FULL-DAY KINDERGARTEN: EFFECTS ON MATERNAL LABOR SUPPLY

Elizabeth Dhuey

(corresponding author)

Department of Management

University of Toronto
Scarborough

Toronto, Ontario M5S 2E8
Canada

elizabeth.dhuey@utoronto.ca

Jessie Lamontagne

Scotiabank

Toronto, Ontario M5A 0E1
Canada

lamontagnejessie@gmail.com

Tingting Zhang

School of Labor and
Employment Relations

University of Illinois at
Urbana-Champaign

Champaign, IL 61820

zhangt@illinois.edu

Abstract

We examine the effects of offering full-day kindergarten as a replacement for half-day kindergarten on mothers' labor supply using the rollout of full-day kindergarten in Ontario, Canada. We find no effect on the extensive margin but found an effect on the intensive margin. In particular, we find that access to full-day kindergarten increases weekly hours worked and decreases absenteeism among mothers with kindergarten-aged children. This effect is driven by specific subgroups, namely, nonimmigrant mothers with low education levels who live in urban areas and have only one child.

1. INTRODUCTION

In recent decades, the importance of high-quality learning and care during the early years of life has received significant attention. As a result, many jurisdictions worldwide have implemented or expanded government-provided or -subsidized programs for younger children before compulsory schooling begins. The reasoning is that public child care and preschool programs have the potential to promote long-term economic growth in two distinct ways. First, they may better prepare children for school, which can have a cascading effect on their long-run human capital acquisition and subsequent labor market outcomes (e.g., Heckman 2006). Second, a more immediate effect is that children's caregivers may be able to increase their labor force attachment and therefore their lifetime earnings.

In this study, we evaluate the effects of expanding universal public kindergarten from a half-day (2.5 hours/day) to a full day (6.5 hours/day) on the labor market outcomes of mothers. Beginning 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 in public schools to all children aged 4 and 5 years. Prior to the reform, the majority of children aged 4 and 5 years in Ontario attended half-day kindergarten. While this rollout was planned rather than randomized, based on a difference-in-differences approach certain factors in its implementation led to variations over time and space that we can use to analyze how universal full-day kindergarten has affected the labor supply of mothers of age-eligible children.

Our estimation strategy in this paper relies on variation across schools in the timing of the introduction of full-day kindergarten, to isolate its effects on maternal labor market outcomes. For this strategy to be valid, the introduction of full-day kindergarten must be exogenous to other underlying trends in maternal labor market outcomes that differ between treated and untreated schools. To explore this issue, we take two approaches. First, we use an event-study analysis to document that there are no clear pre-trends in the outcome variables. We further explore this issue by examining which school and neighborhood characteristics predict the timing of introducing full-day kindergarten within particular schools.

This paper is the first to report positive effects on maternal labor outcomes of moving from half-day to full-day kindergarten in a large English-speaking education system. Previous research has found only suggestive evidence (e.g., Cannon, Jacknowitz, and Painter 2006; Gibbs 2014) or focused on non-English speaking systems (e.g., Haeck, Lefebvre, and Merrigan 2015; Dhuey, Eid, and Neill 2020). This paper adds to the large body of work on the effects of early education programs on parental labor supply, including literature related to child care subsidies and universal preschool, by providing evidence of the effects of adding additional schooling at the start of primary education.

We find that the implicit subsidy of extending the length of day of universal public school for 4-year-old children has no impact on labor 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. This effect is driven primarily by nonimmigrant women who live in urban areas, have only one child, and have only a high school education or less.

2. EXPECTED EFFECTS OF FULL-DAY KINDERGARTEN
AND LITERATURE REVIEW

The expansion of universal full-day schooling for 4- and 5-year-olds (hereafter, full-day kindergarten) was mainly sold to the public in Ontario based on the idea that the program would increase school readiness for all children. However, a meta-analysis of the effects of providing universal early childhood education and care arrangements across many jurisdictions revealed mixed results, while also revealing that quality matters critically and gains are concentrated among populations of disadvantaged children (van Huizen and Plantenga 2018).

Care for preschool-aged children is subsidized in many ways worldwide, ranging from providing free public universal education programs, increasing parental leave (unpaid and paid), and providing various kinds of subsidy programs that reduce out-of-pocket expenses for parents. Subsidy programs are often targeted at lower-income families, and the literature regarding the impact of these subsidies on maternal labor supply decisions is mixed and generally inconclusive.[1]

To reconcile these results, one must rely on economic theory and contextual factors. The subsidization of care changes maternal labor supply by changing a mother's budget constraint. For example, 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 (how many people work), 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 2016). The contextual factors within a particular country may serve as a moderator of these policy effects;[2] these may include, for example, current maternal employment rates and current subsidization rates for child care. The scope of a policy to increase maternal labor supply may be more limited in countries with very high female employment rates and/or highly subsidized early child care systems. If affordable child care (either informal or privately paid child care) is already widely available, increased subsidization might lead to little or no increase in maternal labor supply because this will only crowd out other forms of nonparental care. However, if low maternal employment is driven by a lack of affordable child care, increased subsidization may encourage more mothers to work, in turn increasing their attachment to the labor force in the long term. With regard to the present investigation, the context is as follows: as of 2014, at 77.76 percent, Canada had the eighth-largest female labor force participation rate in the Organisation for Economic Co-operation and Development (OECD 2019a), but was in the mid-range in terms of net child care costs (OECD 2019b).[3]

The literature most relevant to this study is the body of work focusing on the maternal labor supply effects of universal kindergarten programs for 5-year-olds and universal preschool programs for 4-year-olds in the United States, along with work focusing on the expansion of kindergarten programs in the United States and Canada from half-day to full-day programs. Research has revealed that in the United States, the

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1. See Cascio (2015) and Cascio, Haider, and Nielsen (2015) for informative discussions.
2. Cascio, Haider, and Nielsen (2015) provide an overview of six studies on maternal labor supply responses due to changes in policies within different countries.
3. Ontario's labor force participation rate is close to the national average (Statistics Canada 2019).

expansion of the primary school system to include half-day programs for 5-year-olds increased the maternal labor supply most in terms of single mothers (Gelbach 2002; Cascio 2009; Fitzpatrick 2012). More recent research has focused on the expansion of universal preschool programs for 4-year-olds in the United States with mixed results: One study found little effect on labor supply for most women (Fitzpatrick 2010) while another found some positive effect on labor supply (Sall 2014).

In another recent trend, governments have been extending the kindergarten school day for 5-year-olds from a half-day to a full-day, despite little evidence on whether this move will affect the labor supply decisions of mothers. Cannon, Jacknowitz, and Painter (2006) estimated the likelihood that a mother would work full-time if her child attended full-day kindergarten, and found no statistically significant lasting effects when the child moves into the first or third grade. Similarly, Haeck, Lefebvre, and Merrigan (2015) found no significant labor market response among parents when full-day kindergarten was introduced in Quebec. However, Dhuey, Eid, and Neill (2020) observed small effects on hours worked from the introduction of full-day kindergarten in the francophone school system in Ontario in the 1990s and early 2000s. Additionally, in a policy paper prepared for the U.S. Department of Labor, Gibbs (2014) focused on changes implemented in the state of Indiana; a triple-difference analysis strategy yielded evidence suggesting an increase in maternal employment.[4]

3. KINDERGARTEN REFORM IN ONTARIO

Ontario has four different publicly funded school systems/boards: English Public, English Catholic, French Public, and French Catholic. Additionally, approximately 5 percent of students in Ontario attend mostly religious (Protestant denominations) private schools (Card, Dooley, and Payne 2010). Schools are administered by school boards, which receive funding from the province. Every school board in Ontario is governed by a Board of Trustees, generally elected via municipal elections every four years.[5] Each school board also has a director of education who serves as secretary on the Board of Trustees. All school board staff report either directly or indirectly to the Director of Education. As governors of the school board, the two most important responsibilities of boards of trustees are the development and monitoring of multiyear strategic plans, and the hiring and performance management of directors of education. The Board of Trustees also approves the school board's annual budget. School boards receive funding from the province almost entirely based on an educational funding formula, and the Board of Trustees is responsible for ensuring the school board has a balanced budget that reflects their strategic plan. During the rollout of the changes under consideration here, it is possible that there was competition between schools within a school board that may have affected the timing of the implementation, but there is no evidence, anecdotal or empirical, that this occurred. It is also very unlikely because the rollout was planned to be swift and universal.

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

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

5. Exceptions include First Nation Trustees and Student Trustees, Hospital Board Trustees, and the Centre Jules-Leger Consortium, but these unelected bodies make up a very small fraction of Trustees in the system.

French Catholic system, at least one of the child's parents must be a French-language rightsholder;[6] approximately 4 percent of students attend schools operated by the French Public or the French Catholic Boards (Card, Dooley, and Payne 2010). To enroll a child in a Catholic primary school (English or French), parents must be willing to allow the child to be educated in a faith-based school and must request admittance by the school board. Catholic families are always given priority, but some boards allow non-Catholic families to send their children to Catholic schools if enrollment permits; others have strict rules regarding religion, particularly in primary schools.[7] Overall, the vast majority of Catholic school students are Catholic, and there is little movement of students between different types of school boards after entry into kindergarten. Each school board defines school catchment areas, and prospective students are guaranteed a place in the school that corresponds to their assigned school catchment area. The boundaries of English Public and English Catholic school boards typically coincide in more heavily populated areas.[8]

For children in Ontario, mandatory schooling starts in grade 1 at the age of 6 years. Nevertheless, 90 percent of all children in Ontario attend publicly funded kindergarten, which is universally offered through the public school system for two grades: junior kindergarten for 4-year-olds, and senior kindergarten for 5-year-olds. The percentage of children attending both years of kindergarten is similar and has stayed stable since 2006 regardless of its being a half or full-day program.[9] The school entry cutoff date is 1 January of the year but delayed entry or retention in early grades is virtually nonexistent.[10]

The full-day universal kindergarten reform in Ontario was rolled out in English Public and English Catholic school boards over a period of five years (2010–14). Ontario also has approximately 600 French Public and French Catholic schools; these are not included in the present analysis because they had previously implemented full-day kindergarten (Dhuey, Eid, and Neill 2020), but French-language speakers are not excluded from the analysis. The primary objective of the reform was to reduce the number of "at risk" children—that is, children who are identified as having low readiness for school (Pascal 2009). Breaking the cycle of poverty by increasing investment in education so that children born into poverty would not remain there was touted as

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6. A French-language rightsholder is a parent or guardian who lives in Ontario, is a Canadian citizen and meets at least one of the following criteria: (1) His/her native language is French, that is, the first language learned and still understood; or (2) He or she has received his or her education at the elementary level in a French-language education institution in Canada; or (3) He or she is the parent (guardian) of a child who has received or receives his/her education at the elementary or secondary level in a French-language education institution in Canada.

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

8. 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.

9. These numbers are based on Statistics Canada population estimates (Statistics Canada 2016a) and Ontario Ministry of Education enrollment data (Ontario Ministry of Education 2020); 89 percent of all children attended junior kindergarten and senior kindergarten in both 2006 and 2011 (Statistics Canada 2006, 2011a).

10. 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 1 January 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 it is quite rare (McDiarmid 2013).

a secondary aim in government publications (Government of Ontario 2010). A 2009 Ontario provincial government budgetary report stated that it would cost $1.5 billion to fully implement this full-day kindergarten reform, and that approximately 265,000 children aged 4 and 5 years would benefit from this reform per year (Government of Ontario 2010). The final cost, according to the Ontario Ministry of Education (2014), was $2.138 billion.

The rollout started with schools that had immediate capacity to double their kindergarten classroom space, and it also prioritized schools with high-needs students based on the percentage of low-achievement and low-income students at each school.[11] The implementation of full-day kindergarten in Ontario began with the announcement of the program in September 2009 and was complete by 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 percentage points more in 2011, 25.4 percentage points more in 2012, 24.7 percentage points more in 2013, and the remainder in 2014.

The initial implementation of the reform caused some friction, as some schools lacked the physical capacity to accommodate their kindergarten cohorts for a full day, and the initially planned rollout was based on forecasted renovation completion in schools that had to retrofit existing rooms or build new ones.[12] Additionally, the reform became a major point of contention in the period leading to the 2011 provincial elections, 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 project completion increased to five years rather than three years as originally planned (Pascal 2009).

Concurrent with this rollout, the Ministry of Ontario started to require school boards to offer before- and after-school programs (for children aged 4–12 years) where demand from parents and families was "sufficient." School boards or third-party providers were permitted to operate these programs, and school boards determined whether need was "sufficient" by assessing demand as well as the viability of before- and after-school programs; thus, schools and school boards had considerable latitude with regard to the provision of before- and after-school child care.[13] Our analysis of the introduction of full-day kindergarten may reflect a composite effect of the increased length of the school day along with the increased probability of before- and after-school child care.

Overall, the initial rollout plans were not random. However, actual implementation differed considerably from planned implementation, mainly due to capacity constraints (ability to open new classrooms) and political upheaval due to the provincial election. Although capacity was considered during planning, even optimistic estimates of the cost of the reform suggested that at most 35 percent of schools would be able to open immediately, with the rest requiring some level of investment (Pascal 2009). As noted above, children living in the assigned catchment area of a school are guaranteed access if they request it, so schools scheduled to start offering full-day universal kindergarten for 4- and 5-year-olds could only do so if they had the capacity to enroll all potential students. Figure 1 presents the rollout in the largest school board in our sample, the

11. Prior to the rollout, many students attended half-day kindergarten, either in the morning or the afternoon.
12. Few mentions of this can be found in official government documents but it was widely reported in the news at the time (see, e.g., Hammer 2010).
13. See Ontario Ministry of Education (2019) for more details on policies and guidelines.
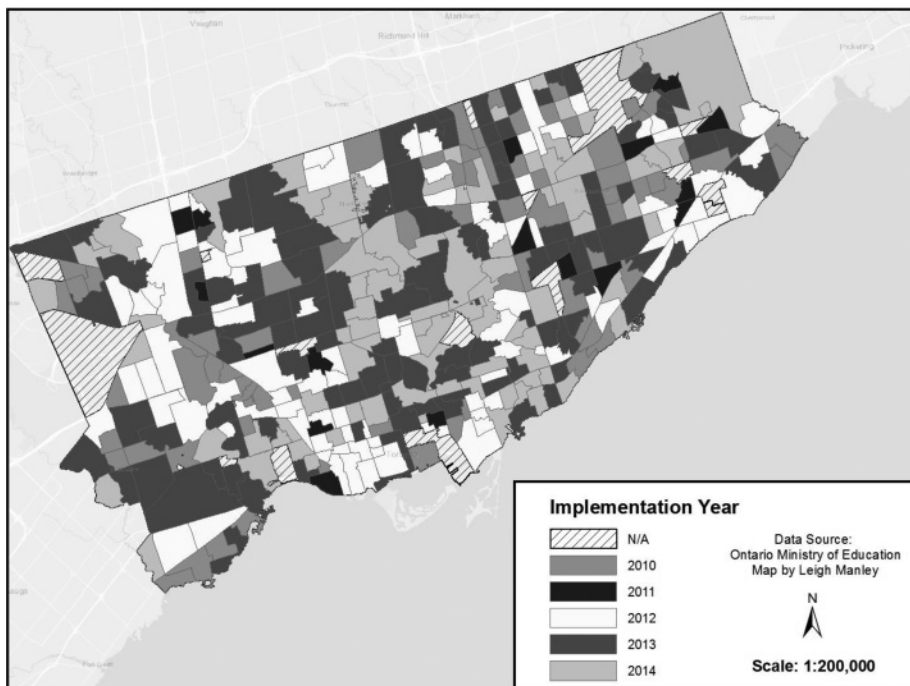
Note: n/a indicates nonresidential areas (including municipal core and general employment zones).

Figure 1. Rollout of Full-Day Kindergarten in the Toronto District School Board, By School Catchment Area

Toronto District School Board, illustrating the geographic variation within the board in terms of the timing of implementation.

4. DATA AND DESCRIPTIVE STATISTICS

The data used in this analysis come from several 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 Account-ability Office (EQAO), as well as geospatial data provided by individual school boards and Canada Post.

The Statistics Canada monthly LFS collects information on labor market outcomes. We focus on mothers surveyed between September 2008 and August 2014.[14] The main advantage of these data is that we are able to precisely assign treatment year using academic rather than calendar year, which has been problematic in previous research (Gelbach 2002). To do this, we aggregate all respondents surveyed between September of a given year to the following August; the academic year 2010, for example, runs from September 2010 to August 2011.[15]

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14. Here, "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 (our sample does not include any same-sex couples).

15. Due to data limitations, we are not able to identify repeated sampling and treat each respondent as independently sampled. However, the LFS is designed to be used this way, as outlined in its methodology section (Statistics Canada 2016b).

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, as well as data from the Ontario EQAO, an independent agency that administers provincial testing and provides information on grade 3 reading and math scores at the school level. The EQAO data used in this analysis also include information on the percentage of students in each school who need special education support and the 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 geospatial 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, and then matched catchment areas to postal code data. For the vast majority of our data, the school catchment area is much larger than the postal code area, so we match many postal code areas to a given school catchment area,[16] as shown in Appendix figure A.1.[17] Each specific school catchment area in a school board includes many postal codes, and catchment boundaries generally follow postal code boundaries. Next, we 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 (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 using board and school identifier numbers. Labor force information is linked to the postal code based on each survey respondent's residential address. We are able to assign a postal code to respondents for 93 percent of households in our sample, and then use this geographic identifier to link households to school catchment areas. The remaining 7 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 (from 2010 to 2014) during which the vast majority of households were first offered full-day kindergarten in Ontario.[18] Our final dataset includes 25,500 mothers, and 1,340 schools.[19]

We restrict our sample to mothers aged 18–55 years at the survey date with their youngest own child aged 4 years. We only know the age of the youngest child in years in which the survey data were collected. We exclude from the sample mothers of 3- and 5-year-olds—admission to school in Ontario is based on the age of the child in January, meaning some children start junior kindergarten at three years and consequently start grade 1 at 5 years; the status of these children (with regard to treatment) is uncertain.

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16. In rural areas, postal codes can cover a very large area, and in some cases one postal code area encompasses 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 encompass two or more catchment areas and are available upon request.

17. Appendix figure A.1 is available in a separate online appendix that can be accessed on *Education Finance and Policy*'s web site at https://doi.org/10.1162/edfp_a_00321.

18. 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. We did not have data for the full academic year due to a large structural change in the LFS.

19. Sample sizes for the LFS are rounded to comply with confidentiality requirements of Statistics Canada Research Data Centre.

Table 1. Mothers' Labor Market Outcomes, Characteristics of Mothers, Neighborhood, and Schools

		By Year of Full-day Kindergarten Adoption					
	All Years	2009	2010	2011	2012	2013	2014
Mothers' labor market outcomes							
Labor force participation	0.763	0.790	0.763	0.730	0.790	0.780	0.800
	(0.425)	(0.400)	(0.425)	(0.450)	(0.400)	(0.420)	(0.400)
Employed	0.705	0.740	0.687	0.680	0.720	0.770	0.748
	(0.456)	(0.440)	(0.464)	(0.470)	(0.450)	(0.420)	(0.434)
Full-time | employment	0.791	0.720	0.788	0.820	0.870	0.840	0.800
	(0.407)	(0.450)	(0.409)	(0.390)	(0.340)	(0.360)	(0.400)
Weekly hours worked	33.330	32.000	32.747	34.600	36.100	35.300	34.002
	(11.010)	(16.900)	(10.784)	(16.500)	(7.400)	(8.800)	(10.587)
Weekly earnings (log)	6.607	6.480	6.625	6.670	6.870	6.790	6.667
	(0.727)	(0.660)	(0.709)	(0.670)	(0.530)	(0.720)	(0.765)
Absent from work	0.204	0.216	0.208	0.188	0.178	0.174	0.251
	(0.403)	(0.411)	(0.406)	(0.391)	(0.383)	(0.379)	(0.434)
Mothers' characteristics							
Age	36.200	35.600	36.797	36.500	36.500	37.000	36.285
	(5.400)	(4.600)	(5.201)	(5.500)	(5.200)	(5.100)	(5.103)
Only has one child	0.285	0.290	0.273	0.270	0.270	0.300	0.282
	(0.451)	(0.460)	(0.446)	(0.440)	(0.450)	(0.460)	(0.450)
Immigrant	0.377	0.320	0.372	0.270	0.270	0.190	0.350
	(0.485)	(0.470)	(0.483)	(0.450)	(0.440)	(0.390)	(0.477)
High school or lower education	0.229	0.320	0.220	0.270	0.270	0.190	0.190
	0.420	0.470	0.414	0.450	0.440	0.390	(0.392)
Single	0.081	0.080	0.077	0.101	0.107	0.050	0.070
	(0.273)	(0.271)	(0.267)	(0.301)	(0.309)	(0.218)	(0.256)
Neighborhood characteristics							
% individuals holding a BA+ degree	0.307	0.260	0.292	0.250	0.310	0.350	0.339
	(0.189)	(0.190)	(0.181)	(0.150)	(0.200)	(0.210)	(0.207)
Labor force participation of male without children	0.850	0.840	0.863	0.850	0.850	0.850	0.834
	(0.141)	(0.170)	(0.131)	(0.130)	(0.130)	(0.200)	(0.172)
Urban	0.891	0.882	0.873	0.904	0.902	0.886	0.894
	(0.312)	(0.322)	(0.333)	(0.333)	(0.294)	(0.297)	(0.307)
School characteristics							
% students in the school who met provincial standards in math	0.671	0.600	0.665	0.650	0.680	0.690	0.665
	(0.153)	(0.170)	(0.156)	(0.140)	(0.170)	(0.160)	(0.157)
% students in the school who met provincial standards in reading	0.611	0.530	0.601	0.590	0.650	0.670	0.645
	(0.145)	(0.130)	(0.137)	(0.150)	(0.150)	(0.140)	(0.146)
% special needs students	0.157	0.160	0.141	0.180	0.160	0.160	0.180
	(0.103)	(0.100)	(0.092)	(0.110)	(0.110)	(0.100)	(0.107)
% students who do not speak official language at home	0.250	0.320	0.252	0.200	0.290	0.210	0.230
	(0.254)	(0.300)	(0.259)	(0.240)	(0.290)	(0.200)	(0.233)
School capacity measure	0.912	0.770	0.974	0.880	0.890	1.060	0.882
	(0.375)	(0.190)	(0.582)	(0.260)	(0.260)	(0.310)	(0.283)

Notes: Mothers' labor market outcome, mothers' characteristics, and neighborhood characteristics data are from the Canadian Labour Force Survey. School characteristics were obtained from the Ministry of Education and the Ontario Education Quality and Accountability Office. The data were linked using geospatial data provided by school boards and from Canada Post. All summary statistics are weighted using sample weights provided by Statistics Canada. The sample includes only mothers (ages 18–55 years) surveyed between September 2008 and August 2014 whose youngest child is 4 years old.

The descriptive statistics in table 1 show the average labor force participation among mothers across years is 76.3 percent, with the overall average employment rate of 70.5 percent for this group. The data reveal that of the mothers in our sample, 79.1 percent work full-time conditional on employment, and the average weekly hours worked is

33.3, with the log of weekly earnings of 6.61. Absence from work refers to whether an individual who is working full-time is absent from work at any point during the reference week. According to Statistics Canada (2015), roughly a third of these absences are due to personal or family responsibilities. In our sample, we find that 20.4 percent of mothers with a 4-year-old are absent from work at some point in the reference week. Reducing absenteeism is one of the ways that policy makers believe providing full-day kindergarten can help the labor force: Children spending more time in primary education is expected to result in lower absenteeism among parents. According to one study, "improving the availability of child care [preschool] could save employers billions of dollars from avoided employee absences" (Brown et al. 2013, p. 5).

The average mother in our sample is 36 years old and has two children: 37.7 percent of mothers 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) have at least a bachelor's degree, 85.0 percent of childless men 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 students have special needs, and 25.0 percent of students do not speak an official language (English or French) at home.[20] 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.

There is some variation in all our outcome measures across time, as can been seen in the remaining columns of table 1 when the summary statistics are calculated by catchment level by year of full-day kindergarten adoption. We find that the education levels are lower for mothers living in neighborhoods defined by the catchment areas that adopted full-day kindergarten in earlier years. In addition, academic achievement levels as measured by EQAO standardized exams are also lower during earlier years of adoption. Table A.1 (available in the online appendix) presents the summary statistics by catchment level by year of kindergarten adoption and by whether the household was assigned to a treated school (FDK) or a nontreated school (NO FDK). As shown in the table, for each year, students in the treated schools generally scored lower on the EQAO standardized exams and constituted a larger fraction who do not speak English or French at home. Table A.2 in the online appendix provides some background summary statistics of mothers' labor market outcomes, and characteristics of neighborhoods and schools by subgroup.

5. EMPIRICAL STRATEGY

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

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20. 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.

We estimate using the following equation:

$$Y_{ist} = \alpha + \beta FDK_{st} + X'_{it}\delta + S'_{st}\phi + N'_{st}\eta + T_t + C_s + \varepsilon_{ist}, \qquad (1)$$

where Y_{ist} denotes the maternal labor market outcomes for individual i assigned to school s in school year t, which include indicator variables for maternal 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_{st} is the treatment status and corresponds to an indicator variable equal to one if a mother's household is assigned to a school in the English Public Board that offers universal full-day kindergarten in a given year and zero otherwise. 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'_{st} is a vector of time-varying 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 3 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.[21] N'_{st} 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.[22] We also include school year fixed effects (T_t) to capture unobserved shocks common to all schools in Ontario in a given school year along with school fixed effects (C_s) to capture unobserved differences common to a geographic area associated with each school. School year is defined as starting in September of each year, and ε_{ist} is the usual error term.[23]

We estimate linear probability models (for the probability of maternal 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.[24] 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 universal full-day kindergarten program in a local English Public school. In the difference-in-differences specification, identification of β comes from the deviation from the trend in labor supply outcomes of mothers with eligible-aged children whose household is assigned to a school with full-day kindergarten relative to mothers with eligible-aged children whose household is assigned to a school where full-day kindergarten is not offered. If we believe the deviations from trend are unrelated to all other unobserved characteristics, then the effect we observe is causal.[25]

21. EQAO tests are administered to all children in the province in grade 3 and are scored on a scale from 1 to 4; the provincial standard for passing is 3 or higher.

22. 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. Neighborhood variables were calculated from the LFS (aggregated at the FSA level). School characteristics were obtained from the Ontario Ministry of Education and EQAO.

23. 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 households are assigned the same school based on their geographic location.

24. We also ran the specification with a probit model and obtained similar results (results are available upon request).

25. Some research in this area has used a triple difference framework to estimate the effect on labor supply. Unfortunately, in the context of this policy rollout, we do not have a natural control group that is fully untreated by

β can be interpreted as an intent-to-treat (ITT) effect, because we observe only whether a mother's household is assigned a school that offers full-day kindergarten, not whether her child actually attends full-day kindergarten that year. The ITT estimate represents a lower bound on the effects of the treatment on the treated (the effect of having a child in full-day rather than half-day kindergarten).

A mother can decline treatment in three ways: 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.[26] A challenge to our identification relates to the possibility that mothers use the availability of kindergarten as the reason to send their child to a specific school, thus selecting into treatment. Parents in Ontario can send their children to a school that is not their assigned school if the particular school requested has space to accommodate more children. Each board has slightly different rules regarding optional attendance but most follow these general rules. During the end of the calendar year, school boards review preliminary enrollment projections and decide whether each school in their board is open or closed to optional attendance. Parents are then allowed to apply in December and January for the following September enrollment to schools that are only accepting optional-attendance students. Applications for junior and senior kindergarten are often not approved until the third week of September after the final school enrollment numbers are confirmed. Therefore, there is a lot of uncertainty around placement into nonassigned schools that lasts into the school year. Unfortunately, there are no published numbers on the percentage of kindergarten children attending a school that is not their assigned school. However, anecdotal evidence regarding this issue suggests that the numbers are small. Additionally, 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. Busing is not available to students who utilize optional attendance. Selecting into optional attendance, if available, would require students to travel farther to attend school, so they would be reliant on parents for transportation; we posit that few mothers trying to optimize their labor market opportunities would select into transporting their child to and from school.

We cannot ensure that mothers were not selecting into given locales given the fact that the specific area offered full-day kindergarten. Thus, it is possible that the provision of full-day kindergarten did not lead to changes in labor market outcomes but rather that mothers who already want to work select into areas that offer full-day kindergarten—meaning mothers who are less likely to work full time anyway are more likely to live in areas without full-day kindergarten. This is a limitation of this study, but it is unlikely that mothers would move residence or engage in optional attendance for the purpose of employment and thereby optimize maternal labor supply. This is also

the policy. However, we ran a triple difference model using mothers with 2-year-olds and untreated 6-year-olds as the control group as a robustness check (see section 6) and obtained similar results. It is important to note that using children in other Canadian provinces as a comparison group is unlikely to improve on these results, as labor trends and child care policies differ markedly by province.

26. We are not concerned with the case that some mothers might not know about the availability of full-day kindergarten in their assigned school, which is extremely unlikely. 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 2006, 2011a).

supported by the fact that actual implementation differed greatly from planned implementation, so the particular schools that were expected to offer full-day programing often changed at the last moment, and the difficulties involved in the implementation were widely known to the public. Overall, it is unlikely a mother would move or engage in optional attendance based on the planned implementation schedule. Nevertheless, we do include controls for observable characteristics that may be associated with selection into treatment in that context (e.g., more educated mothers might be better informed and have stronger labor force attachments) and find 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 based on a combination of low test scores and low income). As shown in figure 1, which presents the rollout of the reform for the Toronto District School Board (the largest in Ontario), there was no obvious systematic geographic pattern in the timing of implementation, with early- and late-implementation schools spread relatively evenly over the whole city. This lack of apparent pattern is consistent across our dataset, so it is likely the capacity constraint provided a level of randomness to the implementation that supports our quasi-experimental strategy.

However, given the planned aspect of the rollout, we would expect areas that have more at-risk students and more capacity would adopt full-day kindergarten earlier. Following Hoynes and Schanzenbach (2010, 2012), we can measure this by taking school and neighborhood data from 2009 (before the announcement of the program) to predict the timing of the school's adoption of full-day kindergarten. The dependent variable is the year in which the school started full-day kindergarten. Schools that adopted full-day kindergarten in 2010 are given a dependent variable that equals 1, schools in 2011 are assigned 2 for the dependent variable, and so on. The independent variables include all of the school and neighborhood characteristics listed in table 1. Table 2 presents the results.[27] Negative coefficients indicate the school and neighborhood characteristics predict an earlier roll-out date. We find that schools with a higher percentage of students who are special needs or who do not speak either French or English at home implement full-day kindergarten earlier. We also find that the higher the school capacity measure (which indicates less space in the school)—as well as schools in neighborhoods with higher percentages of individuals who have a bachelor's degree or greater—implement full-day kindergarten later.[28] Similar to Hoynes and Schanzenbach (2010, 2012), we find that the timing of the introduction of full-day kindergarten is predicted by a few observed characteristics. However, we also similarly find that most of the variation remains unexplained.

This analysis focuses on estimating the ITT effect of full-day kindergarten in the English Public system in Ontario. As noted above, the Ontario public schooling system is complex, but the majority of students attend English Public schools. We also estimate the ITT effect of the second-largest school system, English Catholic schools, later in

27. We also ran a different specification in which an indicator for full-day kindergarten implementation is regressed on the time-varying control variables. These results can be found in table A.3, which is available in the online appendix.

28. Corroborating evidence of these trends can be seen in the summary statistics provided in table A.1 in the online appendix.

Table 2. Determinants of Full-Day Kindergarten Start Date Using 2009 School Level Data

	Year of Adoption
% students in the school who met provincial standards in math	0.504
	(0.771)
% students in the school who met provincial standards in reading	0.283
	(0.831)
% special needs students	−1.186**
	(0.505)
% students who do not speak official language at home	−0.877**
	(0.433)
School capacity measure	0.696***
	(0.235)
Urban	−0.136
	(0.244)
% individuals holding a BA+ degree	1.200***
	(0.430)
Labor force participation of male without children	−0.561
	(0.470)
Percentage of women with one child	−0.260
	(0.172)
Immigrant	0.084
	(0.171)
Age	−0.009
	(0.008)
Single	0.283
	(0.189)
High school or lower education	−0.061
	(0.155)
Observations	12,000
R^2	0.037

Notes: Standard errors in parenthesis clustered at the school level. The number of observations is rounded to the nearest 100 according to vetting requirements of the Statistics Canada Research Data Centre. Year of adoption equals 1 for schools that adopted full-day kindergarten in 2010, 2 for adoption in 2011, 3 for adoption in 2012, 4 for adoption in 2013, and 5 for adoption in 2014. Data are from the Canadian Labour Force Survey, the Ontario Ministry of Education, and the Ontario Education Quality and Accountability Office. The data were linked using geospatial data provided by school boards and from Canada Post. All summary statistics are weighted using sample weights provided by Statistics Canada. The sample includes only mothers (ages 18–55 years) surveyed between September 2008 and August 2014 whose youngest child is 4 years old. Labor force participation, employed, full-time employment, and absent from work are all indicator variables. Weekly hours of work is measured as the usual number of hours worked per week and the weekly earnings (log) is the log of the weekly earnings.

***$p < 0.01$; **$p < 0.05$.

the Other Specifications discussion in section 6. English Catholic school boards serve roughly 28 percent of students in Ontario (Ontario Ministry of Education 2020). As noted in section 3, for a child to attend a Catholic primary school, generally one or both parents must be Catholic, but school boards can grant exceptions. Unfortunately, our data do not include any information regarding religion, so we do not know whether a particular child would be eligible to attend a Catholic primary school. We can 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 enrollment of the two schools associated with the mother that is being treated with full-day kindergarten. For

Table 3. Difference-in-Differences Estimates of the Impact of Full-Day Kindergarten (FDK) on Maternal Labor Market Outcomes

	Labor Force Participation (1)	Employed (2)	Full-time (3)	Hours Worked (4)	Log (earnings) (5)	Absent (6)
Panel A: No Control Variables						
FDK	−0.006 (0.033)	−0.021 (0.034)	0.046 (0.031)	1.726[*] (0.892)	−0.045 (0.070)	−0.057[**] (0.027)
Panel B: With Individual-Level Controls						
FDK	0.007 (0.033)	−0.006 (0.034)	0.048 (0.032)	1.908[**] (0.883)	−0.033 (0.066)	−0.058[**] (0.028)
Panel C: With Individual and School/Community-Level Controls						
FDK	0.006 (0.033)	−0.01 (0.034)	0.048 (0.031)	1.839[**] (0.877)	−0.045 (0.063)	−0.057[**] (0.028)
Panel D: School Specific Linear Time Trends						
FDK	0.003 −(0.040)	−0.015 −(0.040)	0.06 −(0.038)	2.617[***] −(0.808)	0.015 −(0.057)	−0.068 −(0.042)
Number of observations	22,500	22,500	18,900	16,200	14,000	12,400

Notes: Standard errors in parentheses clustered at the school level. FDK is an indicator variable equal to one if the school where the household is assigned to 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 is rounded to the nearest 100 according to vetting requirements of the Statistics Canada Research Data Centre. Labor force participation, employed, full-time employment, and absent from work are all indicator variables. Weekly hours of work is measured as the usual number of hours worked per week and the weekly earnings (log) is the log of the weekly earnings.

[***]$p < 0.01$; [**]$p < 0.05$; [*]$p < 0.1$.

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 in 2013 and beyond it would equal 1.

6. RESULTS

Difference-in-Differences

Table 3 presents the results of estimating equation 1 for the sample of mothers aged 18–55 years in Ontario with their youngest child aged 4 years,[29] using six different outcome variables: labor 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 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 5 percent level. Next, we include all the control variables, including school and community level controls in the model in

29. As noted above, due to data limitations we only use mothers with children who are 4 years old. This will include a mixture of students in junior and senior kindergarten.

panel C, and find the positive effect on hours worked remains 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 (a roughly 30 percent decline). Because we find no statistically significant increase in weekly earnings, it may be the case that the positive increase in hours is simply reflecting a decrease in absenteeism and not additional hours associated with additional income. We find that our results are robust to the inclusion of observable characteristics that may be associated with selection into treatment results, which provides evidence that selection into treatment is not driving the results.

Previous research on child care subsidies or the provision of new programs has generally found statistically significant positive effects on labor force participation but with considerable heterogeneity. However, studies using more recent data, or data from countries other than the United States, have reported smaller elasticities than those using early data from the United States (Morrissey 2017). Given the policy context of our quasi-experiment—a province with high maternal labor force attachment overall (Cattan 2016)—it may not be surprising that we find smaller and fewer significant effects on labor force outcomes than earlier studies based in the United States. However, our estimated point estimates are very consistent to the findings regarding French-speaking mothers in Ontario and Quebec (Baker, Gruber, and Milligan 2008; Haeck, Lefebvre, and Merrigan 2015; Dhuey, Eid, and Neill 2020). We are not aware of any other studies measuring the effects of full-day kindergarten on material absenteeism from work. However, research has shown that increasing child care assistance decreases absenteeism (Gullekson et al. 2014), and the presence of young children is related to families having more absenteeism. Women also lose more days of work than men for personal or family reasons (Statistics Canada 2011b).

Robustness Checks

The key identifying assumption in our difference-in-differences model is that mothers assigned to the treatment schools would, in the absence of the treatment, have labor market trends similar to those of mothers assigned to the control schools. Our sample includes many schools and years, which, in the absence of a treatment effect, allows us to relax the common trends assumption by introducing a degree of nonparallel evolution in outcomes between schools. Following Angrist and Pischke (2014), we include school-specific linear time trends in table 3, panel D. This provides an important check on causal interpretations 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 panels A through C.

Other robustness checks, including using an event study approach and triple difference models, are described in detail in the online appendix. The results of these models are consistent with the overall findings.

Other Specifications

As noted in section 5, our preferred specification is to use the treatment of full-day kindergarten in English Public school boards to estimate the ITT effects because most

Table 4. Difference-in-Differences Estimates of the Impact of Full-Day Kindergarten (FDK) on Maternal Labor Market Outcomes—Different ITT Measures

	Labor 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	22,500	22,500	18,900	16,200	14,000	12,400
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	22,500	22,500	18,900	16,200	14,000	12,400
Panel C: Share of Enrollment						
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	22,500	22,500	18,900	16,200	14,000	12,400

Notes: Standard errors in parentheses clustered at the school level. FDK is an indicator variable equal to one if the school where the household is assigned to offers full-day kindergarten in a particular year. In panel A, FDK includes only Catholic schools. In panel B, the FDK measures use the first school in the mother's catchment area to offer full-day kindergarten. In panel C, the FDK measures use the share of enrollment for each school from each school board type. 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 is rounded to the nearest 100 according to vetting requirements of the Statistics Canada Research Data Centre. Labor force participation, employed, full-time employment, and absent from work are all indicator variables. Weekly hours of work is measured as the usual number of hours worked per week and the weekly earnings (log) is the log of the weekly earnings.

***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

students in Ontario attend these schools. However, English Catholic school boards also serve approximately 28 percent of students in Ontario. Therefore, we can run a specification to estimate the ITT of access to full-day kindergarten in English Catholic school boards. Panel A in table 4 displays the coefficient for the indicator variable that equals 1 if the English Catholic school to which the household is assigned offers full-day kindergarten in that school year. The significance and the magnitude of the coefficient on hours worked is smaller than for English Public school treatment (table 3, column 4) but the coefficient on absenteeism continues to be negative and significant. Panel B presents the results of a model that includes an indicator variable that equals 1 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 shown in panel A for the ITT effect of access to full-day kindergarten in English Catholic boards. Finally, panel C presents the results of a model that captures the treatment intensity of the availability of full-day kindergarten in both English Public and English Catholic school boards. Here, we create an intensity measure based on the share of enrollment of the two schools that are being treated with full-day kindergarten and show how this is 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.

Heterogeneity

We next explore whether having access to full-day English Public kindergarten affects mothers differently based on their observable characteristics. In table 5, we estimate heterogeneous effects two separate ways. For each outcome variable of interest, we run two different models. First, we subsample on the following observable characteristics of the mother: (1) being a single mother (Single); (2) having been born outside Canada (Immigrant); (3) living in an urban area (Urban); (4) having only one child (One child); and (5) having a high school or lower education level (H.S. education). We run our difference-in-differences model from equation 1 and report only the coefficient on FDK. Then, we also run models in which we interact the variable of interest (FDK) with the observable characteristic indicator variables. In these models we report the coefficient for FDK, the coefficient for the interaction, and the coefficient for the observable characteristic indicator variables along with the F-statistic.

Panel A presents the results focusing on the effect of the availability of full-day kindergarten on urban mothers. Consistent with the previous results in table 3, we find no evidence of an effect on participating in the labor force and being employed. Column 6 presents some marginally significant evidence that urban mothers are more likely to work full time given the availability of full-day kindergarten. However, similar to table 3, we find strong evidence in columns 7 and 8 that urban mothers work, on average, about two hours more per week. The coefficient for FDK is the effect on rural mothers—it is not significant and close to zero. Interestingly, the interaction term between FDK and urban is not statistically significant but suggests that most of the weight of the average effect of the policy is from urban mothers. We find similarly consistent evidence for being absent from work. Urban mothers are less likely to be absent from work and among rural mothers we see no statistically significant relationship between the availability of full-day kindergarten and being absent from work.

Panel B (mothers having only one child) and panel C (mothers with a high school or lower education level) both reveal similar patterns in results for working full time, hours worked, and absenteeism. Panel D (mother's marital status) reveals patterns similar to those in panels A through C but with slightly more imprecise coefficients.

Panel E presents differences between immigrant and nonimmigrant mothers; the results are not consistent across the two different specifications. We find a statistically significant relationship between being an immigrant and working full time, weekly hours, and absenteeism in the sub-model specifications (columns 5, 7, and 11). However, when moving to an interaction model, we find the opposite. Here, we find that the rollout of full-day kindergarten has statistically significant effects on working full time, weekly hours, and absenteeism among nonimmigrants. This difference in results from the two models may be due to a variety of reasons. For example, the interaction model is based on the assumption that the residual variance is homoscedastic, which may not be true in this case. Also, the interaction model does not include the full complement of interactions due to sample size constraints.

To explore this issue in more depth, we run models that include all the interactions; the regression coefficients for FDK and FDK interactions are presented in table A.4 in

Table 5. Difference-in-Differences Estimates of the Impact of Full-Day Kindergarten (FDK) on Maternal Labor Market Outcomes with Heterogeneous Effects

	Labor Force Participation		Employed		Full-time		Hours Worked		Log (earnings)		Absent	
	Sub-sample	Interaction	Sub-sample	Interaction	Sub-sample	Interaction	Sub-sample	Interaction	Sub-sample	Interaction	Sub-sample	Interaction
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel A: Urban												
FDK	0.012 (0.036)	−0.014 (0.057)	−0.006 (0.037)	−0.003 (0.058)	0.041 (0.033)	−0.005 (0.066)	1.965** (0.954)	−0.334 (1.731)	−0.041 (0.068)	−0.079 (0.103)	−0.069** (0.031)	0.014 (0.067)
FDK * Urban		0.022 (0.057)		−0.007 (0.058)		0.061 (0.066)		2.476 (1.790)		0.038 (0.103)		−0.080 (0.067)
Urban		−0.103*** (0.026)		−0.135*** (0.028)		0.010 (0.027)		−0.446 (0.768)		−0.224*** (0.048)		−0.010 (0.020)
F Statistic: FDK * Urban + FDK = 0		0.06		0.09		3.01*		5.43**		0.39		4.99**
Panel B: One Child												
FDK	0.009 (0.052)	0.003 (0.037)	0.040 (0.056)	−0.012 (0.037)	0.134** (0.053)	0.035 (0.032)	4.835*** (1.557)	1.410 (0.991)	0.011 (0.121)	−0.044 (0.069)	−0.103** (0.048)	−0.048 (0.032)
FDK * One Child		0.009 (0.043)		0.007 (0.048)		0.042 (0.042)		1.275 (1.275)		−0.001 (0.079)		−0.025 (0.037)
One Child		0.079*** (0.030)		0.073** (0.033)		0.028 (0.032)		0.548 (0.845)		−0.033 (0.054)		−0.036 (0.026)
F Statistic: FDK * One Child + FDK = 0		0.08		0.01		3.01*		5.21**		0.33		4.19**
Panel C: High School (H.S.) Education												
FDK	0.027 (0.068)	0.010 (0.034)	−0.072 (0.064)	0.000 (0.035)	0.074 (0.067)	0.039 (0.030)	3.859** (1.739)	1.437 (0.876)	0.02 (0.111)	−0.067 (0.067)	−0.176** (0.080)	−0.051* (0.030)
FDK * H.S. Education		−0.014 (0.050)		−0.041 (0.053)		0.046 (0.061)		2.450 (1.576)		0.140 (0.096)		−0.037 (0.042)
H.S. Education		−0.147*** (0.036)		−0.133*** (0.038)		−0.030 (0.060)		−2.146 (1.337)		−0.299*** (0.065)		0.053 (0.036)
F Statistic: FDK * H.S. + FDK = 0		0.01		0.55		1.72		5.34**		0.60		4.56**

Table 5. Continued.

	Labor Force Participation		Employed		Full-time		Hours Worked		Log (earnings)		Absent	
	Sub-sample	Interaction	Sub-sample	Interaction	Sub-sample	Interaction	Sub-sample	Interaction	Sub-sample	Interaction	Sub-sample	Interaction
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
					Panel D: Single							
FDK	0.088	0.011	−0.025	−0.005	0.151**	0.046	3.124*	1.773*	0.130	−0.051	−0.321**	−0.055*
	(0.115)	(0.034)	(0.105)	(0.035)	(0.068)	(0.031)	(1.663)	(0.909)	(0.126)	(0.064)	(0.154)	(0.028)
FDK * Single		−0.057		−0.060		0.044		0.970		0.085		−0.037
		(0.057)		(0.067)		(0.068)		(1.814)		(0.140)		(0.069)
Single		−0.012		−0.061		−0.056		0.720		−0.006		−0.012
		(0.044)		(0.050)		(0.049)		(1.230)		(0.096)		(0.049)
F Statistic:												
FDK * Single + FDK = 0		0.59		0.92		1.53		2.45		0.06		1.62
					Panel E: Immigrant							
FDK	−0.085	0.017	−0.086	0.010	0.083**	0.075**	3.266**	2.275**	0.050	−0.035	−0.117**	−0.061*
	(0.073)	(0.030)	(0.069)	(0.033)	(0.041)	(0.035)	(1.307)	(0.921)	(0.119)	(0.066)	(0.058)	(0.031)
FDK * Immigrant		−0.029		−0.052		−0.078**		−1.500		−0.035		0.011
		(0.047)		(0.046)		(0.034)		(1.068)		(0.102)		(0.039)
Immigrant		−0.092***		−0.115***		0.040		0.144		−0.210***		−0.015
		(0.030)		(0.032)		(0.033)		(0.947)		(0.066)		(0.023)
F Statistic:												
FDK * Immigrant + FDK = 0		0.05		0.72		0.01		0.42		0.47		1.67
Number of observations	22,500	22,500	22,500	22,500	18,900	18,900	16,200	16,200	14,000	14,000	12,400	12,400

Notes: Standard errors in parentheses clustered at the school level. FDK is an indicator variable equal to one if the school where the household is zoned 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 is rounded to the nearest 100 according to vetting requirements of the Statistics Canada Research Data Centre. Labor force participation, employed, full-time employment, and absent from work are all indicator variables. Weekly hours of work is measured as the usual number of hours worked per week and the weekly earnings (log) is the log of the weekly earnings. H.S. = high school.

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

the online appendix. The only statistically significant interaction effect is for mothers with a high school education or lower. 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 statistically significant effect of access to full-day kindergarten on both full-time work and hours worked among nonimmigrant mothers. We also find a statistically significant effect among mothers who live in an urban area, with 2.04 additional hours worked and less chance of being absent from work. We find similar results for mothers with one child and mothers with only a high school education or lower.

There are a few possible reasons why these effects are concentrated within these groups of mothers. It is possible that in Ontario, mothers in urban areas are more able to change the number of hours worked weekly than mothers in nonurban areas because there are different patterns in female employment in rural versus urban environments, in addition to fewer child care facilities (Phimister, Vera-Toscano, and Weersink 2001). It could also be that child care expenses are generally more expensive in urban versus rural areas if material labor outcomes are driven by the lack of affordable child care. It is possible that child care subsidies, in the form of full-day kindergarten, increase a mother's effective wage rate more among those with only a high school education or lower, and therefore the subsidization affects their labor market outcomes more.

In terms of other factors, it could be that having only one child signals a stronger connection to the labor force, so even a small child care subsidy (or a slightly bigger one, such as full-day kindergarten) would be enough to induce mothers to change their labor force participation. It could also be that because full-day kindergarten is only for 6.5 hours a day, a mother working full time will need before- and after-school 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 English Public school boards on the intensive margin in terms of increased hours and decreased absence from work. These effects are found primarily for nonimmigrant mothers who have a low education level, only one child, and live in an urban area. Our results are consistent with much of the literature reporting stronger maternal labor market effects for single and low-income mothers (Cascio 2009; Fitzpatrick 2010; Havnes and Mogstad 2011; Dhuey, Eid, and Neill 2020).

7. CONCLUSION

The kindergarten reform in Ontario provides all families with 4- and 5-year-olds access to 6.5 hours of formal early primary education each weekday, an increase from the previous 2.5 hours. Using a robust research strategy, we find no response in the extensive margin of labor force supply of mothers who were intended for treatment, but do find an effect at the intensive margin of increased number of hours worked and decreased absenteeism. We find that access to full-day kindergarten increases hours worked and decreases absenteeism among mothers. This effect is concentrated in specific subgroups: nonimmigrant, 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 labor force participation rate (in 2014, Canada was the eighth highest of forty OECD countries; OECD 2019a). However, Ontario does not have particularly high levels of subsidization for child care services (OECD 2019b). These contextual factors serve as a moderator of the policy effects of early care subsidization. Indeed, the results of this study support the idea that an increased subsidy increases some maternal labor market outcomes by making early child care more affordable. When applying these results in another context, it will be important to consider the economic and contextual factors. For example, larger effects may be found in a similar policy experiment in areas that have lower labor force participation or high child care costs. Similarly, smaller effects may be found in areas with higher labor force participation and/or lower child care costs.

A comprehensive analysis of the rollout of full-day kindergarten would include the benefits and costs for children, families, child care, and the educational system. This kind of comprehensive cost–benefit analysis is beyond the scope of this paper but will be necessary to analyze the full effects of the policy change. Additionally, because the evidence regarding expansion of subsidized programming in early years is mixed, it will be important to explore this issue in other locales. Specifically, if increasing maternal labor supply is the desired policy outcome, it will be necessary to consider expanding early education programs to predict the possible magnitudes of effect on maternal labor supply and possibly consider more targeted subsidies as a way to increase maternal labor supply.

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