DISCUSSION PAPER SERIES

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ABSTRACT

The Impact of Full-Day Kindergarten on Maternal Labour Supply

We examine the impact of offering full-day as a replacement for half-day kindergarten on mothers' labour supply using the rollout of full-day kindergarten in Ontario, Canada. We find no impact on the extensive margin but do find one on the intensive margin. In particular, we find that access to full-day kindergarten increases weekly hours worked and decreases absenteeism for mothers of four-year-olds. We find that this effect is driven by specific sub-groups, namely non-immigrant mothers of only one child with low education levels who live in urban areas.

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I. INTRODUCTION

In recent decades, the importance of high-quality learning and care during the early years of life has received significant attention. Following this, a large number of jurisdictions around the world have implemented or expanded government-provided or -subsidized programs for younger children before compulsory schooling begins. The reasoning behind providing or subsidizing programs such as childcare and preschool is that they have the potential to promote long-term growth of an economy in two distinct ways. First, children may become better prepared for school, which can have a cascading effect on their long-run human capital acquisition and subsequent labour market outcomes (e.g Heckman, 2006). Second, a more immediate effect is that the children's caregivers may be able to increase their labour force attachment and therefore their lifetime earnings.

In this study, we evaluate the effect of expanding universal public kindergarten for four-year-olds from half-day (2.5 hours/day) to full-day (6.5 hours/day) on the labour market outcomes of their mothers. Starting in September 2010 and with a progressive rollout over the following four years, the Canadian province of Ontario implemented a reform of early education to offer full-day kindergarten to all children aged four and five in public schools. Prior to the reform, the majority of children in Ontario attended half-day kindergarten for during these two years. While the rollout was planned (rather than randomized), certain factors in its implementation create variation over time and space that we use to identify the impact of universal full-day kindergarten on the labour supply of mothers of age-eligible children with a difference-in-differences (DD) approach.

We find that the implicit subsidy of extending the length of day of universal public school for four-year-old children has no impact on labour force participation at the extensive margin. We do, however, find evidence that some women are able to work longer hours. Specifically, we find that having access to full-day rather than half-day school increases the average number of hours worked per week for mothers with eligible aged children and decreases their rate of absenteeism from work. The effect is driven primarily by non-immigrant women who live in urban areas, have only one child, and have only a high school education or less.

The main way the expansion of universal full-day schooling for four- and five-year-olds (we will refer to this as full-day kindergarten for the remaining of the paper) was sold to the public in Ontario was based on the idea that the program would increase school readiness for all children. However, the evidence to support that claim is mixed. We know that small model targeted preschool programs (often for two- to four-year-olds) have large effects on child outcomes, especially on children from disadvantaged families (Waldfogel, 2015) and that these programs often pay for themselves in the long-run due to raising students' achievement and life outcomes (e.g. Heckman et al. 2010). But this evidence is stronger for short-term effects versus longer-term outcomes (e.g. Puma et al. 2012; DeCicca, 2007). In more universal programs, such as universally provided preschool for four-year-olds in the United States, the children from disadvantaged families are the ones to see the most improved outcomes (e.g. Havnes and Mogstad, 2011). Some of the evidence from Canada is not as promising. This includes the findings of no improvement in school readiness from the universal childcare and kindergarten reform in Quebec (Haeck, Lefebvre, and Merrigan, 2015) along with negative effects on

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behavior, development, and health (Baker et al., 2008).[1] Indeed, van Huizen and Plantenga (2018) conduct a meta-analysis from natural experiments across many jurisdictions on the effects of providing universal Early Childhood Education and Care arrangements, such as universal preschool, and finds overall mixed results. However, they do find that evidence that quality matters critically and that gains are concentrated within the group of disadvantaged children.

Preschool aged children's care is subsidized in many ways across the world, ranging from providing free public universal education programs, increasing parental leave (unpaid and paid), along with a variety of different subsidy programs that reduce parents' out-of-pocket contributions. These subsidy programs are often targeted at low-SES families. The literature regarding the impact of these subsidies on maternal labour supply decisions is mixed and generally inconclusive.[2]

To reconcile these results, one must rely on economic theory and contextual factors. The subsidization of care changes maternal labour supply by changing a mother's budget constraint. For instance, a free universal preschool program or child care subsidy will increase a mother's effective wage rate (wage rate net of cost of care) and this in turn will increase the opportunity cost of not working and remaining at home with the child. Therefore, on the extensive margin, the maternal employment rate should not fall. However, for a woman who would have already been working regardless of the subsidization, the effect on hours worked is ambiguous (Cattan,

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[1] Kottenlenberg and Lehrer (2013) examine the Quebec childcare subsidization expansion long term and find that most of the negative impacts of the reform on children were driven by children from families who only attended childcare in response to the implementation of this policy.

[2] See Cascio et al. (2015) for a nice discussion.

2016). The contextual factors of a particular country may serve as a moderator of these policy effects.[3] These factors include things such as current maternal employment rates and current subsidization rates for childcare. The scope of a policy to increase maternal labour supply is more limited in countries with very high female employment and/or highly subsidized early childcare systems. If there is already significant availability of affordable child care (either informal or privately paid childcare), increasing the subsidization might result in little to no increase in maternal labour supply because it only crowds out other forms of non-parental care. But if low maternal employment is driven by the lack of affordable childcare, increased subsidization may encourage more mothers to work and in turn increase attachment to the labour force in the long run. The context for this policy experiment is as follows. Canada's female labour force participation rate was the 8th largest in the OECD at 77.76 percent in 2014 (OECD, 2019a) but the middle of the pack in terms of net childcare costs (OECD, 2019b).[4]

The literature most relevant to this study is the literature regarding the maternal labour supply effects of universal kindergarten programs for five-year-olds and universal preschool programs for four-year-olds in the United States along with the literature on the expansion of the kindergarten program from half-day to full-day programs in the United States and Canada. In the United States, the expansion of the primary school system to include five-year-olds, found that these half-day programs increased the maternal labour supply the most for single mothers (Gelbach, 2002; Cascio, 2009; Fitzpatrick, 2012). More recently, the expansion of universal

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[3] Cascio et al. (2015) provides a nice overview of five different studies on maternal labour supply responses due to changes in policies from different countries.

[4] Ontario's labour force participation rate is close to the national average (Statistics Canada, 2019).

preschool programs for four-year-olds in the United States has been examined, with some research finding little effect on the labour supply of most women (Fitzpatrick, 2010) while others have found some positive effect on labour supply (Sall, 2014).

More recently, there has been a trend to extend the kindergarten school day from half-day to full-day for five-year olds despite little evidence on whether this move will affect the labour supply decisions of mothers. Cannon et al. (2006) estimate the likelihood that a mother would work full-time if their child attended full-day kindergarten but find no statistically significant effects for the parents when their child is in first or third grade. Haeck, Lefebvre, and Merrigan (2015) similarly find no significant labour market response of parents from the introduction of full-day kindergarten in Quebec. However, Dhuey et al. (2019) find small effects on hours worked from the introduction of full-day kindergarten in the Francophone system in Ontario and, in a policy paper prepared for the US Department of Labour, Gibbs (2014) uses a policy change in the state of Indiana and a triple-difference strategy and finds suggestive evidence of an increase in maternal employment.[5]

II. THE KINDERGARTEN REFORM IN ONTARIO

The school system in Ontario is made up of four different publicly funded school systems/boards: English Public, English Catholic, French Public, and French Catholic. In addition, approximately five percent of students in Ontario attend private religious schools of

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[5] DeCicca (2007) also presents descriptive statistics that suggest that the percentage of mothers in the labour force is higher when children have access to full-day kindergarten.

mostly Protestant denominations (Card, Dooley, and Payne, 2010). Schools are administered by school boards, which receive funding from the province. Parents can choose the school system to which they send their children, with some restrictions based on language and religion. To attend the French Public or French Catholic system, one of the child's parents must be a French-language right-holder. Approximately four percent of students attend schools operated by the French or the French Catholic Boards (Card, Dooley, and Payne, 2010). To attend a Catholic primary school in English or French, parents must be willing for their children to be educated in a faith-based school and be admitted by the school board. While Catholic families are always given priority, some boards allow non-Catholic families to send their children to Catholic schools if enrolment permits, while others have strict rules regarding religion, particularly in primary schools.[6] Overall, the vast majority of Catholic school students are Catholic and there is little movement of students between school boards of differing types after kindergarten entry. Each school board defines school catchment areas, and prospective students are guaranteed a place in the school that corresponds to their school catchment area. The boundaries of the English Public and English Catholic boards typically coincide in more heavily populated areas.[7]

For children in Ontario, mandatory schooling starts at six-years-old in grade one. Nevertheless, more than 90% of all children attend kindergarten, which is universally offered

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[6] For examples, see enrollment requirements for Toronto Catholic District School Board (2017) or Catholic District School Board of Eastern Ontario (2017).

[7] In our analysis, we exclude "specialty schools" in school boards that have significantly larger or overlapping catchment areas. These schools generally have specialty programs that draw students from across the school board.

through the public school system for two grades: Junior Kindergarten for four year olds, and Senior Kindergarten for five year olds. The percentage of children attending both years of kindergarten is similar.[8] The school entry cutoff date is January 1st of the year. Delayed entry or retention in early grades is virtually non-existent.[9]

The full-day universal kindergarten reform was rolled out over a period of five years between 2010 and 2014 in the English Public and English Catholic school boards.[10] The primary objective of the reform was to lower the number of "at risk" children, who are identified as having low readiness for school (Pascal, 2009). Poverty reduction was touted as a secondary aim in government publications (Government of Ontario, 2010). According to the 2009 Ontario provincial government budgetary report, it would cost $1.5 billion in total to fully implement the full-day kindergarten reform, and approximately 265,000 children aged four and five would benefit from this reform per year.[11]

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[8] These numbers are based on Statistics Canada population estimates (Statistics Canada, 2016a) and Ontario Ministry of Education enrollment data (Ontario Ministry of Education, 2016).

[9] Although we are aware of no official statistics on delayed entry or retention in early grades in Ontario, there is the possibility that some parents of children born in the fall (before the January 1st cutoff) elect to have their children start a year later, a phenomenon known as "redshirting." This practice is banned in many school boards and all available evidence suggests that these parents are few and far between (McDiarmid, 2013).

[10] There are approximately 600 French and French Catholic schools in Ontario but we exclude these schools in our analysis as they previously implemented full-day kindergarten (Dhuey, Eid, and Neill, 2019) but we do not exclude French language speakers from the sample.

[11] The cost projection proved to be an underestimate according to Ontario Ministry of Education (2014), "$200 million in support … for the [full-day kindergarten] program in year 1, $300 million in year 2, $675 million in year 3 and $963 million in year 4".

The rollout started with schools that had immediate capacity to double the kindergarten classroom space and it also prioritized schools with high needs students based on the percentage of low achievement and low-income students at a particular school.[12] Figure 1 shows the cumulative implementation of full-day kindergarten in Ontario from the announcement date in September 2009 to full implementation in September 2014. In September 2010, 16.2 percent of English Public and English Catholic schools started to offer full-day kindergarten, followed by 5.7 percent more in 2011, 25.4 percent more in 2012, 24.7 percent more in 2013, and the remainder in 2014.

There was some friction in the initial implementation of the reform, as some schools lacked the physical capacity to accommodate their kindergarten cohorts for a full-day of schooling and the initially planned rollout was based on a forecast of renovation completion for those schools that had to retrofit existing rooms or build new ones.[13] In addition, in the period leading to the 2011 provincial elections, the reform became a major point of contention in the electoral race, with the Conservative Party promising to cancel it altogether. Due to this uncertainty, September 2011 saw a rollout much smaller than initially planned. Following a Liberal victory in the election, the time to roll out increased again to finish in five years rather than the initial three years originally planned (Pascal, 2009).

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[12] Half-day kindergarten was often held in shifts prior to the expansion. Student would either attend in the morning or the afternoon.

[13] There are few mentions of this in official government documents, but it was widely reported in the news at the time; see for example Hammer (2010).

Therefore the initial rollout plans were not random. However, the actual implementation differed from the planned one significantly mainly due to capacity constraints (the ability to open new classrooms) and to the political upheaval from the provincial election. While capacity was considered in the planning, even optimistic estimates of the cost of the reform admitted that only at most 35 percent of schools would be able to open immediately, with the rest requiring some level of investment (Pascal, 2009). As mentioned previously, children living in the catchment area of a school are guaranteed access if they request it. As such, schools scheduled to start offering full-day universal kindergarten for four- and five-year-olds could only do so if they could fit all the potential students. Figure 2 shows the rollout in the largest school board in our sample, the Toronto District School Board, and highlights the level of geographic variation within board in the timing of implementation.

III. EMPIRICAL STRATEGY

The goal of this research is to estimate the impact of moving from half-day to full-day universal kindergarten on the labour market outcomes of mothers with eligible-aged children. We use a difference-in-differences (DD) estimation strategy with pooled cross-sectional data spanning from 2008 to 2014 that exploits the rollout of the kindergarten reform.

We estimate the following equation:

$$Y_{ict} = \alpha + \beta FDK_{ct} + X'_{it}\delta + S'_{ct}\phi + N'_{ct}\eta + T_t + C_c + \varepsilon_{ict} \qquad (1)$$

where Y_{ict} denotes the maternal labour market outcomes for individual i in school catchment area c in school year t, which include indicator variables for maternal

labour force participation, employment, full-time employment and absenteeism as well as the number of weekly hours of work, and the log of weekly earnings. FDK_{ct} is the treatment status and corresponds to an indicator variable equal to one if a mother living in a school catchment area that offers universal full-day kindergarten for four- and five-year-olds in a given year and zero otherwise for schools in the English Public Board. X'_{it} is a vector of individual-level maternal control variables: mother's age, marital status, immigration status, level of education, and number of children. S'_{ct} is a vector of school-level controls: a capacity measure indicating the ratio of existing students to available space in each school, the percentage of students in the school who met provincial standards in math and reading in grade three EQAO tests in the previous academic year, the percentage of students in the school whose first language is neither English nor French, and the percentage of students in the school with special needs.[14] N'_{ct} is a vector of neighborhood-level controls made up of the percentage of university-educated residents, labour force participation rate of childless males, and a rural-urban indicator.[15] We also include school year fixed effects (T_t) to capture unobserved shocks common to all school catchment areas in Ontario in a given school year along with school-catchment fixed effects (C_c)

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[14] EQAO tests are administered to all children in the province in grade three and are scored on a one to four scale. The provincial standard for passing is three or higher.

[15] Here we define neighborhood as a forward sortation area (FSA); an area that is characterized as having the same first three digits in the postal code. The neighborhood variables were calculated from the Labour Force Survey (aggregated at the FSA level). The school characteristics were obtained from the Ontario Ministry of Education and EQAO.

to capture unobserved differences common to a geographic area associated with each school. School year is defined as starting in September of each year. ε_{ict} is the usual error term.[16]

   We estimate linear probability models (for the probability of maternal labour force participation, employment, full-time employment, and absenteeism) and ordinary least squares models (for the number of weekly hours, and the log of weekly earnings) as our main specifications.[17] In this model, the β is the parameter of interest and can be interpreted as the change in maternal labour market outcomes associated with having access to the universal full-day kindergarten program in the local English Public school. In the difference-in-differences specification, identification of β comes from the deviation from the trend in labour supply outcomes of mothers with eligible-aged children in a catchment area relative to mothers with eligible-aged children in other catchment areas where full-day kindergarten is not offered. If we believe that the deviations from trend are unrelated to all other unobserved characteristics, then the effect we observe is causal.[18]

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[16] Given the structure of the data, one might be concerned about possible bias of the standard errors caused by serial correlation. To address these concerns, we cluster our error terms at the school level, that is, we allow for arbitrary serial correlation and heteroscedasticity for mothers whose school catchment area belongs to the same school.

[17] We also ran the specification with a probit model and found similar results. The results are available from the authors upon request.

[18] Some literature in this area has used a triple difference framework to estimate the effect on labour supply. Unfortunately, in this policy rollout, we do not have a natural control group that we can use that was fully untreated by the policy. We have run a triple difference model using mothers with untreated two-year olds as the control group as a robustness check in Section V.B. and have found mostly similar results, but we remain unconvinced of the validity of using this strategy. Similarly, we do not believe that using children in other Canadian provinces as a comparison group might improve on these, as labour trends and childcare policies are markedly different by province.

β can be interpreted as an intent-to-treat (ITT) effect since we observe only whether a mother lives within the catchment area of a school that offers full-day kindergarten, not if her child actually attends full-day kindergarten that year. The ITT estimate represents a lower bound on the impact of the treatment on the treated (effect of having a child in full-day rather than half-day kindergarten).

There are three ways in which a mother can decline treatment: by sending her child out of catchment to a school that does not yet offer full-day kindergarten, by keeping her child home an extra year, or by sending her child to a school in a different type of school board.[19] A challenge to our identification lies in the possibility that mothers use the availability of kindergarten as the reason to send their child to a specific school, selecting into treatment. Parents in Ontario can send their children to a school different from the school catchment area they reside in if they have special requirements that are not met otherwise and the particular school requested has space to accommodate more children. Unfortunately, there are no published numbers on the percentage of children who attend school out of their catchment area in kindergarten but the qualitative evidence on it suggests that the numbers are small. In addition, policies on attending different schools are idiosyncratic to each school board and many boards do not even allow optional attendance for kindergarten because it is not compulsory.

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[19] We are not concerned with the case that some mothers might not know about the availability of full-day kindergarten in their school catchment area. The reform itself was very widely publicized, and roughly 90 percent of children in Ontario attend kindergarten, based on Statistics Canada population estimates (Statistics Canada, 2016a) and Ontario Ministry of Education enrollment data (Ontario Ministry of Education, 2016).

We cannot ensure that mothers were not selecting into given locales given the fact that the specific area offered full-day kindergarten. Thus, it may not be the provision of full-day kindergarten that led to changes in labour market outcomes, but rather that mothers who already want to work select into areas that offer full-day kindergarten, thus leaving areas without full-day kindergarten with mothers who are less likely to work full time anyway. This is a limitation of this study but we believe that residential moving for the purpose of optimizing maternal labour supply is not particularly likely. Because the actual implementation differed greatly from the planned implementation the particular schools which were to have full-day programing were often changed at the last moment and the difficulties of the implementation were widely known to the public. Therefore, it seems unlikely that a mother would move based on the implementation schedule. Nevertheless, we do include controls for observable characteristics that may be associated with selection into treatment in that context (more educated mothers might be better informed and have stronger labour force attachments, for example) and find that the results are robust to the inclusion.

We also include controls for the determinants of rollout (high needs schools as defined by the Ministry of Education were targeted first, conditional on capacity; high needs are defined by a combination of low test scores and low income). Looking at Figure 2, which documents the rollout of the reform for the Toronto District School Board, the largest in Ontario, we can see that there was no obvious systematic geographic pattern in the timing of implementation, with early- and late-implementation catchment areas spread rather evenly over the whole city. This lack of apparent pattern is consistent across our dataset, and we would argue that the capacity constraint

provided a level of randomness to the implementation that supports our quasi-experimental strategy.

We focus on estimating the ITT effect of full-day kindergarten in the English Public system in Ontario. As mentioned, the Ontario public schooling system is complex, but the majority of students attend the English Public System. We also estimate the ITT effect of the second largest school system, the English Catholic school boards, explicitly into our model in Section V.C. The English Catholic school boards serve roughly 28 percent of students in Ontario (Ontario Ministry of Education, 2016). As mentioned in Section II, to attend a Catholic primary school, generally one or both parents need to be Catholic, but school boards can grant exceptions. Unfortunately, in our data, we do not have any information regarding religion, and therefore do not know whether a particular child would be eligible to attend a Catholic primary school. We also run models that include an indicator variable for the year in which the first school (either English Catholic or English Public) assigned to the mother implemented full-day kindergarten. This model measures the ITT of being treated to full-day kindergarten in any English school. Finally, we also use a measure of the share of enrolment of the two schools that is being treated with full-day kindergarten associated with the mother. For instance, suppose the English Catholic school was treated in 2011 and had 50 kindergarten students and the English Public school was treated in 2013 and had 150 students. The FDK variable would equal 0 until 2011. In 2011 and 2012 it would equal 0.25 and finally in 2013 and beyond it would equal 1.

IV. DATA AND DESCRIPTIVE STATISTICS

Our data come from a number of sources. We combine survey data from the monthly

Canadian Labour Force Survey (LFS), administrative data from the Ministry of Education,

student test scores from Ontario Education Quality and Accountability Office (EQAO), as well

as geo-spatial data provided by individual school boards and from Canada Post.

The information on labour market outcomes is gathered through the Statistics Canada

monthly Labour Force Survey. We focus on mothers surveyed between September, 2008 and

August, 2014.[20] The main advantage of this data is that we are able to precisely assign treatment

year using academic rather than calendar year, something that other authors have struggled with

(Gelbach, 2002). In order to do so, we aggregate all respondents that have been surveyed

between September of a given year, to the following August; the academic year 2010, for

example, runs from September 2010 to August 2011.[21]

We also use data collected by the Ontario Ministry of Education regarding when each

primary school began offering full-day kindergarten and a measure of school capacity. In

addition, data from the Ontario Education Quality and Accountability Office (EQAO), an

independent agency that administers provincial tests, provides information on grade three

reading and math scores at the school level. EQAO data used in this paper also include

information on the percentage of students in each school who need special education support and

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[20] Mother is defined as the female adult household member who either answered the survey, or was identified by the survey respondent as his spouse who lives in the household (we do not have any same-sex couples in the sample).

[21] Due to data limitation, we are not able to identify repeated sampling, and treat each respondent as independently sampled. However, the Labour Force Survey is designed to be used this way, as outlined in the methodology section of the LFS. See the discussion about LFS data sources and methodology (Statistics Canada, 2016b).

percentage of students in each school whose first language at home is neither of Canada's official languages (English and French).

We use two important geo-spatial data sources to link all our data together: school catchment areas and postal codes. First, we hand collected school catchment area data for all schools in Ontario. Then we matched catchment areas to postal code data. For the vast majority of our data, the school catchment area is much greater than the postal code area, so we match many postal code areas to a given school catchment area.[22] Appendix Figure 1 illustrates that process. Each specific school catchment area in a school board is composed of many postal codes and the catchment boundaries generally follow the postal code boundaries. We then link the kindergarten full-day implementation year to each postal code which allows us to assign each mother who lives in a particular postal code to a kindergarten full-day implementation year. We are able to match 250,676 postal codes with 3,322 schools (both English Public and English Catholic) in Ontario, a match rate of 89.8 percent.

Administrative data from the Ontario Ministry of Education and EQAO are linked to each school catchment area using board and school identifier numbers. Labour force information is linked to the postal code based on the survey respondents' dwelling address. We were able to assign a postal code to respondents for 93 percent of households in our sample, and then used this geographic identifier to link households to school catchment areas. The remaining seven

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[22] In the rural areas, the postal code can cover a very large area, and in some cases one postal code area splits over to multiple catchment areas. The matching rule is that a postal code is matched to a catchment area if the catchment area covers at least 75% of the postal code area. Our results are similar if we exclude postal codes that straddle two or more catchment areas, and are available upon request from authors.

percent did not provide a postal code when surveyed or the postal code could not be matched to a school. Through this process, we are able to identify the academic year (between 2010 and 2014) during which the vast majority of households were offered full-day kindergarten in Ontario.[23] Our final dataset includes 25,500 mothers, and 1,340 schools.[24]

We restrict our sample to mothers between 18 and 55 years old at the survey date with the youngest own child aged four-years-old. We only know the age of the youngest child in years at the time the survey was collected, so we exclude mothers of three- and five-year-olds from the sample because admission to school in Ontario is based on the age of the child in January. As such, some children start junior kindergarten at three years old, and consequently start grade one at five; the status of these children (with regards to treatment) is uncertain.

Descriptive statistics in Table 1 show that the labour force participation amongst mothers of four-year-olds is 76.3 percent, with the overall employment rate 92.4 percent for this group. 79.1 percent work full-time conditional on employment, and the average weekly hours worked over all mothers of four-year-olds in our sample is 33.3, with the log of weekly earnings of 6.61. Absence from work measures whether an individual who is working full-time was absent from work at any point during the reference week. According to Statistics Canada (2015), roughly a third of those absences are due to personal or family responsibilities. In our sample, we find that

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[23] The remaining schools are French Public and French Catholic schools, which rolled out kindergarten over a different schedule, in the late 1990s, as well as English Public and English Catholic schools who started offering full-day kindergarten in the academic year 2014, as we did not have data for the full academic year due to a large structural change in the LFS survey.

[24] Sample sizes for the Labour Force Survey are rounded to comply with confidentiality requirements of Statistics Canada Research Data Centre.

20.4 percent of mothers with a four-year-olds are absent from work at some point in the

reference week. Reducing absenteeism is one of the ways that policy makers believe that

providing full-day kindergarten can help the labour force. They believe the extra time in primary

education for the children will result in lower absenteeism from the parents. Brown et al. (2013)

writes that "improving the availability of child care [preschool] could save employers billions of

dollars from avoided employee absences".

    The average mother in our sample is 36 years old and has two children. Out of the mothers

in our sample, 37.7 percent are immigrants, 22.9 percent have not completed education at a level

that exceeds high school and 8.1 percent are single. At the neighborhood level, 30.7 percent of

respondents (or adult household members) hold at least a bachelor's degree, 85.0 percent of

childless males are in the workforce, and 89.1 percent of respondents live in urban areas. The

average school matched to the mothers in our sample has a 67.1 percent pass rate on EQAO

math, a 61.1 percent pass rate on EQAO reading, 15.7 percent of its students have special needs,

and 25.0 percent of its students do not speak an official language (English or French) at home.[25]

The average school capacity measure is 91.2 percent which indicates that the average school has

room for 8.8 percent more students based on the number of students allocated for each school.

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[25] The EQAO results are matched to schools with a lag, meaning, for example, that the results from the academic year 2010 are assigned to the schools as their results for the academic year 2011; we did it this way to reflect the fact that if we think parents might select a school based on EQAO results, they would be unable to predict the current year's result before enrolling their children

V. RESULTS

A. Difference-in-Differences

Table 2 presents the result of estimating equation 1 on the sample of mothers aged 18 to 55 in Ontario with their youngest child aged four, using six different outcome variables: labour force participation, employment, full-time employment, weekly hours of work, log of weekly earnings, and absenteeism. In Panel A, the models only include school-year and school catchment fixed effects along with the indicator variable, FDK. We find a marginally significant positive effect on hours worked and a statistically significant negative effect on being absent. Our results confirm that reducing absenteeism is a way in which access to full-day kindergarten may help mothers participate in the workforce.

We expand our model to include maternal-level individual characteristics and find similar results in Panel B as we do in Panel A but the coefficient in column 4 for weekly hours worked is now statistically significant at the five percent level. Next, we include all the control variables, including school and community level controls in the model in Panel C and find that the positive effect on hours worked stays stable at 1.84 additional hours a week which translates into a 5.5 percent increase in weekly hours. We continue to estimate a negative effect on absenteeism. In fact, because we find no statistically significant increase in weekly earnings, it may be that the positive increase in hours is just reflecting a decrease in absenteeism and not additional hours that are associated with additional income.

B. Robustness Checks

The key identifying assumption in our difference-in-differences model is that the treatment school catchments have similar trends to the control school catchments in the absence of the treatment. Our sample includes many school catchments and years, which allows us to relax the common trends assumption by introducing a degree of nonparallel evolution in outcomes between school catchment areas in the absence of a treatment effect. Following Angrist and Pischke (2014), we include school catchment specific linear time trends in Table 3 Panel A. This provides an important check on the causal interpretation when using a difference-in-differences model with multi-period data. Using this model, we continue to find a positive statistically significant effect on hours worked but the significance of the result for absenteeism decreases despite having a similar magnitude as in Table 2.

Another way to assess the difference-in-differences identification is to include leads and lags of the treatment variable. The coefficients on the lead variables should all be zero to support the identifying assumption. In Panel B of Table 3 we run our model with two years of leads and one year of lags. We find no statistically significant results for the leads and similar but less precise estimates for weekly hours worked but continue to find a statistically significant effect on absenteeism. We find no statistically significant effects for our lag variable but that may be because we do not have many years of lagged data for many of the treatment catchments because of data limitations.

We continue to explore the robustness of our estimates by implementing a triple difference model (DDD). This is not our preferred specification because our data makes it difficult to find a

proper control group. However, running this model may help to alleviate concerns that deviations

from trend might not be exogenous to unobserved characteristics. Therefore, we estimate a DDD

which compares mothers of four-year-old children in a school catchment area that offers full-day

kindergarten in a given year to mothers of children ineligible for full-day kindergarten (two-year-

olds) in the same school catchment area and school year.

$$Y_{ict} = \alpha + \beta_1 FDK_{ct} + \beta_2 4yrold_{ct} + \beta_3 FDK_{ct} * 4yrold_{ct}$$

$$+X'_{it}\delta + S'_{ct}\phi + N'_{ct}\eta + T_t + C_c + \varepsilon_{ict} \qquad (2)$$

In the DDD specification, the parameter of interest is β_3 and it identifies the marginal

effect of the policy on the treatment group (mothers of four-year-olds) relative to the control

(mothers of two-year-olds). In this case, identification of β_3 comes from the deviation from trend

in labour supply outcomes of the treated group relative to the untreated group within a catchment

area.

Table 4 includes the results from the triple-differences model. The coefficient on the

interaction term in column 4 for the dependent variable hours worked is statistically significant

and positive. This indicates that mothers who were treated with full-day kindergarten with four-

year-old children work on average 1.96 more hours per week than mothers who were treated

with full-day kindergarten with two-year-old children. The total effect of being able to access

full-day kindergarten on a mother of a four-year-old who is eligible to attend is an increase of

1.69 hours per week (-0.27 hours from the main effect and 1.96 hours from the interaction

effect), a five percent increase. We also find a marginally significant effect on full-time

employment that may be driven by the increased hours. Interestingly, the coefficient on FDK,

when using absent as a dependent variable (Column 6), is statistically significant but the interaction is not. This indicates that the women who had either a two- or a four-year-old who lived in catchments treated by full-day kindergarten both experience a decrease in absenteeism and that the mothers of the four-year-olds did not see a differential decrease. This may be due to some other factor that is decreasing absenteeism that is correlated with the roll-out of full-day kindergarten, but it also may be that two-year-olds are not an ideal control group. Many of the two-year-olds will eventually be treated by full-day kindergarten and their mothers may be adjusting their labour supply or childcare arrangements given the upcoming treatment or maybe the four-year-olds moving into kindergarten freed up childcare spots for the two-year-olds.

C. Other specifications

As outlined in Section III, our preferred specification is to use the treatment of full-day kindergarten in the English Public board to estimate the ITT effects because most students attend schools in the English Public boards. However, the English Catholic school boards do serve roughly 28 percent of students in Ontario. Therefore, we are also able to run a specification that estimates the ITT of access of full-day kindergarten in the Catholic Public board. Panel A of Table 5 displays the coefficient for the indicator variable that equals 1 if the Catholic Public school in which the household lives within its catchment offers full-day kindergarten in that school year. The significance and the magnitude of the coefficient on hours worked is smaller than the coefficient that was found with the English Public school treatment (Table 2, column 4) but the coefficient on absenteeism continues to be negative and significant. In Panel B, we run a

model that includes an indicator variable that equals one as soon as the first school (either English Public or English Catholic) associated with a particular postal code offers full-day kindergarten. This measures the effect of access to full-day kindergarten regardless of school board. The results are similar to the results found in Panel A for the ITT effect of access to full-day kindergarten in the Catholic Public boards. Finally, in Panel C, we implement a model that captures the treatment intensity of the availability of full-day kindergarten in both the English Public and the English Catholic board. We create an intensity measure based on the share of enrolment of the two schools that are being treated with full-day kindergarten associated with the mother. The point estimate on the intensity variable for hours worked is similar in magnitude to the point estimate of our preferred model and a negative effect on absenteeism is still present regardless of the specification. Summarizing all the specifications, we consistently find that access to full-day kindergarten increases weekly hours worked and decreases absenteeism.

C. Heterogeneity

We next explore whether having access to full-day English Public kindergarten affected women differently based on their observable characteristics. We estimate heterogeneous effects by interacting the variable of interest (FDK) with a number of categorical variables including: being a single mother (Single), having been born outside Canada (Immigrant), living in an urban area (Urban), having only one child (One child), and having a high school or lower education level (H.S. education). We then calculate a variety of marginal effects for interpretation purposes.

In Table 6 we display the regression coefficients for FDK and FDK interactions. The only statistically significant interaction effect is for mothers with a high school education only. Because interpretation of this table is difficult due to the quantity of interactions effects, we include the marginal effects for different observable characteristics. We find a positive and statisticially significant effect of access to full-day kindergarten on both full-time work and hours worked for non-immigrant (~62 percent of the sample) mothers. Mothers who lives in an urban area show a statistically significant effect of 2.04 additional hours works and less chance of being absent from work. We find similar results for women with one child and who only have a high school education or less.

There could be a variety of reasons for these effects to be concentrated within these group of women. It is possible that women in urban areas are more able to change the number of hours worked weekly than women in non-urban areas in Ontario because there are many different dynamic patterns in female employment in rural versus urban environments in Canada in addition to lower number of childcare facilities (Phimister, Vera-Toscano, and Weersink, 2001). It also could be because childcare expenses are generally more expense in urban areas than in rural areas in Ontario if material labour outcomes are driven by the lack of affordable childcare. The percentage that the subsidy may increase a mother's effective wage rate may be higher for mothers with only a H.S. education, and therefore the subsidization effects their labour market outcomes more.

In terms of other factors, it could be that having only one child signals a stronger connection to the labour force, so even a small subsidy (or a slightly bigger one, such as full-day

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kindergarten) would be enough to induce them to change their labour force participation. It could also be that because full-day kindergarten is only for 6.5 hours a day, a mother truly working full-time will need wrap-around care. This is most likely to be financially and/or logistically viable for mothers with one child.

Overall, we see an effect for mothers whose children have access to full-day kindergarten in the English Public school boards on the intensive margin in terms of increased hours and decreased absence from work. These effects are found primarily for non-immigrant women with a low education level, with only one child, living in an urban area.

VI. CONCLUSION

The kindergarten reform in Ontario offered all families with four- and five-year-olds access to 6.5 hours of formal early primary education a day, from a previous 2.5 hours. Using a robust research strategy, we find a no response in the extensive margin of labour force supply of mothers who were intended for treatment but do find an effect at the intensive margin. We find that access to full-day kindergarten for four-year-olds increases their mothers' hours worked and decreases their absenteeism. This impact is concentrated more in specific subgroups: non-immigrant, urban, low education, one-child mothers. The heterogeneous response we observe is consistent with constraints over many dimensions: monetary, time, and possibly the availability of space or price in early childhood education centers.

Canada has a relatively high maternal labour force participation rate. In 2014, Canada was the 8th highest out of 40 OECD countries (OECD, 2019a). However, Ontario does not have

particularly high levels of subsidization for childcare services. These contextual factors serve as a moderator of the policy effects of early care subsidization. Indeed, the results found in this study support the notion that the increased subsidy increased some maternal labour market outcomes by making early childcare more affordable.

Therefore, because the evidence of benefits for children from attending universal programming in early years is quite mixed, it would be important for other locales considering expanding early education programs to predict the possible magnitudes of effect on maternal labour supply and possibly consider more targeted subsidies as a way to increase maternal labour supply.

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Figure 1─Rollout of the full-day kindergarten program in Ontario English language schools, by percentage of schools

Full-day kindergarten (FDK) program announced

FDK fully implemented in Ontario public English schools

100

72

47.3

21.9

16.2

MAR-09 JUL-09 NOV-09 MAR-10 JUL-10 NOV-10 MAR-11 JUL-11 NOV-11 MAR-12 JUL-12 NOV-12 MAR-13 JUL-13 NOV-13 MAR-14 JUL-14 NOV-14 MAR-15

Source: Ontario Ministry of Education, authors' calculations
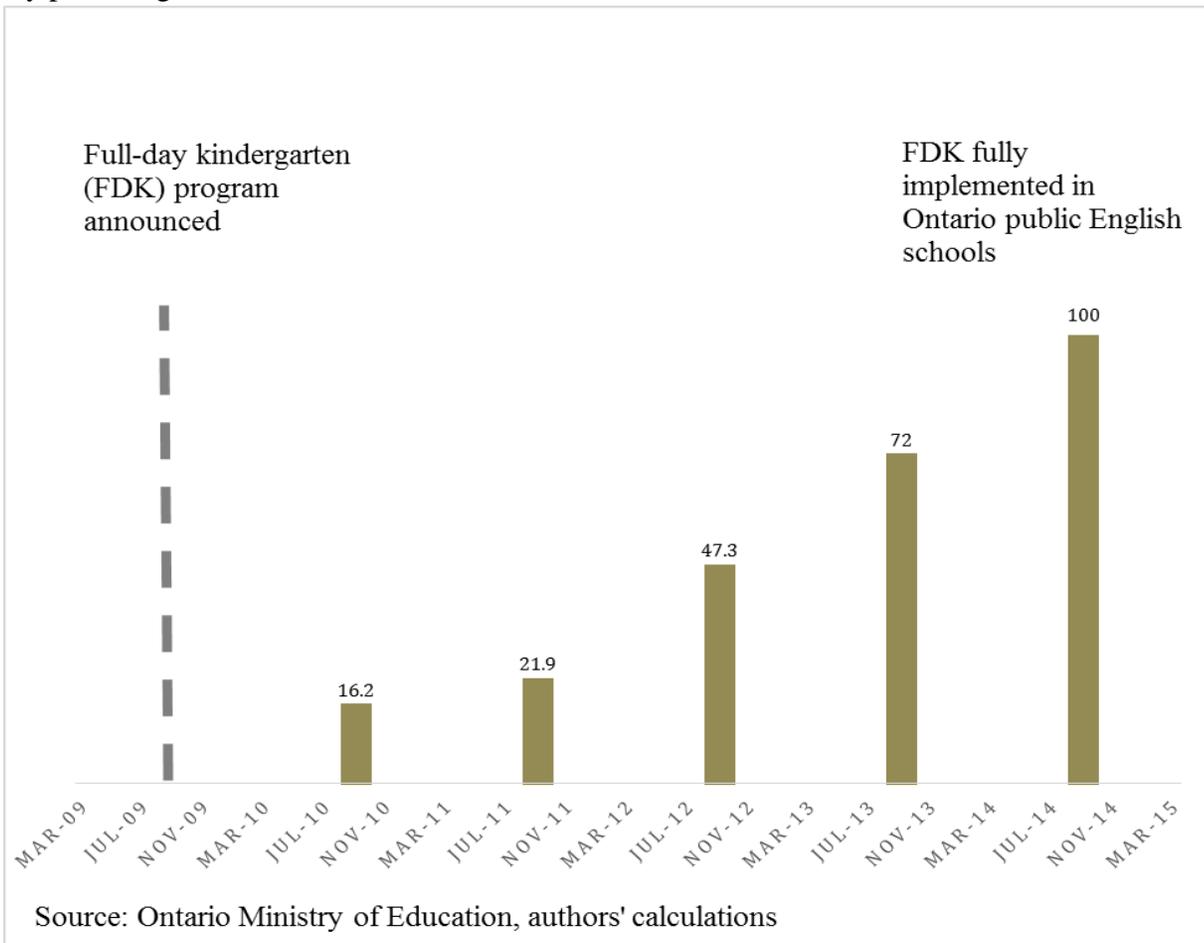
Figure 2—Rollout of full-day kindergarten in the Toronto District School Board, by school catchment area
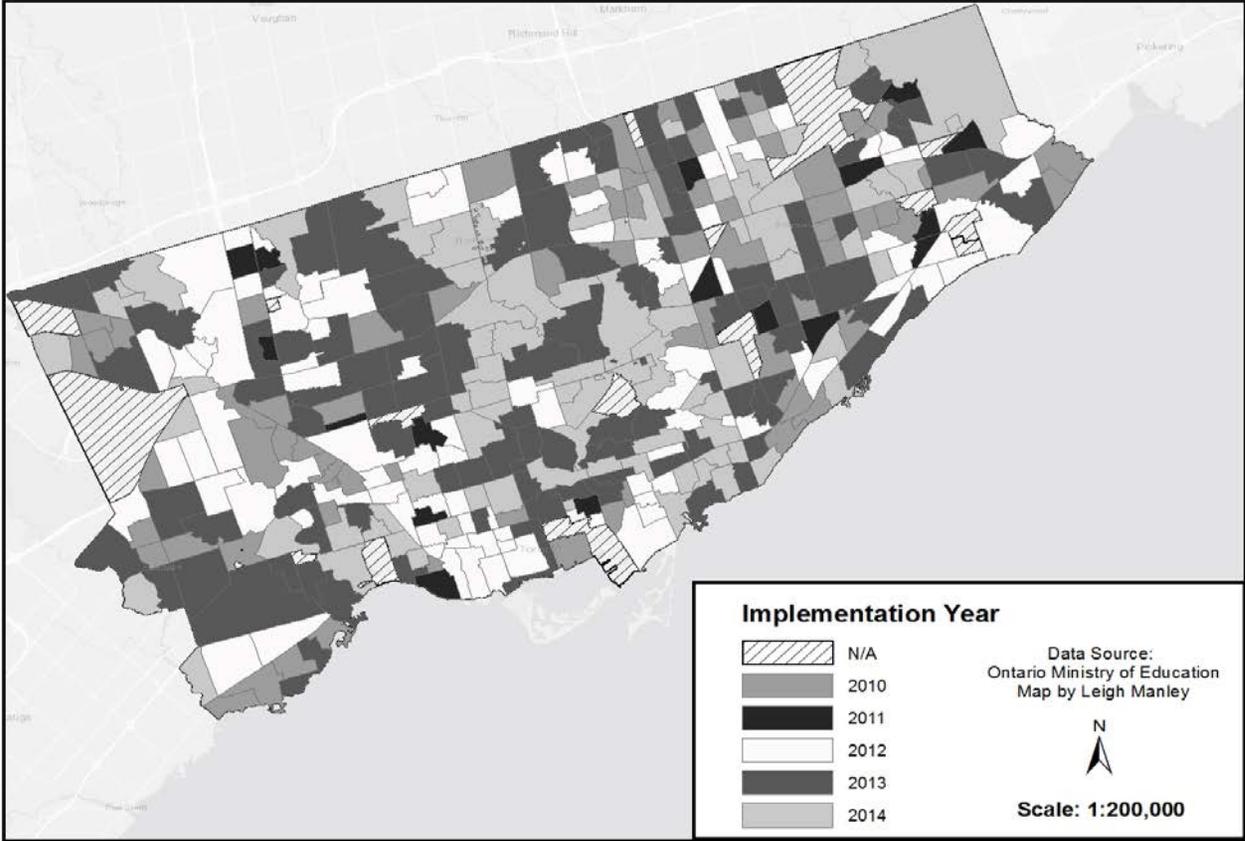
Note: n/a indicates non-residential areas (including municipal core and general employment zones)

Table 1 - Mothers' labour market outcomes, characteristics of mothers, neighborhood and schools

	Mean	Std dev.
Mothers' labour market outcomes		
Labour force participation	0.763	[0.425]
Employed	0.705	[0.456]
Full-time | employment	0.791	[0.407]
Weekly hours worked	33.33	[11.01]
Weekly earnings (log)	6.607	[0.727]
Absent from work	0.204	[0.403]
Mothers' characteristics:		
Age	36.2	[5.4]
Number of children	2.028	[0.917]
Immigrant	0.377	[0.485]
High school or lower education	0.229	[0.420]
Single	0.081	[0.273]
Neighbourhood characteristics		
% individuals holding a BA+ degree	0.307	[0.189]
Labour force participation of male without children	0.850	[0.141]
Urban	0.891	[0.312]
School characteristics		
% students in the school who met provincial standards in math	0.671	[0.153]
% students in the school who met provincial standards in reading	0.611	[0.145]
% special needs students	0.157	[0.103]
% students who do not speak official language at home	0.250	[0.254]
School capacity measure	0.912	[0.375]

Notes: All summary statistics are weighted.

Table 2 - Difference-in-differences estimates of the impact of full-day kindergarten on maternal labour market outcomes

	Labour force participation	Employed	Full-time	Hours worked	Log (earnings)	Absent
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: No control variables						
FDK	-0.006	-0.021	0.046	1.726*	-0.045	-0.057**
	(0.033)	(0.034)	(0.031)	(0.892)	(0.070)	(0.027)
Panel B: With individual-level controls						
FDK	0.007	-0.006	0.048	1.908**	-0.033	-0.058**
	(0.033)	(0.034)	(0.032)	(0.883)	(0.066)	(0.028)
Panel C: With individual & school/community-level controls						
FDK	0.006	-0.01	0.048	1.839**	-0.045	-0.057**
	(0.033)	(0.034)	(0.031)	(0.877)	(0.063)	(0.028)
Number of observations	22500	22500	18900	16200	14000	12400

Notes: ***p<0.01; **p<0.05; *p<0.1. Standard errors in parenthesis clustered at the school catchment level. FDK is an indicator variable equal to one if the school catchment area where the household lives offers full-day kindergarten in a particular year. Each regression includes a constant, school year fixed effects as well as school fixed effects. The controls variables included in each panel can be found in Section III. All models use the appropriate sampling weights provided by Statistics Canada. The number of observations are rounded to the nearest 100 according to vetting requirements of the Statistics Canada Research Data Centre.

Table 3 - Difference-in-differences estimates of the impact of full-day kindergarten on maternal labour market outcomes: Utilitizing different time trends

	Labour force participation	Employed	Full-time	Hours worked	Log (earnings)	Absent
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: School catchment specific linear time trends						
FDK	0.003	-0.015	0.060	2.617***	0.015	-0.068
	0.04	(0.040)	(0.038)	(0.808)	(0.057)	(0.042)
Panel B: With all controls & school catchment specific linear						
2 years prior to FDK	0.008	-0.001	-0.02	-0.861	0.007	-0.036
	(0.032)	(0.031)	(0.028)	(0.876)	(0.056)	(0.029)
1 year prior to FDK	0.015	0.039	0.004	-0.024	0.045	0.007
	(0.028)	(0.031)	(0.029)	(0.872)	(0.060)	(0.026)
FDK	0.008	-0.021	0.037	1.426*	-0.049	-0.079***
	(0.036)	(0.036)	(0.031)	(0.844)	(0.069)	(0.029)
1 year after FDK	-0.009	0.008	-0.031	-1.124	-0.078	0.005
	(0.041)	(0.043)	(0.037)	(1.212)	(0.089)	(0.037)
Number of observations	22500	22500	18900	16200	14000	12400

Notes: ***p<0.01; **p<0.05; *p<0.1. Standard errors in parenthesis clustered at the school catchment level. FDK is an indicator variable equal to one if the school catchment area where the household lives offers full-day kindergarten in a particular year. Each regression includes a constant, school year fixed effects, school fixed effects, as well as individual, school, and neighborhood control variables. All models use the appropriate sampling weights provided by Statistics Canada. The number of observations are rounded to the nearest 100 according to vetting requirements of the Statistics Canada Research Data Centre.

Table 4 - Triple Differences of the impact of full-day kindergarten on maternal labour market outcomes (2 year old control group)

	Labour force participation	Employed	Full-time	Hours worked	Log (earnings)	Absent
	(1)	(2)	(3)	(4)	(5)	(6)
FDK	-0.005	0	0.008	-0.269	0.049	-0.074***
	(0.026)	(0.028)	(0.024)	(0.701)	(0.044)	(0.019)
4-year-old child	0.025	0.021	-0.014	-0.445	-0.019	-0.001
	(0.018)	(0.019)	(0.017)	(0.504)	(0.034)	(0.013)
FDK*4-year-old child	0.029	0.025	0.040*	1.957**	-0.048	-0.007
	(0.028)	(0.030)	(0.024)	(0.762)	(0.048)	(0.020)
F Statistic:						
FDK*4-year-old child+FDK=0	1.02	0.95	3.82*	5.27**	0.00	16.70***
Number of observations	53300	53300	43800	36500	31600	28200

Notes: ***p<0.01; **p<0.05; *p<0.1. Standard errors in parenthesis clustered at the school catchment level. FDK is an indicator variable equal to one if the school catchment area where the household lives offers full-day kindergarten in a particular year. Each regression includes a constant, school year fixed effects, school fixed effects, as well as individual, school, and neighborhood control variables. All models use the appropriate sampling weights provided by Statistics Canada. The number of observations are rounded to the nearest 100 according to vetting requirements of the Statistics Canada Research Data Centre.

Table 5 - Difference-in-differences estimates of the impact of full-day kindergarten on maternal labour market outcomes - Different ITT measures

	Labour force participation	Employed	Full-time	Hours worked	Log (earnings)	Absent
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Catholic						
FDK	0.011	0.012	-0.002	0.883	0.017	-0.099***
	(0.033)	(0.037)	(0.035)	(0.964)	(0.065)	(0.029)
Number of observations	22500	22500	18900	16200	14000	12400
Panel B: First school (either public or catholic)						
FDK	0.022	0.014	-0.003	1.021	-0.025	-0.074**
	(0.035)	(0.036)	(0.038)	(1.030)	(0.063)	(0.032)
Number of observations	22500	22500	18900	16200	14000	12400
Panel C: Share of enrolment						
FDK	-0.020	-0.030	0.027	1.964*	-0.026	-0.109**
	(0.045)	(0.045)	(0.041)	(1.115)	(0.073)	(0.043)
Number of observations	22500	22500	18900	16200	14000	12400

Notes: ***$p<0.01$; **$p<0.05$; *$p<0.1$. Standard errors in parenthesis clustered at the school catchment level. FDK is an indicator variable equal to one if the school catchment area where the household lives offers full-day kindergarten in a particular year. Each regression includes a constant, school year fixed effects, school fixed effects, as well as individual, school, and neighborhood control variables. All models use the appropriate sampling weights provided by Statistics Canada. The number of observations are rounded to the nearest 100 according to vetting requirements of the Statistics Canada Research Data Centre.

Table 6 - Difference-in-differences estimates of the impact of full-day kindergarten on maternal labour market outcomes with heterogeneous effects

	Labour force participation	Employed	Full-time	Hours worked	Log (earnings)	Absent
	(1)	(2)	(3)	(4)	(5)	(6)
Regression coefficients:						
FDK	-0.010	0.002	-0.009	-0.622	-0.075	0.015
	(0.057)	(0.057)	(0.065)	(1.727)	(0.103)	(0.067)
FDK * Single	0.058	0.069	0.069	1.865	0.142	0.069
	(0.048)	(0.047)	(0.035)	(1.079)	(0.103)	(0.039)
FDK * Immigrant	0.058	0.060	0.066	1.843	0.110	0.068
	(0.044)	(0.049)	(0.042)	(1.256)	(0.080)	(0.038)
FDK * Urban	0.057	0.061	0.066	1.628	0.100	0.052
	(0.058)	(0.060)	(0.066)	(1.843)	(0.110)	(0.068)
FDK * One child	0.013	0.015	0.048	1.398	-0.003	-0.020
	(0.044)	(0.049)	(0.042)	(1.256)	(0.080)	(0.038)
FDK * H.S. education	0.017	0.018	-0.095	-3.814**	0.031	-0.049
	(0.057)	(0.061)	(0.066)	(1.628)	(0.100)	(0.052)
Marginal effects of FDK:						
Married (single=0)	0.013	-0.002	0.045	1.715*	-0.033	-0.053*
	(0.034)	(0.034)	(0.031)	(0.920)	(0.065)	(0.029)
Single (single=1)	-0.052	-0.066	0.061	1.866	0.022	-0.075
	(0.062)	(0.071)	(0.072)	(1.799)	(0.152)	(0.073)
Non-immigrant (immigrant=0)	0.021	0.015	0.077**	2.310**	-0.013	-0.061*
	(0.030)	(0.033)	(0.035)	(0.924)	(0.068)	(0.031)
Immigrant (immigrant=1)	-0.015	-0.043	-0.014	0.414	-0.064	-0.041
	(0.053)	(0.051)	(0.035)	(1.197)	(0.103)	(0.040)
Rural (urban=0)	-0.025	-0.019	-0.023	-0.58	-0.099	0.012
	(0.060)	(0.060)	(0.066)	(1.764)	(0.113)	(0.067)
Urban (urban=1)	0.012	-0.006	0.055*	2.037**	-0.020	-0.063**
	(0.034)	(0.034)	(0.032)	(0.938)	(0.067)	(0.030)
Only one child (one child=1)	0.018	0.005	0.078*	2.632**	-0.022	-0.069*
	(0.042)	(0.047)	(0.045)	(1.211)	(0.082)	(0.036)
Multiple children (one child=0)	0.003	-0.012	0.033	1.347	-0.032	-0.048
	(0.037)	(0.037)	(0.032)	(1.000)	(0.072)	(0.032)
H.S. graduate or less (H.S. education=1)	0.001	-0.034	0.084	3.691**	0.081	-0.084**
	(0.052)	(0.055)	(0.063)	(1.661)	(0.095)	(0.042)
Some college or above (H.S. education=0)	0.01	0.001	0.036	1.307	-0.052	-0.048
	(0.034)	(0.034)	(0.030)	(0.889)	(0.069)	(0.031)
Number of observations	22500	22500	18900	16200	14000	12400

Notes: ***p<0.01; **p<0.05; *p<0.1. Standard errors in parenthesis clustered at the school catchment level. FDK is an indicator variable equal to one if the school catchment area where the household lives offers full-day kindergarten in a particular year. Each regression includes a constant, school year fixed effects, school fixed effects, as well as individual, school, and neighborhood control variables. All models use the appropriate sampling weights provided by Statistics Canada. The number of observations are rounded to the nearest 100 according to vetting requirements of the Statistics Canada Research Data Centre.

Appendix Figure 1—Matching household postal codes to school catchment areas