Did full-day kindergarten policy changes in the Maritime provinces in the 1990s change maternal labour force participation?

Tara Wilson

Student number: 4172601

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Supervisor: Professor Pierre Brochu

Abstract:

The growing trend of Canadian provinces transitioning from half- to full-day kindergarten begs the question: do these reforms affect mother's employment decisions? Existing Canadian literature on Quebec's 1997 subsidized childcare and full-day kindergarten program show large, positive, and significant maternal labour force participation effects. However, there is a gap in maternal employment literature on the effects of increasing the hours of kindergarten provided, unaccompanied by wide-sweeping childcare changes. This paper aims to fill this gap using both a difference-in-difference and triple-difference methodology and taking advantage of full-day kindergarten reform in New Brunswick in 1992 and Nova Scotia in 1997. The results indicate that in New Brunswick full-day kindergarten has a small negative impact on maternal labour supply in terms of amount worked. In Nova Scotia, there was a large and significant increase in maternal labour force participation. This result holds even when steps are taken to mitigate an endogeneity problem of the Child Tax Benefit Program that was implemented during the same time period.

1. Introduction

Elementary schools in both Ontario and British Columbia are currently transitioning from half-day to full-day kindergarten. The costs of these changes are substantial, with the capital costs of implementing full-day kindergarten amounting to $245 million and $365 million in Ontario and British Columbia, respectively (Ontario Ministry of Education, 2011; British Columbia Ministry of Education, 2011). The main reason for this shift to full-day kindergarten is the perceived academic and social benefits of full-day kindergarten over half-day kindergarten. However, the spill-over effects of a full-day kindergarten policy change may also extend to the children's mothers. There is a greater incentive for mothers to return to the labour force with the child at school for the full day, especially with lowered childcare costs due to less time spent in childcare. Although it is too early to know the effects of switching from half-day to full-day kindergarten in Ontario and British Columbia, policies enacted in New Brunswick and Nova Scotia during the 1990s provide evidence of the outcomes of full-day kindergarten on maternal employment in a Canadian context.

There have been several papers examining the impact of Quebec's innovative childcare policies that overhauled the old early childcare system of half-day kindergarten and implemented full-day kindergarten and $5/day preschool in 1997. However, to date, there has been no research on the kindergarten changes that occurred over the same time frame in the Maritimes. These kindergarten policy changes are similar to the recent new policies in Ontario and British Columbia, as neither was accompanied by dramatic changes in childcare policies. With Quebec's reforms including both a switch to full-day from half-day kindergarten and the addition of subsidized childcare, it is impossible to parse out the effects of kindergarten policies alone. This study proposes to fill this gap in the literature by determining if there are spill-over effects

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of increased maternal labour force participation with the move to full-day kindergarten when this policy is not accompanied by changes in childcare policies.

The central question I aim to address is: do policies that increase the amount of kindergarten schooling hours available, and are unaccompanied by wide-sweeping childcare reforms, lead to mothers returning to the labour force? Two Maritime Provinces enacted relevant policy changes that allow me to answer this questiont: Nova Scotia, in switching from half- to full-day kindergarten in 1997, and New Brunswick, implementing full-day kindergarten reform in 1992. A difference-in-difference methodology will be used comparing Nova Scotia and New Brunswick to similar Canadian provinces that did not experience policy changes. Nova Scotia will also be compared to provinces that similarly implemented the Child Tax Benefit Program reforms during this time. The difference-in-difference methodology will isolate changes caused by the policy from existing trends in maternal employment within these provinces. A triple-difference methodology will also be used under the assumption that the maternal labour force trend differs within the treatment province compared with the rest of Canada. The Labour Force Survey (LFS) will be used to analyse kindergarten reform in both Nova Scotia and New Brunswick and the Survey of Labour and Income Dynamics (SLID) will also be used for Nova Scotia as well.

My results reveal that the transition from half-to full-day kindergarten does not affect maternal employment unless accompanied with tax reforms. Using the LFS to analyse the 1992 kindergarten reform in New Brunswick shows a small decrease in maternal labour supply. This decrease in maternal employment is found in triple-difference results and occurs in the intensive margin of employment of decreasing usual hours worked and a proportionately more part-time work. In contrast, I find a large increase in labour force participation accompanies kindergarten

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reform in Nova Scotia, specifically for labour force status. These results are robust to specifications that lessen the identification problem of the Child Tax Benefit Program occurring at the same time. The results from the SLID are not statistically significant because the small sample size I use results in very large standard errors. The SLID results however indicate that the Child Tax Benefit Program may have effects on maternal labour supply beyond strategies used to eliminate the Child Tax Benefit Program endogeneity concern. Specifically, when a variable for Child Tax Benefits is included to control for the endogeneity problem of the Child Tax Benefit program occurring at the same time as kindergarten reforms, there is a decrease in the maternal labour supply effect for all specifications including those that should mitigate the effects of the Child Tax Benefit Program.

The structure of this paper is as follows: Section 2 provides a review of the maternal employment literature. In Section 3, I present the datasets used in my analysis, Section 4 explains the econometric model, and Section 5 reviews the main results. Finally, Section 6 provides the conclusion.

2. Literature Review

The literature on maternal employment has been well established since the 1970s. The maternal employment literature includes a literature on kindergarten and childcare reforms employing quasi-experimental techniques, which I focus on as this paper takes advantage of quasi-experimental reforms. I also review papers within the maternal employment literature using different techniques including instrumental variable (IV) methods and regression discontinuity models.

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The majority of papers presented in this section use the labour-leisure decision model as their theoretical framework. The main intuition behind the labour-leisure model is that the mother will maximize their utility when there is a change in their budget constraint that increases their income. Mothers will either increase the amount that they work, which is a substitution effect or decrease the amount that they work, which is an income effect. The labour-leisure decision model is discussed in greater detail in section 4.1 and the Appendix.

In this section I provide an overview of this vast literature, focusing on empirical results. The remainder of this section is divided as follows: Firstly, I review kindergarten policies in Canada. Secondly, I provide a more detailed overview of the two Canadian papers which form the basis of this paper by Merrigan and Lefebvre (2008) and Baker et al (2008). Thirdly I briefly review the international literature involving kindergarten and childcare reform, both experimental and non-experimental. Finally, I include a section that discusses the child tax reform in Canada, as it I account for changes in tax policy in my analysis.

2.1 Kindergarten Policies in Canada

In Canada, education policies are determined by the provincial governments. The policy landscape for kindergarten is relatively homogenous with all provinces offering publicly provided kindergarten for five year old children and Ontario also offering kindergarten for four year olds.[1] Kindergarten in Canada was a half-day program prior to the 1990s, but since then many provinces have been making the change to full-day kindergarten. Many eastern provinces implemented the transition to full-day kindergarten in the 1990s, starting with New Brunswick in 1992, followed by Quebec and Nova Scotia in 1997. New Brunswick also made kindergarten mandatory for five year old children in 1998. P.E.I. followed with full-day kindergarten reform

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[1] For a more detailed discussion of kindergarten and childcare in Canada see reports by childcarecanada.org.

in 2010, and Ontario and British Columbia are currently in the process of implementing full-day kindergarten.

2.2 Canadian Literature on Full-Day Kindergarten

In Canada, there are two influential papers by Lefebvre and Merrigan (2008) and Baker et al. (2008) that examine the effect of changes in early childhood policy on maternal employment. As previously mentioned, the childcare policies initiated by Quebec in 1997 saw the province overhauling the old early childcare system which included half-day kindergarten and implementing full-day kindergarten. Reforms also included replacing a universal child allowance with a modified child tax benefit and, most famously, $5/day childcare. Initially, subsidized childcare was offered for children aged 4. Over time, the number of subsidized childcare places increased and is now offered to children aged 0 to 4. Both Lefebvre and Merrigan (2008) and Baker et al. (2008) find a significant increase in maternal employment following the reforms.

Using a modified triple-difference-in-difference model, Lefebvre and Merrigan (2008) focus on identifying how the labour supply of Quebec mothers changed following the reform. They use the annual Survey of Labour and Income Dynamics (SLID) master files from 1993 to 2002 to look at several measures of maternal labour force participation from before, during, and after the policy change. These measures include a measure of the mothers employment during two months of the year, the amount of weeks and hours worked in a year, average annual earnings, and a measure for full-time versus part-time.

The empirical model Merrigan and Lefebvre (2005) use is based on the difference-in-difference and triple-difference methodology, and is modified from an empirical model introduced by Francesconi and Van der Klauuw (2004). Merrigan and Lefebvre (2005) point out

that the typical difference-in-difference model suffers from the assumption that the trend through time of maternal employment is the same in Quebec and the rest of Canada prior to the childcare reforms. A triple-difference methodology that compares the periods before, during, and after the reform resolves this issue by assuming that there is a differing maternal employment trend in Quebec compared with the rest of Canada. However, unless the periods compared before and after are equal, then the difference estimator will be positively or negatively biased. To correct for this, Lefebvre and Merrigan (2008) introduce a term that allows for a common aggregate trend following the reform period. The identifying assumption of the model is that there were no other childcare policy changes that would affect the relative labour force participation of mothers in Quebec compared to the rest of Canada during the time of the policy. The final model compares mothers with young children in Quebec, the treatment group, to mothers with children of the same age in the rest of Canada, the control group. The control and treatment groups are compared from before, during, and after, the policy implementation.

Lefebvre and Merrigan (2008)'s results indicate that there was a large and statistically increase in maternal labour force participation due to Quebec's kindergarten and childcare policy. In examining the results for labour force participation, the program had a statistically significant and economically significant effect that increased over time. For example, mothers with child(ren) aged 1-5 were 8.04 percentage points more likely to report working in the month of April in 1999 than prior to the reform, in a specification that assumes that each region in Canada has different trends of maternal employment. For the results of hours worked and weeks worked show similarly significant and large effects, which are especially strong for women with lower educational attainment.

Baker et al. (2008) also examine labour force outcomes for mothers affected by Quebec's policy changes and in addition look at childcare outcomes and measures of well-being for the child and parents. The paper utilizes the National Longitudinal Survey of Children and Youth (NLSCY), a longitudinal survey that follows children over time and has rich measures of the child's developmental outcomes. The cycles of the NLSCY Baker et al (2008) use include the years 1994-1997 for the period before Quebec's reform and the years 2000-2003 for after the reform. The sample is restricted to married mothers because they were expected to better capture the effects of the reform. For single mothers the effects of the policy were not as large as they were already more likely to be receiving childcare support prior to the reform, and are more likely to be impacted by changes in social assistance that occurred throughout Canada at the same time with the Child Tax Benefit. A difference-in-difference empirical approach is used to examine the various maternal labour force, childcare, and well-being outcomes. Similar to Lefebvre and Merrigan (2008), this paper finds a strong and statistically significant increase in the mothers labour supply, with a 7.7 percentage point increase in the labour supply of Quebec mothers compared to mothers in other provinces.

2.3 Quasi-experimental Literature

Contreras et al. (2010) use the quasi-experimental nature of a legislative policy change in Chile in 1996 that lengthened the school day of children ages 8-17 to examine the effects on maternal employment. Contreras et al (2010) use a fixed effects model with repeated cross-section bi-annual or tri-annual data from the Chilean Socio-Economic Characterization Survey from 1990 to 2006. The authors find that a 1% increase in the percentage of full-day school enrollment in the mother's municipal area results in a 5% increase in the likelihood of labour force participation. In particular, higher educational attainment and age are associated with

increased labour force participation. An additional finding is that mothers were less likely to work when there were young children in the household (5 years and younger). Interestingly, the substitution effect dominates mothers aged 20-39, who work less hours following the reform. However, the income effect dominates for mothers aged 50-65 who work longer hours following the reform.

Havnes and Mogstad (2009) analyse the changes to maternal employment after The Kindergarten Act in 1975 in Norway, which aimed to provide universal, accessible childcare to children throughout Norway within a few years of being implemented. This paper exploits panel administrative data from Statistics Norway that covers the entire population from 1967-2006 as well as complete administrative data on formal childcare for Norway. Havnes and Mogstad (2009) present an alternative to most of the literature that suggests that increased access/funding of childcare leads to greater employment. Their results suggest that publicly provided childcare leads only to a crowding out of informal childcare arrangements, that is, childcare provided by the mother or by a non-market arrangement, and little increase in maternal employment. The outcome measured in this paper is the growth rate of employment within municipalities. This contrasts with common measures used in the literature such as hours worked per week. Havnes and Mogstad (2009) believe that this measure more accurately corrects for existing time trends in maternal employment between different regions, a potential weakness in other papers. Using a triple-difference model, Havnes and Mogstad (2009) compare the growth rate of employment for mothers affected by the treatment in municipal areas with a large increase in the amount of childcare to mothers in areas where there was little or no increase in childcare. The authors further compare mothers with children young enough to be affected by the policy to those who would not be affected (ages 7-10). The key findings of this paper is that government funded

universal childcare results in only a negligible increase in the growth rate of maternal employment because it crowds out informal care by approximately 94%.

Berlinski and Galiani (2007) conduct a study in Argentina investigating the effect on maternal employment of an increased number of pre-primary positions available through infrastructure building program. Berlinski and Galiani (2007) use pooled repeated cross-sections of the 1994-2000 Encuesta Permanente de Hogares, the Argentine household survey. Using a difference-in-difference model with variation stemming from pre-primary facilities being built in different regions, the authors find that there is a significant increase in maternal labour supply, with hours worked per week rising by an average of 2.2 - 4.5 hours per week.

Nollenberger and Rodriguez-Planas (2011) conduct a quasi-experimental study on maternal employment exploiting a legislative change that provided accessible and universal preschool to 3 year olds in Spain implemented over a ten year span in the early 1990s. The paper uses the 1987-1997 Spanish Labour Force Survey, which has a repeated cross section design. They restrict their sample to mothers aged 18-45. They show that publicly provided universal childcare for 3 year olds raises the likelihood of mothers working by 7.9% and if employed, increases the hours worked by 8.9%. Further, the authors measure the "persistence" of the reform, which is if the effects of the reform lasted several years following the reform. They find that the persistency effects of the policy differ with the mother's level of educational attainment. The employment effects are especially persistent for high school graduates and fade out quickly for high school dropouts. The results indicate no effect for college educated mothers, who may already use informal or paid childcare, to which public childcare provides a free alternative.

Schlosser (2011) uses a quasi-experimental framework to investigate changes in the labour force participation of Arab mothers after pre-school is implemented gradually in Israel in

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the late 1990s. As Arab mothers in Israel have particularly low levels of employment compared to Jewish mothers, even a small increase in employment levels would lead to a large increase in Arab mothers labour force participation. Schlosser (2011) uses the Israeli Labour Force Survey from 1998-2003 and a difference-in-difference model comparing towns that implemented free preschool to towns of a similar socio-economic status that did not yet have pre-school. The paper finds that the employment rate of Arab mothers increased by 0.071 percentage points, which may seem small, but represents a 17.1% increase in employment when considering the low employment rate prior to the reforms. The effect of the policy is driven by women with their youngest child in pre-school (age 2-4), and women with higher levels of educational attainment. Interestingly, maternal labour force outcomes are observed only after the policy has been implemented for three to four years.

In the United States, Cascio (2009) examines the effect on maternal employment of the introduction of kindergarten to different school districts in the United States since the 1960s. Using United States Census Data, a triple-difference methodology is employed comparing states with and without kindergarten. Cascio (2009) only finds a statistically significant effect of kindergarten on maternal employment for single mothers with children under five. Otherwise, the results indicate that there is a crowding out effect of private care at kindergarten age, which is replaced by the government provided schooling.

2.4 Non-experimental Literature

In a paper that precedes Casico, Gelbach (2002) uses the universally accessible nature of kindergarten in the US in 1980 to determine the impact of enrollment in public school on maternal employment as well as the outcome of "public assistance receipt". Gelbach (2002) is

faced with the identification problem that parents could choose to hold back their child from kindergarten if they felt that they were not ready. To resolve this issue, quarter of birth is used as an instrumental variable for enrollment in school. Using 1980 Census Data, Gelbach (2002) determines that kindergarten results in a statistically significant increase in maternal labour supply for married mothers with a 5 year old and single mothers with a 5 year old as their youngest child.

Del Boca (2002) uses a random choice framework to examine maternal labour force participation in Italy and uses biennial panel data from the Bank of Italy's Survey of Households Income and Wealth from 1991, 1993, and 1995. The paper uses a conditional maximum likelihood estimator to calculate elasticity estimates of childcare on maternal employment. Imposing a two period model using pooled cross-sections of their data, the authors conclude that an increase of childcare availability in the first period measured would increase the likelihood of a mother working by 29.6% in the second period.

In contrast with the majority of studies in the childcare and maternal employment literature, Fitzpatrick (2010) does not find an effect on maternal employment of pre-kindergarten programs in the states of Oklahoma and Georgia. Fitzpatrick (2010) uses a regression discontinuity framework, where she compares the labour force participation of mothers whose child's age is directly after the cut-off date for enrollment in kindergarten with those before the cut-off date. These two groups can be considered to be randomly selected, as a mother would not feasibly chose their child's date of birth based on a future preschool program. Using the 2000 United States Census Decennial Long Form Restricted Access data, Fitzpatrick (2010) finds that although enrolment in the pre-kindergarten program significantly increased, there was no corresponding increase in labour force participation of mothers with pre-school aged children.

2.5 Child Tax Benefit Program

In this paper, the identifying assumption in using the difference-in-difference model is that the only shock impacting maternal employment in Nova Scotia during the time period examined is kindergarten reform. A challenge to this assumption is the National Child Benefit Program introduced in 1998.[2] The purpose of this program was to achieve a better coordination of tax benefits available to parents by the federal government and provinces and to encourage labour market participation for recipients of social assistance. Within the National Child Benefit Program, there is a base benefit of the income-tested Canadian Child Tax Benefit as well as the new National Child Benefit Supplement, which replaced the previous Work Income Supplement. Provinces that chose to implement the program as it was originally conceived resulted in families' provincial child-related social assistance "clawed back" dollar for dollar. Thus, families would be receiving the same amount of money, but through the National Child Benefit Supplement rather than through provincial social assistance. The provinces which decided to implement the National Child Benefit Program with the "clawback" were P.E.I., Nova Scotia, Ontario, Manitoba, and Alberta. New Brunswick and Newfoundland decided to continue providing child related social assistance.[3] The federal government also agreed to increase funding for childcare subsidies and health promotion programs throughout Canada.

Milligan and Stabile (2007) examine the social assistance take-up and maternal labour supply effects of the National Child Benefit Program. The authors use the person and family SLID master files from 1996 to 2000 and restrict their sample to single mothers. Changes in social assistance take-up and maternal labour supply are identified using a triple-difference

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[2] See Lefevbre and Merrigan (2003) and Merrigan and Stabile (2006) for more detail on Canadian child tax reform
[3] Quebec, Saskatchewan, and British Columbia had a more complicated implementation of the National Child Benefit Program.

methodology comparing a treatment group of provinces who clawed back benefits (P.E.I., Nova Scotia, Ontario, Manitoba, and Alberta) to a control group of those who did not claw back benefits (New Brunswick and Newfoundland). The third level of difference comes from comparing mothers with different numbers of children. The IV method is used to resolve the endogeneity issue of simultaneity between labour force outcomes as the dependent variable and changes in tax benefits as the key independent variable. Milligan and Stabile (2007) construct this IV using a random sample of families from their sample and synthetically calculating the tax benefits that the family would receive if they were in each province and each year. By using this method, their measure is highly correlated with the tax benefits but is not correlated with labour force outcomes, as it is a synthetic sample. Milligan and Stabile (2007) find that there is a large and significant decrease in the take-up of social assistance, and a positive maternal labour effect in the clawback provinces as a result of the National Child Benefit Program.

3. Data

I rely on two data sets to conduct my analysis, the master files of the Labour Force Survey (LFS) and the repeated cross-section person-reference master files of the Survey of Labour and Income Dynamics (SLID). I use the LFS from 1990-2000 to analyse New Brunswick and Nova Scotia and the SLID from 1995-2000 to analyse Nova Scotia.[4] The master files are needed because they hold information that identifies the age of each of the mother's children. This allows me to identify the mothers who are impacted by the kindergarten policy change.[5]

3.1 Labour Force Survey

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[4] The SLID began in 1992, and as such cannot be used to look at the 1992 reform in New Brunswick.
[5] Within the public use files of the LFS and SLID, information on a child's age is only available as aggregate age groups of children or as a variable of the age of youngest child.

The Labour Force Survey (LFS) provides information about the employment status and other related characteristics of individual Canadians. The LFS samples the working age population of all Canadian provinces and territories, excluding individuals who are institutionalized, full-time members of the Canadian armed forces, as well as individuals living on reserves.

The key advantage of using the LFS in my analysis is that the sample sizes are much larger than the SLID, with the LFS sampling approximately 56,000 households every month. This is very useful when dealing with smaller provinces like New Brunswick and Nova Scotia. Further, the LFS covers the years of change of policy for New Brunswick in 1992, which is not possible with the SLID. However, the LFS is less detailed in terms of questions asked, and although it contains information on wages, it does not contain detailed information on income, a potential determinant of labour force status. The master files of the LFS contain relevant variables to my analysis such as identifying the exact age of the child, labour force status, weekly hours worked, and demographic characteristics to use as controls including age, educational attainment, as well as spousal demographic and labour force characteristics.

3.2 Survey of Labour and Income Dynamics

The Survey of Labour and Income Dynamics (SLID) is a longitudinal survey that provides information about individuals within households on their labour force status, measures of income, and other socio-demographic characteristics. I use the SLID as a repeated cross-sectional design.

The SLID shares the same characteristics of individuals sampled as the LFS, as the SLID is a sample of two of the "rotation groups" of those households sampled by the LFS. Unlike the

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LFS, the SLID contains information about household members under age 15, the working age in Canada. The SLID contains detailed income information, with approximately 80% of respondents allowing Statistics Canada to access their tax files to obtain the relevant information. The SLID also contains variables necessary to this paper such as the specific age of the child, socio demographic information about the mother including age, educational attainment, spousal demographics and labour force characteristics. The advantage of using the SLID in this paper is two-fold. Firstly, I can more closely replicate and follow the methods used by Lefebvre and Merrigan (2008), as they also use the master files of the SLID in their analysis. Secondly, I am able to include Child Tax Benefits as a control variable. When analysing Nova Scotia this is particularly useful as these benefits were changed the same year as the kindergarten reform.

3.2 Sample Restrictions

I restrict my sample to mothers aged 18-56. The age restriction is used to reflect the population of interest, Canadian mothers with five year old children. I restrict the upper bound of age to 56, because as women age, they are less likely to have children and more likely to retire and not be part of the labour force. Summary statistics are displayed in Table 1 for the SLID and Tables 2 and 3 for the LFS.[6] The summary statistics for the sample restrictions for age and sex are displayed under "Women aged 18-56". Note that restricting the sample by age, sex, and having a 5 year old child significantly reduces the sample size, for example, from 619,679 for all individuals to 31,527 for mothers aged 18-56 with at least one five year old. As the analysis for Nova Scotia is restricted to the years 1996 and 1999, the sample size is further reduced in my

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[6] I primarily use the LFS data shown in Table 2 for my analysis, and use the data shown in Table 3 for a robustness check, as shown in section 5.3.2.is

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analysis. Restricting the sample for age and sex in the LFS when all observations are used, in Table 2, eliminates 3,600,000 observations.

The average age of the respondent is lower in the SLID because it includes both children and adults, while the LFS only includes adults of working age with information on children in the household. As well, the sample sizes for the LFS are much larger than the SLID. Although I include more years in my sample for the LFS compared to the SLID, before restricting sample years when I conduct my analysis, it is clear that the LFS is substantially larger than the SLID. For example, the SLID contains 619,679 observations for age, while the LFS contains 7,500,000. All observations have been weighted in both the SLID and the LFS because smaller regions in Canada are initially oversampled. By weighting observations, the summary statistics more accurately represent the composition of the Canadian population for the given year.

4. Model

4.1 Theoretical Model

The theoretical basis of this paper is adapted from a model of maternal employment presented by Schlosser (2011), Lefebvre and Merrigan (2008), and Blau and Currie (2006).[7] Schlosser (2011) examines the introduction of free preschool, while Lefebvre and Merrigan (2008) examine the introduction of subsidized daycare, and Blau and Currie (2006) focus on childcare subsidies.[8] The majority of papers presented in section 2.2 use the labour-leisure

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[7] A more detailed explanation of my theoretical model is available in the Appendix.
[8] Lefebvre and Merrigan (2008) base their theoretical model on a work-leisure and childcare decision model proposed by Blau (2003). In this model, as childcare costs increase, the mother's net wage decreases. The decrease in the mother's net wage in turn leads to an increase in the mother's reservation wage, which is the minimum level of wage that is necessary for a worker to accept a job. Assuming that there is no change in the jobs offered to mothers, a higher reservation wage means that there will be a lower maternal labour supply. In applying Blau (2003)'s theoretical model of childcare, Lefebvre and Merrigan (2008) note that prior to 1997 some families received a child tax benefit, a non-linear subsidy in the form of a tax credit conditional on family income. This tax

decision model as their theoretical framework, as in this paper. A mother faces a decision of choosing between earning a wage through work yet paying for childcare or staying home and taking care of the child herself. To make this choice, the mother will maximize her utility, which depends on income from work and leisure (non-work time). Leisure is a normal good and includes time the mother spends providing childcare for her child. In maximizing her utility, the the mother is constrained by both time and money. There are a fixed number of hours in the day that the mother can devote to childcare or work. Also, the mother must make her choice considering a budget which includes non-labour income as well as her income, net of paying for childcare, from working if she chooses to do so.

When kindergarten is introduced, it is as if the mother receives a subsidy that pays for the entirety of childcare for a fixed numbers of hours a day. This provision of kindergarten changes the budget available to the mother, and thus influences the mother's employment decisions.[9] The policy change of full-day from half-day kindergarten simply increases the number of hours of childcare that are fully subsidized. For mothers who had not worked prior to the full-day kindergarten reform, there is an incentive to work in moving from half-to full-day kindergarten, and the mother will choose to work more. This is due to a substitution effect between leisure and working where the mother substitutes her hours of leisure to instead spend these hours at work. The mother has greater motivation to work because she gains a higher wage with the subsidization of childcare increasing her net wage for the hours that the child is in kindergarten,

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credit encouraged women to be more likely to have a job, but due to competing substitution and income effects, the impact on hours worked is ambiguous. Subsidized childcare and full-day kindergarten, introduced with the 1997 policy, is considered a fixed cost of working for the mother rather than an increased net wage in the Merrigan and Lefebvre (2008) model. Similar to the non-linear subsidy, the 1997 policy should increase maternal employment, but due to substitution and income effects, there is no hypothesis made about hours worked.

[9]Figure 1 in the Appendix shows the shift in the budget constraint from half-day kindergarten (labelled c = y + (w-p)h + h*w) to full-day kindergarten (labelled c = y + (w-p)h + h**w)

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which fully subsidizes childcare for the period of time. For mothers who worked prior to the reform, there is an income effect if the mother worked an amount of hours less than a full school day. With the increase in net income because of free childcare for a set number of hours in the day, the mother can afford to spend more time with leisure. As the mother gains utility from leisure, she has an incentive to reduce the amount of time that she works. The substitution and income effects work in the opposite direction because working is an inferior good while leisure is a normal good, which results in demand for leisure increasing when income increases. For mothers working an amount of hours less than a full school day, it is ambiguous whether the substitution effect or income effect will dominate, and the mother will therefore work more or less.

4.2 Empirical Model

I focus my analysis on determining the impact on maternal employment due to the transition from half-day to full-day kindergarten implemented by New Brunswick in 1992 and Nova Scotia in 1997. The following outlines my empirical strategy: I start with simple difference estimators, then build to a difference-in-difference model, and finish off with a triple-difference model.

Model 1. Simple Difference Estimator (across time):

$$Y_{it} = \beta_0 + \beta_1 Post_{it} + \varepsilon_{it} \quad (1)$$

where Y_{it} is the dependent variable of interest, e.g. labour force status, for individual i in period t, and ε is the error term.

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The main variable of interest in model 1, $Post_{it}$, is a dummy variable equal to 1 if the individual is a mother of at least one kindergarten aged child after the kindergarten policy change, and equal to 0 if the individual is a mother with at least one kindergarten aged child before the kindergarten policy change. To better understand how the policy effect is identified in this model, I focus on the province of Nova Scotia (pre and post reform) and use the labour force status as the dependent variable of interest. The β_1 parameter captures the difference in labour force status, on average, between mothers with at least one kindergarten aged child when kindergarten was half-day and mothers when kindergarten is full-day. The assumption of model 1 is that there are no other shocks influencing maternal employment measures during this time, such as an expanding economy between time periods. Thus, the difference in labour force status between periods is due only to the kindergarten policy change.[10]

Model 2. Simple Difference Estimator (across provinces):

$$Y_{ip} = \beta_0 + \beta_1 Treat_{ip} + \varepsilon_{ip} \quad (2)$$

where Y_{ip} is the dependent variable of interest, e.g. labour force status, and p is the province in which individual i resides

In model 2, the independent variable $Treat_{ip}$ is a dummy variable equal to 1 if the mother resides in a province that implemented the kindergarten reform and 0 if the mother resides in one of the provinces used as a control. The parameter β_1 captures the difference, on average, between the labour force outcome such as labour force status in Nova Scotia compared with the rest of Canada. The main assumption of model 2 is that differences between maternal employment

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[10] Some econometrics textbooks alternatively describe the simple difference estimator as the first difference, see Wooldridge 4e.

measures are due to the makeup of the population or characteristics of the labour force in the different provinces, and not due to exogenous time shocks, such as changes in childcare policy in one province.

Model 3. Difference-in-Difference estimator (DID):

$$Y_{ipt} = \beta_0 + \beta_1 Treat_{ip} + \beta_2 Post_{it} + \beta_3 (Treat * Post)_{ipt} + \varepsilon_{ipt} \quad (3)$$

The difference-in-difference model is an enriched version of the two previous models. $Treat_{ip}$ controls for time-invariant differences across provinces, while $Post_{it}$ controls for common shocks to all provinces that would impact maternal employment measures. The parameter of interest, β_3, is the difference-in-difference estimator. It is a comparison between the observed change in a maternal labour force outcome, such as labour force status, between a mother of a kindergarten aged child in Nova Scotia following the policy change compared to the counterfactual of a mother who also has a kindergarten aged child in another Canadian province that did not experience the policy change.

An alternative way to visualize the difference-in-difference estimator is:

$$\beta_3 =$$

$$\left(\bar{y}_{treatment\ province,post\ period} - \bar{y}_{treatment\ province,preperiod} \right) - \left(\bar{y}_{control\ province,post\ period} - \bar{y}_{control\ province,preperiod} \right) \quad (4)$$

When control variables are added, the model becomes:

$$Y_{ipt} = \beta_0 + \beta_1 Treat_{ip} + \beta_2 Post_{it} + \beta_3 (Treat * Post)_{ipt} + X_{ipt}\emptyset + \varepsilon_{ipt} \quad (5)$$

where X is a vector of socio-economic controls such as age, age squared, educational attainment, children in the household, and spousal controls if the mother is married.

Model 4. Triple-difference Estimator (DDD):

$$Y_{igpt} = \beta_0 + \beta_1 Treat_{ip} + \beta_2 Post_{it} + \beta_3 Treat\ Mother_{ig} + \beta_4 (Treat * Post)_{ipt} +$$

$$\beta_5 (Treat * Treat\ Mother)_{igp} + \beta_6 (Post * Treat\ Mother)_{igt} + \beta_7 (Treat * Post *$$

$$Treat\ Mother)_{igpt} + \varepsilon_{ipt} \quad (6)$$

where Y_{igpt} is the dependent variable of interest, for example labour force status, and g represents the control or treatment group of mothers that individual i is part of.

In model 4, $Treat\ Mother_{ig}$ is a dummy variable equal to 1 if the mother is in a treatment group that is comprised of mothers with at least one kindergarten aged child, and equal to zero if the mother has children that are not kindergarten aged. The triple-difference coefficient of interest, β_7, measures the relative difference between the observed change in maternal labour force outcomes, on average, between a mother of a kindergarten aged child in the province of interest following a policy change, with a control group of mothers. For example, it would measure the relative change in labour force status following the reform between a mother with at least one kindergarten aged child and no children over 12, and a mother with children aged 13-15 but no children under age 12.[11] The assumption of the triple-difference is that the two groups of mothers were affected differently by the policy change, with the mothers of children aged 13-15 unaffected by the policy change that affects five year olds.

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[11] Note that this further restricts the sample size so that the control and treatment groups are mutually exclusive, which is needed to create a dummy variable. This reduction in sample size is important because it means that I am unable to run triple-difference models in the SLID, as there is already a very small sample size.

The advantage of the triple-difference over the difference-in-difference is that it is able to control for province-specific trends because it assumes that although the treatment and control group of mothers may have different labour force outcomes on average, they share a common trend of maternal employment within their own province.

For the triple-difference model, two control groups are used. For the first control groups, the sample is restricted to include mothers with at least one child aged 6-12, but no children under 6, and a treatment group of mothers with a five year old child, but no children older than 6. Similarly, the second control group is mothers with children aged 13-15, but no children under aged 12, while the treatment group is mothers with at least one kindergarten aged child but no children over age 12. Ideally, the control groups are composed of individuals who are very similar in labour force behaviour except for having a kindergarten-aged child. By using two control groups, I am able to test the robustness of the triple-difference estimates. I expect mothers of teens being less similar to the mothers with children closer in age to kindergarten aged children, so their behaviour may be influenced by other factors, such as being more likely to work as they do not have to pay for childcare.

When control variables are added, the model becomes:

$$Y_{igjt} = \beta_0 + \beta_1 Treat_{ip} + \beta_2 st + \beta_3 Mother_{ig} + \beta_4 (Treat * Post)_{ipt} + \beta_5 (Treat * Treat\ Mother)_{igp} + \beta_6 (Post * Treat\ Mother)_{igt} + \beta_7 (Treat * Post * Treat\ Mother)_{igpt} + X_{igpt}\emptyset + \varepsilon_{ipt} \ (7)$$

4.3 Identification Issues

One challenge facing this paper is a potential identification problem in using the difference-in-difference methodology for Nova Scotia. The Child Tax Benefit Program was introduced during the same time period as kindergarten reform. As shown by Milligan and Stabile (2007), these reforms also encouraged maternal labour force participation. To mitigate this problem, I use three strategies including re-estimating all models with a restricted sample of married mothers, re-estimating my models using a restricted set of provinces, and adding a control variable in the SLID of *child tax benefits*.

Firstly, I am guided by the maternal employment literature in Canada for restricting my sample to married mothers (including common law) who are living with their spouse. in light of the Child Tax Benefit reforms, Baker et al. (2008) restrict their analysis to two-parent families. As the Child Tax Benefit reforms were connected with welfare reforms, the authors note that because married mothers have a lower usage of welfare compared with single mothers, this restriction mitigates the endogeneity concern. Likewise, in a Milligan and Stabile (2007) paper that examines changes to the maternal labour force due to the Child Tax Benefit, the sample is restricted to single mothers to capture those most affected by the reform. If my results are insignificant when restricting my sample to married mothers, it is likely that the changes in maternal employment are driven by Child Tax Benefit reforms rather than the kindergarten reform. Further, by restricting my sample to married mothers I am able to include additional control variables that likely influence maternal labour supply including the spouse's age and age squared, spousal educational attainment, and spousal labour force status.

Secondly, I follow Milligan and Stabile (2007) in identifying "clawback" provinces that similar to Nova Scotia, implemented the Child Tax Benefit Program such that maternal employment was encouraged. By restricting my analysis to clawback provinces, I am able to take advantage of the difference-in-difference model. In these restricted "clawback" provinces, the Child Tax Benefit Program could be considered an exogenous shock that affects maternal employment. The difference-in-difference model removes common exogenous shocks, and thus by restricting provinces, the Child Tax Benefit Program should not influence the difference-in-difference estimates for Nova Scotia.

Thirdly, I am able to take advantage of the detailed income variables available in the SLID by including a *child tax benefits* variable that is a measure of both the provincial and federal child tax benefits received. By comparing the difference-in-difference coefficient with and without the inclusion of the *child tax benefits* variable within my model, I can determine if and how Child Tax Benefit reforms influence the difference-in-difference estimator.

5. Results

5.1 Results for the Labour Force Survey

5.1.1 Nova Scotia: All Provinces

Table 4 shows the linear probability results of the effect of the Nova Scotia reform where the dependent variable is the labour force status. Given that the dependent variable is binary, the coefficient estimates are interpreted as a marginal effect, i.e. the impact on the probability of being in the labour force.

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Column (1) of Table 1 shows the results of the simple (across time) difference estimation (model 1). The coefficient of the *Post* variable indicates that mothers with at least one kindergarten aged child in Nova Scotia are 21.8 percentage points more likely to be employed following the kindergarten reform. This finding is statically significant at the 1% level. The estimated effect is too large to be believed. The *Post* variable is probably also picking up the effect of the economic expansion experienced over the 1996 to 1999 period.

Column (2) of Table 2 shows the results of the simple (across province) difference estimation (model 2). In this case, mothers with a child that is of kindergarten age in Nova Scotia is compared to similar mothers in all other provinces, except New Brunswick and Quebec which also instituted changes in kindergarten policies during this time. Note that this substantially increases the sample size relative to column (1) to 3,799 observations (408 mothers in Nova Scotia and 3,391 mothers in the other provinces).

Columns (3) and (4) of Table 4 show the results of the difference-in-difference model with and without controls (model 3).[12] This difference-in-difference estimate represents the change in maternal labour supply, removing variation due to common exogenous shocks to the maternal labour market affecting all Canadian provinces. The difference-in-difference model coefficient of interest for labour force status is economically large and statistically significant at the 1% level. A mother with a kindergarten aged child is 18.4 percentage points more likely to work

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[12] Socio-economic controls include age, age squared, number of children, number of children under 5, age of youngest child, and dummy variables for a child under 4, marital status, and educational attainment. The educational attainment dummy is split into three categories with high school graduates and below, college and other certificates, and university graduates. The marital status dummy is split into single mothers including widowed, divorced, and single mothers while the married group includes both married and common-law mothers. When the sample is restricted to married mothers, the controls also include the spousal controls of spouse's age, age squared, labour force status, and educational attainment.

after the kindergarten reform than before the reform. Interestingly, the results (for the effect of the reform) are unchanged when I include a set of socio-economic controls.

The difference-in-difference model assumes that although mothers in different provinces may have different levels of maternal employment, their trend of maternal employment is the same. This advantage of this assumption is that changes in maternal labour force outcomes following a kindergarten reform unique to one province can be attributed to that reform. However, this assumption is not realistic if there are different maternal labour force trends between the provinces that exist prior to the reform. The triple-difference estimate for the dependent variable full-time status compares mothers with a kindergarten aged child to a control group of mothers (model 4). The triple-difference model is useful because it assumes that the maternal employment trend is not necessarily the same between the treatment and control provinces, but that the trend is the same between treatment and control mothers in the same province. If maternal employment was increasing at a greater rate in the treatment province than the control provinces, the difference-in-difference model would not account for this trend and instead attribute changes in maternal employment to the kindergarten reform. Although the triple-difference model is also impacted by the endogeneity problem of the introduction of the Child Tax Benefits Program, it avoids the assumption of the same underlying trend in maternal employment among provinces. For example, although mothers of teens are more likely to be employed than mothers of kindergarten aged children, this model assumes that both groups of mothers face the same trend in maternal employment when they live within the same province. The first control group of mothers is comprised of mothers with a child aged 6-12, but no children under age 6, while the second control group is mothers with children age 12-15. Both control groups are mutually exclusive with the treatment groups of treatment mothers.

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The triple-difference estimates for labour force status with and without controls are presented in Table 4, columns (5) to (8). The triple-difference results using control group 1 and 2 are not statistically significant for labour force status or any other labour force outcome dependent variables.

Nova Scotia is also analysed using a restricted group of control group provinces including P.E.I., Ontario, Manitoba, and Alberta. The purpose of using these restricted control provinces is that they initiated similar Child Tax Benefits Program reforms at the same time as Nova Scotia's kindergarten reform. All difference-in-difference and triple-difference results are similar for the restricted provinces in terms of magnitude and significant coefficients of interest except for the results discussed below.[13]

Table 5 displays the triple-difference results for Nova Scotia using restricted provinces for the dependent variables of full-time status and usual hours using control group 2, which includes mothers of children aged 12-15. Columns (1) and (2) display the triple-difference linear probability model estimation for full-time status with and without controls. As with labour force status, full-time status is a binary dependent variable with the mother either working full-time or part-time. As such, the coefficient estimates are interpreted as a marginal effect. Mothers with at least one kindergarten aged child but no children over age 12 are 12.9 percentage points less likely to work full time compared with mothers of at least one child aged 12-15 and no children under age 12. This estimate is slightly smaller in magnitude than the triple-difference estimate without a set of controls.

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[13] I estimate triple-difference models using both control group 1 and control group 2 mothers and present only statistically significant results.

Columns (3) and (4) of Table 5 display the triple-difference coefficients for usual hours worked per week in tenths of hours with and without controls. Mothers of children at least one child aged 5 but none older than age 5 report working on average 3.2 hours less following the reform than mothers with at least one child aged 12-15, and none younger than age 12, as shown in column (3). The triple-difference estimate is significant at the 10% level when the model includes the set of controls.[14]

The results from triple-difference models using the restricted provinces indicate that there may also be a small substitution effect occurring in Nova Scotia, where mothers substitute leisure for labour following the reform. The triple-difference results are not robust to choice of control group, as there is no statistically significant effect when mothers with kindergarten aged children are compared to control group 1, mothers with a child aged 6-12 and no children younger than 6.

5.1.2 New Brunswick

In this section I present the statistically significant results for New Brunswick. All difference-in-difference results except for labour force status are not statistically significant. The control provinces used in my estimation are Newfoundland, P.E.I., Nova Scotia, Quebec, and Ontario.

Table 6 shows the difference-in-difference results of the dependent variable of labour force status in columns (1) and (3) without controls and columns (2) and (4) with controls. The results are displayed for a sample of both all mothers with a kindergarten aged child and a

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[14] By restricting the control variables, I determine that the change in significance is driven by educational attainment. This supports prior maternal labour force literature that educational attainment is an important factor in the effect of a policy including Contreras et al. (2010), Nollenberger and Rodriguez-Planas (2011), and Schlosser (2011).

sample restricted to married mothers.[15] For the model without controls, mothers with a kindergarten aged child are 10.3 percentage points less likely to be employed following the reform. This labour force status difference-in-difference result is no longer statistically significant when controls are included, in columns (2) and (4).[16]

Table 7 displays the triple-difference linear probability model results with control group 1 for full-time status as the dependent variable.[17] Results are shown both without control variables in column (1) and with control variables in column (2). Mothers with at least one kindergarten aged child and no children over kindergarten age are 8 percentage points more likely to be working at a part-time job rather than a full-time job following the reform than mothers with at least one child aged 6-12, and no children under age 6. This result is statistically significant at the 5% level. This is an economically significant result as the incidence of full-time work decreases with kindergarten reform. Interestingly, the triple-difference effect of the reform is unchanged when a set of socio-economic controls are included.

Columns (3) and (4) in Table 7 display the triple-difference regression results for the dependent variable of usual hours worked per week, in tenths of an hour. Mothers with a kindergarten aged child work an average of 2.3 hours less per week in a usual week compared with the mothers with children aged 6-12, but no children under 6. This result is significant at the 5% level. This result remains significant and of the same magnitude with the inclusion of socio-economic control variables. The triple-difference results for the dependent variable of

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[15] I restrict my sample to married mothers as a robustness check for both Nova Scotia and New Brunswick, as explained in section 5.3.2. I include the results for married mothers in Table 6 to illustrate the reduced statistical significance for both all mothers and the restricted group of mothers.
[16] By restricting the control variables, similar to the difference-in-difference results obtained with Nova Scotia, I determine that the change in significance is driven by educational attainment.
[17] Control group 1 is composed of mothers with children aged 6-12, with no chil under 6, while the treatment group is mothers with at least one 5 year old child and no children over age 5.

actual hours worked per week are not significant, which is unusual as I would assume there is a high correlation between these variables.[18]

In reference to my theoretical model, my results show that mothers of kindergarten aged children in New Brunswick respond to full-day kindergarten as a substitution effect that allows them to pay less for daycare and thus be able to spend less time working. This effect is not strong enough to encourage mothers to leave their employment or dissuade them from being employed, as the difference-in-difference results for labour force status were not significant in the specification including control variables.

5.2 Results for the Survey of Labour and Income Dynamics

I fail to reject the null hypothesis that there is an effect of full-day kindergarten reform on maternal employment in Nova Scotia as none of the difference-in-difference estimates are statistically significant.[19][20] This could be for one of two reasons. Firstly, it is possible that there is simply no effect of full-day kindergarten. This is a reasonable interpretation, as other control variables are statistically significant when they are included in the model, indicating that they affect maternal labour force outcomes. Alternatively, my sample size is too small, and thus does not have enough statistical power to capture the effect of a change in maternal labour supply due to kindergarten reform. Given my interpretation of the results of the LFS, I do not believe that there is no effect of full-day kindergarten in Nova Scotia, but rather that due to my sample size I am not able to capture the effects of the reform.

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[18] I do not present the results for the actual hours worked variable here, for brevity.
[19] I use the dependent variables labour force status in April and August, two definitions of annual labour force status, total weeks employed during the year, and total usual hours worked.
[20] I do not present tables of my results for the SLID, as none of my results are statistically significant. However, I do present my results for labour force status to show the change in results with the inclusion of the *child tax benefit* variable.

Tables 8 and 9 show the annual labour force status of mothers of a kindergarten aged child with both the full sample of provinces used as a control group and restricted "clawback" provinces. Results are shown for both a sample comprised of all mothers in Table 8 and a sample restricted to married mothers in Table 9. Columns (3) and (6) are the difference-in-difference estimates that include control variables as well as the control variable of *child benefits.*[21] Comparing columns (2) with (3) and (5) with (6) in each table, the inclusion of the *child benefits* variable reduces the difference-in-difference estimate in each of the comparisons. Thus, even when I eliminate single mothers from my sample and restrict the provinces I examine, the Child Tax Benefit Program still influences my difference-in-difference results, biasing the effect on maternal labour supply upward. However, note that when the *child benefits* variable is included, changes to the difference-in-difference estimates are not statistically significant, as the difference-in-difference estimate remained consistently not statistically significant.

5.3 Robustness Checks

I conduct several checks to determine if my results are robust to different specifications. These robustness checks include re-estimating linear probability models as probits, re-estimating all results for mothers who are married (including common law) and living with a spouse, as well as re-estimating models using the LFS keeping only the first response for the household. [22] I do not present my results here.

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[21] The set of control variables I use includes age, age squared, number of children under 6, number of children over 5, and marital status.

[22] I additionally use the LFS to analyse maternal labour force changes within the province of Quebec for their 1997 policy change using the same difference-in-difference models I use for Nova Scotia and New Brunswick. Prior literature by Lefebvre and Merrigan (2008) and Baker et al. (2008) demonstrate a large increase in labour force participation of Quebec mothers following reforms in 1997. My difference-in-difference results for Quebec are

5.3.1 Probit models

Probit models are estimated for all dependent variable that are binary and have been initially estimated using a linear probability model, which includes labour force status and full-time/part-time labour force status. Results have the largely the same level of significance as using a linear probability model, and estimates are slightly smaller in magnitude, but not in an economically significant way.

5.3.2 Married Mothers

Restricting my analysis to married women did not largely change the results. Though there were very small changes in the magnitude of the estimates, restricting my sample to married mothers did not change the significance of results, except in a few cases outlined in the rotation groups section.

5.3.2 Rotation groups

A further test of robustness within the LFS is keeping within my sample only the incoming response of individuals. The main reason for eliminating repeated observations is that having the same household more than once in the analysis results in autocorrelation, which violates the OLS assumption of lack of autocorrelation. When the same household is sampled more than once, it is likely that their error terms when estimating models of maternal labour force outcomes will be correlated over the six samples for each household. While autocorrelation will not bias the coefficients for my variables of interest, it will bias the standard errors which affect the statistical significance of the results.

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positive, economically significant, and statistically significant for all dependent variables. I do not present my results for Quebec here.

Note that my analysis using the SLID faces the same issue of autocorrelation, as I am using the SLID as a repeated cross-section survey rather than a longitudinal survey. However, I do not similarly eliminate repeated observations in the SLID. This is because my analysis with the SLID is already challenged by very low sample sizes, and by further eliminating observations I would not expect the regressions to have any explanatory power.

As eliminating repeated individuals reduces the LFS dataset to $1/6^{th}$ of its original size, I estimate regressions using an additional year on either side of the reform to shore up my number of observations. For example, for Nova Scotia, the years 1996 and 1997 are used for the pre-reform time period and 1999 and 2000 for the post-reform time period, rather than the single years of 1997 and 1999. A potential drawback of using this "double reform years" approach is that it may be less precise than using the years directly before and after the reform, and may be capturing additional variation in the data due to shocks to the maternal labour force unrelated to kindergarten reform. Thus, although I double my sample size by using the double years approach, I also introduce more noise into the regressions by including these extra years.

Nova Scotia

The model for Nova Scotia using all provinces and restricted provinces as a control group is relatively similar between this rotation group robustness check and using all observations. However, the difference-in-difference linear probability model for the dependent variable of labour force status for the model using the full sample of provinces has a lower statistical significance, at the 10% instead of 5% level. Further, for the same difference-in-difference linear probability model of labour force status that restricts the sample to married mothers, the effect of the reform is not longer statistically significant.

The results when individuals with repeated observations are eliminated for New Brunswick reveals relatively similar results to the full sample.[23] However, now the triple-difference estimates using control group 1 for the dependent variables full-time status and usual hours worked are no longer significant for married mothers. As well, triple-difference estimate for labour force status using control group 2 is significant for married mothers at the 1% level, rather than the 5% level. According to the specification using controls, married mothers are 8.2 percentage points less likely to be employed following the kindergarten reform.

5. Conclusion

In this paper, I examine the effect of the transition from half- to full-day kindergarten on maternal employment in the provinces of New Brunswick, with a 1992 reform, and Nova Scotia, with a 1997 reform. I aim to fill a gap in the maternal employment literature by focusing on the transition from half- to full-day kindergarten without other large programs such as the childcare subsidies in Quebec.

There is a minor effect on maternal employment for New Brunswick, with a decrease in usual hours worked and full-time status when a triple-difference approach is used. However, the results for Nova Scotia show that maternal employment significantly increased following kindergarten reforms when using the LFS. These results continue to be significant with restrictions on my sample to counter concerns of endogeneity due to the Child Tax Benefit Program occurring during the same time period. Results for Nova Scotia from the SLID are not significant, but do suggest that the Child Tax Benefit Program may still result in an endogeneity

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[23] As the results for this robustness check are very similar, I do not include a table for brevity.

concern even when restricting the sample. In general, my results suggest that when full-day kindergarten reforms are implemented unaccompanied by other child reforms, they do not increase maternal labour supply and may even decrease the amount that mothers work. However, when full-day kindergarten reform is accompanied by other policies designed to increase maternal employment, there is a strong and large effect on maternal labour supply.

The results of this paper are informative for other provinces in Canada currently in the process of implementing full-day kindergarten and those considering this policy, as previously they could only turn to the results of Quebec's 1997 policy in understanding the maternal labour force outcomes of full-day kindergarten. Policy makers should understand that although full-day kindergarten may have strong labour force outcomes, as with Nova Scotia, it is in no way guaranteed, and may lead to mothers working less, similar to New Brunswick.

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Appendix: Theoretical Model

In this Appendix, I provide a more detailed explanation of a theoretical model of maternal supply, including a graphical representation. Consider a static model of labour supply with one mother and one child, where the mother acts both as the agent and the provider of childcare. When the mother does not have access to free childcare such as kindergarten, she faces a budget constraint of:

$$c = y + (w - p)h$$

where c is consumption (other than childcare), y is non-labour income, $(w-p)$ is the wage minus the cost of childcare, and h is the hours worked

If one defines l as leisure time, which is time spent caring for the child, and we assume that a minimum of 8 hours per day are spent on activities of daily living such as sleeping and eating, the time constraint faced by the mother is as follows

$$h + l = 16$$

The mother's utility of consumption and leisure is

$$u(c, l)$$

Kindergarten can be considered a 100% subsidy on childcare, with a fixed number of h* hours provided for half-day kindergarten and h** hours provided for full-day kindergarten. The introduction of kindergarten causes a kink in the budget constraint at h* for half-day kindergarten and h** for full-kindergarten. This can be seen in Figure 1, where the budget

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constraint rotates upward for a brief period of h* for half-day kindergarten and h** for full-day kindergarten

For mothers who had not worked prior to the full-day kindergarten reform, there is a further incentive to work in the move from h* to h**, which is a substitution effect between leisure (recall that leisure also includes the mother-provided childcare) and working. The mother would choose to work because she can gain more income and thus raise her consumption compared with prior to the reform, now that more hours of childcare are subsidized. For mothers who worked prior to the reform, there is an income effect if the mother worked an amount of h>h**, ie. an amount of hours less than a full school day, where the mother would reduce the amount of time that they work. This is because leisure is assumed to be a normal good, so when the mother receives a higher income she will choose to consume more leisure. For mothers working 0<h<h** hours, which would be an amount of hours less than a full school day, it is ambiguous whether the mothers will be affected by a substitution effect and therefore work more or an income effect and then work less.
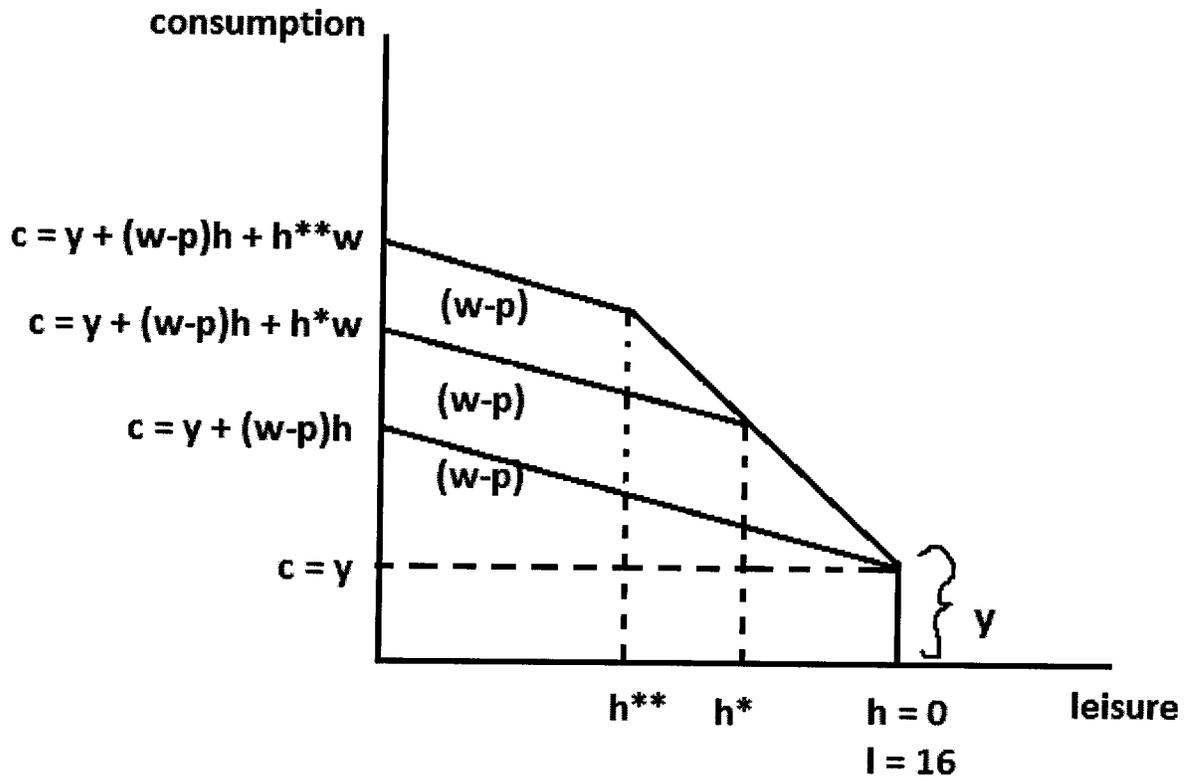
Figure 1. Theoretical model demonstrating the effect of full-day kindergarten on the mother's time and budget constraints.

Table 1: SLID Summary Statistics: All observations, 1990-2002

	All Observations			Women 18-56			Mothers of a Kindergarten aged Child		
	Mean	SD	N	Mean	SD	N	Mean	SD	N
Annual Labour Force Status	0.740	0.438	402,372	0.770	0.420	164,970	0.810	0.391	13,492
Annual Labour Force Status Alternate Definition	0.558	0.496	402,372	0.577	0.493	164,970	0.659	0.473	13,492
Total Weeks Employed	56.925	35.689	619,679	40.722	26.954	176,123	73.425	32.598	31,517
Total Usual Hours	4,529	4,302	619,679	2,166	2,901	176,123	6,523	4,240	31,517
Labour Force Status April	0.655	0.474	402,372	0.682	0.465	164,970	0.746	0.435	13,492
Labour Force Status August	0.683	0.465	402,372	0.703	0.456	164,970	0.756	0.429	13,492
Age	36.188	21.544	619,679	36.902	10.678	176,123	18.857	15.196	31,517
Married	0.596	0.490	486,879	0.629	0.482	175,957	0.876	0.328	14,220
Single	0.403	0.490	486,879	0.370	0.482	175,957	0.123	0.328	14,220
Years of Education	36.830	39.156	619,679	20.677	24.047	176,123	63.673	42.598	31,517
Newfoundland	0.018	0.133	619,679	0.018	0.135	176,123	0.015	0.122	31,517
P.E.I.	0.004	0.067	619,679	0.004	0.066	176,123	0.004	0.068	31,517
Nova Scotia	0.030	0.172	619,679	0.030	0.172	176,123	0.025	0.158	31,517
New Brunswick	0.024	0.155	619,679	0.024	0.155	176,123	0.021	0.144	31,517
Quebec	0.243	0.428	619,679	0.245	0.430	176,123	0.222	0.416	31,517
Ontario	0.382	0.486	619,679	0.382	0.486	176,123	0.398	0.489	31,517
Manitoba	0.036	0.187	619,679	0.034	0.182	176,123	0.039	0.194	31,517
Saskatchewan	0.032	0.176	619,679	0.029	0.168	176,123	0.034	0.182	31,517
Alberta	0.096	0.295	619,679	0.096	0.295	176,123	0.112	0.316	31,517
British Columbia	0.131	0.337	619,679	0.131	0.338	176,123	0.124	0.330	31,517

Note. All observations are weighted. Total usual hours are per week and in tenths of an hour. Total weeks employed is total weeks employed in the year.

Table 2: LFS Summary Statistics: All observations, 1990-2005

	All Observations			Women 18-56			Mothers of a Kindergarten Child		
	Mean	SD	N	Mean	SD	N	Mean	SD	N
Labour Force Status	0.765	0.423	7,400,000	0.683	0.456	3,900,000	0.595	0.490	291,144
Usual Hours	382.337	122.530	5,600,000	33.933	116.353	2,600,000	310.926	124.401	170,589
Actual Hours	348.333	172.271	5,600,000	290.566	159.195	2,600,000	0.650	0.476	170,589
Full-time Status	0.854	0.352	5,600,000	0.730	0.443	2,600,000	0.650	0.476	170,589
Age	40.251	8.801	7,500,000	38.510	7.990	3,900,000	33.330	5.087	291,333
Married	0.914	0.279	7,500,000	0.872	0.333	3,900,000	0.903	0.294	291,333
Single	0.085	0.279	7,500,000	0.127	0.333	3,900,000	0.096	0.294	291,333
University	0.179	0.383	7,500,000	0.161	0.367	3,900,000	0.161	0.367	291,333
College	0.400	0.490	7,500,000	0.406	0.491	3,900,000	0.410	0.491	291,333
High School	0.429	0.493	7,500,000	0.431	0.495	390,0000	0.428	0.494	291,333
Newfoundland	0.021	0.143	7,500,000	0.020	0.142	3,900,000	0.017	0.131	291,333
PEI	0.004	0.068	7,500,000	0.004	0.068	3,900,000	0.004	0.068	291,333
Nova Scotia	0.031	0.173	7,500,000	0.031	0.174	3,900,000	0.030	0.171	291,333
New Brunswick	0.026	0.159	7,500,000	0.026	0.159	3,900,000	0.024	0.154	291,333
Quebec	0.244	0.430	7,500,000	0.244	0.429	3,900,000	0.232	0.422	291,333
Ontario	0.388	0.487	7,500,000	0.387	0.487	3,900,000	0.385	0.486	291,333
Manitoba	0.036	0.186	7,500,000	0.036	0.186	3,900,000	0.039	0.193	291,333
Saskatchewan	0.031	0.174	7,500,000	0.031	0.175	3,900,000	0.036	0.186	291,333
Alberta	0.096	0.294	7,500,000	0.096	0.295	3,900,000	0.036	0.309	291,333
British Columbia	0.119	0.324	7,500,000	0.120	0.325	3,900,000	0.107	0.326	291,333
							0.121		291,333

Note. All observations are weighted. Total usual hours and actual hours are per week and in tenths of an hour.

Table 3: LFS Summary Statistics: Restricted Rotation Group Observations, 1990-2005

	All Observations			Women 18-56			Mothers of a Kindergarten Child		
	Mean	SD	N	Mean	SD	N	Mean	SD	N
Labour Force Status	0.766	0.422	1,200,000	0.683	0.465	633,288	0.591	0.491	47,042
Usual Hours	385.829	127.413	907,629	333.006	118.571	423,752	311.41	127.135	27,327
Actual Hours	355.294	176.561	907,629	294.272	0.444	423,752	278.845	159.31	27,327
Full-time Status	0.853	0.353	907,629	0.728	0.444	423,752	0.648	0.477	27,327
Age	40.284	8.765	1,200,000	38.56	7.973	634,004	33.352	5.098	47,081
Married	0.914	0.279	1,200,000	0.871	0.334	634,004	0.904	0.294	47,081
Single	0.085	0.279	1,200,000	0.128	0.334	634,004	0.095	0.294	47,081
University	0.180	0.384	1,200,000	0.161	0.368	634,004	0.159	0.366	47,081
College	0.401	0.490	1,200,000	0.408	0.491	634,004	0.414	0.492	47,081
High School	0.418	0.493	1,200,000	0.430	0.495	634,004	0.425	0.494	47,081
Newfoundland	0.020	0.143	1,200,000	0.02	0.141	634004	0.017	0.13	47,081
PEI	0.004	0.063	1,200,000	0.004	0.068	634,004	0.004	0.069	47,081
Nova Scotia	0.031	0.173	1,200,000	0.031	0.174	634,004	0.03	0.171	47,081
New Brunswick	0.026	0.159	1,200,000	0.026	0.159	634,004	0.024	0.153	47,081
Quebec	0.245	0.430	1,200,000	0.244	0.43	634,004	0.233	0.423	47,081
Ontario	0.388	0.487	1,200,000	0.387	0.487	634,004	0.385	0.486	47,081
Manitoba	0.036	0.186	1,200,000	0.036	0.186	634,004	0.038	0.193	47,081
Saskatchewan	0.031	0.175	1,200,000	0.031	0.175	634,004	0.106	0.308	47,081
Alberta	0.096	0.294	1,200,000	0.096	0.295	634,004	0.106	0.308	47,081
British Columbia	0.119	0.324	1,200,000	0.12	0.325	634,004	0.122	0.327	47,081

Note. All observations are weighted. Restricted rotation groups restricts the sample to the first month of responses of the individual. Total usual hours and actual hours are per week and in tenths of an hour.

Table 4: LFS LPM DID Results: Labour Force Status, All mothers, Nova Scotia

	(1)	(2)	(3)	(4)	Control Group 1		Control Group 2	
					(5)	(6)	(7)	(8)
Post	0.218***		0.034*	0.023	0.041***	0.034***	0.024	0.032**
	(0.053)		(0.020)	(0.019)	(0.010)	(0.010)	(0.016)	(0.016)
Treat		0.033	-0.156***	-0.161***	0.041***	0.034***	0.024	0.032**
		(0.041)	(0.038)	(0.038)	(0.010)	(0.010)	(0.016)	(0.016)
Treat * Post			0.184***	0.184***	0.010	0.009	0.022	0.011
			(0.057)	(0.056)	(0.029)	(0.028)	(0.047)	(0.045)
Treat mothers					-0.040***	0.020*	-0.074***	-0.012
					(0.009)	(0.011)	(0.012)	(0.012)
Treat * Treat mothers					0.026	0.022	0.028	0.018
					(0.024)	(0.024)	(0.035)	(0.034)
Treat mothers * Post					-0.005	-0.004	0.014	-0.002
					(0.012)	(0.012)	(0.017)	(0.017)
Treat * Post * Treat Mothers					0.004	0.009	-0.008	0.004
					(0.035)	(0.034)	(0.050)	(0.048)
Controls	NO	NO	NO	YES	NO	YES	NO	YES
N	408	2391	3,799	3,799	41,207	41,207	41,207	41,207
R-squared	0.05	0.00	0.00	0.09	0.01	0.07	0.01	0.07

Notes. Dependent variable is a dummy variable equal to one if the mother is employed and zero if the mother is unemployed or not part of the labuour force. Control group 1 includes mothers with children aged 6-12, with no children under the age of 6. The treatment group is mothers with at least one child aged 5, and no children over age 5. Control group 2 includes mothers with children aged 13-15, with no children under the age of 13. The treatment group is mothers with at least one child aged 5, and no children over age 12. Controls include mother's age, age squared, a dummy variable for marital status and educational attainment, number of children under 6, and number of children over 5, the age of the youngest child, and a dummy variable for the number of children under 4. Control provinces include Newfoundland, P.E.I., Ontario, Manitoba, Saskatchewan, Alberta, and British Columbia. Robust standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table 5: LFS LPM and Regression Triple-Difference Results: Restricted Provinces, using Control Group 2, Nova Scotia

	Full-time Status		Usual Hours	
	(1)	(2)	(3)	(4)
Treat	-0.057	-0.051	-19.352*	-17.638
	(0.037)	(0.037)	(10.964)	(10.972)
Post	-0.014	-0.003	-2.815	-0.370
	(0.018)	(0.018)	(4.863)	(4.841)
Treat Mothers	-0.040***	-0.017	-11.484***	-3.387
	(0.013)	(0.013)	(3.742)	(3.814)
Treat * Post	0.146***	0.134***	31.050**	28.057**
	(0.049)	(0.049)	(13.721)	(13.775)
Treat * Treat Mothers	0.051	0.040	18.033	15.183
	(0.040)	(0.040)	(11.753)	(11.729)
Post * Treat Mothers	0.022	0.012	2.548	-0.135
	(0.019)	(0.019)	(5.229)	(5.195)
Post * Treat * Treat Mothers	-0.143***	-0.129**	-32.749**	-29.033*
	(0.053)	(0.053)	(14.817)	(14.840)
Controls	NO	YES	NO	YES
N	28,603	28,603	28,603	28,603
R-squared	0.00	0.03	0.00	0.03

Notes. Dependent variable is a dummy variable equal to one if the mother works full-time and zero if the mother works part-time. Usual hours is the usual hours worked per week in tenths of hours. Controls include mother's age, age squared, a dummy variable for marital status and educational attainment, number of children under 6, and number of children over 5, the age of the youngest child, and a dummy variable for the number of children under 4. Control provinces include P.E.I, Ontario, Manitoba, and Alberta. Robust standard errors in parentheses. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table 6: LFS LPM DID Results: Labour Force Status, New Brunswick

	All mothers		Married Mothers	
	(1)	(2)	(3)	(4)
Treat	0.006	0.013	0.012	0.020
	(0.034)	(0.032)	(0.037)	(0.035)
Post	-0.002	-0.029	0.012	-0.012
	(0.020)	(0.019)	(0.021)	(0.021)
Treat * Post	-0.103**	-0.079	-0.101*	-0.086
	(0.052)	(0.050)	(0.056)	(0.055)
Controls	NO	YES	NO	YES
N	5,396	5,396	4,718	4,645
R-squared	0.00	0.09	0.00	0.08

Notes. Dependent variable is a dummy variable equal to one if the mother is employed and zero if the mother is unemployed or not part of the labour force. Controls include mother's age, age squared, a dummy variable for marital status and educational attainment, number of children under 6, and number of children over 5, the age of the youngest child, and a dummy variable for the number of children under 4. Additional controls for married mothers include spouse's age and age squared, spousal educational attainment, and spousal labour force status. Control provinces include Newfoundland, P.E.I., Nova Scotia, Quebec, and Ontario. Robust standard errors in parentheses. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table 7: LFS Regression and LPM Triple-Difference Results: All mothers, using Control group 1, New Brunswick

	Full-time Status		Usual hours worked	
Treat	-0.023	-0.023	-7.656	-7.776
	(0.021)	(0.021)	(5.892)	(5.844)
Post	-0.004	-0.001	1.034	1.715
	(0.012)	(0.011)	(3.249)	(3.224)
Treat Mothers	-0.009	0.009	-2.860	3.366
	(0.010)	(0.012)	(2.677)	(3.455)
Treat * Post	0.038	0.036	8.924	8.346
	(0.031)	(0.030)	(8.571)	(8.487)
Treat * Treat Mothers	0.045*	0.044*	17.163**	16.832**
	(0.025)	(0.025)	(7.044)	(6.980)
Post * Treat Mothers	0.030**	0.025*	6.546*	5.405
	(0.014)	(0.014)	(3.902)	(3.863)
Post * Treat *	-0.080**	-0.079**	-22.098**	-22.154**
Treat Mothers	(0.037)	(0.036)	(10.260)	(10.161)
Controls	NO	YES	NO	YES
N	38,953	38,953	38,953	38,953
R-squared	0.00	0.02	0.00	0.02

Notes. Dependent variable full-time status is a dummy variable equal to one if the mother is employed and zero if the mother is unemloyed or not part of the labour force. Controls include mother's age, age squared, a dummy variable for marital status and educational attainment, number of children under 6, and number of children over 5, the age of the youngest child, and a dummy variable for the number of children under 4. Control provinces include Newfoundland, P.E.I., Nova Scotia, Quebec, and Ontario. Robust standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table 8: SLID LPM Results: Annual Labour Force Status, All Mothers, Nova Scotia

	All Provinces			Restricted Provinces		
	(1)	(2)	(3)	(4)	(5)	(6)
Treat	-0.034	-0.020	-0.014	-0.053	-0.048	-0.031
	(0.094)	(0.088)	(0.089)	(0.096)	(0.089)	(0.090)
Post	0.029	0.018	0.040	0.008	-0.012	0.021
	(0.036)	(0.034)	(0.033)	(0.042)	(0.039)	(0.037)
Treat * Post	0.067	0.039	0.023	0.087	0.069	0.046
	(0.115)	(0.105)	(0.106)	(0.118)	(0.107)	(0.108)
Controls	NO	YES	YES	NO	YES	YES
Child Benefit Control	NO	NO	YES	NO	NO	YES
N	1,512	1,472	1,472	1,119	1,090	1,090
R-squared	0.00	0.12	0.13	0.00	0.12	0.15

Notes. Dependent variable is a dummy variable equal to one if the mother is employed and zero if the mother is unemployed or not part of the labour force. Controls include mother's age, age squared, years of education, years of education squared, a dummy variable for marital status, number of children under 6, and number of children over 5. All provinces include Nova Scotia, Newfoundland, P.E.I., Ontario, Manitoba, Saskatchewan, Alberta, and British Columbia. Restricted provinces include Nova Scotia, P.E.I., Ontario, Manitoba, and Alberta. Robust standard errors in parentheses. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table 9: SLID LPM DID Results: Annual Labour Force Status, Married Mothers, Nova Scotia

	All Provinces			Restricted Provinces		
	(1)	(2)	(3)	(4)	(5)	(6)
Treat	0.005	0.003	0.017	-0.011	-0.024	0.004
	(0.106)	(0.096)	(0.096)	(0.107)	(0.096)	(0.096)
Post	0.006	0.000	0.020	-0.016	-0.032	-0.002
	(0.037)	(0.035)	(0.034)	(0.044)	(0.040)	(0.038)
Treat * Post	0.061	0.023	-0.003	0.084	0.057	0.017
	(0.127)	(0.116)	(0.116)	(0.129)	(0.118)	(0.118)
Controls	NO	YES	YES	NO	YES	YES
Child Benefit Control	NO	NO	YES	NO	NO	YES
N	1,301	1,269	1,269	9,56	9,33	9,33
R-squared	0.00	0.10	0.12	0.00	0.11	0.14

Notes. Dependent variable is a dummy variable equal to one if the mother is employed and zero if the mother is unemployed or not part of the labour force. Controls include mother's age, age squared, years of education, years of education squared, number of children under 6, and number of children over 5. All provinces include Nova Scotia, Newfoundland, P.E.I., Ontario, Manitoba, Saskatchewan, Alberta, and British Columbia. Restricted provinces include Nova Scotia, P.E.I., Ontario, Manitoba, and Alberta. Robust standard errors in parentheses. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.