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Public Preschool and Maternal Labor Supply in Algeria: Evidence from a Natural Experiment

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Public Preschool and Maternal Labor Supply in Algeria:

Evidence from a Natural Experiment

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Abstract

Globally, female labor force participation rates have remained low and stagnant for some time. What will it take to increase women's participation? We test the potential of public pre-primary to reduce the opportunity cost of work for women and increase their participation using a natural experiment in Algeria. Publicly provided pre-primary in Algeria expanded from 6% enrollment in 2005 to 79% in 2011. We use a discontinuity in whether children are eligible, based on their birthdates, to identify the effect of this expansion on women's labor market outcomes. We find that increased access to pre-primary education decreased women's participation. We explain this counter-intuitive result by the fact that pre-primary education is a half day, making it more difficult for women to work than if they used full-day nursery care.

Keywords: Female labor force participation, pre-primary, Algeria

JEL Classification: H52, I28, J21, J22

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1. Introduction

Globally, female labor force participation (FLFP) has remained low and unequal for decades. From 1998 to 2018, the FLFP rate fell by more than two percentage points, from 51.3% to 48.5% (Verick, 2018). Developing countries have made uneven progress in increasing FLFP, with the Middle East and North Africa (MENA) region persistently having the lowest FLFP in the world, below 20%. What can countries do to address stagnant and low FLFP?

There are three main theories to explain low FLFP globally and in MENA: (1) high opportunity cost of time for women (2) low labor demand either overall or for female-intensive sectors and (3) restrictive social norms (Spierings, Smits, & Verloo, 2010; Verick, 2018; World Bank, 2013). Expanding access to early childhood care and education (ECCE) is considered a promising policy to address the key constraints on women's employment, particularly the high opportunity cost of their time, given their disproportionate domestic responsibilities. We test the impact of expanding ECCE on FLFP in Algeria.

Expanding ECCE access, primarily through greater public provision or lower costs, can increase FLFP, but its impacts are not guaranteed. Moreover, most of the evidence comes from Western countries. Child care costs fully explain the lower FLFP of mothers of preschoolers in the U.S. (Connelly, 1992). Estimates from the U.S. indicate that child care subsidies increase the employment of (low-income) mothers between 12 and 33 percentage points (Berger & Black, 1992; Blau & Tekin, 2007; Crawford, 2006; Davis, Carlin, Krafft, & Forry, 2018). Public provision of pre-primary (kindergarten and preschool) has more mixed results. Some studies have found no or little effect from expanding pre-primary, or only impacts on specific sub-groups, e.g. single mothers (Cascio, 2009; Fitzpatrick, 2010, 2012; Havnes & Mogstad, 2011). Other studies do find significant effects of pre-primary on FLFP (Baker, Gruber, & Milligan, 2008; Gelbach, 2002).

In developing countries, the evidence on the impact of pre-primary on FLFP is also mixed. Most of the evidence is from Latin America and shows both positive and no impacts of pre-primary on FLFP (Angeles et al., 2012; Attanasio, Carneiro, & Olinto, 2017; Berlinski, Galiani, & McEwan, 2011). There are two studies to date in Africa, finding positive employment effects of subsidized care in Mozambique and Kenya (Clark, Kabiru, Laszlo, & Muthuri, 2019; Martinez, Naudeau, & Pereira, 2012). However, none of these studies are in socially-conservative, low-FLFP settings.

Can ECCE impact FLFP in a low-FLFP context with limited socially acceptable employment opportunities for women? We answer this question in Algeria, where the rapid expansion of public pre-primary education facilitates analyses. We use the cut-off age for pre-primary enrollment (age as of September 7) to identify the effect of pre-primary on FLFP using a regression discontinuity design (RDD), comparing 2006 and 2012.

We find that the expansion of pre-primary actually decreased female labor force participation. We posit that this result is due to pre-primary school being a half day. Whereas women who

worked may have previously used all day child care for pre-primary aged children, as pre-primary expanded, they could not reconcile school half-days with employment. These results are, in part, aligned with studies elsewhere that show full-day kindergarten or afterschool care can increase FLFP (Berthelon, Oyarzún, & Kruger, 2015; Cannon, Jacknowitz, & Painter, 2006; Dhuey, Lamontagne, & Zhang, 2019; Martínez A. & Perticará, 2017). However, to the best of our knowledge, our paper is the first to show that part-day schooling actually reduces FLFP. These results may be due to the challenging and low-FLFP context in Algeria. They underline the importance of careful policy design in attempting to increase FLFP in low-FLFP contexts.

The paper is organized as follows. In Section 2, we provide background on pre-primary and the labor market in Algeria. We then describe the survey data in Section 3. Section 4 describes our identification strategy of RDD. Section 4 presents our results, first in terms of patterns of FLFP and pre-primary and then in terms of the impact of pre-primary on FLFP. Section 5 concludes with a discussion of implication for policy and increasing FLFP globally.

2. Background

2.1. Algeria's labor market

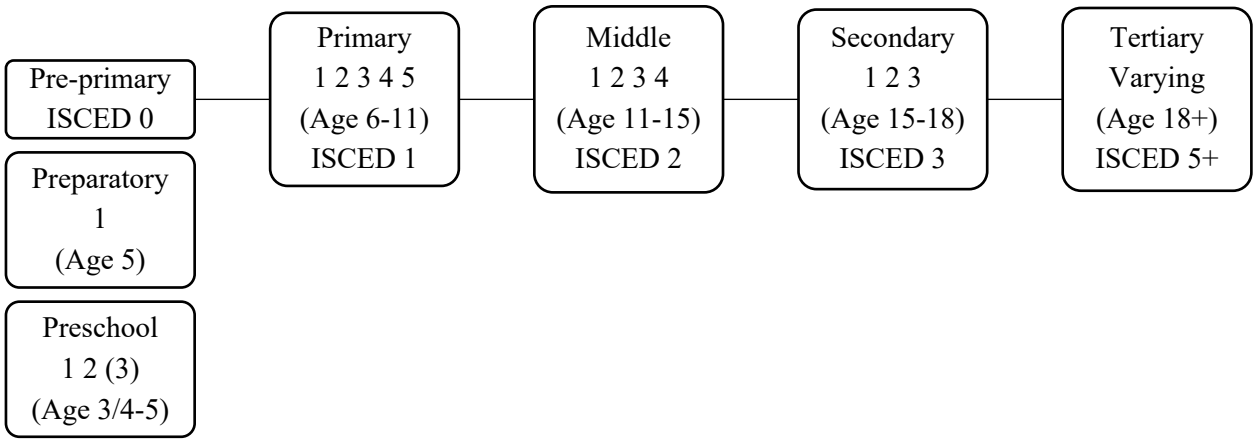
A rich literature examines the determinants of FLFP in MENA countries. The determinants can generally be organized into "needs," the economic and care requirements of the household, "values" including gender norms, and "opportunities," whether jobs are accessible and suitable (Spierings, Smits, & Verloo, 2010). Empirically, women's participation and employment depends on household composition, especially the presence of young children (Krafft, Keo, & Fedi, 2019). The availability of public sector employment has historically been critical to women's employment (Assaad, Hendy, Lassassi, & Yassin, 2018). However, little is known about what programs or policies might increase FLFP in the MENA region. In particular, there is limited empirical evidence on the effects of child care costs, an important component of women's opportunity costs, for women in the MENA region.

Algeria is one of the many MENA countries with low FLFP, estimated at 16.6% as of 2018 (Algeria National Statistics Office, 2018). This compares to a LFP rate of 66.7% for men. Algeria had the fourth-largest (of 146 countries) increase in years of schooling from 1980-2010 (Campante & Chor, 2012). Recent cohorts have achieved gender parity in education (Assaad, Hendy, Lassassi, & Yassin, 2018). Despite increases in women's education, FLFP has only increased very slightly over time, from 10.2% in 1990 to 16.6% in 2018 (Algeria National Statistics Office, 2018). Historically, as in other MENA countries, public sector employment played a key role in Algerian women's economic participation. That role continues today in Algeria, to a greater extent than other MENA countries. Importantly, participation is higher for unmarried than married women (Assaad, Hendy, Lassassi, & Yassin, 2018). This suggests that domestic responsibilities, such as child care, that come with marriage and family formation, are a key constraint on FLFP.

2.2. Education system in Algeria

Algeria's official education system begins with pre-primary education (Figure 1). Children then proceed through primary education (starting at age six and lasting five years), middle school (starting at age 11 and lasting four years). They may continue on to secondary school (starting at age 15 and lasting three years) and then tertiary education (starting at age 18, with varying durations).

Figure 1. Structure of Algeria's education system

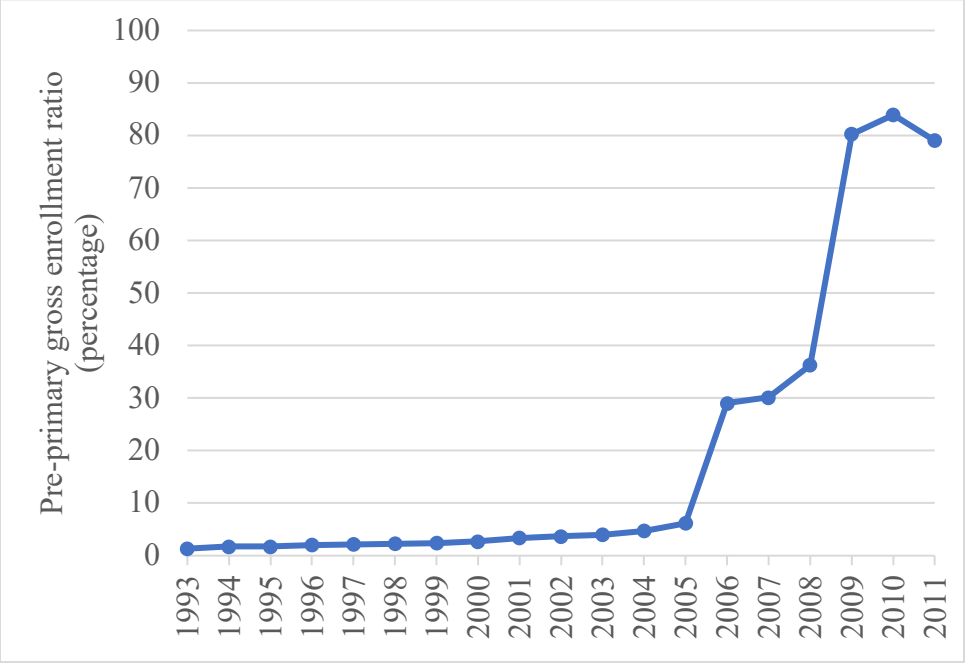


Source: Authors' construction based on UNESCO Institute for Statistics (2014).

There are two types of pre-primary education (Mahdjoub, 2017). Preparatory education is one year in duration and starts at age five. Preschool education is officially three years and starts at age three, but may be two years starting at age four. Pre-primary education is voluntary (Mahdjoub, 2017). After its independence, in 1965, Algeria did away with public pre-primary education to focus on achieving universal compulsory (primary and middle school) education (Bouzoubaa & Benghabrit-Remaoun, 2004). With its 2003 education reform plan, Algeria planned to expand preschool once more starting in the 2004-2005 school year. In January of 2008, the National Education Guideline Law No. 08-04 further emphasized pre-primary education (Mahdjoub, 2017).

Algeria has made enormous progress in preschool attendance in recent years (Figure 2). Starting in 1993, gross enrollment in pre-primary (for five-year-olds) was only 1 percent. As recently as 2005, the gross enrollment rate in pre-primary was only 6%, but starting in 2006, enrollments rapidly increased, to 29% in 2006, 36% by 2008, and 80% by 2009 (then 83% in 2010 and 79% in 2011).

Figure 2. Algeria's pre-primary gross enrollment ratio (percentage), 1993-2011



Source: Authors' construction based on World Bank EdStats (World Bank, 2019).

As of the 2014-15 school year, there were 418,409 pupils in preparatory, which is public and managed by the Ministry of Education (Mahdjoub, 2017). There were 509,952 children in preschool, primarily in Ministry of Religious Affairs preschools (450,000), with the rest in private or other public forms of preschool. Of primary school entrants at the beginning of the 2015 school year, 70% had attended pre-primary, 71% of whom attended a preparatory class, 25% a Ministry of Religious Affairs preschool, and the rest other private or public programs (Mahdjoub, 2017). Public pre-primary schools are physically and administratively attached to primary schools (Secretary General of the Republic of Algeria, 2008). They typically operate two shifts (morning and afternoon) each for three and a half hours a day, five days a week over the nine-month school year.

3. Data

3.1. Surveys

We use data from the Algeria Multiple Indicator Cluster Surveys (MICS) conducted in 2006 and 2012/13 (we refer to this as 2012) by UNICEF in collaboration with the Algerian government (Ministry of Health Population and Hospital Reform, 2015; Ministry of Health Population and Hospital Reform & National Office of Statistics, 2008). The MICS is a nationally representative survey. The MICS contains four questionnaires: a household questionnaire, a household member questionnaire, a questionnaire for women aged 15-49, and a questionnaire for children under the age of 5 (addressed to the mother or primary caretaker of the child).

For the survey conducted in 2006, 29,008 households, 43,642 women, and 15,000 children under the age of five were interviewed (Ministry of Health Population and Hospital Reform & National

Office of Statistics, 2008). Fielding took place from March 2006 to June 2006. For the survey conducted in 2012, 27,198 households, 38,548 women, and 14,701 children under the age of five were interviewed (Ministry of Health Population and Hospital Reform, 2015). Fielding took place from October 2012 to March 2013. Various samples are used for different analyses, and we discuss these below.

3.2. Outcome measures

We primarily focus on the impact of pre-primary on labor force participation. Particularly for women whose children may have just started school, it may take them some time in unemployment before finding a job. Labor force participation captures both unemployment and employment; we make additional separate analyses of employment as well.

3.3. Pre-primary measures

Since pre-primary is available for children aged 3-5 at the start of the school year, we obtain information on pre-primary from both the under-five (for ages three and four) and the household member questionnaires (for ages five and six). For ages three and four, their parent or guardian is asked whether the child attends an out-of-home or preschool education program such as a public or private center or kindergarten.[3] We consider a "yes" response to this question to be attending pre-primary for ages 3-4. For aged five and six, we use a question on whether or not the child is attending school in the current school year (2005-2006 for 2006; 2012-2013 for 2012). If the child is not attending school, he or she is not in pre-primary. If she or he is attending school, if he or she is in pre-primary we consider this to be attending pre-primary. Some five-year-olds and most six-year-olds are already in primary school, and we count them as missing (ineligible) for our primary measure. Moreover, some six-year-olds at the time of the survey might have been five at the start of the school year, and therefore eligible and we include them in our pre-primary measure. Essentially, we measure pre-primary for children under age six at the start of the school year, as well as three-year-olds at the time of the survey who would not yet have been three at the start of the school year, but are useful for our regression discontinuity comparisons.

While children can only have one pre-primary status (they either attend, or don't, or are ineligible and missing), women may have multiple children of varying ages, potentially multiple children who are eligible for pre-primary. We use the pre-primary status of a woman's youngest eligible child as the measure of whether her children are in pre-primary.

3.4. Covariates

As we discuss below, we characterize participation of children in pre-primary education and participation of women in the labor force. We therefore have covariates for both children and women, in various models and descriptives.

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[3] The exact question is slightly different in 2006 versus 2012. The 2006 question focuses on out of home or preschool programs and includes Koranic programs in the list of examples (2012 does not), whereas the 2012 question mentions educational learning programs and nurseries (2006 does not) (Ministry of Health Population and Hospital Reform, 2015; Ministry of Health Population and Hospital Reform & National Office of Statistics, 2008).

For both groups, we have data on the location of the household, both in terms of urban vs. rural residence and the region (seven regions are used). We also can measure the wealth of the household. For children, we include information on children's age, mother's education, father's education, and children's sex. For women, we include information on their education, age group, and marital status. We also quantify the presence of children of various ages: 0-2, 3-5, 6-11, 12-17, by sex. These correspond to children with varying access to education, and particularly, pre-primary for ages 3-5. We further specify the age of the youngest child, as this may be particularly deterministic of women's participation decisions.

4. Methods

As with past studies (e.g. Berlinski, Galiani, & McEwan, 2011; Fitzpatrick, 2010), we use an RDD strategy and exploit policies that set a cutoff date for pre-primary eligibility. The essential idea of RDD is that the treatment (preschool, *s*) is determined by some 'forcing variable,' *F*. In our case, the preschool law states that children are eligible only if preschool age as of September 7 (treatment threshold). Therefore, weeks from the age cutoff at September 7 is our forcing variable (floor of (September 7 – birth date)/7). If the birth date is September 7 or earlier, this value is zero or positive, and the child can enter pre-primary sooner. If the birth date is later in the year than September 7, this value is negative, and the child has to wait until the next school year to enter pre-primary.

Since children can enter pre-primary and various ages, we divide our sample into discontinuity groups, based on the age on September 7. Specifically, we use six months older or younger than would turn age three on September 7, and likewise for ages four and five. We thus have three groups, the age three group (2.5-3.5 years old on September 7), the age four group (3.5-4.5 years old on September 7) and the age five group (4.5-5.5 years old on September 7). For women, we operationalize these same concepts based on the youngest eligible child. Children and women thus fall into one (and only one) discontinuity group and are near equally distributed on each side of the discontinuity.

If there is a change in outcome *y,* e.g. FLFP, at the treatment threshold, it can be attributed to the treatment (pre-primary) so long as we can expect a smooth (continuous) relationship between the outcome and forcing variable in the absence of treatment. For example, we expect that women are generally more likely to work when their children are older, but aside from the ability to enroll children in pre-primary, the effect of a child's birth date moving from a few weeks before September 7 to a few weeks after would be no different than an equivalent shift at any other date.

RDD models can be estimated parametrically or non-parametrically; we do both, with the more flexible functional form based on kernel-weighted local linear regressions.[4] Because pre-primary is not compulsory, the cutoff will not be 100% deterministic of enrollment, our RDD is 'fuzzy,' based on a jump at the cutoff. We therefore use the typical fuzzy RDD estimator of

[4] Estimates are implemented using the program 'rd' version 2.9 in STATA 14.2 (Nichols, 2007).

the treatment effect, namely the ratio of the jump in the outcome to the jump in the probability of treatment (pre-primary) (Imbens & Lemieux, 2008).

5. Results

We initially begin with a descriptive analysis of FLFP, pre-primary and their relationship. Our RDD models follow.

5.1. Descriptive analysis

Table 1 presents pre-primary enrollment among children age 3-6 at fielding and under six on September 7 of the start of the school year. The table also compares 2006 and 2012. Pre-primary enrollment increases substantially with age as well as over time. While only 16% of children in 2006 were enrolled in pre-primary, 28% of children were enrolled in 2012. Enrollments have approximately doubled at each age: from 4% to 10% for age three, from 14% to 25% for age four, and from 26% to 53% for age five. Based on their age on September 7, very few children aged two on September 7 were enrolled at the time of the survey (5% in 2012), but enrollments increased at age three (13% in 2012), four (33% in 2012) and five (53% in 2012).

Table 1. Pre-primary enrollment of children (percentage) by characteristics of children, 2006 and 2012

	2006	2012
Age		
3	4	10
4	14	25
5	26	53
6	29	15
Age on September 7		
2	3	5
3	9	13
4	22	33
5	31	53
Sex		
Male	16	27
Female	15	28
Mother's education level		
None	7	15
Primary	15	22
Middle	19	30
Secondary	25	34
Tertiary	40	46
Father's education level		
None	6	15
Primary	13	24
Middle	17	28
Secondary	23	32
Tertiary	34	42
Absent/Missing	21	32

Household wealth quintile		
Poorest	5	16
Poor	9	24
Middle	16	28
Richer	21	32
Richest	35	41
Location		
Urban	22	33
Rural	9	19
Region		
North Center	16	29
North East	19	33
North West	15	23
High Central Plains	6	16
High East Plains	15	26
High West Plains	10	20
South	22	37
Total	16	28
N	8,868	7,994

Source: Authors' calculations based on MICS 2006 and MICS 2012.
Notes: Children age 3+ at time of fielding and <6 on September 7 of start of school year.

Although there is gender parity in pre-primary enrollments, there are also clear inequities by socioeconomic status, with children with more educated parents and from wealthier households more likely to enroll. The pre-primary expansion does seem to have improved equity in access; while only 5% of children from the poorest quintile of households attended pre-primary in 2006, this rose to 16% in 2012, while the corresponding increase for the richest was smaller, from 35% to 41%. There are definite geographic disparities, favoring urban areas, as well.

Table 2 turns to the question of women's labor market outcomes. The table presents labor force participation, employment and unemployment rates. Unemployment rates are as a share of the labor force, while employment and participation are as a share of the working age (15-64) population. In 2006, the FLFP rate was 16% and rose to 17% by 2012. Employment also rose by one percentage point, from 11% to 12%. Unemployment was high but decreased slightly from a rate of 31% to 26%.

Among women with eligible children, women whose youngest child was enrolled in pre-primary were more likely to be in the labor force and be employed. In 2012, women whose youngest child was not enrolled had a FLFP rate of 7% compared to 16% for women with children enrolled. Notably, however, the LFP and employment rates of women with children in pre-primary dropped from 2006 to 2012, FLFP from 21% to 16% and employment from 20% to 14%.

As expected, more educated women are more likely to participate and be employed, although unemployment is high across education levels. Participation rises and then falls with age,

peaking in the 25-29 age group (at 26% in 2006 and 29% in 2012). Unemployment is highest at ages 15-19 (63% in 2012). This is closely related to marital status; single women participate more than married women, although much of the higher participation is unemployment. In 2012, while 16% of single women were employed, 9% of married women were employed. Women in wealthier households and urban areas are more likely to be employed.

Table 2. Women's labor market outcomes by characteristic (percentage), 2006 and 2012

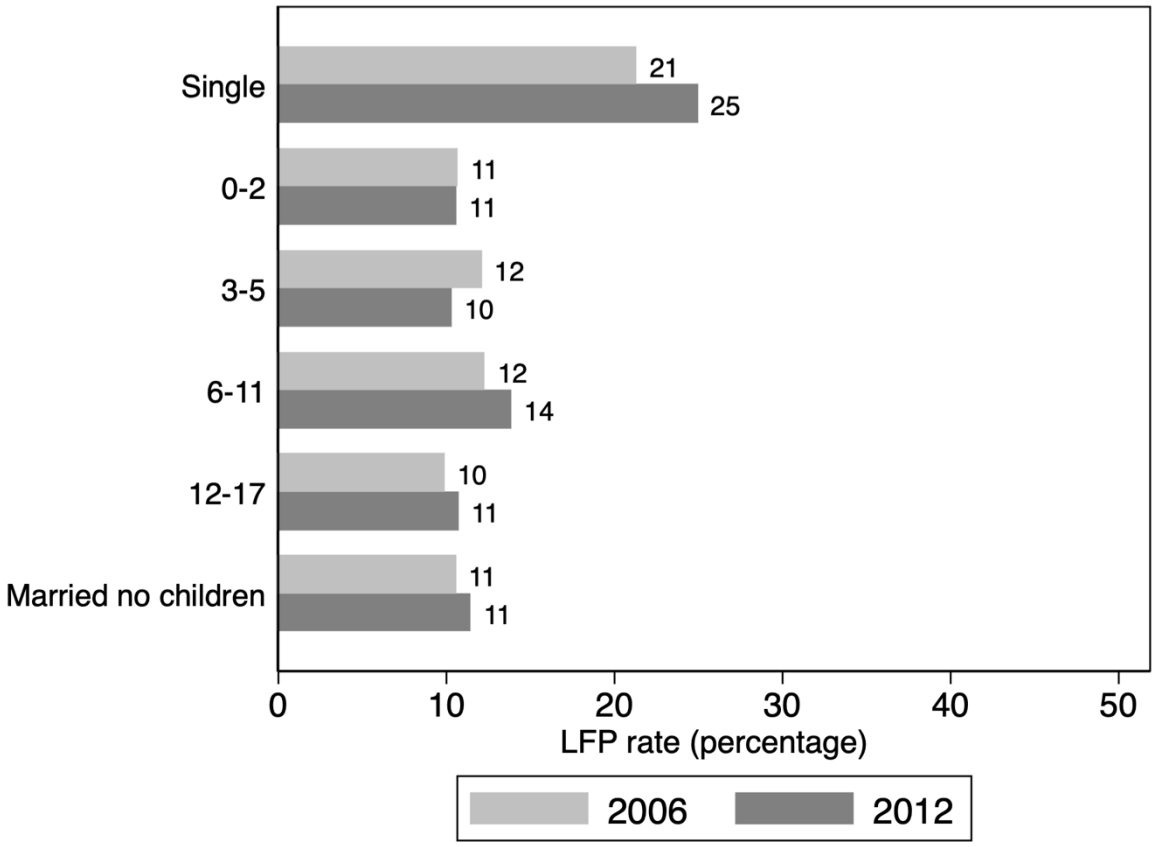
	2006			2012		
	LFP rate	**Emp. rate**	**Unemp. rate**	**LFP rate**	**Emp. rate**	**Unemp. rate**
Youngest child in pre-primary (women with ECE eligible children)						
No	9	8	11	7	6	13
Yes	21	20	6	16	14	9
Education level						
None	7	5	23	5	3	34
Primary	11	7	36	9	6	35
Middle	16	9	42	14	8	41
Secondary	23	16	27	19	15	20
Tertiary	41	30	27	46	37	19
Age Group						
15-19	7	3	60	4	2	63
20-24	18	9	51	18	10	47
25-29	26	16	39	29	21	28
30-34	22	16	25	23	17	23
35-39	18	15	16	20	16	20
40-44	18	17	9	17	15	12
45-49	14	13	7	16	15	8
50-54	10	9	6	10	9	8
55-59	6	6	6	7	6	12
60-64	3	3	16	2	2	18
Age of youngest child						
Single	21	12	43	25	16	35
Age 0-2	11	9	15	11	9	16
Age 3-5	12	11	8	10	10	8
Age 6-11	12	11	8	14	13	10
Age 12-17	10	9	6	11	10	8
Married no children	11	9	15	12	10	15
Marital status						
Single	21	12	43	25	16	35
Married	10	9	11	10	9	13
Divorced	40	33	16	37	32	14

	2006			2012		
	LFP rate	**Emp. rate**	**Unemp. rate**	**LFP rate**	**Emp. rate**	**Unemp. rate**
Widowed	16	14	9	10	9	9
Household wealth quintile						
Poorest	10	7	33	10	6	40
Poor	11	7	35	12	8	35
Middle	14	9	38	16	11	31
Richer	19	12	34	19	14	25
Richest	25	19	23	27	23	16
Location						
Urban	20	14	31	20	15	23
Rural	11	7	33	11	7	37
Region						
North Center	16	11	31	19	14	26
North East	14	11	25	23	14	40
North West	16	12	27	14	11	17
High Central Plains	10	7	35	11	7	35
High East Plains	18	10	42	12	10	17
High West Plains	16	10	36	15	10	31
South	18	13	28	15	13	12
Total	16	11	31	17	12	26
N	55,650	55,650	9,047	49,733	49,733	7,812

Source: Authors' calculations based on MICS 2006 and MICS 2012.

An important relationship is visualized in Figure 3, showing how FLFP varies by the age of the youngest child. In 2006, participation is similar, 12%, for those with youngest children 3-5 and 6-11, slightly lower, 11%, for women with youngest children 0-2 and married with no children, and 10% for women with children aged 12-17. In 2012, while patterns for women with children 0-2 remained identical, at 11% participation, the same as married with no children and 12-17, LFP fell for women with oldest children 3-5, from 12% to 10%, while it rose for those with 6-11-year olds, from 12% to 14%. At least observationally, when pre-primary expanded, women's participation did not. However, it is not clear if differences are significant or driven by composition.

Figure 3. Women's labor market outcomes by youngest child age (percentage), 2006 and 2012

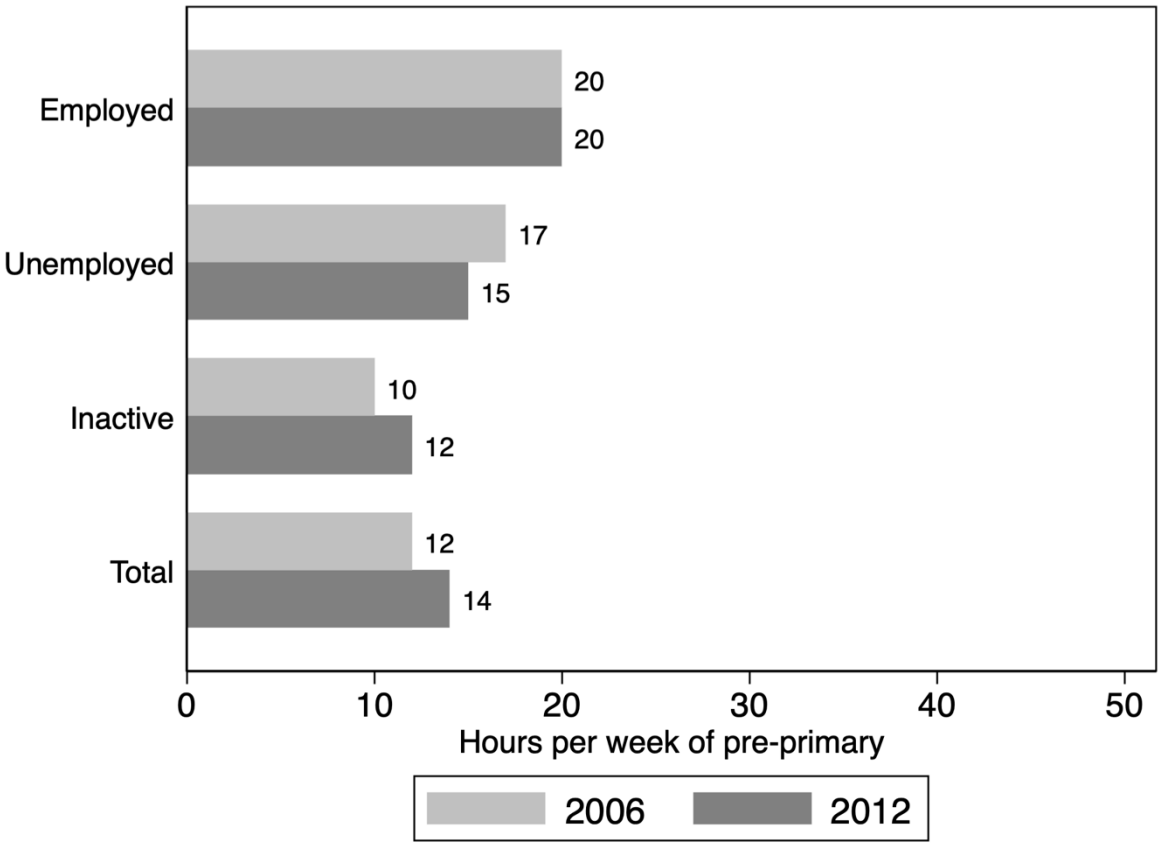


Source: Authors' calculations based on MICS 2006 and MICS 2012.

It is also important to note that many women with young children worked but did not enroll their children in pre-primary; in 2006 only 34% of working women with young children had them enrolled in pre-primary. Interestingly, this is the group that experienced the smallest increase in pre-primary enrollment, to 47% in 2012. While still higher than other groups (37% of the unemployed and 26% of the inactive had their children enrolled), this represents a 38% increase in enrollments for the employed, compared to 73%-75% for the unemployed and inactive. Although we do not have data on other care arrangements in the MICS, presumably working women have other care arrangements; women's mothers and mothers-in-law are key caregivers in other MENA countries (Assaad, Krafft, & Selwaness, 2017).

Figure 4 explores the hours of pre-primary education per week for women's youngest child, if he or she was in pre-primary, by women's labor market status. The median hours per week of pre-primary was 10 in 2006 and 14 in 2012. Employed women had a median of 20 hours per week in both periods. Unemployed women had fewer, but more than the median hours, at 15 in 2012. Inactive women had the fewest hours, at 12 per week. The longer hours of care employed women need may mean that the half-days of public pre-primary are not well-matched to their needs.

Figure 4. Median hours of pre-primary education per week for youngest child by women's labor market status, women with youngest child in pre-primary



Source: Authors' calculations based on MICS 2006 and MICS 2012.

5.2. Regression discontinuity design models

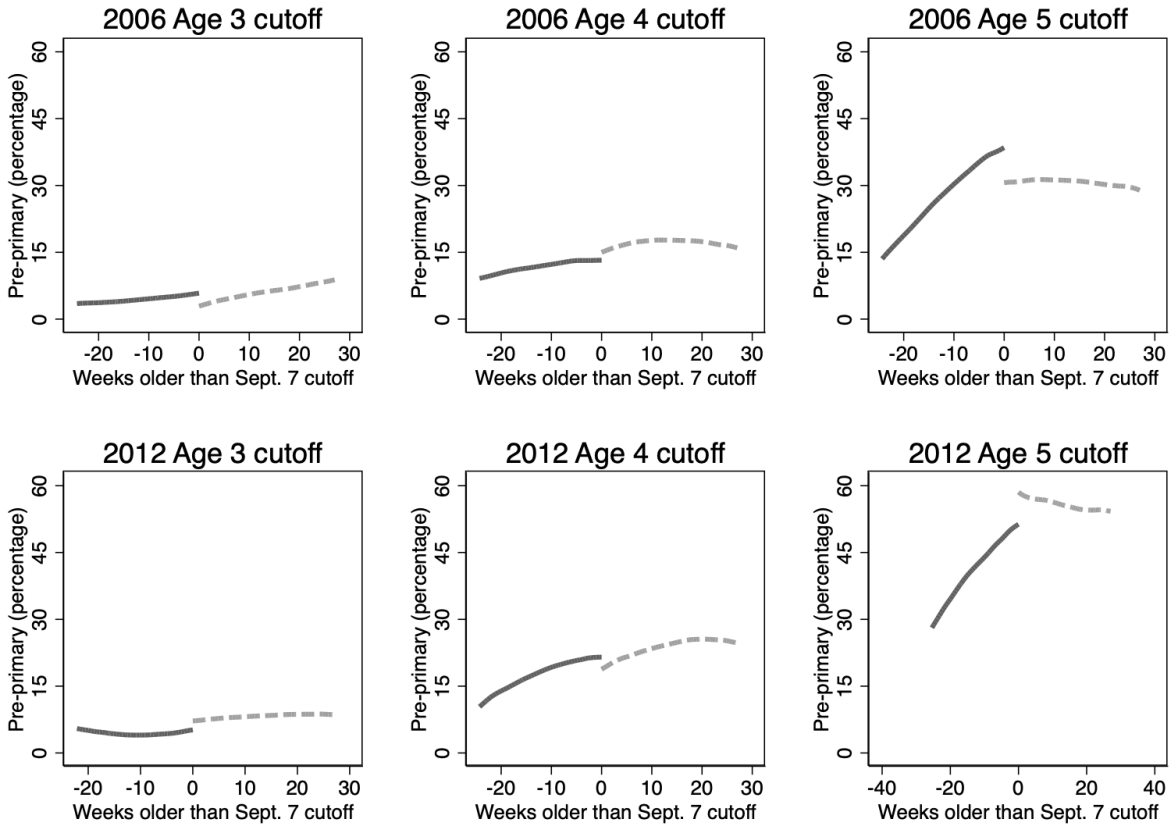
The preceding results have shown that, while women who work are more likely to use pre-primary, the expansion of pre-primary was actually associated with lower participation for women with pre-primary age children. We also showed that many of the characteristics associated with FLFP are associated with pre-primary enrollment, e.g. socio-economic status, women's education, and urban residence. We therefore turn to our RDD models to estimate the causal relationship between pre-primary and FLFP. We first present the discontinuity in pre-primary, then the non-parametric RDD estimates, followed by parametric models.

5.2.1. Discontinuity in pre-primary

Recall that for the discontinuity we have three groups of youngest eligible child's age, the age three group (2.5-3.5 years old on September 7), the age four group (3.5-4.5 years old on September 7) and the age five group (4.5-5.5 years old on September 7). A woman would be in one and only one group. Figure 5 presents the discontinuity in pre-primary enrollment by the various cutoffs over time. Generally, women with older children, even within a year of age, are more likely to have their children enrolled in pre-primary. However, there are not clear

discontinuities for age three or four, when enrollments are lower and likely to be discretionary. In 2006, although right at the cutoff the children not yet eligible had higher enrollment rates, there is more of the expected pattern, with a flat profile for the age 5 group who were old enough to quality on September 7, and an increasing profile for those younger than the cutoff (for whom enrollment would be more discretionary). There is definitely a discontinuity for the age five group in 2012. It is also clear that, on average, enrollments are lower below the cutoff than above the cutoff.

Figure 5. Pre-primary by weeks from September 7 cutoff, youngest eligible child's age group and year



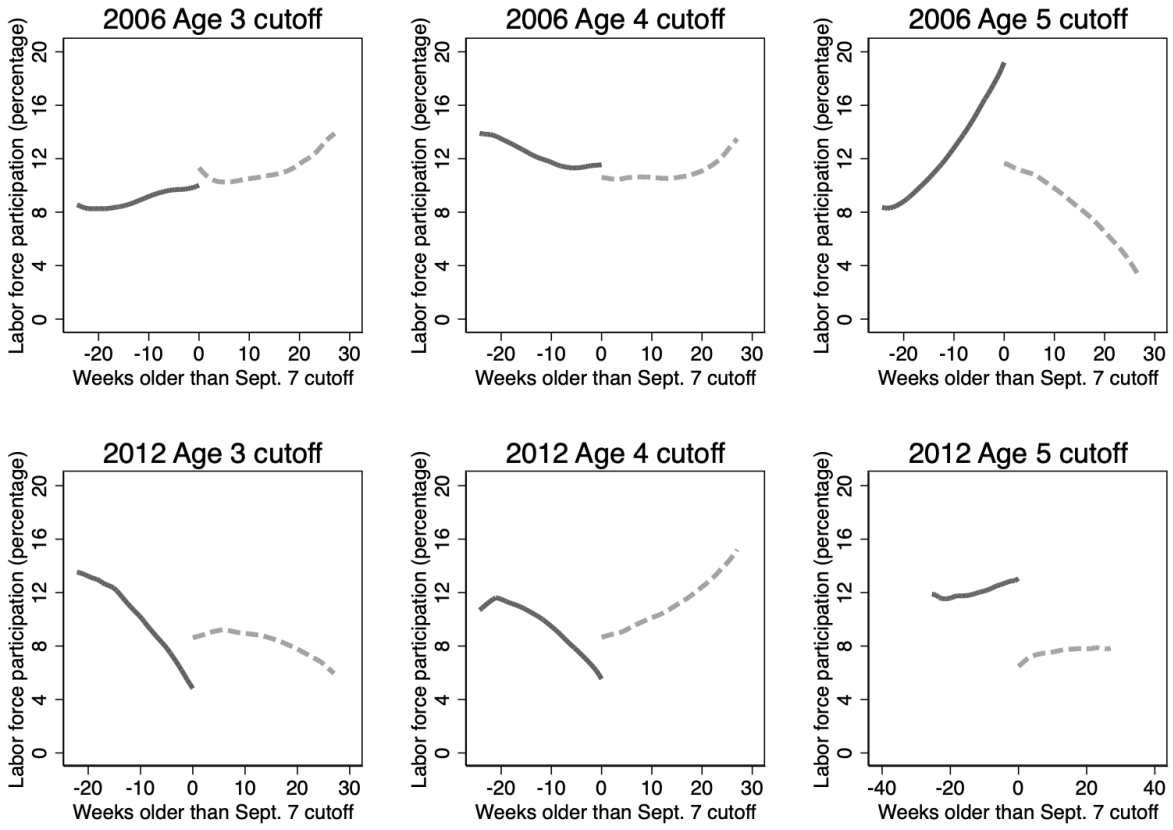
Source: Authors' calculations based on MICS 2006 and MICS 2012.
Notes: Estimates based on rd command with bandwidth 25 and six bins on each side of the cutoff.

5.2.2. Non-parametric RDD estimates

Figure 6 presents the RDD results for FLFP (results for employment are similar). Notably, in 2012 for age five, which has the clearest discontinuity, FLFP is substantially higher when children are *not* eligible for pre-primary. There appears to be a *negative* relationship between pre-primary and FLFP. The numerator of the local Wald estimate for age five in 2012 is significant (6.6 percentage points lower FLFP, p=0.045) but the denominator is not (a 7.2

percentage point increase in pre-primary, p=0.188) and the resulting Wald estimator is also insignificant (-0.9, p=0.314).

Figure 6. Women's labor force participation (percentage) by weeks from September 7 cutoff, youngest eligible child's age group, and year

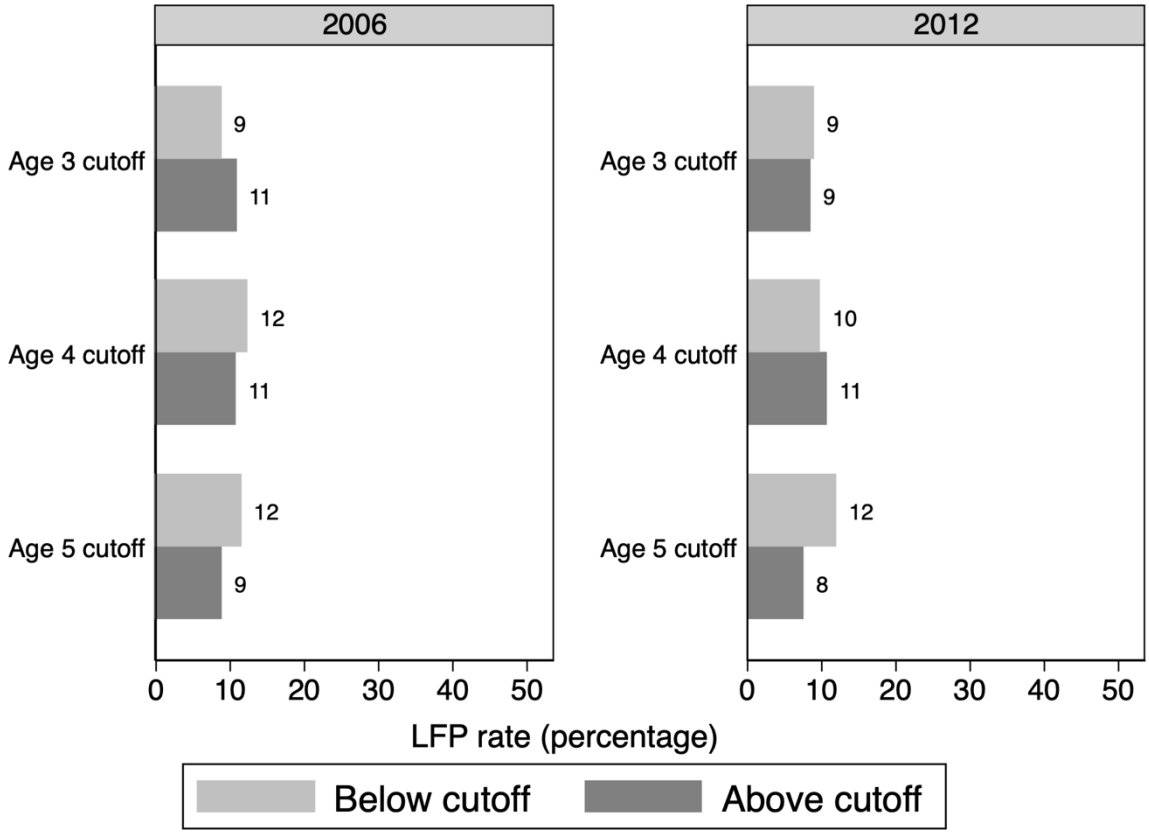


Source: Authors' calculations based on MICS 2006 and MICS 2012.
Notes: Estimates based on rd command with bandwidth 25 and six bins on each side of the cutoff.

5.2.3. Parametric RDD estimates

Using the discontinuity and non-parametric RDD reduces the amount of data available and may be noisy due to the presence of covariates. We therefore turn to replicating the RDD estimates but in a parametric framework. First, in Figure 7, we present FLFP by youngest eligible child's age, year, and whether the child was above the cut-off (and thus on average more likely to attend pre-primary) or below the cut-off. Notably, with children in the age 5 category (age 4.5-5.5), women with eligible and thus older children were substantially less likely to participate in the labor force; although we would expect women with older children to be equally or more likely to work in general, in 2006, women with age group five pre-primary eligible children were less likely to work (12% vs. 9%), and even more so in 2012 (from 12% to 8%). Results for employment were even larger (from 11% below the cutoff to 6% above the cutoff in 2012; similar differences to LFP in 2006).

Figure 7. Women's labor force participation (percentage) by youngest eligible child above or below September 7 cutoff, youngest eligible child's age group, and year



Source: Authors' calculations based on MICS 2006 and MICS 2012.
Notes: Estimates based on rd command with bandwidth 25 and six bins on each side of the cutoff.

We test for the significance of this pattern in 2012 for the age five group in Table 3 using a linear probability model. We control for weeks from the cutoff in a quadratic form; the expected relationship of increasing LFP with increasing age is found. However, being above the cutoff decreases FLFP by 6.4 percentage points and is statistically significant at the 1% level. As pre-primary has expanded, women with children who are particularly likely to go (age five in 2012) are less likely to participate in the labor force. We attribute this surprising result to the likely inadequacy of pre-primary (which is a median of 14 hours per week) in terms of child care. Indeed, it may be *more* difficult to combine pre-primary and other childcare, and thus be able to work, than to arrange for full-time childcare without pre-primary.

Table 3. Linear probability model for FLFP, women with children in eligibility group for age 5 in 2012

Youngest eligible child above cutoff (below omit.)	
Above cutoff	-6.414**
	(2.031)

Weeks from cutoff	
Weeks	0.130
	(0.069)
Weeks squared	0.001
	(0.003)
Presence of children	
Have male children 0-2	1.683
	(1.272)
Have female children 0-2	-1.440
	(1.282)
Have male children 3-5	-3.257
	(1.859)
Have female children 3-5	-2.235
	(1.827)
Have male children 6-11	-1.489
	(1.167)
Have female children 6-11	-0.159
	(1.164)
Have female children 12-17	-1.175
	(1.446)
Have male children 12-17	-0.111
	(1.448)
Education (none omit.)	
Primary	0.029
	(1.631)
Middle	3.307*
	(1.555)
Secondary	9.996***
	(1.680)
Tertiary	55.724***
	(2.404)
Age group (20-24 omit.)	
25-29	2.804
	(3.673)
30-34	1.887
	(3.626)
35-39	6.610
	(3.720)
40-44	11.527**
	(3.857)

45-49	10.278*
	(4.176)
50-54	8.059
	(7.175)
55-59	-31.203*
	(15.726)
Marital status (single omit.)	
Married	8.799
	(7.506)
Divorced	38.478***
	(8.535)
Widowed	41.437***
	(9.019)
Location (urban omit.)	
Rural	-0.689
	(1.114)
Region (North Central omit.)	
North East	0.064
	(1.714)
North West	-6.162***
	(1.646)
High Central Plains	-5.989**
	(2.065)
High East Plains	-4.842**
	(1.622)
High West Plains	-5.530*
	(2.277)
South	-1.576
	(1.787)
Constant	-2.555
	(8.651)
N	2537

Source: Authors' calculations based on MICS 2006 and MICS 2012.
Notes: *p<0.05; **p<0.01; p<0.001

6. Discussion and conclusions

Pre-primary education is frequently cited as an important intervention to raise FLFP in developing countries generally and MENA in particular. Conceptually, increasing access to pre-primary would address a key constraint on FLFP, women's domestic responsibilities and opportunity cost of time. Empirically, evidence from other countries shows ECCE generally has the potential to increase FLFP (Baker, Gruber, & Milligan, 2008; Berger & Black, 1992; Berlinski & Galiani, 2007; Blau & Tekin, 2007; Clark, Kabiru, Laszlo, & Muthuri, 2019; Crawford, 2006; Davis, Carlin, Krafft, & Forry, 2018; Martinez, Naudeau, & Pereira, 2012). Pre-primary may, however, have no effects or only effects on specific sub-groups (Cascio, 2009; Fitzpatrick, 2010, 2012; Havnes & Mogstad, 2011). We investigated whether pre-primary can increase FLFP in a socially conservative setting.

We specifically tested the effect of a substantial pre-primary expansion in Algeria on FLFP. What we found was that the pre-primary expansion may have actually *decreased* FLFP. Particularly for women with children aged five in 2012 – who experienced the highest rates of pre-primary – we find lower FLFP (and lower employment) among those whose children are eligible for pre-primary. Although our non-parametric RDD results are not significant, the parametric models are.

Why would pre-primary have a *negative* effect on FLFP in Algeria? We speculate the half-day nature of pre-primary (median of 14 hours per week) is inadequate for women to work. The majority of working women, even with pre-primary age children, do not use pre-primary. Care by other family members or not in a formal pre-primary setting may be better able to meet women's need for care during work hours. The effects of pre-primary on children's development may still make even tradeoffs in FLFP worthwhile, an issue that merits further investigation.

The fact that Algeria's pre-primary expansion decreased FLFP underlines the importance of policy design. In order for pre-primary to increase FLFP, it likely needs to provide work-day length care. The importance of all-day school or afterschool to raising FLFP has been demonstrated in other contexts (Berthelon, Oyarzún, & Kruger, 2015; Cannon, Jacknowitz, & Painter, 2006; Dhuey, Lamontagne, & Zhang, 2019; Martínez A. & Perticará, 2017). Ours is the first work to show that part-day care can actually reduce FLFP, but is congruent with the importance of all-day care. Ensuring that pre-primary expansions align with women's work schedules will be a critical area for future investigation; if Algeria switched to all-day pre-primary, would this then increase FLFP?

[Note: We are working on difference-in-difference and instrumental variables identification strategies as well]

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