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The Impact of After-School Care on Maternal Income: Evidence from Canadian Administrative Data*

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Abstract

We study the impact of affordable after-school care programs on the labor market outcomes of mothers. Specifically, we analyze the effects of a policy implemented in Quebec (Canada) in 1998, which reduced the costs and expanded the availability of after-school care programs for primary school children. To identify the causal effects of the policy, we use tax return data and a triple difference strategy, where we compare mothers of primary school children in Quebec and the rest of Canada, before and after the policy, relative to women with no children. Ten years after the policy implementation, we find an average increase in after-school care use of at least 32 school days. This increase is associated with a significant 11% increase in labor income for mothers with primary school children, mainly driven by an increase at the intensive margin of labor supply.

Keywords: after-school care, maternal income, triple-difference
JEL Codes: J22, J13, J18

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1 Introduction

The gender earnings gap remains a persistent issue in developed countries such as Canada, arising from disparities in labor force participation, work hours, and wages between men and women (OECD 2012). Recent studies have shown that this gap is substantially driven by a woman-specific "child penalty", which refers to the fact that women experience a significant decrease in earnings after having a child while men do not (Paull 2008; Angelov, Johansson, and Lindahl 2016; Kleven, Landais, and Søgaard 2019; Kleven, Landais, and Søgaard 2021; Aaronson et al. 2021; Andresen and Nix 2022; Karademir, Laliberté, and Staubli, 2024). An implication is that the time required to take care of children can be detrimental to women's careers.

An extensive body of research investigates how access to affordable childcare options for preschool-aged children affects mothers' labor market outcomes (see for a review, Olivetti and Petrongolo 2017). At the same time, the effects of affordable childcare options around school hours for primary school-aged children are understudied. Yet, access to affordable childcare remains crucial when children enter primary school: since school hours are often not aligned with work schedules, childcare around school hours can facilitate the work-life balance of mothers, allowing mothers to work longer hours and pursue jobs that require greater flexibility, potentially leading to higher earnings.[1]

In this paper, we study the effects of providing low-cost after-school care for children in primary school on the employment income of mothers. Specifically, we assess the effects of a policy implemented in 1998 in the Canadian province of Quebec which increased the number of school-based after-school care programs for primary school children and decreased the fees for parents to \$5/day.

We identify the causal effects of the policy using a triple difference approach, comparing the evolution over time of the difference in outcomes between mothers with primary school-aged children and childless women in Quebec with the evolution over time of the difference between the same two groups in the other Canadian provinces where no similar policy was introduced during the same time period. Our analysis relies on an administrative dataset derived from tax returns: the Canadian Longitu-

1. It can do the same for fathers, but evidence shows that they do not suffer from a fatherhood penalty. Thus, we do not expect them to be affected substantially.

dinal Administrative Databank. This dataset offers several advantages that enable us to precisely estimate the effects of the policy: it provides reliable information on family characteristics, childcare expenses, and income, for 20% of the entire population of tax filers, and for several years before and after the policy implementation.

We estimate that the policy increased after-school care take-up by 32 days, on average, over the period extending from 1999 until 2008. The increase in after-school care use translated into higher earnings for mothers. Specifically, we find that the policy increased the average annual labor income of mothers with primary school children by 11%, 10 years after its introduction.

To assess the credibility of our estimates, we show that our results are robust to different specifications and inference methods. We also study the mechanisms through which the policy might be affecting income and show that the results are mainly driven by women working for longer hours or earning a higher hourly wage rather than more women getting employed after the policy.

We find that women with younger children are more affected by the policy and that those with higher opportunity costs in terms of forgone income benefit more. Finally, we conduct a cost-benefit analysis using the information on the amount of tax collected available in our data as well as the cost of the policy from an external source. We find that the increase in provincial taxes collected following the increase in maternal income covers the costs to the government, implying an infinite marginal value of public funds (Hendren and Sprung-Keyser 2020).

Previous research on the impact of affordable after-school care provision on the labor market outcomes of mothers is limited.[2] In Chile, Martínez and Perticará (2017) find positive effects of free after-school care on mothers' labor force participation. Closely related to our context, Nemitz (2015), Shure (2019), and Dehos and Paul (2021) study the expansion of subsidized after-school care programs in Germany. While the effects on maternal labor force participation are mixed, all studies concur that the expansion of after-school care did not lead to an increase in working hours among employed mothers.[3]

2. Felfe, Lechner, and Thiemann (2016) examine a policy that increased the availability of after-school care slots in Switzerland without subsidizing after-school care slots (around USD 40 per day).

3. Nemitz (2015) and Shure (2019) report an increase in maternal labor force participation following the reform, while Dehos and Paul (2021) are unable to replicate these findings.

Our contribution to this literature is threefold. First, we are the first to study the effects of Quebec's 1998 after-school care reform on mothers' labor market outcomes.[4] Second, we investigate the effects of affordable after-school care on mothers' labor market earnings, while prior research has primarily focused on labor supply measures. Studying the effect on labor market earnings has the advantage of summarizing all labor supply responses into one single outcome, as well as capturing changes in women's career opportunities that are not necessarily captured by traditional labor supply measures (e.g., by enabling them to pursue jobs that require greater flexibility and often come with higher hourly wages). Last, we rely on administrative data that covers 20% of the entire population of tax filers, which allows us to estimate the effects of affordable after-school care provision with greater precision compared to previous studies that rely on survey data (Nemitz 2015; Shure 2019; Dehos and Paul 2021).

More generally, our paper contributes to the extensive literature on the impacts of affordable childcare options on maternal labor market outcomes, which disproportionately focuses on childcare options for preschool-aged children (e.g., Baker, Gruber, and Milligan 2008; Lefebvre and Merrigan 2008; Cascio 2009; Havnes and Mogstad 2011; Haeck, Lefebvre, and Merrigan 2015; Givord and Marbot 2015; Bettendorf, Jongen, and Muller 2015; Nollenberger and Rodríguez-Planas 2015; Karademir, Laliberté, and Staubli, 2024). Our findings indicate that, like affordable childcare programs for preschool-aged children, low-cost after-school care programs are effective in improving mothers' labor market outcomes, and should not be overlooked.

Our paper also relates to the literature that examines the impact of school schedules on the labor market outcomes of mothers. For example, Contreras and Sepúlveda (2017) and Padilla-Romo and Cabrera-Hernández (2019) find positive effects of extended school hours on mothers' labor market outcomes. In addition, Duchini and Van Effenterre (2022) show that changing the school schedule in France, from 4 days of school to 5, led to a 3% increase in mothers' monthly wage.

The paper continues as follows. Section 2 gives context and introduces Quebec's after-school care reform. In Section 3, we describe the dataset and sample selection and provide descriptive statistics for our sample. Section 4 details our methodology to identify the causal effects of the reform. We present our main results in Section 5 along with some robustness checks. In Section 7, we study possible mechanisms for

4. He and Sayour (2020) study the effects of the same reform on children's development.

the effect of the policy on maternal income. In Section 8, we study heterogeneous effects by the youngest child's school grade, mother's age, partner's income, and area of residence. Section 9 presents a cost-benefit analysis of the after-school care policy. Lastly, Section 10 concludes.

2 Context

2.1 After-school Care Programs

In Quebec, primary school hours generally run from 8:00 a.m. to 12:00 p.m. and from 1:00 p.m. to 3:30 p.m. Since a typical work week includes 40 hours of work plus commuting time, school hours are not aligned with parents' work schedules. After-school care programs are thus motivated by the need to accommodate working parents and ensure the well-being of their children during non-school hours. School-based childcare programs typically operate from 7:00 am until school hours, during the lunchtime break, and after school until 6:00 p.m. (Mainville 2006). Since these programs also typically operate during lunchtime and before school hours, they are also known as before- and after-school care programs or out-of-school care programs.

Before the reform, only half of the primary schools offered after-school programs (923 providers in 1997–1998 out of roughly 1,700 schools), and less than 15% of primary-school children were enrolled in such programs (92,664 children in 1997–1998 out of roughly 640,000 children enrolled in primary school) (Mainville 2006; ASGEMSQ 2015).

2.2 The 1998 Reform

In September 1998, the Quebec Ministry of Education introduced a new policy regarding after-school programs. Under the new policy, any school governing board can request the creation of an after-school program in their school – if sufficient demand exists – at a fee of \$5/day.[5] The responsibility of running the programs lies with the school boards, who receive direct subsidies from the Ministry of Education.

If an after-school care program is available in a school, all children attending the school are eligible for the \$5/day child care, provided they attend the program a

5. The fee was later raised to \$7/day starting in 2004.

minimum of 3 days a week.[6] In case the program cannot accommodate all children, spots are allocated on a first-come-first-served basis.

According to the Ministry of Education, the reform significantly lowered the fee of after-school care paid by parents, although the exact cost prior to the policy implementation was not well-documented as there was no regulated after-school care program implemented prior to 1998. Moreover, as can be seen in Figure A1, the availability of after-school care programs increased sharply following the reform. The number of providers went from 923 in 1997–1998 to 1,613 in 2004–2005. Since then, most schools operate after-school care programs ($\approx$ 1,650 providers among 1,700 schools).

Meanwhile, although some school-based after-school care programs were available in other Canadian provinces, no government subsidies were offered in those provinces.

3 Data

3.1 Data Source

We use the Canadian Longitudinal Administrative Databank (LAD), an administrative dataset derived from tax returns, as the main data source in our analysis. Specifically, the LAD provides information on a 20% random sample of tax filers and their non-filing spouses in Canada from 1982 to 2020 and has variables that are useful for our study. First, it contains information on individuals' annual earnings, which is the focus of our analysis. Second, it provides information on formal childcare expenses, which are useful for studying the effect of the policy on after-school care take-up.[7] Third, the LAD provides socio-demographic data such as gender, number of kids, their corresponding age and year of birth, which are necessary to restrict our sample and conduct heterogeneity analysis. Finally, it contains information on taxes and transfers, which we employ to conduct a cost-benefit analysis.

The large sample size and the information contained in the LAD make it particularly suitable for our study. Moreover, the LAD spans several years before and

6. They also need to attend the program for at least two sessions a day, namely morning plus lunchtime, lunchtime plus afternoon or morning plus afternoon.

7. This information is collected since parents can receive a childcare expenses deduction to reduce the amount of tax they need to pay.

after the introduction of the policy, allowing us to credibly assess the plausibility of the common trend assumption and estimate the effects of the policy after its initial phase-in period.

The LAD is a representative sample of tax filers and their non-filing spouses. Women who do not file a tax return and who live with a spouse who does not file either are, thus, not included in our analysis. However, the percentage of such mothers is likely to be small. In fact, since Canadian residents are required to file a tax return to obtain various deductions and transfers, the tax filing rate is very high in Canada, especially for parents who can claim child benefits and other tax credits.

3.2 Outcomes of Interest

From this data, we construct three main outcomes of interest:

1. Annual childcare expenses: a variable that captures the total annual childcare expenses. We use this variable to investigate the effect of the reform on after-school take-up. Specifically, since the after-school policy decreased the fee paid by the parents, an increase in annual childcare expenses is an indication of an increase in take-up.

2. Annual childcare expenses greater than $900: a binary variable equal to 1 if the annual childcare expenses declared by the tax filer or spouse is greater than $900, and 0 otherwise. We use this variable to proxy for the use of after-school care. Specifically, since the parents' out-of-pocket cost for the after-school program was $5 per day, and since the school year consists of 180 days, having childcare expenses above $900 is likely an indication of using after-school care.

3. Annual employment income: a variable that captures the total income an individual received from formal employment during a year, before deductions. It excludes tips, gratuities, and self-employment income (i.e., it only includes income from T4 slips). We chose to exclude tips, gratuities, and self-employment income from our main outcome of interest since they can be misreported. The variable is expressed in 2021 Canadian dollars and is winsorized at the 99% percentile (by year and gender).

3.3 Sample

Our main sample consists of mothers with at least one child in primary school since they are the ones potentially affected by the policy. A child is considered in primary school if she is of the age of attending primary school during the entire tax year based on her year and month of birth. That is, a child is considered in primary school if she is of the age of starting Grade 2 to Grade 6 in September of the tax year. Importantly, we exclude mothers who also have a younger child – i.e., we only keep mothers whose youngest child is in primary school – since a universal childcare policy was implemented in Quebec around the same time for preschool-aged children, which affected maternal labor supply (Baker, Gruber, and Milligan 2008; Lefebvre and Merrigan 2008).

To conduct our triple difference analysis, we also include women who do not have any children declared in the tax returns. This group consists of childless women and mothers with children old enough to be living independently. We also distinguish between two geographical groups of women: women living in Quebec on December 31st of the tax year and women living in the other Canadian provinces excluding the territories (hereafter, rest of Canada) on December 31st of the tax year, as reported by the individual.

We limit our sample to women of working age (i.e., aged between 18 and 65 years) and to married and cohabiting women. We impose the latter restriction because a change in the National Childcare Benefit paid to low-income families in 1998 impacted single mothers' labor force participation differently across provinces, as shown in Milligan and Stabile (2007).

We restrict our time window to the years following 1992 since a change in the Child Tax Benefit in January 1993 increased the incentive for women to file a tax return, affecting the composition of our sample. We also restrict our analysis to the first 10 years after the implementation of the policy. Since the after-school policy was implemented in September 1998, it means that we observe 5 fiscal years before the policy implementation (1993–1997) and 10 fiscal years after the policy implementation (1999–2008).

Table A1 provides descriptive statistics of our sample before and after the implementation of the policy for the four groups of women used in our analysis (mothers

and childless women in Quebec and the rest of Canada). Our sample is composed of 9,859,900 observations in total (year × woman), among which 379,700 observations are affected by the policy (i.e., mothers in Quebec post-policy). Women in our sample are, on average, 46 years old. They are slightly older after the policy implementation than before, in both Quebec and the rest of Canada. Mothers have, on average, 2.1 declared children. These numbers are slightly smaller post-policy implementation.

4 Methodology

We use a triple difference methodology to identify the causal effects of the after-school care policy. Specifically, we compare the outcomes of mothers whose youngest child is in primary school residing in Quebec to the outcomes of their counterparts residing in the rest of Canada, before and after the policy implementation in 1998, controlling for the outcomes of women who do not have any declared children observed in the same year and in the same group of provinces. While mothers in the rest of Canada control for shocks that specifically affect women who have children in primary school across Canada, women without children control for Quebec-specific macro shocks. Our identification strategy relies on the assumption that, in the absence of the policy, the evolution of the difference in outcomes between women whose youngest child is in primary school and women with no declared children would have been the same in Quebec and in the other provinces ("common trend assumption").

We formally estimate the average causal effects of the policy during the first 10 years after its implementation by estimating the following triple difference regression model by Ordinary Least Squares:

$$\begin{aligned} y_{it} = \beta_0 &+ \beta_1(Qc_{it} \times \mathbb{1}(t \geq 1999) \times Primary_{it}) \\ &+ \beta_2(Qc_{it} \times \mathbb{1}(t \geq 1999)) + \beta_3(\mathbb{1}(t \geq 1999) \times Primary_{it}) \\ &+ \beta_4(Qc_{it} \times Primary_{it}) + \beta_5 Primary_{it} + \mathbf{Prov_{it}} + \mathbf{Year_t} + \epsilon_{it}, \end{aligned} \tag{1}$$

where y_{it} is the outcome of interest for woman i in year t; Qc_{it} a binary variable which takes the value of 1 if woman i lives in Quebec, and 0 otherwise; $\mathbb{1}(t \geq 1999)$ is a binary variable which takes the value of 1 if the outcome is observed after 1998, and 0 otherwise; $Primary_{it}$ is a binary variable which takes the value of 1 if woman i has a child in primary school, 0 otherwise; $Prov_{it}$ is a set of provincial fixed effects; and

$Year_t$ is a set of year fixed effects. In our main specification, we add a control for the age of the woman (age and age squared). We test the sensitivity of our results to alternative specifications in Section 6.

Standard errors are clustered at the provincial level to account for autocorrelation in residuals within each province (Bertrand, Duflo, and Mullainathan 2004). To address concerns over the limited number of clusters, we also compute p-values following the subcluster wild bootstrap procedure recommended by MacKinnon and Webb (2018). In addition, we perform a permutation test by re-estimating the event-study effects for each province. We discuss the results in Section 6.

Our coefficient of interest, β_1, measures the average effect of the policy on Quebec mothers whose youngest child is in primary school, regardless of after-school care take-up (i.e., the intent-to-treat effect). Note that we exclude the observations in 1998, the year of the policy introduction, to cleanly separate the pre- and post-policy periods. β_1 thus captures the average effect of the policy over 1999–2008.

To study the dynamic effects of the policy on take-up and labor market outcomes, as well as to investigate the plausibility of the common trend assumption, we also conduct an event study analysis by estimating the following equation by Ordinary Least Squares:

$$\begin{aligned} y_{it} = \alpha &+ \sum_{\substack{k=1993,\\ k\neq 1997}}^{2008} \gamma^k (Qc_{it} \times Primary_{it} \times \mathbb{1}(t=k)) \\ &+ \sum_{\substack{k=1993,\\ k\neq 1997}}^{2008} \delta^k (Qc_{it} \times \mathbb{1}(t=k)) \\ &+ \sum_{\substack{k=1993,\\ k\neq 1997}}^{2008} \theta^k (Primary_{it} \times \mathbb{1}(t=k)) \\ &+ \lambda (Qc_{it} \times Primary_{it}) + \rho Primary_{it} + \mathbf{Prov_{it}} + \mathbf{Year_t} + \epsilon_{it}, \end{aligned} \tag{2}$$

where the variables are defined as in equation (1) and $\mathbb{1}(t=k)$ is a binary variable which takes the value of 1 if the outcome is observed in year k, and 0 otherwise. Our vector of interest, γ^k, measures the effect of the policy on Quebec mothers whose youngest child is in primary school, regardless of after-school care take-up, in year k

relative to the reference year 1997. Since this model allows us to estimate the effects of the policy year-by-year, we do not exclude the observations in 1998. As with the canonical model, we add a control for the age of the woman (age and age squared), and standard errors are clustered at the provincial level.

5 Main Results

5.1 Take-up

We use total childcare expenses to investigate the effects of the policy on take-up. While a decrease in childcare expenses after the policy is not necessarily informative as it could be driven by a decrease in the expenses brought about by the high subsidization of the after-school care fee when spots are rather limited; a positive effect would provide evidence of an increase in take-up given the decrease in the cost of the service.

Figure 1a reports the estimates of the treatment effects on total childcare expenses. We find a negative effect of the policy on childcare expenses in 1999 and 2000, which is most likely due to the decrease in the after-school care fee. However, from 2003 onward, we find a positive and significant increase in total childcare expenses compared to 1997, providing evidence that the policy did increase after-school care take-up in the long run.

We can translate the changes in childcare expenses into changes in the number of days of after-school use. First, the results show that, on average, childcare expenses increased by around $127 from 1999 until 2003 (from -$53.1 in 1999 to $73.6 in 2003). Given that the price of a school-based after-school spot was $5 a day during that time, the $127 increase in expenses is equivalent to 25 additional days of after-school care on average per woman. Second, performing the same exercise over the period spanning from 2004 until 2008, when the daily rate was $7, we find an increase of 7 days of after-school care on average per woman. Thus, our analysis suggests that the after-school care policy increased take-up by at least 32 days on average over the period spanning from 1999 until 2008. This is a lower bound for the effects of the policy on take-up since it ignores the possible increase in take-up happening between 1997 and 1999, which we cannot estimate given the price change that occurred at that

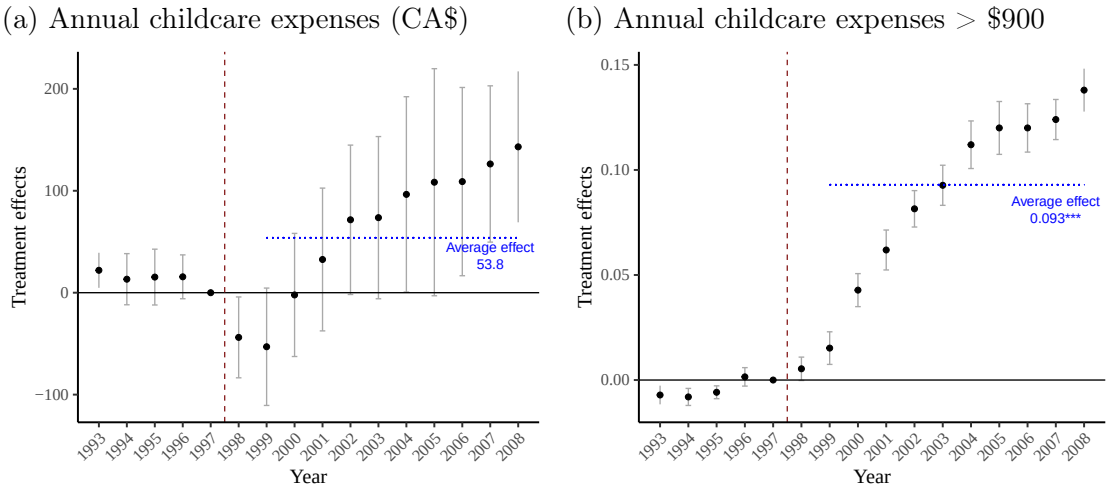

Figure 1: Dynamic Treatment Effects of the After-school Care Policy on Childcare Expenses

Notes: The figure plots the treatment effects of the after-school care policy on annual childcare expenses from 1993 until 2008. The average effects are estimated from the canonical model, excluding the year 1998 (equation 1). The dynamic effects are estimated from the event study regression using 1997 as the omitted year (equation 2). Grey error bars represent the 95% level confidence intervals. The corresponding values are reported in Table A2.

time. To put this number into perspective, there are 180 school days in a calendar year in Quebec. The 32-day increase in after-school care take-up thus implies that at least 18% of women were affected by the policy.[8][9]

We also estimate the effects of the policy on the share of parents reporting more than $900 in childcare expenses, which corresponds to full-time use under a $5 daily rate. The variable does not capture part-time use and thus cannot be used to understand the full extent of the effect on take-up. However, it might be helpful to understand the dynamic of the treatment effects, in particular in 1998 and 1999, when the change in take-up was unclear from Figure 1a. Results are presented in

8. In the extreme case that the increase in take-up is solely driven by women who change their usage from 0 to 180 days, the 32-day increase in after-school care take-up implies that 18% of women are affected by the policy. The opposite extreme case is that all women increased use by 32 days.

9. Using a representative sample of primary school children from the National Longitudinal Survey of Children and Youth (NLSCY), He and Sayour (2020) estimate an average treatment effect of the policy of 10 percentage points in the time period ranging from 1999 until 2005. Our estimated take-up effect is larger than the one found in He and Sayour (2020). This could be due to the fact that the NLSCY addresses the question of after-school care use to women who use it while working or studying and excludes women who use it for another reason, such as doing household chores.

Figure 1b. We find that the policy increased the share of parents reporting more than $900 in childcare expenses starting from 1999. This indicates an increase in take-up arising from the first year following the reform and confirms the fact that the decrease in expenses observed in Figure 1a is driven by the decrease in cost.[10] The dynamic of the effects from 1999 to 2008 follows the same pattern as the effect on total childcare expenses: it shows a progressive increase until 2005, with the increase slowing down after that.

5.2 Employment Income

We then formally estimate the average causal effects of the policy on income during the first 10 years after its implementation. Figure 2 presents the results. All income values are expressed in 2021 constant Canadian dollars.

Over the period of 1999–2008, we find that the policy significantly increased the average annual employment income of mothers with a child in primary school by $2,206. Mirroring the evolution in take-up suggested in the previous section, the effect of the policy on income progressively increased from 1999 to 2005, and then remained stable thereafter. We estimate that by 2008, the policy increased mothers' annual employment income by $3,360. Given that in 2008, women with a child in primary school in Quebec earned, on average, $33,802 in employment income, the $3,360 treatment effect implies a counterfactual income of $30,442 and thus corresponds to an 11% increase in maternal employment income.

The effect we measure is an intent-to-treat effect: the average effect of the policy on all mothers with children in primary school regardless of after-school care attendance. Using our earlier estimate of a 32-day increase in take-up, the $3,360 increase in annual employment income is equivalent to $105 extra income per additional day of use or a $19,000 annual increase in income for women who were induced to increase their use from 0 to 180 days (i.e., full-time use).

10. Figure 1b shows no significant effect in 1998, which is expected given that the policy was initiated in September 1998, and so parents taking up after-school care at that time would not spend more than $900.

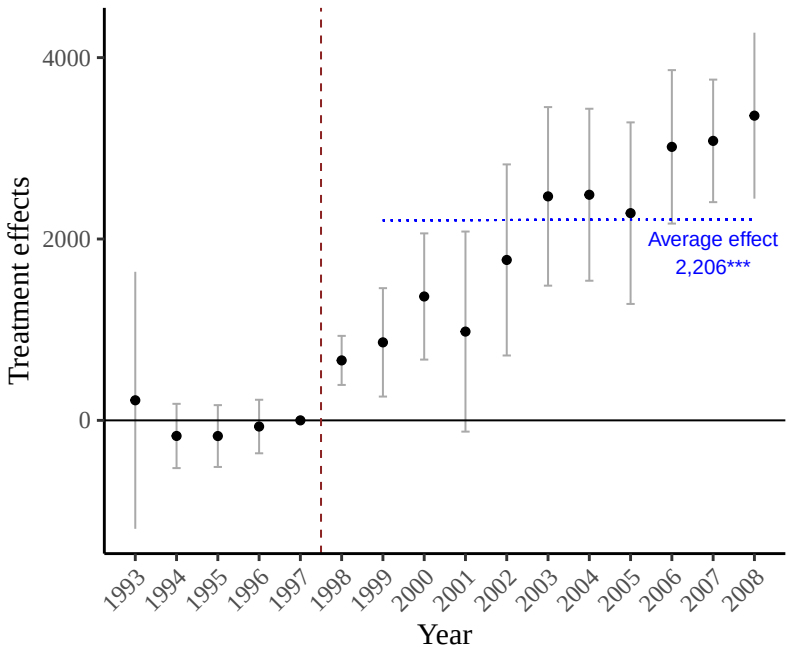

Figure 2: Dynamic Treatment Effects of the Policy on Annual Maternal Employment Income (CA$)

Notes: The figure plots the treatment effects of the after-school care policy on annual employment income from T4 slips of mothers from 1993 until 2008. The outcome is expressed in 2021 Canadian dollars. The average effect is estimated from the canonical model, excluding the year 1998 (equation 1). The dynamic effects are estimated from the event study regression using 1997 as the omitted year (equation 2). Grey error bars represent the 95% level confidence intervals. The corresponding values are reported in Table A2.

6 Robustness Checks

6.1 Plausibility of the Common Trend Assumption

Our identification strategy relies on the assumption that, in the absence of the policy, the evolution of the difference in outcomes between women whose youngest child is in primary school and women with no declared children would have been the same in Quebec and in the other provinces ("common trend assumption"). While we cannot test the validity of the common trend assumption directly, we can inspect its "plausibility" by checking that the outcomes of mothers in Quebec and those in the rest of Canada evolved similarly before the implementation of the reform, relative to women

who have no declared children in the tax returns. As we can see from Figures 1 and 2, prior to the reform, the triple difference estimates are not significantly different than zero and do not display any trend, providing support for the common trend assumption.

6.2 Alternative Specifications

To further support our results, we estimate the treatment effects under several alternative specifications. As a first step, we conduct our analysis by adding additional control variables into the regression (grade level of the youngest child, whether the family lives in an urban or rural area, and dummies for the total number of children). Second, we rerun our analysis excluding the province of Ontario, the largest province in Canada, from the control group. Lastly, we use a double differences methodology that compares mothers of primary school children in Quebec before and after the policy implementation relative to similar mothers in the rest of Canada.[11]

Figure A2 presents the average effects over 1999-2008 (i.e., from the canonical model) under the alternative specifications for our main outcomes of interest. We find similar results across all specifications. In particular, for income, the estimated average treatment effects are statistically significant and remarkably similar across all specifications.

6.3 Inference and Permutation Test

To address concerns over the small number of clusters, we report in Appendix Table A3, p-values following the subcluster wild bootstrap procedure recommended by MacKinnon and Webb (2018) when the number of treated clusters is very small (one in our case). Specifically, we subcluster at the regional level and present both restricted and unrestricted wild bootstrap p-values. Both the restricted and unrestricted wild bootstrap p-values are very close to the province-clustered asymptotic p-values.

In addition, we perform a permutation test by re-estimating the event-study coefficients from equation 2, assigning each province as the treated province. Figure

11. Although the double and triple differences give similar results, we prefer the triple differences model over the double differences model because it leads to more precise estimates and is more robust to alternative specifications. The full set of results with the double differences model is available upon request.

3 presents the results. In Panel (a), we present the estimated coefficients for all provinces, and in Panel (b), we exclude two small provinces that show strong differential trends before 1998 (Newfoundland and Labrador and Prince Edward Island). The figure shows that the actual estimated treatment effects for Quebec are outliers, implying randomized-inference p-values equal to 0.10 or less.

Figure 3: Permutation Graph for the Treatment Effects on Annual Maternal Employment Income (CA$)

Notes: The figure plots the event-study coefficients from equation 2, assigning each of the ten provinces as the treated province. The bold black line represents the actual estimated effects for Quebec, while each of the colored lines represents one province. Panel (a) presents the estimated coefficients for all provinces. Panel (b) restricts the results to provinces that show no strong differential trends before 1998 (i.e., excluding Newfoundland and Labrador and Prince Edward Island).

6.4 Universal Childcare Reform for Pre-school Children

Our sample excludes mothers with children under 6 since they can potentially be affected by a universal childcare reform implemented in Quebec in 1997 for children under 5. However, we do not exclude mothers whose children were eligible for the universal childcare program in the past. Thus, there are concerns that our results might be driven by long-lasting effects of the universal childcare program on maternal income once the child is in primary school. We believe that this is not the case for three reasons.

First, we observe some effects on income starting as early as 1998. However, up to 2001, only a small fraction of women in our sample were ever affected by the universal childcare reform, and women who were, were only affected for one year, thus are unlikely to be driving the results.[12] It is only starting from 2010 that all women in our sample were affected by the universal childcare program from the birth of their youngest child.

Second, while the pattern of treatment effects on income over time is hard to reconcile with the timing of the introduction of the universal childcare program, that pattern follows the same dynamic as the observed direct effects on childcare expenses. In fact, the treatment-on-the-treated effects implied by the ratios of the effects on income to the effects on expenses are remarkably stable over time. This suggests a mediating link between the effect on childcare expenses and the effects on income.

Lastly, we re-estimate in Table A4 our results while restricting the sample to mothers whose children were never eligible for the universal childcare program in the past and find very similar implied treatment-on-the-treated effects to those found using the main sample. Note that the restriction means that we exclude Quebec mothers with children in Grade 1/2 in 2000, in Grade 1/2 and Grade 2/3 in 2001, and so on up until 2004 when all Quebec mothers are excluded (and thus, the treatment effects cannot be estimated). The table shows similar effects for the restricted sample as the ones found for the main sample from 1998 until 2000. Beyond 2000, we find smaller effects when correcting for the universal childcare exposure compared to the initial sample. It is true for both the effects on income and childcare expenses, such that the ratios of the effects on income to the effects on expenses, i.e., the treatment on the treated, are very similar to the ones found using the main sample. The smaller effects beyond the year 2000 are likely due to the fact that our sample consists mainly of women with older children. We anticipate less need and more resistance to attending after-school care among this group, resulting in a smaller impact of the reform. This is confirmed by our heterogeneity analysis by grade level presented in Table 2.

12. Specifically, in 1998 and 1999, no women were affected in the past, in 2000 and 2001, at most 20% of the women in our sample were affected for one year.

7 Mechanisms

The increase in income can reflect different changes in the labor market outcomes of mothers, such as an increase in labor force participation, working hours, or hourly wage.[13] In Table 1, we report the effects of the policy on the probability that a mother is employed at one point during the year and on income for women who work (i.e., who report some employment income during the year).[14]

Table 1: Treatment Effects of the Policy on Additional Labor Market Outcomes

Variables	Any employment income (1)	Employment income cond. on working ($CA) (2)
Qc × Primary × Post	0.009**	2,407***
	(0.004)	(398)
Sample size	9,260,100	6,088,800
Counterfactual mean	0.727	38,147

Notes: The table reports the average treatment effects of the after-school care policy on the probability that a mother is employed at one point during the year and on income for women who work (i.e., who report some employment income during the year). The effects are estimated from the canonical model, excluding the year 1998 (equation 1). Robust standard errors clustered at the provincial level in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% respectively. Counterfactual values are obtained by subtracting the estimated treatment effect from the observed outcome mean for treated women (mothers in Quebec).

We estimate that the policy increased the probability that a mother is employed at one point during the year by 0.9 percentage points, which is significant at the 5% level. It suggests that some of the increase in income we observe might come from an increase at the extensive margin of the labor supply of mothers. At the same time, we observe a substantial increase in income for women who work, suggesting that the intensive margin of labor supply and/or the hourly wage of women might have been affected by the policy as well. However, since there is a small increase in employment following the policy, mothers who work are likely to differ before and after the policy,

13. A change in hourly wage might arise if the policy allows women to pursue jobs that require greater flexibility, ultimately leading to higher earnings.

14. We do not directly observe wages and hours worked in our tax data.

introducing a potential selection bias when estimating the effects of the policy on income for working mothers.

Under the assumption that women who were induced to work earn the same, on average, as women who work regardless of the reform, we can use those results to decompose the total effect on annual employment income into an extensive margin effect (i.e., driven by women induced to work some time) and an intensive margin effect (i.e., driven by changes in work hours and/or hourly wage). The decomposition indicates that 79% of the total effect on income is driven by the intensive margin, 16% by the extensive margin, and the rest by the interaction between the two. See Appendix C for details on the calculation.

8 Heterogeneous Effects

The after-school care policy could induce heterogeneous responses in care take-up and employment income depending on the youngest child's grade in primary school. We expect the take-up to be larger for younger children and hence expect a larger income effect for the mothers of this group. Results in Table 2 support our hypothesis. Both take-up proxies are positive; however, the effects are much stronger and larger in magnitude for children in Grade 1/Grade 2. The effects decrease the older the child. We find similar effects on maternal income: a significant increase in income across all mothers, irrespective of their youngest child's grade level, but a greater effect is seen for mothers with younger children.

In addition to the child's grade level, the policy responses might differ depending on the mother's socioeconomic characteristics. For this reason, we first study heterogeneous effects by maternal age. Specifically, we compare mothers aged 39 years old and above to those below. Moreover, since mothers' labor supply decisions are closely related to their household income and economic status, this policy could induce differential behavior for mothers from wealthier as opposed to poorer households. For this reason, we consider heterogeneous effects by partner income (above or below the median). Lastly, we study the presence of heterogeneous effects by area of residence, specifically we compare mothers residing in urban areas vs rural areas. Table 3 shows that more economically advantaged women – namely, those who are older, have partners with higher incomes, and live in urban areas – benefit from larger increases in

Table 2: Heterogeneity of the Average Treatment Effect
by Grade Level of the Youngest Child

Sample	Annual childcare expenses ($CA) (1)	Annual childcare expenses > $900 (2)	Annual employment income ($CA) (3)
Grade 1/2	104.0*	0.132***	2,789***
	(52.2)	(0.006)	(519)
Grade 2/3	60.0	0.115***	2,348***
	(55.2)	(0.007)	(576)
Grade 3/4	37.0	0.095***	2,121***
	(51.6)	(0.006)	(538)
Grade 4/5	22.9	0.073***	1,985***
	(44.8)	(0.005)	(498)
Grade 5/6	2.0	0.039***	2,041***
	(41.2)	(0.006)	(394)

Notes: The table reports the average treatment effect of the after-school care policy on the main outcomes of interest, by grade level of the youngest child. Each average effect is estimated from the canonical model, excluding the year 1998 (equation 1), for each sub-sample. Sample "Grade X/Y" refers to the sample of women whose youngest child is, theoretically, in Grade X at the beginning of the calendar year and in Grade Y at the end, based on the child's date of birth. Robust standard errors clustered at the provincial level in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% respectively.

their employment income in response to the after-school care policy. These findings suggest that the policy may have a limited effect on mitigating intra-gender inequality.

9 Cost-Benefit Analysis

We finally conduct a cost-benefit analysis from the government's perspective. The policy was funded by the Quebec government (Ministère de l'Éducation et de l'Enseignement supérieur (MELS)). The costs of the policy for the government are reported in Table A5. The government funding increased from $65 million in 1998–1999 to $186 million in 2003–2004, but then decreased to $116 million as parents' contributions were raised to $7 per day. Based on the assumption that the amounts observed in 2004–2005 remained constant until 2008, the total cost of the policy for the Quebec government from 1999 to 2008 was around $1.28 billion (an average of

Table 3: Heterogeneity of the Average Treatment Effect
by Socio-Economic Characteristics of the Woman

Difference in treatment effect	Annual childcare expenses (CA$) (1)	Annual childcare expenses > $900 (2)	Annual employment income (CA$) (3)
Age above vs. below	33.7***	0.019***	3,549***
39 years old	(9.2)	(0.004))	(652)
Partner's income above	-39.9**	0.026***	1,340***
vs. below median	(16.2))	(0.002)	(313)
Urban vs. rural	-36.5	0.058***	1,928**
	(34.2)	(0.003)	(723)

Notes: The table reports differences in the average treatment effect of the after-school care policy on the main outcomes of interest, between several socio-economic groups. Each difference in treatment effect is estimated from the canonical model (equation 1), interacting the treatment variables with a dummy for the subgroup of interest. Robust standard errors clustered at the provincial level in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% respectively.

$128 million per year).

On the other hand, the increase in income for mothers implies an increase in taxes collected by the government. Using the same triple difference approach, we estimate the impact of the policy on the provincial taxes collected from mothers with a child in primary school. Table A6 shows the average treatment effect on annual taxes collected since the introduction of the after-school care policy and until 2008, as estimated from equation (1). Total provincial taxes increased, on average, by $385 per woman and per year. During the period from 1999 to 2008, approximately 400,000 women in Quebec had a child in primary school, such that the after-school care policy is estimated to have increased the amount of taxes collected by the provincial government by approximately $1.54 billion from 1999 to 2008 (an average of $154 million per year).

In summary, according to our analysis, the additional taxes derived from the after-school care policy by the provincial government roughly covered its costs during the period from 1999 to 2008 ($1.28 billion in costs vs. $1.54 billion in additional taxes), making it neutral to the government. The increase in income for the women benefiting from the policy could also lead to reduced government transfers, such as social assistance and child benefits, which could further increase the benefits of the

policy to the government. In addition, it is important to note that the policy has some private benefits (increase in maternal income) as well as some benefits to the federal government through additional taxes collected (Table A6). This implies an infinite marginal value of public funds (Hendren and Sprung-Keyser 2020).

10 Conclusion

This paper studies the effect of access to subsidized after-school childcare programs in primary schools on after-school care use and maternal income. We exploit a unique policy introduced in Quebec in 1998, which increased the provision of low-cost after-school care for primary school-aged children, and apply a triple difference methodology to the Canadian Longitudinal Administrative Databank, where we compare mothers of primary school children in Quebec and the rest of Canada, before and after the policy, relative to women with no reported children in the tax files.

We find that formal after-school care use, proxied by the total childcare expenses and the share of mothers claiming childcare expenses above $900, increased because of the new policy. Specifically, we estimate that the policy increased after-school care take-up by 32 days on average. We also find that the policy led to a significant increase in maternal annual employment income, reaching $3,360 by 2008, an 11% increase from the income they would have received in the absence of the policy. We show that these results are robust to different specifications, clustering methods, and sample definitions. We also show that our results are not driven by the long-term effects of Quebec's universal childcare policy.

Considering the mechanisms, we find that the effects are mainly driven by an increase in work hours and hourly wage rather than an increase in employment. Heterogeneity analysis shows that the effects are mainly driven by mothers with children in lower grade levels, older women, women whose partners' income is above the median, and those living in urban areas. Lastly, from the government's perspective, we show that additional provincial taxes generated by the policy cover its costs.

Although the literature has disproportionately focused on the effects of affordable childcare options for preschool-aged children on maternal labor market outcomes, our findings indicate that access to affordable childcare remains crucial when children enter primary school.

Research on the relationship between child-care options and labor market responses for mothers with school-aged children is still scarce. Although our empirical analysis adds to this literature, it relies on a specific policy introduced in Quebec, which may or may not be applicable to other provinces and/or other countries. Future research could consider devising a structural model that builds on mothers' behavioral choices of child-care options and labor supply, which might prove helpful for policy analysis.

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Appendix A: Additional Tables

Table A1: Descriptive Statistics

	Mothers, youngest child in primary school				Women without declared children			
	Quebec		Rest of Canada		Quebec		Rest of Canada	
	1993–1997	1998–2008	1993–1997	1998–2008	1993–1997	1998–2008	1993–1997	1998–2008
Age	38.66	39.75	38.95	40.11	45.26	46.60	44.90	46.37
	(4.68)	(5.00)	(5.11)	(5.24)	(13.87)	(13.65)	(13.84)	(13.60)
Employment income (2021 CA$)	23,100	29,800	25,200	30,400	19,600	23,200	23,600	27,400
	(25,900)	(30,600)	(27,900)	(32,300)	(24,600)	(27,800)	(27,800)	(32,100)
Some employment income	0.669	0.736	0.693	0.729	0.587	0.634	0.625	0.649
	(0.471)	(0.441)	(0.461)	(0.445)	(0.492)	(0.482)	(0.484)	(0.477)
Number of children	2.10	2.09	2.24	2.14				
	(0.84)	(0.88)	(0.92)	(0.93)				
Childcare expenses (CA$)	330	650	380	680				
	(890)	(1,190)	(1,120)	(1,790)				
Number of observations	167,500	379,700	546,100	1,247,200	529,300	1,366,700	1,630,100	3,993,200

Notes: The table reports the descriptive statistics for our sample, by province of residence, time period, and group. The 1993–1997 period matches the pre-policy years. The 1998–2008 period matches the post-policy years. The standard deviations are reported in parentheses.

Table A2: Treatment Effects of the Policy on the Main Outcomes of Interest

Variables	Annual childcare expenses (CA$) (1)	(2)	Annual childcare expenses > $900 (3)	(4)	Annual employment income (CA$) (5)	(6)
Qc × Primary × 1993	22.0**		-0.007**		221	
	(8.8)		(0.002)		(723)	
Qc × Primary × 1994	13.2		-0.008***		-172	
	(12.8)		(0.002)		(181)	
Qc × Primary × 1995	15.3		-0.006***		-173	
	(14.0)		(0.002)		(174)	
Qc × Primary × 1996	15.6		0.001		-68	
	(11.0)		(0.002)		(151)	
Qc × Primary × 1998	-43.9*		0.005*		661***	
	(20.2)		(0.003)		(138)	
Qc × Primary × 1999	-53.1		0.015***		860**	
	(29.4)		(0.004)		(305)	
Qc × Primary × 2000	-2.2		0.043***		1,366***	
	(30.8)		(0.004)		(355)	
Qc × Primary × 2001	32.6		0.062***		979	
	(35.7)		(0.005)		(563)	
Qc × Primary × 2002	71.5*		0.082***		1,769***	
	(37.4)		(0.004)		(538)	
Qc × Primary × 2003	73.6		0.093***		2,470***	
	(40.6)		(0.005)		(502)	
Qc × Primary × 2004	96.5*		0.112***		2,488***	
	(48.9)		(0.006)		(484)	
Qc × Primary × 2005	108*		0.120***		2,285***	
	(56.8)		(0.006)		(511)	
Qc × Primary × 2006	109**		0.120***		3,016***	
	(47.1)		(0.006)		(432)	
Qc × Primary × 2007	126**		0.124***		3,082***	
	(39.1)		(0.005)		(345)	
Qc × Primary × 2008	143***		0.138***		3,360***	
	(37.8)		(0.005)		(467)	
Qc × Primary × Post		53.8		0.093***		2,206***
		(48.5)		(0.006)		(494)
R-squared	0.079	0.079	0.125	0.124	0.113	0.113
Sample size	9,859,900	9,260,100	9,859,900	9,260,100	9,859,900	9,260,100
Counterfactual mean	596		0.163		27,594	

Notes: The table reports the dynamic treatment effects of the after-school care policy on the main outcomes of interest from 1993 until 2008. The effects in Columns 1, 3, and 5 are estimated from the event study regression using 1997 as the omitted year (equation 2). The effects in Columns 2, 4, and 6 are estimated from the canonical model, excluding the year 1998 (equation 1). Robust standard errors clustered at the provincial level in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% respectively. Counterfactual values are obtained by subtracting the estimated treatment effect from the observed outcome mean for treated women (mothers in Quebec).

Table A3: *P*-values for the Average Treatment Effect (1999-2008) on the Main Outcomes of Interest

Method	Annual childcare expenses (CA$) (1)	Annual childcare expenses > $900 (2)	Annual employment income (CA$) (3)
Conventional cluster-robust	0.296	0.000	0.001
Subcluster wild bootstrap (restricted)	0.702	0.024	0.027
Subcluster wild bootstrap (unrestricted)	0.699	0.007	0.023

Notes: The table reports *p*-values for the canonical average treatment effect computed from equation 1 on the main outcomes of interest. Conventional *p*-values are based on the cluster-robust standard errors reported in Table A2 and the $t(9)$ distribution. Subcluster wild bootstrap *p*-values follow the procedure described in MacKinnon and Webb (2018), subclustering at the regional level. We use 9,999 replications and the six-point distribution proposed by Webb (2023).

Table A4: Treatment Effects Restricting to Women with no Child Affected by the Universal Childcare Program in the Past

Variables	Annual childcare expenses (CA$) (1)	Annual childcare expenses > $900 (2)	Annual employment income (CA$) (3)
Qc × Primary × 1993	29.4**	-0.005**	166
	(9.3)	(0.002)	(726)
Qc × Primary × 1994	20.9	-0.006**	-229
	(13.1)	(0.002)	(184)
Qc × Primary × 1995	24.0	-0.004**	-239
	(14.5)	(0.001)	(176)
Qc × Primary × 1996	19.6	0.002	-98
	(11.1)	(0.002)	(150)
Qc × Primary × 1998	-49.9**	0.004	707***
	(20.2)	(0.003)	(142)
Qc × Primary × 1999	-60.3*	0.013***	915**
	(29.4)	(0.004)	(309)
Qc × Primary × 2000	-20.4	0.028***	1,115**
	(27.7)	(0.004)	(364)
Qc × Primary × 2001	3.9	0.032***	409
	(30.2)	(0.005)	(590)
Qc × Primary × 2002	18.6	0.035***	1,044
	(28.0)	(0.005)	(573)
Qc × Primary × 2003	4.7	0.024***	1,801**
	(27.0)	(0.005)	(554)
R-squared	0.079	0.112	0.115
Sample size	9,620,900	9,620,900	9,620,900

Notes: The table reports the dynamic treatment effects of the after-school care policy on the main outcomes of interest from 1993 until 2003. The effects are estimated from the event study regression using 1997 as the omitted year (equation 2). The sample is restricted to women with no child affected by the universal childcare program in the past. Robust standard errors clustered at the provincial level in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% respectively.

Table A5: After-school Care Programs Funding by Parents and the Government

	(1) Parents		(2) MELS		(3) Total
Year/Contributions	($)	(%)	($)	(%)	($)
1998–1999	63,823,760	49.7	64,671,705	50.3	128,495,465
1999–2000	84,723,100	47.3	94,543,044	52.7	179,266,144
2000–2001	105,148,120	43.4	137,337,761	56.6	242,485,881
2001–2002	119,370,790	42.8	159,513,974	57.2	278,884,764
2002–2003	129,517,080	42.7	173,093,057	57.3	302,610,137
2003–2004	134,726,900	42.0	185,833,804	58.0	320,560,704
2004–2005	182,437,486	61.1	116,298,454	38.9	298,735,940

Notes: Column 1 reports the share of after-school care funding paid by parents (in $ and %) from the years 1998–1999 until 2004–2005. Column 2 reports the share paid by the Ministère de l'Éducation et de l'Enseignement supérieur (MELS). The total cost is reported in Column (3).

Table A6: Treatment Effects of the Policy on Annual Taxes Paid by the Woman

Variables	Total annual taxes ($CA) (1)	Annual federal taxes ($CA) (2)	Annual provincial taxes ($CA) (3)
Qc × Primary × Post	704***	319***	385***
	(105)	(28)	(80)
Sample size	9,260,100	9,260,100	9,260,100

Notes: The table reports the average treatment effects of the after-school care policy on the amount of annual taxes paid by the woman. The effects are estimated from the canonical model, excluding the year 1998 (equation 1). Robust standard errors clustered at the provincial level in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% respectively.

Appendix B: Additional Figures

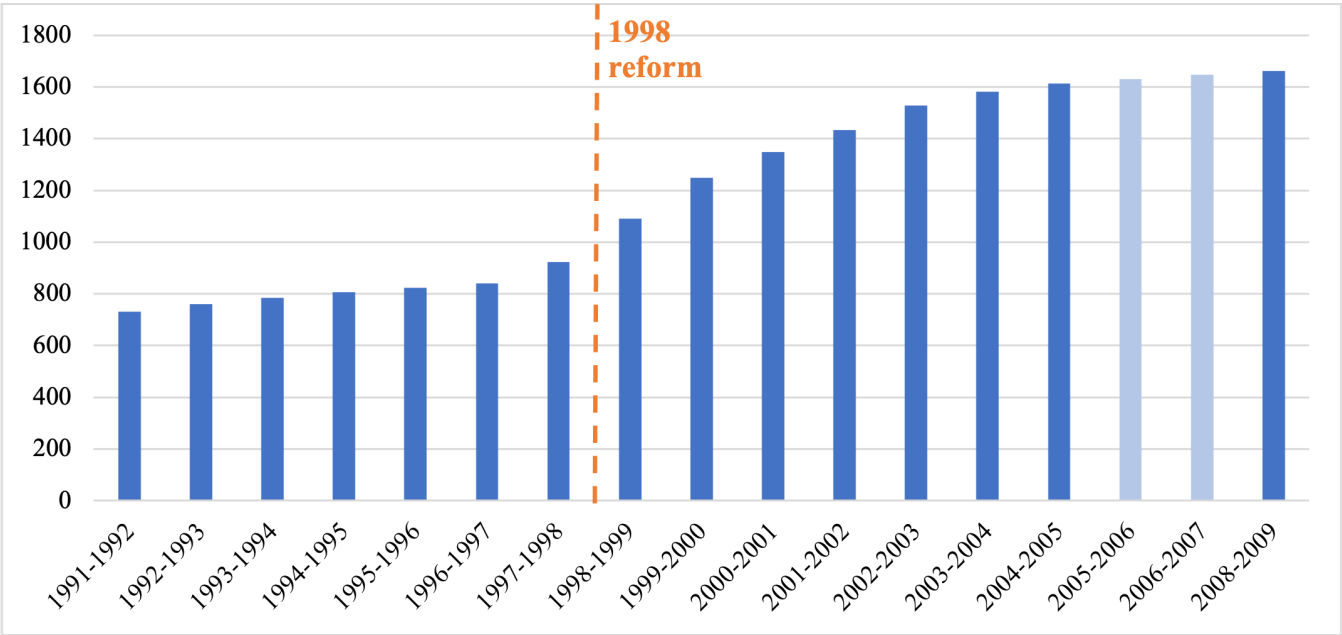

Figure A1: Number of School-based After-school Care Providers from 1991–1992 to 2008–2009

Notes: The figure plots the number of school-based after-school care providers in Quebec from 1991–1992 to 2008–2009. The data is retrieved from Mainville (2006) and ASGEMSQ (2015). In light blue are imputed values.

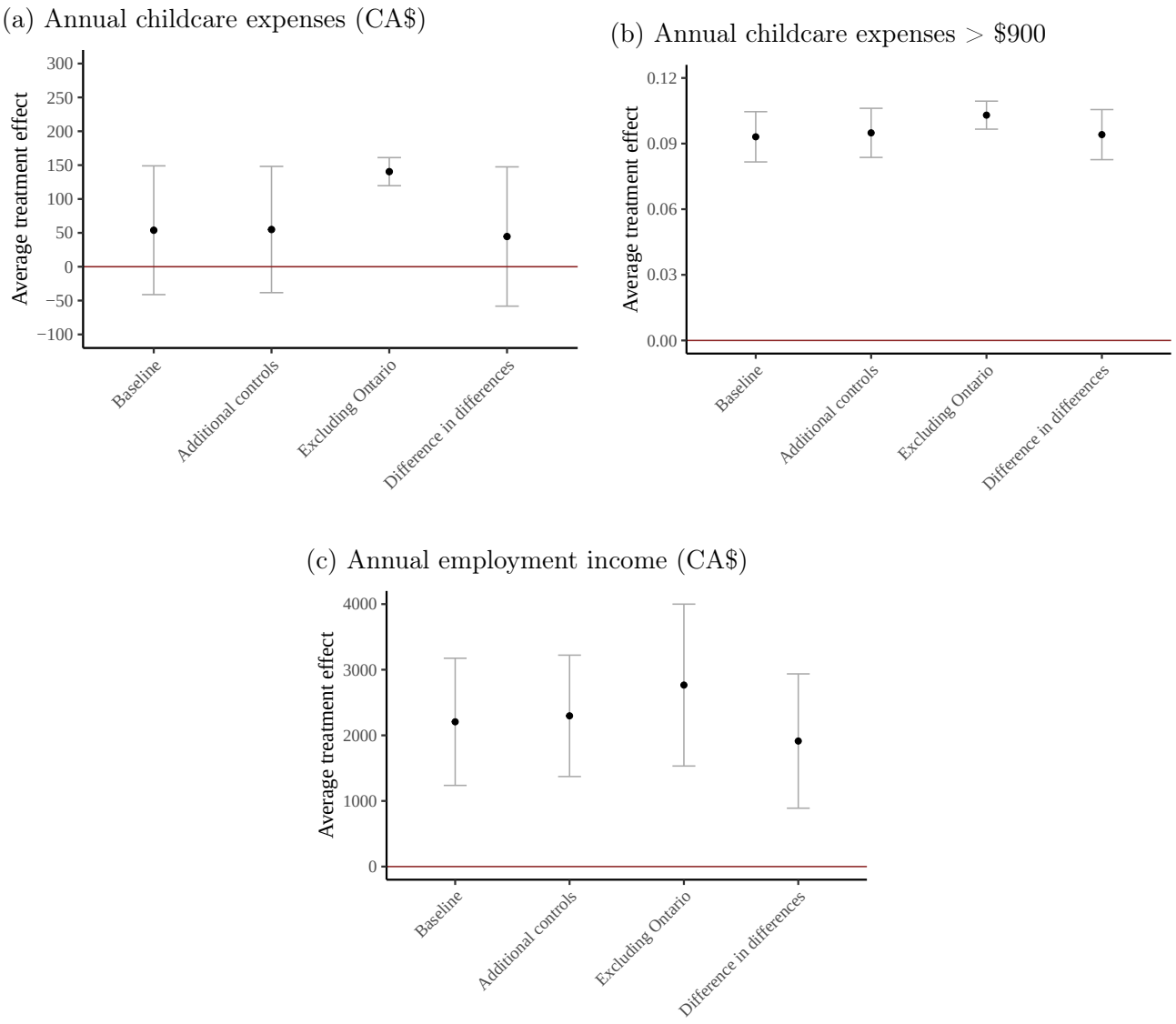

Figure A2: Treatment Effects under Alternative Specifications

Notes: The figure plots the average treatment effects of the after-school care policy on our main outcomes of interest under alternative specification (adding additional controls, excluding the province of Ontario, clustering at the province level, using a double differences methodology). The effects are estimated from the canonical model, excluding the year 1998 (equation 1). Grey error bars represent the 95% level confidence intervals.

Appendix C: Decomposition of Total Effect

Let β_1 be the average treatment effect of the policy on total employment income, α_1 the average treatment effect of the policy on employment, and, θ_1 the average treatment effect of the policy on income conditional on employment.

In addition, define $E[Y^1]$, the average employment income of mothers observed after the policy in Quebec, and $E[Y^0]$, the counterfactual value, which is not observed. Similarly, define $E[Y^1|W^1 = 1]$ as the average employment income of working mothers observed after the policy in Quebec, and $E[Y^0|W^0 = 1]$ as the counterfactual value; and define $P[W^1 = 1]$ as the average employment rate of mothers observed after the policy in Quebec, and $P[W^0 = 1]$ as the counterfactual value.

By definition, the average treatment effect of the policy on total employment income is:

$$\beta_3 = E[Y^1] - E[Y^0] \tag{A1}$$

Since, $E[Y] = E[Y|W = 1]P[W = 1]$, under parallel trends for all three outcomes, we can rewrite β_3 as follows:

$$\beta_3 = E[Y^1|W^1 = 1]P[W^1 = 1] - E[Y^0|W^0 = 1]P[W^0 = 1], \tag{A2}$$

which can be further rewritten as:

$$\begin{aligned}\beta_3 = &\underbrace{P[W^0 = 1]\left(E[Y^1|W^1 = 1] - E[Y^0|W^0 = 1]\right)}_{\text{Intensive margin effect}} \\ &+ \underbrace{E[Y^0|W^0 = 1]\left(P[W^1 = 1] - P[W^0 = 1]\right)}_{\text{Extensive margin effect}} \\ &+ \underbrace{\left(E[Y^1|W^1 = 1] - E[Y^0|W^0 = 1]\right)\left(P[W^1 = 1] - P[W^0 = 1]\right)}_{\text{Interaction effect}}.\end{aligned} \tag{A3}$$

Expressing all terms in terms of treatment effects and observed values, we get the following:

$$\begin{aligned}&\text{Intensive margin effect} = (P[W^1 = 1] - \alpha_1) \times \theta_1 = (0.736 - 0.009) \times 2407 = 1750, \\ &\text{Extensive margin effect} = (E[Y^1|W^1 = 1] - \theta_1) \times \alpha_1 = (40554 - 2407) \times 0.009 = 343.\end{aligned} \tag{A4}$$