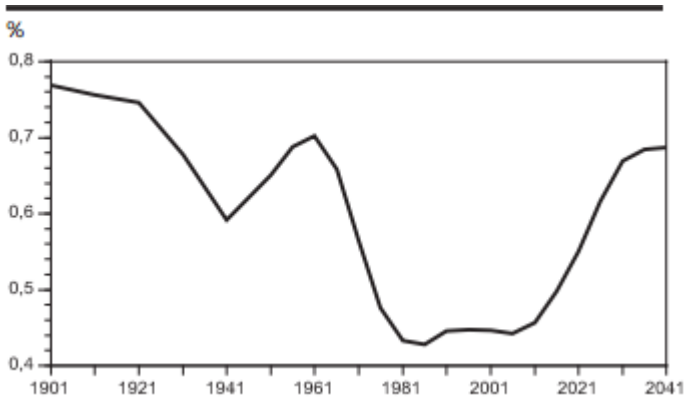
10. Annexes:

Figure 20 : Dependency rate, Quebec, 1901-2041



Source : Institut de la Statistique du Québec, Bilan 2006

Table 14 : Fertility rate per age group, Quebec, 1988-2008

	15-19	20-24	25-29	30-34	35-39	40-44	45-49
1988	15,6	70,5	113,6	62,4	18,1	2,8	0,1
1989	16,6	74,7	120,1	68,3	19,4	2,6	0,1
1990	18,1	79,7	128,4	75,3	22,0	2,8	0,1
1991	17,6	80,0	129,3	78,0	22,7	3,0	0,1
1992	18,3	77,1	129,6	81,2	23,6	3,3	0,1
1993	17,6	76,0	124,4	81,4	24,1	3,6	0,1
1994	17,6	75,2	123,3	82,6	25,3	3,6	0,1
1995	17,3	73,4	119,4	83,3	25,9	3,8	0,1
1996	16,6	72,8	119,0	82,6	27,3	3,8	0,2
1997	15,6	68,0	112,6	81,3	26,7	3,8	0,1
1998	14,8	64,6	109,5	79,2	26,5	4,1	0,1
1999	14,2	61,4	107,4	79,0	27,5	4,0	0,1
2000	13,3	60,0	105,8	79,5	27,3	4,3	0,1
2001	13,3	57,7	109,2	85,0	29,1	4,4	0,1
2002	12,2	55,2	106,0	86,7	29,8	4,5	0,2
2003	11,2	53,3	108,7	89,1	33,2	4,8	0,2
2004	10,3	50,1	105,9	93,9	34,6	5,0	0,2
2005	10,4	50,9	108,1	96,2	36,6	5,7	0,2
2006	9,7	51,7	113,7	106,5	41,3	6,2	0,2
2007	10,0	52,6	114,7	107,9	44,3	7,0	0,2
2008	10,0	53,6	117,2	111,2	46,8	7,5	0,3
2009	10,6	52,6	116,6	110,3	47,2	8,5	0,3
2010	9,1	49,5	113,2	110,1	48,5	8,8	0,3
2011	8,5	48,1	111,7	108,2	49,9	9,6	0,4

Source : Institut de la statistique du Québec (ISQ)

The fertility rate started declining for all age groups in the early 1990`s and started increasing again around 2006.

Table 15 : Total fertility rate per 1,000 females, Canadian Provinces, 2000-2008

	Newfoundland and Labrador	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
2000	1,252.20	1,516.30	1,373.60	1,387.20	1,431.20	1,476.20	1,797.30	1,760.10	1,638.40	1,383.60
2001	1,240.00	1,468.10	1,358.50	1,376.10	1,470.20	1,508.70	1,795.40	1,801.60	1,649.10	1,378.90
2002	1,305.70	1,473.30	1,371.80	1,390.10	1,460.50	1,474.10	1,801.00	1,824.10	1,689.40	1,376.90
2003	1,318.60	1,582.80	1,379.00	1,413.80	1,484.40	1,491.80	1,802.50	1,863.20	1,737.50	1,395.20
2004	1,299.10	1,530.60	1,403.70	1,398.70	1,477.10	1,502.60	1,773.60	1,856.10	1,739.00	1,387.10
2005	1,342.10	1,476.60	1,399.10	1,406.90	1,515.90	1,511.50	1,822.40	1,871.70	1,749.20	1,391.90
2006	1,384.20	1,563.70	1,400.20	1,457.50	1,616.50	1,521.80	1,870.40	1,921.90	1,815.00	1,408.00
2007	1,455.10	1,633.20	1,481.70	1,523.80	1,686.10	1,573.90	1,962.90	2,028.40	1,903.40	1,515.20
2008	1,577.70	1,728.00	1,541.30	1,587.90	1,738.10	1,584.80	1,959.50	2,048.50	1,917.30	1,505.40

Source: CANSIM Table 102-4505

Table 16 : Percentage growth of Total fertility rate per 1,000 females, Canadian Provinces, 2000-2008

	Newfoundland and Labrador	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
2001	-0.010	-0.032	-0.011	-0.008	0.027	0.022	-0.001	0.024	0.007	-0.003
2002	0.053	0.004	0.010	0.010	-0.007	-0.023	0.003	0.012	0.024	-0.001
2003	0.010	0.074	0.005	0.017	0.016	0.012	0.001	0.021	0.028	0.013
2004	-0.015	-0.033	0.018	-0.011	-0.005	0.007	-0.016	-0.004	0.001	-0.006
2005	0.033	-0.035	-0.003	0.006	0.026	0.006	0.028	0.008	0.006	0.003
2006	0.031	0.059	0.001	0.036	0.066	0.007	0.026	0.027	0.038	0.012
2007	0.051	0.044	0.058	0.045	0.043	0.034	0.049	0.055	0.049	0.076
2008	0.084	0.058	0.040	0.042	0.031	0.007	-0.002	0.010	0.007	-0.006

Source: CANSIM Table 102-4505 and author's calculation

Information on variables used:

For the age variables, six age categories of five years each were introduced as dummy variables that take the value of 1 if the respondent's age in within range of the category.

The labour force status variable was generated as a dichotomous variable such that it takes the value of one if the respondent was employed at some time during the year and zero otherwise. It will therefore take the value of one if the respondent was employed all year, employed part of the year but unemployed the rest of the year, employed part of the year but not in the labour force the rest of the year and if the respondent was employed part of the year, unemployed part of the year and not in the labour force the rest of the year.

To obtain the immigration variable, the variable Country of Birth 2nd grouping was recoded such that it takes the value zero if the respondent was born in Canada and 1 if she was born anywhere else.

All the education variables were recoded such that they take the value of one if the respondent as completed the level of education and zero otherwise.

Two set of marital status variables were created. The first was recoded such that it is a dichotomous variable that takes the value of one if the respondent is either in a common-law partnership.

The Quebec variable is a dichotomous variable takes the value of one if the province of residency as given by the province variable as the value Quebec. The variable Ontario is built the same way.

The interaction terms were created by interacting the Quebec variable with a dichotomous variable that takes the value of one if the years are after the introduction of the respective policy. The first interaction variable takes the value of one for the years after 1997 and the second interaction variable takes the value of one for the years greater or equal to 2006. This year was chosen to take into consideration the 2005 introduction of the child assistance payment. Another argument for the choice of 2006 instead of 2007 to take account of the gestation time in the process of having a child is that the policy was adopted in January of 2006 making it likely that individuals new about the incoming change in the legislation thus making them change their behavior a little before 2006 making the event of the births happen in the year 2006.

The variable for the rural was recoded so that it takes the value of one if the respondent lives in a rural area.

The dichotomous variable for the birth of a child had to be generated from the variable for the age of the youngest person in the household and will take the value of one when the youngest person in the household is zero years old. We therefore assume that an individual that is reported as being zero years old was born in the present year.

The ''have one child'' is a dichotomous variable that was generated using the number of children in the family and the birth variable. The variable will take the value of 1 if the

difference between birth and the number of children in the household is one. For example, is the number of children reported in the household is one and there was no birth that year, the variable will take the value of 1 as 1-0 = 1. However, if the value reported is for the number of children is one but this time there was a birth during the year, the variable will take the value of 0 as 1 – 1 = 0. Thus, the variable generated measures the number of children prior to the birth of a child. The variable ``have two children`` as well as '' had three children or more'' are built by the same method.

As stated in the text above. It is constructed by taking the difference between the age of a respondent during the year that she gave birth with the age she reported as the year that she had her first child. The reason we only consider the time between the first and second child is that there is no other indication of the age of the women when they had their infant. Furthermore, some observations had to be dropped when evaluating the models including this variable as some respondents reported an age greater than their current age as the value of their age when their first child was born.

Result from Probit estimation

Table 17 : Marginal effects for random effect and population effect model: 1993-2003

	RE	RE	PA	PA
1994	0.0011	0.0003	0.0022	0.0014
	(0.0015)	(0.0004)	(0.003	(0.0018
1995	0.0017	0.0006	0.0035	0.0024
	(0.0016)	(0.0005)	(0.0031	(0.0019)
1996	0.0018	0.0007*	0.0034	0.0029**
	(0.0013)	(0.0004)	(0.0026	(0.0016)
1997	-0.0006	-0.0000	-0.0016	-0.0004
	(0.0012)	(0.0004)	(0.0025	(0.0016)

1998	0.0001	0.0001	0.0000	0.0001
	(0.0013)	(0.0004)	(0.0026	(0.0016)
1999	0.0004	0.0003	0.0005	0.0012
	(0.0013)	(0.0004)	(0.0026	(0.0016)
2000	-0.0008	-0.0000	-0.0019	-0.0006
	(0.0013)	(0.0004)	(0.0026	(0.0016)
2001	-0.0013	-0.0002158	-0.0029	-0.0013
	(0.0013)	(0.0004)	(0.0026	(0.0016)
2002	-0.0026**	-0.0006*	-0.0056**	-0.0030*
	(0.0012)	(0.0003)	(0.0025	(0.0016)
2003	-0.0005	-0.0000	-0.0013	-0.0004
	(0.0013)	(0.0004)	(0.0026	(0.0016)
Quebec	-0.0003	0.0001	-0.0006	0.0003
	(0.0010)	(0.0004)	(0.0021	(0.0016)
Treatment	**0.0029****	**0.0010*****	**0.0062****	**0.0046*****
	(0.0012)	**(0.0004)**	**(0.0025**	**(0.0016)**
Highschool		-0.0001		-0.0002
		(0.0002)		(0.0008)
College		0.0000		0.0002
		(0.0002)		(0.0007)
University		-0.0005**		-0.0022**
		(0.0002)		(0.0009)
French		-0.0006*		-0.0027**
		(0.0003)		(0.0012)
Allophone		-0.0001		-0.0005
		(0.0003)		(0.0012)
Rural		-0.0001		-0.0003
		(0.0002)		(0.0008)
Immigrant		-0.0006**		-0.0026**
		(0.0003)		(0.0011)
HH Revenue		-0.0005***		-0.0022***
		(0.0001)		(0.0006)
Maj. Inc. earner		0.0002		0.0009
		(0.0002)		(0.0008)
Preschool aged		-0.0054***		-0.0227***
		(0.0007)		(0.0010)
School aged		-0.0044***		-0.0183***
		(0.0006)		(0.0010)
Young adult		-0.0103***		-0.0443***
		(0.0024)		(0.0090)
1 child		0.0029***		0.0129***
		(0.0004)		(0.0008)
2 children		-0.0020***		-0.0077***

		(0.0003)		(0.0009)
3 children or more		-0.0048***		-0.0196***
		(0.0007)		(0.0011)
aged 25-29		0.0007***		0.0027***
		(0.0002)		(0.0009)
aged 30-34		0.0017***		0.0071***
		(0.0003)		(0.0010)
aged 35-39		0.0021***		0.0090***
		(0.0003)		(0.0010)
Work		-0.00000		-0.0000
		(0.0002)		(0.0008)
Married/Com.-law		0.0018***		0.0077***
		(0.0003)		(0.0009)
Number of obs	97537	97537	97537	97537
Number of groups	33718	33718	33718	33718

Robust standard error are reported in parenthesis
p-val ≤ 0.01: ***, 0.01<p-val ≤ 0.05 :**, 0.05<p-val ≤ 0.1 :

Table 18 : Marginal effects for random effect and population effect model: 2004-2008

	RE	RE	PA	PA
2005	-0.0007	-0.0002	-0.0017	-0.0008
	(0.0008)	(0.0003)	(0.002)	(0.0013)
2006	0.0004	0.0003	0.0010	0.0011
	(0.0009)	(0.0003)	(0.0023)	(0.0015)
2007	-0.0002	0.0002	-0.0005	0.0005
	(0.0009)	(0.0003)	(0.0022)	(0.0015)
2008	-0.0004	-0.0000	-0.0008	-0.0002
	(0.0009)	(0.0003)	(0.0022)	(0.0015)
Quebec	0.0019	0.0007	0.0044	0.0029
	(0.0011)	(0.0005)	(0.0026)	(0.0023)
Treatment	**-0.0005**	**0.0000**	**-0.0013**	**0.0001**
	(0.0013)	**(0.0005)**	**(0.0033)**	**(0.0022)**
Highschool		-0.0006*		-0.0030**
		(0.0003)		(0.0014)
College		-0.0003		-0.0014
		(0.0002)		(0.001)
University		0.0003		0.0016
		(0.0003)		(0.0012)
French		-0.0001		-0.0001
		(0.0004)		(0.0019)
Allophone		0.0012***		0.0055***

		(0.0004)		(0.0014)
Rural		0.0006**		0.0030***
		(0.0003)		(0.0011)
Immigrant		0.0004		0.0022
		(0.0003)		(0.0014)
HH Revenue		0.0001*		0.0003*
		(0.0000)		(0.0002)
Maj. Inc. earner		-0.0000		0.0001
		(0.0003)		(0.0013)
Preschool aged		-0.0050***		-0.0236***
		(0.0012)		(0.0015)
School aged		-0.0029***		-0.0133***
		(0.0007)		(0.0015)
Young adult		-		-
1 child		0.0029***		0.0137***
		(0.0008)		(0.0013)
2 children		-0.0019***		-0.008***
		(0.0005)		(0.0013)
3 children or more		-0.0034***		-0.0153***
		(0.0008)		(0.0015)
aged 25-29		-0.0004		-0.0021
		(0.0003)		(0.0014)
aged 30-34		0.0000		0.0003
		(0.0003)		(0.0015)
aged 35-39		0.0008**		0.0035**
		(0.0004)		(0.0014)
Work		-0.0004		-0.0018
		(0.0003)		(0.0012)
Married/Com.-law		0.0018***		0.0085***
		(0.0005)		(0.0013)
Number of obs	43232	42704	43232	42704
Number of groups	21623	21386	21623	21386

Robust standard error are reported in parenthesis
p-val $\leq$ 0.01: ***, 0.01<p-val $\leq$ 0.05 :**, 0.05<p-val $\leq$ 0.1 :*