

The impact of full-day kindergarten on maternal labor supply

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Abstract

We examine the impact of offering full-day as a replacement for half-day kindergarten on mothers' labor supply using the rollout of full-day kindergarten in Ontario, Canada. We find an impact on the labor participation of mothers at the intensive margin in specific sub-groups, namely mothers of only one child and mothers with low education levels. In particular, mothers of only one child are about 11 percent more likely to work full-time and increase their hours worked by about 8 percent.

I. INTRODUCTION

In recent decades, the importance of learning and high quality care during the early years of life has received much attention. Following this, a large number of jurisdictions around the world have implemented or expanded government-provided or -subsidized programs such as child care, preschool, or even expanded primary education to include full-day kindergarten. The reasoning behind providing or subsidizing these types of programs 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 labor market outcomes. Second, the more immediate effect is that their caregivers are able to increase their labor force attachment and therefore their lifetime earnings.

The literature regarding the impact of these early programs on parental labor supply decisions is mixed and generally inconclusive. In particular, the effect on maternal labor supply from the subsidization of child care programs in the United States has been found to be fairly small, ranging between zero and slightly negative (Blau, 2003). However, Baker, Gruber, and Milligan (2008) and Lefebvre and Merrigan (2008) find statistically significant and sizable increases in employment of married mothers due to child care subsidies in Canada but Havnes and Mogstad (2011) find little evidence of a causal effect on the labor supply of mothers in Norway from subsidized child care. In terms of the effects of programs such as Head Start on maternal labor supply, there is very limited evidence (see Hsueh and Farrell (2012) and Sabol and Chase-Lansdale (2015)). Long (2016) found that the availability of Head Start in the early

years of the program actually decreased maternal labor supply. More recently, the expansion of universal pre-kindergarten programs in the United States has been examined, with some research finding little effect on the labor supply of most women (Fitzpatrick, 2010) while others have found some positive effect on labor supply (Sall, 2014).

Our paper adds to the literature on the effects of kindergarten on maternal labor supply by estimating the effect on maternal labor supply of moving from half-day to full-day kindergarten. Gelbach (2002) is the seminal paper regarding kindergarten and labor supply. It looks at the impact of access to universal public kindergarten in the United States and finds public school enrolment has a significant impact on labor-market outcomes among mothers whose youngest child is five years old. In particular, Gelbach finds that access to mostly half-day public kindergarten increases employment at both the extensive and intensive margin, and decreases reliance on public assistance. Cascio (2009) finds that the expansion of universal kindergarten programs in the United States increases the labor force participation of single mothers but not that of other mothers with eligible children.

Both of the previous papers analyzed the introduction of mostly half-day kindergarten programs. Recently, there has been a trend to extend the kindergarten school day from half-day to full-day. Cannon, Jacknowitz, and Painter (2006) provide some analytical results on maternal labor supply following the expansion of kindergarten from half to full-day, albeit as a secondary analysis to their main investigation of childrens' outcomes. They model the likelihood that a mother would work full-time if her child attended full-day kindergarten. They find that mothers whose child attends full-day kindergarten are significantly more likely to work full-time during

the school year than mothers with a child in a half-day kindergarten program. However, this effect fades away by first grade.¹ In the context of Quebec, however, Haeck, Lefebvre and Merrigan (2015) examine the effect of switching from half to full-day kindergarten in Quebec and find no significant labor market response of parents coming from only that policy change. Other recent working papers examine the effect on parental outcomes, for only French-speaking families in Ontario (Dhuey, Eid, and Neill, 2017) or mothers living in the state of Indiana (analysis based on county level employment rates) (Gibbs, 2014), and provide suggestive evidence of positive effects on mothers.

In this research, we evaluate the effect of expanding universal public kindergarten from half-day (2.5 hours/day) to full-day (6.5 hours/day) on the labor market outcomes of 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 during both junior and senior kindergarten. While the rollout was planned (rather than randomized), it creates variation over time and space that we use to identify the impact of full-day kindergarten on the labor 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 in kindergarten has little impact on labor force participation at the extensive margin. We do, however, find evidence that,

¹ DeCicca (2007) also presents descriptive statistics that suggest that the percentage of mothers in the labor force is higher when children have access to full-day kindergarten.

conditional on employment, some women are able to work longer hours. Specifically, using the DD approach, we find that conditional on working, having access to full-day rather than half-day kindergarten increases the likelihood of some mothers of eligible children working full-time and their average number of hours worked per week. The effect is driven primarily by women who have only one child

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 mostly Protestant denominations (Card, Dooley, and Payne, 2010). Schools are administered by school boards, which in turn receive funding from the province. Parents can choose the school system to which they send their children, with some restrictions 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

school.² Overall, the vast majority of Catholic school students are Catholic and there is very 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.³

For children in Ontario, mandatory schooling starts at six years old in grade one.

Nevertheless, almost all children attend kindergarten, which is universally offered through the public school system. Ontario offers two grades of kindergarten: Junior Kindergarten for four year olds, and Senior Kindergarten for five year olds. The school entry cutoff date is January 1st of the year. Delayed entry or retention in early grades is virtually non-existent.⁴

The full-day kindergarten reform was rolled out over a period of five years between 2010 and 2014 in the English Public and English Catholic school boards.⁵ 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

² For examples, see enrollment requirements for Toronto Catholic District School Board (2017) or Catholic District School Board of Eastern Ontario (2017).

³ 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.

⁴ 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).

⁵ 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, 2017).

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.⁶

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. 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 the increased number of students 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.⁷ 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

⁶ 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”.

⁷ 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).

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 rollout increased again to finish in five years rather than the initial three years originally planned (Pascal, 2009).

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 Junior and Senior Kindergarten 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 a 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 kindergarten on the labor market outcomes of mothers with eligible-aged children. We use difference-in-differences (DD) estimation strategies with pooled cross-sectional data spanning from 2008 to 2014 that exploits the rollout of the kindergarten reform.

We estimate the following equation:

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

where Y_{ict} denotes the labor market outcomes for individual i in school catchment area c in year t , which include indicator variables for labor 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 a step function equal to one if a school catchment area offers full-day kindergarten in a given year and zero otherwise for schools in the English Public Board. X'_{it} is a vector of maternal-level 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.⁸ N'_{ct} is a vector of neighborhood-level controls made up of the percentage of university-educated residents, labor force participation rate of childless males, and a rural-urban indicator.⁹ We also

⁸ EQAO tests are administered to all children in the province in grade three and are scored on a 1-4 scale. The provincial standard for passing is 3 or higher.

⁹ 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.

include school year fixed effects to capture unobserved shocks common to all school catchment areas in Ontario in a given school year. School year is defined as starting in September of each year. ε_{ict} is the usual error term.¹⁰

We start with examining only the English Public rollout because of the complexity of the public schooling system in Ontario. As mentioned previously, despite being possibly eligible to attend up to four different schools given a particular home location, not all students may be eligible in all boards, which makes assigning treatment status difficult. We next incorporate the second largest school system, the English Catholic school boards, explicitly into our model. 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 deal with this issue in two ways. First, we include a specification that includes a set of indicator variables that capture the leads and lags in implementation of the full-day kindergarten between the English Public school and the corresponding English Catholic school for a given household. As previously

¹⁰ 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 board level, that is, we allow for arbitrary serial correlation and heteroscedasticity for mothers whose school catchment area belongs to the same school board. Following Cameron and Miller (2015), we also have applied the wild bootstrap to the standard error calculation introduced by the small number of clusters.

mentioned, households are assigned overlapping catchment areas for each of the school boards. Suppose that the English Catholic school to which a household is eligible to send their children starts offering full-day kindergarten in 2011, but the English Public school offers it in 2013. Then the dummy for $t-2$ would be equal to one. If the reverse was true and the English Public school offered full-day kindergarten in 2011 while the English Catholic school offered it in 2013, then the dummy for $t+2$ would be equal to one. These dummy variables capture either the possibility of opting in (out) of an earlier program, or the anticipation effect generated by greater exposure to the reform in the neighborhood. Second, we include a specification that adds an additional indicator variable that corresponds to a step function equal to one if a school catchment area offers full-day kindergarten in a given year and zero otherwise for schools in the English Catholic school board. This helps explicitly model the rollout within the English Catholic school board.

We estimate linear probability models (for the probability of labor 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.¹¹ In this model, the β is the parameter of interest and can be interpreted as the change in maternal labor market outcomes associated with having access to the full-day kindergarten program in the local English Public school. In the difference-in-difference specification, identification of β comes from the deviation from trend in labor supply outcomes

¹¹ We also ran the specifications with a probit model and found similar results. The results are available from the authors upon request.

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.¹²

The parameter of interest, 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 starts full-day kindergarten that year. There are three ways in which a mother can decline treatment in this case: by sending her child out of catchment to a school that does not offer full-day kindergarten yet, by keeping her child home an extra year, or by sending her child to a school in a different type of school board.¹³ ITT (access to full-day kindergarten) has causal interpretation if treatment is randomly assigned, and 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). A challenge to this lies in the possibility that mothers use the availability of kindergarten as the reason to send their child to a specific school, selecting into

¹² Some literature in this area has used a triple difference framework to estimate the effect on labor 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 triple difference models using mothers with two year olds and six year olds as the control groups and have found similar results, but we remain unconvinced of the validity of these control groups. Similarly, we do not believe that using children in other Canadian provinces as a comparison group might improve on these, as labor trends and child care policies are markedly different by province.

¹³ There is no published data on out of catchment attendance, but the qualitative evidence on it suggests that the numbers are small. 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 salient, and roughly 90 percent of children in Ontario attend kindergarten, based on Statistics Canada population estimates (Statistics Canada, 2016) and Ontario Ministry of Education enrollment data (Ontario Ministry of Education, 2016).

treatment.¹⁴ This would only be a problem if certain types of parents tried to locate in areas where they knew a school would be (or not be) rolling out full-day kindergarten. Otherwise, the assignment to treatment is outside of the control of parents, and any initial differences between treatment and control areas are controlled for within the framework. We also include controls for observable characteristics that may be associated with selection into treatment in that context (more educated mothers might be better informed and also have stronger labor force attachments, for example) and find that the results are robust.

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.

The key identifying assumption in our DD model is that the trend in labor market outcomes for mothers in areas without full-day kindergarten represents an accurate counterfactual for those

¹⁴ 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. There are no published numbers on the percentage of children who attend school out of their catchment area in kindergarten because that grade itself is optional, and because policies on attending different schools are idiosyncratic to each school board.

that are treated with full-day kindergarten. A challenge to identification would be if mothers treated in a given wave are more likely to work in an occupation with negative growth, while those treated in another wave are more likely to work in an occupation with positive growth. This would be unlikely, and we have no evidence of this situation in our data.

One common check often used in a difference-in-differences framework is to examine the trends of the treatment and control group before the policy change. In our case, we need to make sure that the parallel trends assumption is credible for each cohort of treatment. In Figure 3, we examine the trends of some of our outcome variables by year of full-day kindergarten treatment status.¹⁵ In particular, we first graph labor force participation. The top-left graph of Panel A shows the average labor force participation rate of mothers who lived in a school catchment area that offered full-day kindergarten in 2010 versus mothers who did not. The data includes the 2008, 2009, and 2010 school years. We find roughly similar trends. To create the middle graph of Panel A we examined the average labor force participation for mothers who were offered treatment in 2012 versus those treated later. Again, we find similar trends. We repeat the exercise one more time in the right-most graph of Panel A, comparing the labor force participation of mothers treated in 2013 versus those who had yet treated by 2013. Again, we find the trends to be similar. We then repeat the exercise for the probability of working full-time (Panel B), for weekly hours worked (Panel C), and for the log of weekly earnings (Panel D). In general, all the

¹⁵ We are unable to show the 2011 results, as the sample sizes are too small to be released from the Canadian Research Data Centre. For similar data release limitation reasons, Figure 3 does not include all our outcome variables. However there were no systematic differences in the outcomes not shown here. .

trends look similar to each other. However, samples are smaller for treatment than for control in any given graph, resulting in more variability. Overall, Figure 3 provides us with more confidence that our empirical strategy is adequate for this situation.

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 labor market outcomes is gathered through the Statistics Canada monthly Labour Force Survey. We focus on mothers surveyed between September, 2008 and August, 2014.¹⁶ 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 2011.¹⁷

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

¹⁶ 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).

¹⁷ 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).

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 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 all school catchment area data for all schools in Ontario. Then we matched catchment areas to postal code data.¹⁸ For the majority of our data, the school catchment area is much greater than the postal code area, so we match many postal code areas to any given school catchment area.¹⁹ Appendix Figure 1 illustrates that process. We are able to match 250,676 postal codes with 3322 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 school catchment area using board and school identifier numbers. Labor force information is linked to the postal code based 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

¹⁸ The postal code data is from Statistics Canada, Statistics Canada Research Data Center, Micro Data Division (2015)

¹⁹ 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.

identifier to link households to school catchment areas. The remaining seven percent did not provide a postal code when surveyed. In doing so, we are able to identify the academic year (between 2010 and 2014) that the vast majority of households were offered full-day kindergarten in Ontario.²⁰ Our final dataset includes 23,300 mothers, and 1,340 schools.²¹

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 have to exclude mothers of three and five year olds from the sample. This is 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 labor force participation amongst mothers of four year olds is 76.4 percent, with the overall employment rate 92.2 percent for this group. Conditional on being in the labor force, 75.2 percent work full-time, 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 6.6. Absence from work measures whether an individual who is working full-time was absent from work during the reference week. According to Statistics Canada (2017), 13 percent of women with a preschool-aged child were absent from work in 2012. Roughly a third of those

²⁰ The remaining schools are French Public and French Catholic schools, which rolled out kindergarten over a different schedule, in the late 90s, 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.

²¹ Sample sizes for the Labour Force Survey are rounded to comply with confidentiality requirements of Statistics Canada Research Data Centre.

absences are due to personal or family responsibilities (Statistics Canada, 2015). In our sample, we find that 14.2 percent of mothers with a four year old are absent in the reference week.

The average mother in our sample is 36 years old, and has two children. Out of the mothers in our sample, 37.5 percent are immigrants, 25.1 percent have not completed education at a level that exceeds high school and only 8.1 percent are single. At the neighborhood level, 31.6 percent of respondents (or adult household members) hold at least a bachelor degree, 71.3 percent of childless males are in the workforce, and 88.3 percent of respondents live in urban areas. The average school matched to the mothers in our sample has a 67 percent pass rate on EQAO math, a 61 percent pass rate on EQAO reading, 15.8 percent of its students have special needs, and 24.7 percent of its students do not speak an official language (English or French) at home.²²

V. RESULTS

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: labor force participation, employment, full-time employment, weekly hours of work, log of weekly earnings, and absenteeism. In Table 2, we report the coefficient for FDK for the English Public school boards from each of the separate regressions in columns 1, 4, 7, 10, 13, and 16. We find no statistically significant results. In the next columns, we include our lags and leads controls for the

²² 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

rollout of the English Catholic school board. We still find no statistically significant effects. Finally, in columns 3, 6, 9, 12, 15, and 18, we also include an FDK indicator variable for the English Catholic school boards rollout and still find no statistically significant effects. None of the Catholic school board indicators are statistically significant either, except for absenteeism. Reducing absenteeism is one of the ways that policy makers believe that providing full-day kindergarten will help the labor force. They believe the extra time in primary education for the children will result in lower absenteeism from the parents.²³ If anything, we see the opposite in our results but the result is neither stable, nor is it found consistently in other specifications found later in the paper. Overall, we are not seeing the move from half-day to full-day kindergarten affecting the maternal labor market outcomes of average mothers.

In Table 3, we explore whether or not the kindergarten rollout affected women differently based on their observable characteristics. In particular, we estimate heterogeneous effects by interacting the variable of interest (FDK) with a number of categorical variables for having only one child (One child), being a single mother (Single), living in an urban area (Urban), having been born outside Canada (Immigrant), and having a low education level (High school or lower).

Overall, in Table 3 we find that the statistically significant effects are positive, and at the intensive margin. In particular, we find that mothers with only one child are around 8 percentage points more likely to work full-time following the implementation of the full-day kindergarten reform, and they work on average 2.6 more hours a week. This translates into about an 11

²³ For example, see Brown et al. (2013) who write that “improving the availability of child care [preschool] could save employers billions of dollars from avoided employee absences”.

percent increase in full-time employment and about an 8 percent increase in hours worked. There could be a variety of reasons for this effect to be concentrated within these women. For instance, it could be that having only one child signals a stronger connection to the labor force, so even a small subsidy (or a slightly bigger one, such as full-day kindergarten) would be enough to induce them to enter the labor force. It could also be that because full-day kindergarten is only for 6.5 hours a day, a mother truly working full-day will need wrap-around care. This is most likely to be financially and/or logistically viable for mothers with one child. We also find that mothers with a high school or lower education level also experience an increase in hours worked at roughly the same magnitude as the mothers with only one child. In particular, we find that mothers with low education work on average 2.3 hours more per week. We suspect that the women who work part-time in occupations that allow for shift work drive this result.²⁴

We run the analysis with the leads and lags of full-day kindergarten for the Catholic boards and find similar results, except for a marginally significant effect for immigrant mothers. Immigrant mothers are 6.5 percentage points less likely to work full-time, which may be an equilibrium effect, if they get displaced by Canadian-born mothers increasing their intensive participation margin. However, neither the magnitude nor the significance is robust to all three specifications. We continue to find similar magnitudes but lower significance levels for the FDK for public schools for the third set of specifications which include the FDK for Catholic schools. The interaction with FDK for the Catholic schools is not statistically significant in any of the

²⁴ Unfortunately, our data does not allow us to test this theory directly due to small sample sizes.

specifications.

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. These effects are found for women with only one child or who have a high school or lower education level. We do not find statistically significant effects for the English Catholic school board rollout.

VI. CONCLUSION

The kindergarten reform in Ontario offered all families 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 limited response in the labor force participation of mothers who were intended for treatment, with the impact concentrated in specific subgroups. The heterogeneous response we observe is consistent with constraints over many dimensions: monetary, time, and availability of space in early childhood education centers. The women who are responding to the implicit child care subsidy are those who have only one child, or have lower educational attainment. We believe this is because they are more likely to work in industries with more flexible shift work. These results are consistent with much of the recent literature on maternal labor supply in developed countries, and highlight the need for more research on how to specifically target certain groups of mothers who may still face too high a cost in entering the labor market, or who are not reaching their desired participation level. Understanding the different constraints that these women face is key to creating public policies that are as cost-efficient as they are effective.

VII. REFERENCES

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

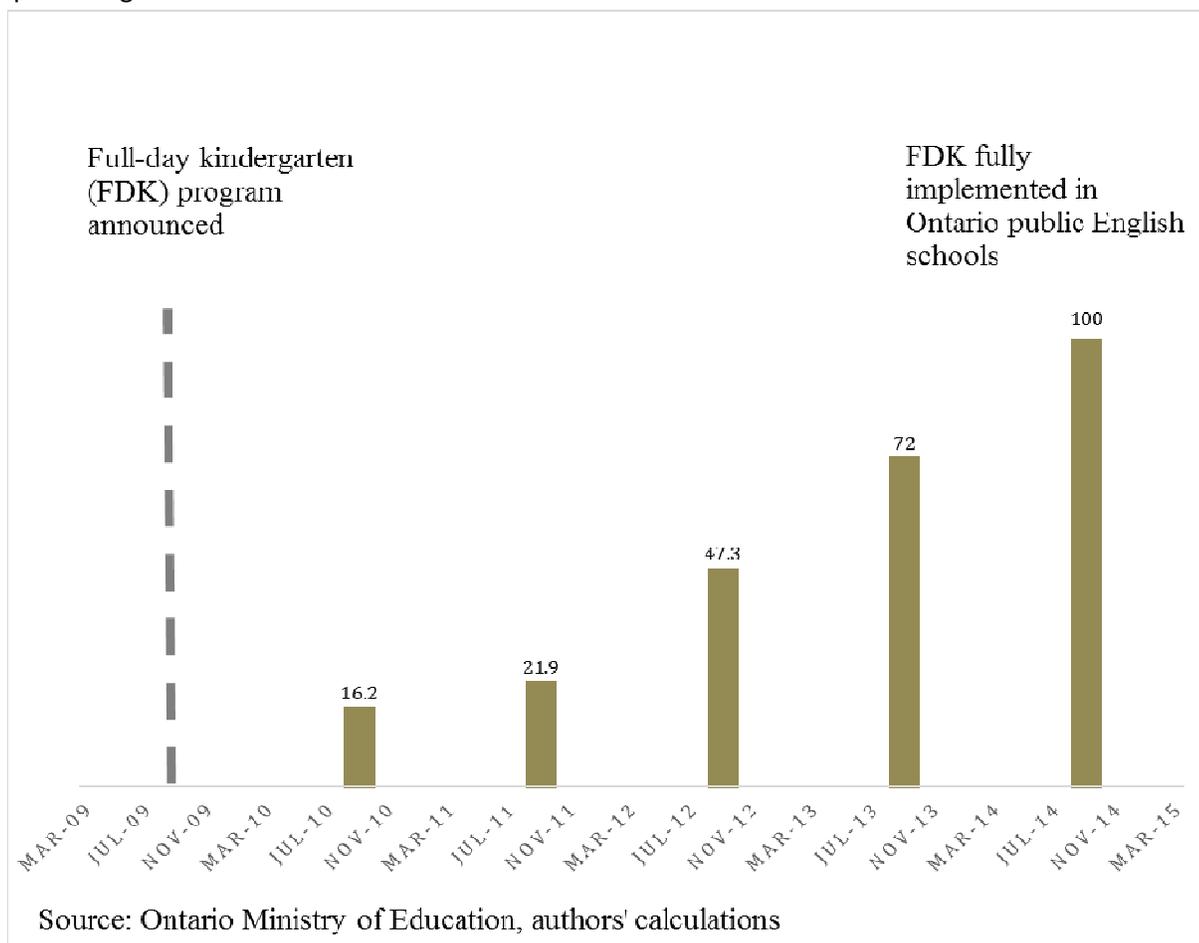
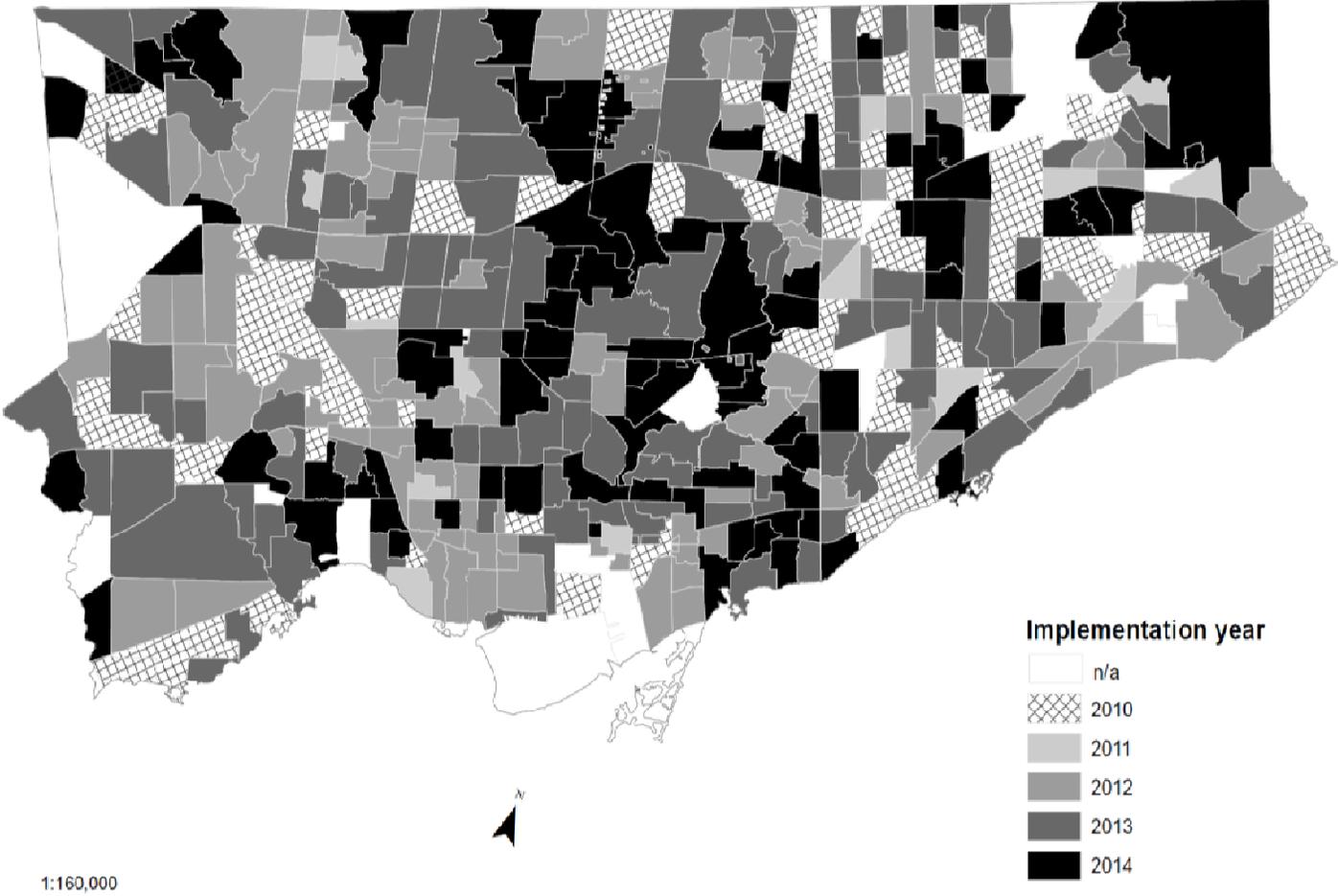


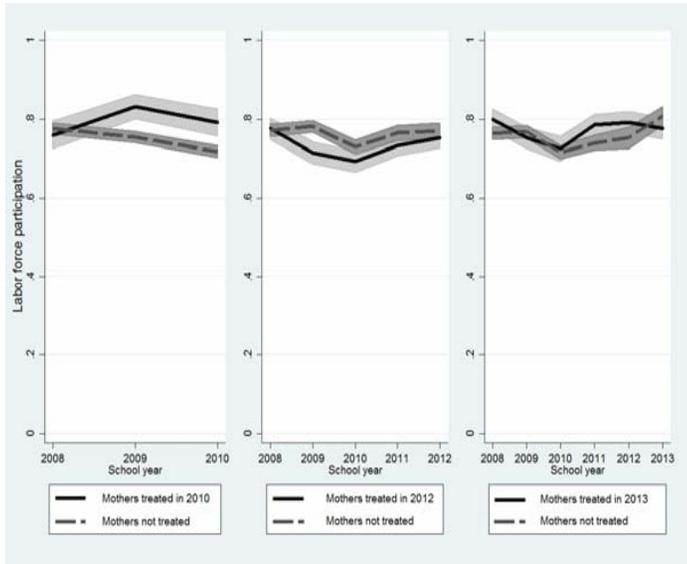
Figure 2—Rollout of full-day kindergarten in the Toronto District School Board, by school catchment area



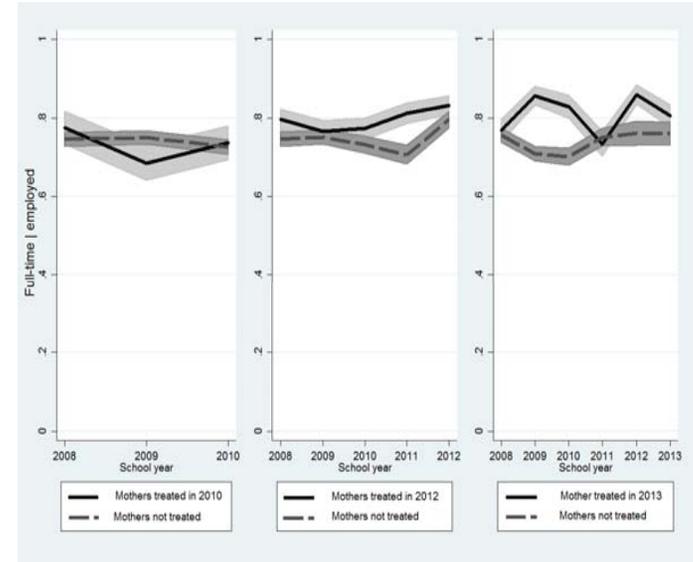
Source: Ontario Ministry of Education, authors' calculations
Note: n/a indicates non-residential areas (including municipal core and general employment zones)

Figure 3—Trends in outcome variables, by year of full-day kindergarten treatment

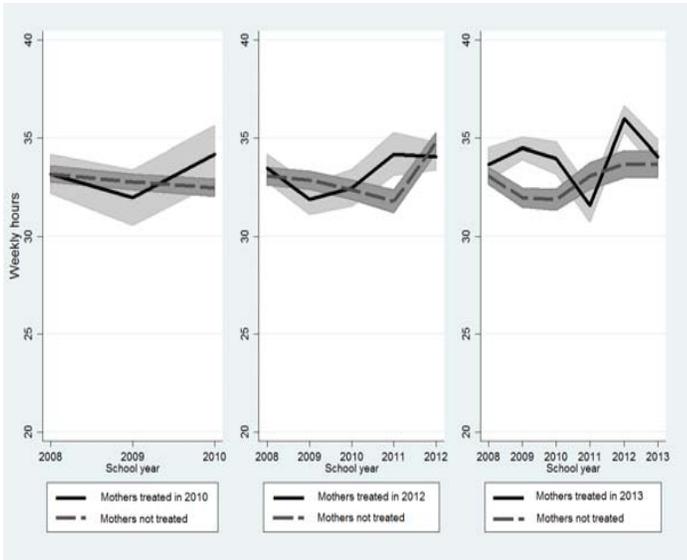
Panel A: Labor force participation



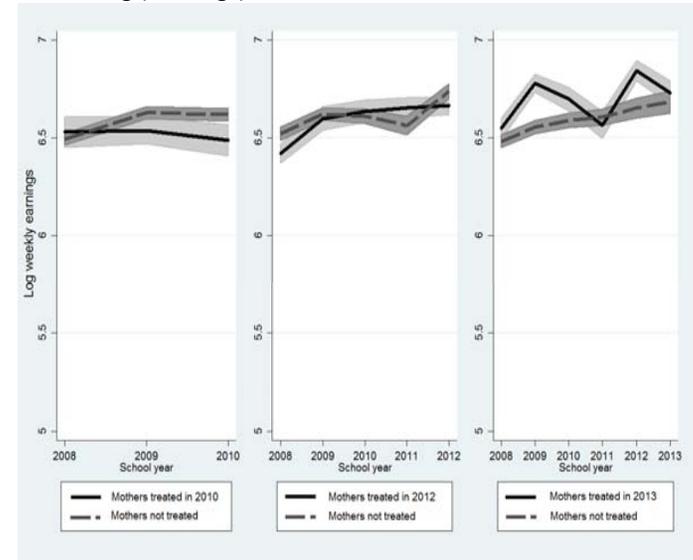
Panel B: Full-time



Panel C: Hours worked



Panel D: Log (earnings)



Note: Shaded areas represent 95% CI.

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

	Mean	Std dev.
Mothers' labor market outcomes		
Labor force participation	0.764	[0.425]
Employed labor force participation	0.922	[0.268]
Full-time being employed	0.752	[0.407]
Weekly hours worked	33.32	[11.01]
Weekly earnings (log)	6.603	[0.727]
Absent from work full-time	0.142	[0.349]
Mothers' characteristics:		
Age	36.10	[5.40]
Number of children	2.026	[0.923]
Immigrant	0.375	[0.484]
High school or lower education	0.251	[0.434]
Single	0.081	[0.273]
Neighbourhood characteristics		
% individuals holding a BA+ degree	0.316	[0.193]
Labour force participation of male without children	0.713	[0.186]
Urban	0.883	[0.322]
School characteristics		
% students in the school who met provincial standards in math	0.670	[0.154]
% students in the school who met provincial standards in reading	0.610	[0.145]
% special needs students	0.158	[0.104]
% students who do not speak official language at home	0.247	[0.253]
School capacity measure	0.909	[0.374]

Notes: All summary statistics are weighted.

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

	Labor force participation			Employed			Full-time			Hours worked			Log (earnings)			Absent		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
FDK _{public}	0.020	0.012	0.020	0.002	-0.011	0.004	0.015	0.001	0.021	0.535	0.056	0.658	-0.029	-0.068	-0.018	0.007	0.013	0.003
	(0.023)	(0.019)	(0.024)	(0.024)	(0.022)	(0.024)	(0.028)	(0.025)	(0.030)	(0.901)	(0.853)	(0.965)	(0.054)	(0.040)	(0.061)	(0.011)	(0.010)	(0.011)
FDK _{Catholic}			0.001			-0.018			-0.039			-0.920		-0.085				0.024**
			(0.016)			(0.011)			(0.029)			(0.719)		(0.073)				(0.013)
Includes leads and	no	yes	no	no	yes	no	no	yes	no	no	yes	no	no	yes	no	no	yes	no
Number of observations	23,300	23,300	23,300	18,000	18,000	18,000	16,800	16,800	16,800	16,700	16,700	16,700	14,500	14,500	14,500	12,100	12,100	12,100

Notes: ***p<0.1; **p<0.05; *p<0.1. Wild bootstrap standard errors in parenthesis clustered at the school board level (31 clusters). FDK is a step function equal to one if the school catchment area where the household lives offers full-day kindergarten. Each regression includes a constant, school year fixed effects as well as the controls variables listed in Section

Table 3 - Difference-in-differences estimates of the impact of full-day kindergarten on maternal labor market outcomes with heterogeneous effects

	Labor force participation			Employed			Full-time		Hours worked			Log (earnings)			Absent			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Panel A: One child																		
FDK _{public} * One child	-0.037	-0.041	-0.048	-0.006	-0.004	-0.011	0.082**	0.085**	0.074	2.564*	2.589**	2.057	0.043	0.053	-0.002	0.004	0.004	0.003
	(0.025)	(0.025)	(0.046)	(0.021)	(0.021)	(0.027)	(0.034)	(0.034)	(0.051)	(1.121)	(1.113)	(1.322)	(0.095)	(0.094)	(0.127)	(0.022)	(0.022)	(0.021)
FDK _{Catholic} * One child			0.023			0.013			0.021			1.196			0.107			-0.001
			(0.063)			(0.027)			(0.059)			(1.161)			(0.088)			(0.017)
Panel B: Single																		
FDK _{public} * Single	-0.039	-0.041	-0.097	0.005	0.002	0.002	-0.057	-0.062	-0.085	-1.785	-1.923	-1.542	-0.109	-0.123	-0.088	-0.002	-0.002	-0.012
	(0.051)	(0.051)	(0.069)	(0.060)	(0.062)	(0.055)	(0.045)	(0.044)	(0.074)	(1.327)	(1.345)	(1.792)	(0.098)	(0.102)	(0.146)	(0.028)	(0.028)	(0.035)
FDK _{Catholic} * Single			0.098			0.010			0.060			-0.125			-0.010			0.013
			(0.057)			(0.035)			(0.100)			(1.435)			(0.166)			(0.042)
Panel C: Urban																		
FDK _{public} * Urban	-0.018	-0.019	0.019	-0.018	-0.013	0.001	0.066	0.070	0.084	1.805	2.017	2.516	-0.027	-0.012	0.039	0.007	0.005	0.002
	(0.042)	(0.046)	(0.049)	(0.025)	(0.025)	(0.025)	(0.064)	(0.065)	(0.069)	(1.867)	(1.958)	(2.210)	(0.117)	(0.121)	(0.143)	(0.026)	(0.026)	(0.026)
FDK _{Catholic} * Urban			-0.086			-0.042			-0.037			-1.541			-0.148			0.007
			(0.048)			(0.026)			(0.063)			(1.457)			(0.123)			(0.024)
Panel D: Immigrant																		
FDK _{public} * Immigrant	0.021	0.024	0.000	-0.030	-0.030	-0.019	-0.062	-0.065*	-0.024	-0.641	-0.722	0.570	-0.057	-0.066	-0.016	0.006	0.005	-0.007
	(0.027)	(0.025)	(0.030)	(0.032)	(0.029)	(0.034)	(0.041)	(0.037)	(0.049)	(1.103)	(1.020)	(1.226)	(0.071)	(0.072)	(0.093)	(0.029)	(0.026)	(0.023)
FDK _{Catholic} * Immigrant			0.047			-0.030			-0.104			-3.218			-0.124			0.034
			(0.042)			(0.024)			(0.047)			(1.375)			(0.152)			(0.036)
Panel E: HS or lower																		
FDK _{public} * HS or lower	-0.012	-0.014	-0.012	0.045	0.043	0.040	0.059	0.050	0.067	2.366**	2.317*	2.175	0.076	0.077	0.094	-0.012	-0.012	-0.003
	(0.029)	(0.029)	(0.033)	(0.020)	(0.021)	(0.024)	(0.043)	(0.044)	(0.053)	(1.020)	(0.986)	(1.296)	(0.090)	(0.090)	(0.103)	(0.025)	(0.025)	(0.032)
FDK _{Catholic} * HS or lower			-0.001			0.011			-0.016			0.480			-0.047			-0.020
			(0.048)			(0.017)			(0.035)			(1.127)			(0.064)			(0.046)
Includes leads and lags?	no	yes	no	no	yes	no	no	yes	no	no	yes	no	no	yes	no	no	yes	no

Notes: ***p<0.1; **p<0.05; *p<0.1. Wild bootstrap standard errors in parenthesis clustered at the school board level (31 clusters). FDK is a step function equal to one if the school catchment area where the household lives offers full-day kindergarten. Each regression includes a constant, school year fixed effects as well as the controls variables listed in Section III.

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

