The impact of full-day kindergarten on maternal labour supply in Ontario

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Abstract

We study the impact of offering full-day rather than half day kindergarten in Ontario and find no impact on the labour participation of mothers at the extensive margin, with some intensive responses in specific sub-groups. The heterogenous response we observe is consistent with constraints over many dimensions: monetary, time, availability of space in early childhood education centres. The women who are able to change the number of hours they work are the least constrained: mothers with one or two children, and another adult in the household.

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Introduction

Governments have long understood the appeal of policies that benefit families, especially if they promote long-term growth of the economy. High quality subsidized early childhood education has the potential to do just that, as children can be better prepared for school, while their caregivers (usually mothers) increase their current labour attachment and lifetime earnings. A large number of countries around the world have implemented some form of subsidy to early childhood education [1], and researchers have been have been taking advantage of reforms to use experimental or quasi-experimental methods to identify the impact of this increase in access (usually through a combination of lower prices and increased available spaces[2]) to early childhood education on maternal labour supply. [3] Most recent research seems to indicate that when the pre-existing labour participation is high, moving the extensive margin of maternal labour force participation is expensive and requires an aggressive approach (for example, combining access to affordable childcare with other labour incentives such as an earned income tax credit). In such a context, employment growth is still possible through the intensive margin, the number of hours worked. We study the impact of expanding public universal kindergarten from part-time (2.5h/day) to full-time (6.5h/day). To the best of our knowledge, only a handful of studies have considered the impact of moving from half-day to full-day kindergarten, two in the U.S. context (Cannon et al. (2006) and DeCicca (2007), one in Canada [4] (Friesen et al. (2013)), and one in Germany (Felfe and Zierow (2015)). Those papers focus on children outcomes, with some secondary consideration to maternal labour supply; our paper is thus the first to focus on the impact of expanding the hours of kindergarten on the labour supply of mothers, considering both the extensive and intensive margin. We find that the response is at the intensive margin, and that heterogeneity matters, with some groups responding

[1] We use early childhood education to refer to both childcare in daycare facilities, and preschool (or kindergarten) in formal school setting; if we abstract from the more rigorous curriculum design, we can think of kindergarten as a form of childcare provision

[2] Cascio, Haider and Nielsen (2015) present a collection of recent national studies on policies that promote maternal labour force participation

[3] See Gelbach (2002), Baker, Gruber and Milligan (2005), Schlosser (2006), Berlinski and Galiani (2007), , Lefebvre and Merrigan (2008), Lefebvre et al. (2009), Cascio (2009), Goux and Maurin (2010), Havnes and Mogstad (2011), Fitzpatrick (2012), Jongen and Muller (2012), Felfe, Lechner and Thiemann (2013), Calderon (2014), Nollenberger and Rodriguez-Planas (2015), Haeck et al. (2015)

[4] in the province of British Columbia

more than others. We interpret this as a result of the fact that women are constrained in more than one dimension. Learning about these constraints and how they matter is key to efficient policy-making. Despite the moniker of full-day, the reform falls short of allowing mothers to take up full-time employment without additional care for the children, and this tempered the response in terms of maternal labour supply. Primary caregivers who work full-time can find additional care in the form of family care (support from a co-parent or from grandparents), informal childcare (nanny or homecare) or after-school care in a formal setting. The kindergarten reform in Ontario was not without controversy, and the implementation came at a high cost; understanding who benefited from it is paramount to evaluating its success. We find that the mothers who were able to work full-time following the reform are married, college-educated, Canadian-born, with one or two kids, living in neighbourhoods with a mix of college and high school education. There is well-established evidence that those mothers have the most elastic labour supply [5]. Elasticity in this context can be understood as a result of the number of binding constraints in the labour participation decision.

Starting in September 2010 and with a progressive roll-out over the following 4 years, the province of Ontario implemented a reform of early education to offer full-day kindergarten to all children aged 4 and 5 in public schools. Prior to the reform, the majority of children in Ontario attended half-day kindergarten. Children in Canada start primary school (grade 1) at 6, and attendance in school is only mandatory from grade 1. Nevertheless, the vast majority of parents (90% according to the Ontario ministry of education[6]) send their kids to kindergarten, which is universally offered through the public school system. The age at which kindergarten is available varies by province, with Ontario offering two grades of kindergarten: Junior kindergarten for 4 year olds, and Senior kindergarten for 5 year olds. The reform only changed the number of hours those kindergarten "grades" are offered. While the roll-out was planned (rather than randomized), it creates variation over time and space that we exploit in order to identify the impact of full-day kindergarten on the labour supply of age-eligible children. We also take advantage of the fact that the reform only targets 4 and 5 year olds, and construct a number of comparison groups to further solidify our result. Using a difference-in-differences approach (DD), we find that conditional on working, having access

[5] Mincer (1962) provided the theory and early evidence, but Eissa and Liebman (1996) most famously showed this to still be the case

[6] http://www.edu.gov.on.ca/kindergarten/FDKReport2013.pdf

to full-day rather than half-day kindergarten increases the likelihood of mothers of 4 or 5 year olds working full-time and the average number of hours worked per week. The results on the likelihood of full-time employment persist in a difference-in-difference-in-differences estimation (DDD). The rate of labour force participation for women of childbearing age in Ontario is around 80% [7], but the maternal labour participation rate is lower[8]. This is because the work of stay at home mothers is excluded from official calculations of employment, but it's not immediately obvious that it is desirable for society to outsource home production to someone else. A number of authors[9] have argued that mothers who wish to rejoin the work force are penalized if their skills have depreciated too much, or lose out on promotion opportunities if they are only working part-time. This in turns lowers their lifetime income. If that is the case, then policies who induce an earlier return to full-time employment for these women are desirable, and this is what we study here.

There is well-established evidence[10] that the labour participation of women has plateau'd, after a few decades of steady growth. The underlying assumption behind government interventions in the costs and availability of early childhood education is that there is an efficiency gain to be achieved from making it easier for mothers to work; that is, there is unexploited growth potential in labour force participation. Similar to Fitzpatrick (2012) we find that an implicit subsidy like extending the length of day in kindergarten has little impact of the labour force participation at the extensive margin. That is, we do not find convincing evidence that women are more likely to be in the workforce after being given access to full-day kindergarten rather than half-day. We do, however, find evidence that conditional on employment, some are able to work longer hours and earn more. This is an important result to establish as this spillover from the kindergarten reform into the labour decision of mothers is an important component to any future program evaluation. The rest of the paper is as follow: section 2 presents a review of the literature, section 3 an overview of the reform, section 4 outlines our empirical strategy, we present results in section 5, discuss in section 6, then conclude.

[7] Statistics Canada table 111-0018

[8] Table 6 [descriptive statistics] not yet released for distribution due to confidentiality requirements

[9] most recently Felfe, Lechner and Thiemann (2013), and Nollenberger and Rodriguez-Planas (2015)

[10] Lee (2014) most recently

Review of the literature

Our paper contributes to a greater literature on maternal labour supply, the earlier part of which is well-summarized in Blau and Currie (2006). We consider the common framework of maternal labour supply in which mothers decide to work outside the home or not, and if they do, can have the children in the care of paid childcare or unpaid childcare (which includes relatives and schools). The decision to join the labour force depends on a number of factors, including the cost and availability of childcare. The seminal paper on kindergarten is Gelbach (2002), which looks at the impact of access to universal public kindergarten in the US, and finds public school enrolment has a significant impact on labour-market outcomes among mothers whose youngest child is five-year-old. In particular, Gelbach finds that access to public kindergarten increases employment at the extensive and intensive margin, and decreases reliance on public assistance.The reform we study changes the number of hours of kindergarten available to Ontario families. An extensive literature studies the *introduction* of early childhood education, that is, the effect of going from zero to non-zero hours of care. Part of that literature focuses on the outcomes for children, and the evidence suggests heterogenous impact based on the relative quality of care (relative to being home with their parents) [11].

Quasi-experimental studies suggest that early childhood education programs also have heterogenous impacts on the labour market outcomes of mothers with eligible child. A group of papers on the creation of a universal daycare subsidy in Quebec (Baker, Gruber and Milligan (2005), Lefebvre and Merrigan (2008), Lefebvre et al. (2009), Haeck et al. (2015)) generally find that cheaper childcare leads to positive labour outcomes for the mothers. Those last papers use a similar approach to ours, but with a difference-in-differences approach based on using mothers in other provinces as control for mothers in Quebec. Berlinski and Galiani (2007) use a difference-in-differences approach to show that building free public preschools in Argentina increased maternal labour supply, but their results are only significant for married mothers with no younger children at home. We use age of

[11] Heckman (2006) includes a good summary up to that point, while Havnes and Mogstad (2011), and Dhuey (2011), present further evidence from Norway and the US, respectively. In general, children coming from homes in which they receive low quality care do better when they have access to higher quality early childhood education, and the reverse is true if the relative quality is reversed

youngest child as a criteria for sample selection and focus on those mothers with no child below 4 and 5 (as the treatment group). Cascio (2009) uses U.S. Census data to show that single mothers with youngest kids aged five benefit the most from the universal kindergarten program and enter the labour force. We find that in Ontario, it's the married mothers who benefit from the extended kindergarten hours, and they respond by working longer hours. Goux and Maurin (2010) look at the availability of public pre-schools for 2 year olds in France and find that single mothers are more likely to be employed. Havnes and Mogstad (2011) study the expansion of the Kindergarten act in Sweden between 1976 and 1979 and find no effect on labour force participation and conclude that in the short run, the additional access to kindergarten does not substantially increase maternal labour force participation, but only crowds out informal childcare arrangements. Fitzpatrick (2012) similarly finds virtually no effect (except for mothers of five year olds with no younger sibling, but not for mothers of four year olds), and argues that childcare subsidies may no longer induce labour participation at the margin in the U.S., because the women who would be targeted by these policies are already working. Our findings line up with that idea, at least on average. We find effects at the intensive margin on the likelihood of working full-time. Bettendorf, Jongen and Muller (2012) study a set of reforms in Holland between 2005-2009: an increase in childcare subsidies associated with an increased in the earned income tax credit. Using a difference-in-differences approach, they find an increase of 3 percent in maternal employment and 6.2 percent in average hours worked. However, it's impossible to disentangle the impacts of the childcare subsidy from that of the EITC, and it seems like the biggest response to the set of policies occurred when the EITC was introduced. This is consistent with the fact that there seems to be a smaller pool of women for whom a childcare subsidy has a strong effect at the extensive margin. Felfe, Lechner and Thiemann (2013) make a similar point about the difficulty of moving the extensive margin, but argue that there are opportunities to incentivize movement at the intensive margin. In their study of after-school care provision in Switzerland, they use a semi-parametric geographic IV (using cantonal borders as instruments), to identify the effect of availability of after-school childcare on parental employment. They find that access to childcare increases the likelihood of full-time employment for mothers by 8 percentage points, a rather large average effect. It may be that the response is large at the intensive margin because so many mothers in Switzerland (47%) work part-time. In Ontario, part-time work is not

as readily available, and there is a smaller pool of women who might be moving from part-time to full-time. We do find a response of similar magnitude, but only for specific sub-groups, not on average over all mothers.

Nollenberger and Rodriguez-Planas (2015) study the effect of offering full-time public preschool for 3 year old children on the labour participation of mothers in Spain, in a context of low maternal labour force participation, lack of existing formal childcare slots, and low labour demand. Despite high unemployment rates in Spain during the period of interest, they find that treated mothers are 3 percentage points more likely to work after universal childcare is introduced in their state, but can only identify this effect in the DDD specification. They also find that this is driven by older mothers with two or more children. Nollenberger and Rodriguez-Planas argue that this is a sizeable effect in the Spanish context at that time, given low initial labour force participation. Calderon (2014) looks at the expansion of subsidized childcare for working mothers in Mexico who are not covered by the social security system (that is, workers who work in the informal sector). This expansion of low cost childcare (with 90% of the cost of childcare paid directly to the childcare provider) also increased available spaces for children aged 1-4 by 357000 between 2007 and 2010. As in the Ontario reform, it affected eligible mothers by relaxing the budget constraints over many dimensions (monetary, time available for work, and availability of space in early childhood education centres), and Calderon uses a triple difference estimation to evaluate the impact of the program; she finds that treated mothers are more likely to be employed, and have higher labour income. Interestingly, she also considers the impact on fathers and find that they are more likely to switch to a better-paid job as well.

The kindergarten reform in Ontario

The reform was rolled out over a period of 5 years, starting with schools targeted as high need based on the percentage of low achievement and low-income students. Figure 1 shows the implementation rollout of the full day kindergarten reform from the announcement date in September 2009 to full implementation in September 2014. The public school system in Ontario is made of four

different shool system: English, English Catholic, French, and French Catholic[12]. Parents can choose the school system they want to send their children to[13]. Each school system defines school catchment areas, and parents are guaranteed a place in the school that corresponds to their school catchment area. Schools are administered by school boards, which in turn receive funding from the province. In September 2010, 16.2% of English schools and 14.4% of English Catholic schools implemented the full-day Kindergarten. There were some frictions in the initial implementation of the reform as schools sometimes lacked physical capacity to accommodate the increased number of students. In addition to that deviation from planned roll-out , in the period leading to the 2011 provincial elections, the reform became a major point of contention in the electoral race, with Conservatives promising to cancel the reform altogether. As a result, only 5.7% of English schools and 6.3% of English Catholic schools implemented the rollout, much fewer than initially planned. Following the Liberal victory in the election, the rollout picked up again in September 2012 with 25.4% of English schools and 25.6% of English Catholic schools implementing full-day kindergarten. Similar percentages of schools implemented the reform in 2013 (24.7% of English schools and 24.4% of English Catholic schools) and the reform was fully implemented in September 2014, with the remainder of the schools adding full-day kindergarten.

The primary objective of the reform was to lower the number of "at risk" children, those identified as having low readiness for school.[14] Poverty reduction was touted as a secondary aim in government publications. [15].

Empirical strategy

The goal of this research is to estimate the impact of the full-day kindergarten (FDK) reform on the labour market outcomes of mothers. We use a difference-in-differences approach with a pooled cross-section spanning from 2008 to 2014 (with monthly cross-sections). We set up a Difference-in-

[12]there are approximately 600 French and French catholic schools, but we exclude those as they implemented full-day kindergarten at different times

[13]with some restrictions based on language and religion

[14]Pascal (2009)

[15]http://www.children.gov.on.ca/htdocs/english/news/newsreleases/12012010.aspx

Differences (DD) that allows for roll-out treatment:

$$y_{ict} = \alpha + \beta FDK_{ct} + X'_{it}\delta + Z'_{ct}\phi + W_c + T_t + \varepsilon_{ict} \tag{1}$$

Y_it is a vector of labour market outcomes (probability of labour force participation, probability of being employed, probability of full-time employment, log of weekly earnings), and β is the parameter of interest: FDK_{ct} is the treatment status, and corresponds to to a step function equal to 1 if a school catchment area offers full-day kindergarten in a given year. X_{it} is a vector of individual-level controls (mother's age, education, and marital status), Z_{ct} is a vector school-level controls (a capacity measure indicating the ratio of available space to existing student, grade 3 EQAO test scores, percentage of students whose first language is neither English nor French, percentage of students with special needs), and Neighbourhood-level controls (percentage of immigrants, percentage of university-educated residents, a rural-urban indicator). We include wave fixed effect to control for unobserved heterogeneity between the different waves of treatment; mothers who get treated first live in school catchment areas that may be systematically different from those treated later. In this context, the term "wave" refers to a geographic distribution of treatment. We also include year fixed effect to capture unobserved shocks common to all school catchment areas in a given year. Given the structure of the data, we are concerned about possible bias caused by serial correlation in the error term, and by the difficulty to assume homoskedasticity over an entire province. To address these concerns, we cluster the error term $\varepsilon_{i(st)}$ at the board*wave level. That is, we allow for arbitrary serial correlation and heteroskedasticity for mothers whose school catchment area belongs to the same school board and were treated in the same wave [16] We estimate a linear probability model as our main specification[17]. Identification of β comes from the changes in the outcome over time in a catchment area.The key identifying assumption in a DD with time trend is that the growth in employment for mothers of children aged 4 and 5 who are treated first are the same as those of mothers whose child is treated later (mothers treated in 2010 for example, compared to those treated in 2011). This may not hold in the time period of interest, as this represents the period in

[16]following Cameron and Miller (2015), we also estimated the model with clustered standard error at the wave level, and corrected for too few clusters by using the student t distribution with 4 degrees of freedom since there were 5 waves of treatment. We found roughly the same significance.

[17]We also ran the model with a probit model and found the same results

which the global economy was recovering from the great recession. A challenge to identification for example would be if mothers treated in a given wave are more likely to work in an industry with negative growth, while those treated in another wave are more likely to work for an industry with positive growth.

We then estimate a Difference-in-Differences-in-Differences estimate (DDD), which compares mothers of eligible children (4 and 5 years old) in school catchment area that offer full-day kindergarten in a given year to mothers of ineligible children (2 and 3 years old) in the same school catchment area and year of roll out.

$$y_{ict} = \alpha + \beta_1 FDK_{ct} + \beta_2 eligible_{it} + \beta_3 FDK_{ct} * eligible_{it} + X'_{it}\delta + Z'_{ct}\phi + T_t + \varepsilon_{ict} \tag{2}$$

Here the parameter of interest is β_3, and it identifies the marginal effect of the policy on the treatment group (mothers of children of kindergarten age) relative to the control (mothers of children slightly younger). The key assumption for DDD is that there is no shock in treated catchment areas that would affect the labour decisions of mothers of 4 and 5 years old over that of mothers of 2 and 3 years old. The DDD exploits variation across time, school catchment areas, and between mothers who are intended to be treated (those with a 4 or 5 year old) and mothers of children slightly too young to be treated (2-3 year olds)[18].

Parameters of interest and challenges to identification

The parameter of interest is β (β_3 in the DDD model), which we interpret 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 two ways in which a mother can decline treatment in this case: by sending her child out of district to a school that doesn't offer full-day kindergarten, or by keeping her child home an extra year.[19]. ITT (access to full-day kindergarten kindergarten) has causal interpretation if treatment is

[18] We also compared with mothers of 6-7 year olds and found similar results

[19] We are not concerned in this 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 the Ontario Ministry of Education estimates that 90% of children attend kindergarten

randomly assigned, and represents a lower bound on the more interesting impact of the treatment on the treated (effect of having a kid 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 treatment[20] We include controls for observable characteristics generally believed to be associated with selection into treatment in that context (more educated mothers might be better informed and also have stronger labour force attachments, for example) and find that the results are robust. We also include controls for the determinants of roll-out (high need schools as defined by the ministry of education were targeted first, conditional on capacity; high need is a combination of low test scores and low income).

The policy roll-out is not random, and is potentially correlated with labour market outcomes, as the original government plan was to roll-out first to schools identified as "high need", with need defined by a combination of low achievement and low income. However, the actual implementation differed from the planned one based on capacity (the physical ability to open a new classroom) and political considerations. While the capacity was considered in the planning, even optimistic estimates of the cost of the reform admitted that only at most 35% of schools would be able to open immediately, with the rest requiring some level of investment[21]. Public schools in Canada are funded at the provincial level, and 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 can only do so if they can fit all the potential students. This helps introduce some random variation in the roll-out from the point of view of recipients as the speed of building or renovating classrooms in order to accommodate all the potential students in the school catchment area was a random variable at the beginning of the roll-out.

Data and descriptive statistics

Our data come from various sources: 1) survey data from the monthly Canadian Labour Force survey, 2) administrative data from the Ministry of Education, 3) aggregate students test scores

[20] 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, the most common one being French immersion for English speaking children

[21] Pascal (2009)

from Ontario Education Quality and Accountability Office (EQAO), and 4) geo-spatial data from individual school boards and Canada Post.

Our labour market outcomes information is gathered through the Statistics Canada monthly Labour Force Survey. The survey is a repeated cross-sectional data that use probability sample to select dwellings. Within selected dwellings, all household members will be asked basic demographic information, and labour force information is collected for all civilian household members aged 15 and over. Despite the relatively smaller sample size compared to the Census, this survey design provides more accurate information of the treatment group as the age of youngest child of the household is included in the survey questionnaire. We focus on the mothers surveyed between January, 2008 and December 2014. We believe that the use of a monthly representative survey is the best way to consider the impact of the policy on the labour participation of women. The main advantage is that we are able to precisely assign treatment year using academic rather than calendar year, something that other authors [22] have struggled with.

The Ministry of Education administrative data include both the record of when any given school in Ontario started offering full-day kindergarten, and the school capacity measures. School capacity is measured as the ratio of students currently enrolled to students that the school can receive (a school with a low capacity number can accept more new students). Ministry of education also provides the number of kindergarten classes in each school in each school year.

Ontario Education Quality and Accountability Office (EQAO) is an independent agency who administers provincial tests on reading, writing and math for both elementary and secondary school students. We obtained information on grade 3 reading and math scores at the school level from EQAO. EQAO data used in this paper also include percentage of students who need special education support and percentage of students 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. We hand collected all school catchment area data from 31 English public (2000 schools) and 29 English catholic school boards (1000 schools) in Ontario. The catchment area data were then matched with postal code data using Geographic Information System programming

[22] Gelbach (2002)

(ArcGIS). Figure X provides an example of how postal code areas can be matched with the school catchment area. We are able to match 250676 postal codes with 3000 schools (both English public and English catholic) in Ontario[23] .

Administrative data from Ministry of Education and EQAO are linked to school catchment area using board and school identifier number. Labour force information is linked to the postal code based on the postal code of dwelling address. Therefore, we are able to identify the academic year (between 2010 and 2014) that the vast majority of households were offered FDK in Ontario. [24]

Table 5[25] shows that the mothers receiving treatment in different waves are not the same in terms of observable characteristics: mothers treated in earlier waves are more likely to be single, have less education, live in neighbourhood with lower average education, and be in the catchment area of a school with more available space (as measured by the capacity variable), lower EQAO scores, more students whose first language is not English, and more students with special needs. This is consistent with the planned roll-out of the reform, which targeted schools identified as high need (a combination of low income and low test scores), conditional on space capacity[26]. This is a potential challenge to the difference-in-differences strategy, but controlling for these observable characteristics as well as using wave fixed effect to control for unobserved heterogeneity yields the same estimates for the impact of the reform on outcomes, which suggests that these do not result in bias. On the other hand, comparing mothers whose youngest child is 4 or 5 to mothers whose youngest child is 2 or 3 in treatment areas shows that they are quite comparable; differences between them are not economically significant, which strengthen the support for the difference-in-difference-in-differences strategy.

Sample selection

Women in Canada usually take advantage of parental leave and stay home for an extended period of time in the child's first year. We leave out women whose youngest child is 0 or 1, as their labour force attachment may be systematically different from that of women whose youngest child is between 4

[23] there were 3917 schools in Ontario in 2014

[24] The remaining schools are French and French Catholic schools, who rolled out kindergarten over a different schedule, starting earlier

[25] Not yet released for distribution

[26] Pascal (2009)

and 5. The kindergarten policy reform targets women who are staying at home with their children because of constraints (in time, money, or access to available space), rather than preferences. We restrict our sample to mothers between 22 and 50 years old at the survey date with the youngest own child aged 2-7 years and reported valid postal code of their dwellings. To estimate the impact of the reform on different sub groups of mothers, we then condition on a number of characteristics: marital status, education (high school or less vs. college and more), urban/rural living, number of children (one, or 2 and more), family size (3 or less, or 4 and more), immigration status (Canadian-born, or first generation immigrant), and educational composition of the neighbourhood (by tercile).

Results

Table 1 presents the result of estimating equation 1 on the entire sample (mothers aged 22-50 in Ontario), using five different outcome variables: labour force participation, employment, full-time employment, weekly hours of work, and log of weekly earnings. Table 2 presents the results of estimating equation 2 using the same outcomes. In both cases, we are not able to detect an average effect over all women, which is consistent with much of the recent literature. However, table 3, repeating the estimation of equation 1 for different sub samples, shows that married mothers who have access to full-day rather than half-day kindergarten are 2.9 percentage points more likely to enter the labour force, while college-educated mothers are 4 percentage points more likely to enter the labour force. Mothers with only 1 child are 8 percentage points more likely to work full-time when they have access to full-day kindergarten, as are mothers who live in families of 3 or less members (we think those are in fact the same mothers). Those sub-groups work on average 2.9 and 2.8 more hours each week. Mothers who live in neighbourhoods that rank in the second tercile for the percentage of bachelor degrees are 6.2 percentage points more likely to work full-time, and work on average 2 more hours each week. We recognize that the DD estimates could be biased by the fact that mothers who were treated early might be likely to work in different industries than the mothers treated in different waves. If this is the case, and that these industries experienced different growth following the 2008 recession, then the triple difference estimation is a better causal estimate of the impact of the reform. Table 4, repeating the estimation of equation 2 for the same sub groups shows

that married mothers are 3.9 percentage points more likely to work full-time, and college adducted mothers are 3 percentage points more likely to work full-time. Mothers with 2 kids or more are 5.2 percentage points more likely to work full-time when they have access to full-day rather than half-day kindergarten, as are mothers living in families of 4 or more (again, we interpret these as being the same mothers, with another adult in the household). Mothers who are born in Canada are 5.3 percentage points more likely to work full-time, and mothers who live in neighbourhoods that rank in the second tercile for the percentage of bachelor degrees are 5.2 percentage points more likely to work full-time. We do not detect any effects at the extensive margin in this specification.

Conclusion

The kindergarten reform in Ontario offered all families access to 6.5 hours of formal early childhood education a day, from a previous 2.5 hours. We find limited response in the labour force participation of mothers who were intended for treatment, with most of the impact concentrated in specific subgroups. The heterogenous response we observe is consistent with constraints over many dimensions: monetary, time, availability of space in early childhood education centres. The women who are able to change the number of hours they work are the least constrained: mothers with one or two children, and another adult in the household. These results are consistent with much of the recent literature on maternal labour 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 labour market, or who are not reaching their desired participation level. Understanding the different constraints that these women face is key to creating efficient reforms that are as cost-efficient as they are effective.

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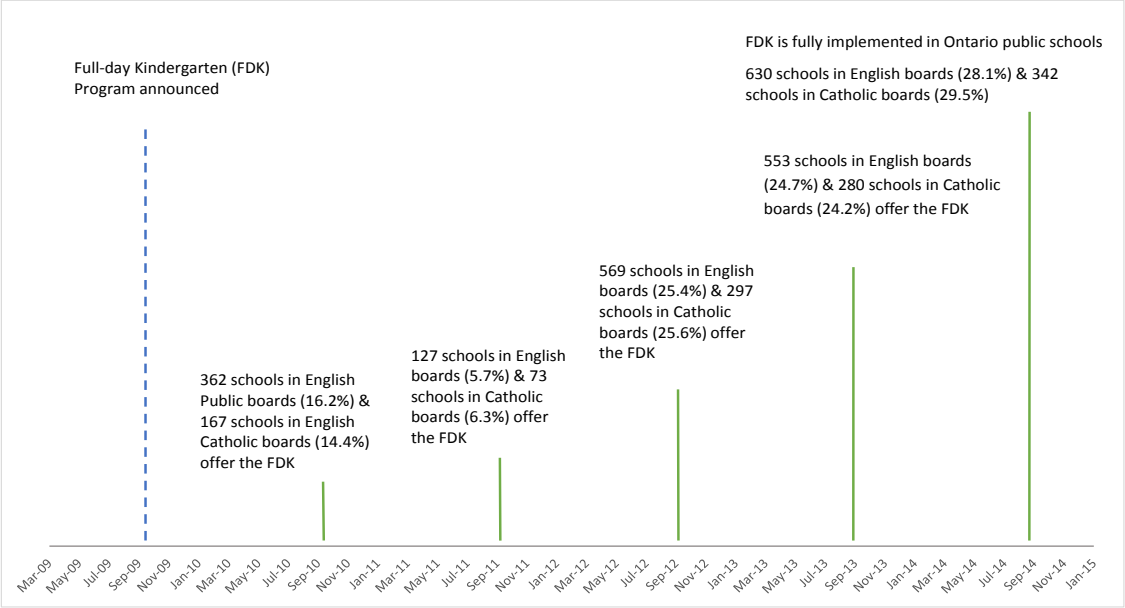

Figure 1: Roll out of full-day kindergarten reform in Ontario, 2009-2014

Table 1: Difference-in-Difference Estimates (control = 4-5 year olds) English board

VARIABLES	LFP	LFP	I(employed)	I(employed)	I(fulltime)	I(fulltime)	weekly hours worked	weekly hours worked	log(weekly earnings)	log(weekly earnings)
FDK	0.030	0.0283+	0.026	0.024	0.010	0.012	0.312	0.342	0.019	0.036
	(0.022)	(0.021)	(0.024)	(0.024)	(0.025)	(0.024)	(0.791)	(0.767)	(0.054)	(0.051)
age		0.00242**++		0.00342***++		0.000		0.032		0.0206***+++
		(0.001)		(0.001)		(0.001)		(0.040)		(0.003)
I(married)		0.014		0.0523***++		0.023		-0.801*		-0.004
		(0.016)		(0.020)		(0.017)		(0.451)		(0.035)
college degree		0.130***+++		0.127***+++		-0.020		-0.433		0.151***+++
		(0.013)		(0.015)		(0.014)		(0.379)		(0.025)
bachelor degree and above		0.122***+++		0.123***+++		-0.018		-0.448		0.336***+++
		(0.018)		(0.019)		(0.015)		(0.474)		(0.037)
I(urban)		-0.009		-0.013		-0.010		-0.437		-0.0818**
		(0.017)		(0.018)		(0.019)		(0.565)		(0.034)
% residents with Bachelor		0.013		0.020		0.0750**		2.965***+		0.506***+++
and above degree		(0.054)		(0.054)		(0.038)		(1.045)		(0.071)
Grade 3 math scores by school		0.085		0.017		-0.108*+		-4.513**+		-0.216
		(0.084)		(0.088)		(0.058)		(2.118)		(0.138)
Grade 3 reading scores		-0.019		0.063		0.030		3.275		0.398***
by school		(0.071)		(0.079)		(0.061)		(2.060)		(0.151)
% kids needs special		-0.068		-0.076		-0.041		-0.161		-0.007
education by school		(0.068)		(0.070)		(0.063)		(1.970)		(0.146)
% kids whose first language		-0.209***+++		-0.261***+++		0.120***+++		1.693*+		-0.223***++
at home is not official language		(0.031)		(0.042)		(0.025)		(0.875)		(0.060)
School capacity ratio		0.026		0.030		0.004		0.042		0.0730**
		(0.016)		(0.024)		(0.020)		(0.575)		(0.028)
year fixed effects?	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
wave fixed effects?	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	50882	50882	50882	50882	43108	43108	37143	37143	32149	32149

Clustered standard errors in parentheses (board*wave). Each regression included a constant.
*** p<0.01, ** p<0.05, * p<0.1
+++ p<0.01, ++ p<0.05, + p<0.1 for df=4 distribution(clustered on wave, then corrected for too few clusters)

Table 2: Triple difference Estimates (2-3 year olds as controls) English board

	2-3 year old control				
	LFP	I(employed)	I(fulltime)	weekly hours worked	log(weekly earnings)
FDK*Eligible	0.017	0.006	0.032	0.767	(0.001)
	(0.017)	(0.019)	(0.019)	(0.629)	(0.038)
FDK	0.008	0.018	-0.0182++	(0.423)	0.009
	(0.017)	(0.019)	(0.013)	(0.454)	(0.031)
Eligible	0.0356***++	0.0319***++	-0.0223**++	-0.604*++	-0.0798***+++
	(0.009)	(0.009)	(0.009)	(0.315)	(0.018)
control variables?	yes	yes	yes	yes	yes
year fixed effects?	yes	yes	yes	yes	yes
wave fixed effects?	yes	yes	yes	yes	yes
Observations	115162	115162	96039	81017	70108

Clustered standard errors in parentheses (board*wave). Each regression included a constant.
*** p<0.01, ** p<0.05, * p<0.1
+++ p<0.01, ++ p<0.05, + p<0.1 for df=4 distribution(clustered on wave, then corrected for too few clusters)

Table 3: Difference-in-Differences Heterogeneity (with controls) English board

	LFP	I(employed)	I(fulltime)	weekly hours worked	log(weekly earnings)
Panel A: Marriage					
Single mom	0.029	0.015	-0.026	-0.823	-0.089
	(0.055)	(0.059)	(0.058)	(1.395)	(0.094)
Married mom	0.0289+	0.026	0.014	0.411	0.044
	(0.023)	(0.026)	(0.025)	(0.824)	(0.056)
Panel B: Education					
high school and less	-0.010	-0.003	0.053	1.911	0.027
	(0.048)	(0.056)	(0.041)	(1.189)	(0.086)
College + educ	0.0399*+	0.033	0.003	-0.024	0.032
	(0.022)	(0.027)	(0.027)	(0.858)	(0.054)
Panel C: Urban Status					
Urban	0.029	0.022	0.009	0.449	0.052
	(0.022)	(0.026)	(0.025)	(0.828)	(0.052)
rural	0.027	0.039	0.033	-0.736	-0.066
	(0.050)	(0.057)	(0.049)	(1.534)	(0.146)
Panel D: Number of kids					
Only 1 kid	0.032	0.063	0.0799**++	2.895**++	0.177**+
	(0.047)	(0.047)	(0.039)	(1.221)	(0.079)
2+ kids	0.028	0.012	-0.008	-0.447	-0.009
	(0.025)	(0.027)	(0.029)	(0.926)	(0.054)
Panel E: Family Size					
3 and less member economic family	0.066	0.0850**	0.0803**++	2.752**++	0.165*
	(0.041)	(0.042)	(0.039)	(1.090)	(0.087)
4 + members	0.016	0.003	-0.006	-0.406	-0.005
	(0.026)	(0.028)	(0.030)	(0.930)	(0.054)
Panel F: Immigrantion Status					
Canadian	0.015	0.016	0.003	-0.409	-0.012
	(0.021)	(0.025)	(0.027)	(0.802)	(0.049)
Immigrants	0.036	0.018	0.023	1.478+	0.092
	(0.035)	(0.042)	(0.033)	(1.177)	(0.081)
Panel G: Neighbourhood					
% BA in the neighbourhood (low 33 percentile)	-0.004	-0.000	-0.005	-0.952	-0.058
	(0.034)	(0.036)	(0.036)	(0.968)	(0.059)
% BA in the neighbourhood (mid 33 percentile)	0.038	0.034	0.0616*+++	1.954*++	0.058
	(0.034)	(0.041)	(0.035)	(1.143)	(0.077)
% BA in the neighbourhood (top 33 percentile)	0.040	0.029	-0.010	-0.074	0.059
	(0.030)	(0.033)	(0.042)	(1.366)	(0.078)

Clustered standard errors in parentheses (board*wave). Each regression included a constant as well as a full set of controls.
*** p<0.01, ** p<0.05, * p<0.1
+++ p<0.01, ++ p<0.05, + p<0.1 for df=4 distribution(clustered on wave, then corrected for too few clusters)

Table 4: Triple Difference (2-3 year old controls) with full controls English board

	LFP	I(employed)	I(fulltime)	weekly hours worked	log(weekly earnings)
Panel A: Marriage					
Single mom	0.029	0.028	-0.041	-0.540	-0.047
	(0.043)	(0.050)	(0.059)	(1.482)	(0.092)
Married mom	0.016	0.004	0.0385*+	0.896	0.003
	(0.018)	(0.020)	(0.020)	(0.657)	(0.041)
Panel B: Education					
high school and less	0.031	0.020	0.041	1.537	0.033
	(0.038)	(0.041)	(0.031)	(1.036)	(0.061)
College + educ	0.011	0.001	0.0298+	0.590	(0.011)
	(0.017)	(0.021)	(0.021)	(0.651)	(0.043)
Panel C: Urban Status					
Urban	0.019	0.006	0.030	0.904	-0.002
	(0.018)	(0.021)	(0.021)	(0.686)	(0.041)
rural	-0.009	-0.000	0.054	-0.220	0.029
	(0.051)	(0.050)	(0.050)	(1.541)	(0.131)
Panel D: Number of kids					
Only 1 kid	0.031	0.040	-0.016	0.377	-0.062
	(0.029)	(0.035)	(0.034)	(0.984)	(0.061)
2+ kids	0.013	-0.007	0.0515**+	0.958	0.027
	(0.020)	(0.022)	(0.021)	(0.755)	(0.045)
Panel E: Family Size					
3 and less member economic family	0.036	0.0548++	-0.017	0.484	-0.056
	(0.025)	(0.034)	(0.033)	(0.934)	(0.056)
4 + members	0.013	-0.012	0.0520**+	0.912	0.026
	(0.019)	(0.022)	(0.022)	(0.729)	(0.046)
Panel F: Immigrantion Status					
Canadian	0.014	0.012	0.0533**++	1.126*+	0.002
	(0.020)	(0.023)	(0.021)	(0.630)	(0.038)
Immigrants	0.014	-0.012	-0.010	-0.131	-0.031
	(0.029)	(0.030)	(0.035)	(1.146)	(0.071)
Panel G: Neighbourhood					
% BA in the neighbourhood (low 33 percentile)	-0.021	-0.018	0.033	0.284	-0.021
	(0.032)	(0.033)	(0.026)	(0.829)	(0.059)
% BA in the neighbourhood (mid 33 percentile)	0.037	0.021	0.0522*+	1.278	0.030
	(0.030)	(0.028)	(0.030)	(0.876)	(0.058)
% BA in the neighbourhood (top 33 percentile)	0.022	0.008	0.018	0.619	-0.006
	(0.021)	(0.025)	(0.028)	(0.952)	(0.056)

Clustered standard errors in parentheses (board*wave). Each regression included a constant as well as a full set of controls
*** p<0.01, ** p<0.05, * p<0.1
+++ p<0.01, ++ p<0.05, + p<0.1 for df=4 distribution(clustered on wave, then corrected for too few clusters)