Universal Childcare Subsidy Expansion and Maternal Labor Supply: Evidence from South Korea

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September 2019

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Abstract

South Korea is among a handful of countries that have implemented universal childcare, but to the best of my knowledge, no previous studies have examined the causal impact of the recent reform. This paper evaluates the effect of the universal childcare reform on parents' employment, hours of work, wages, and family life satisfaction. The government introduced a staged expansion of universal childcare subsidies across all income groups between 2009 and 2013. Using a nationally representative panel data set that provides rich information on household income and assets, I determine each household's annual eligibility and annual tuition coverage rate. Because the tuition coverage rates varied by child's birth cohort and "income/asset" thresholds, I use these two dimensions as the two sources of the identifying variation to implement non-temporal difference-in-difference regression models. My findings suggest that maternal employment increased by six percentage points during the reform period whereas the effect was statistically zero for fathers. In addition, the reform had small but positive effects on various measures of family life satisfaction. The debate continues to this day whether the funding scheme for childcare subsidies places a heavy burden on local governments. In this light, this study may inform current policy debate by considering the effectiveness of the subsidies that are no longer means-tested.

JEL Classification: J13, J21, H40
Keywords: universal childcare, female labor supply, family policy

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1 Introduction

As work-family conflict[1] has become a widespread global phenomenon, provision of universal childcare stands at the heart of the family policy debate in many countries around the world. The traditional, post-World War II model of a male breadwinner earning a "family wage" to support his entire family while his wife would raise the children and manage the household has disintegrated as wages have stagnated and women's labor force participation (LFP) increased dramatically in the second half of the twentieth century. In addition, today's workplace often demands long working hours or unpredictable work schedules. Consequently, a number of working parents experience difficulties in accessing affordable and quality childcare. High childcare costs are often a barrier to employment or career success especially for women who are still expected to be primary caregivers despite the rise in working motherhood.

There is growing public support for universal childcare in many industrialized democracies. In Europe, there have been heated public discussions about the movement towards creating universal, highly subsidized pre-school like Scandinavian countries offer (Havnes and Mogstad 2011; Goux and Maurin 2010). Indeed, in public policy discourse the family-friendly policies in these countries are commonly cited as the key determinant of high LFP rates among women with young children. In the United States, there has been a negative association with publicly available childcare and welfare, which is thought to have impeded the development of such programs. (Morgan 2001; Skocpol 2000). In the 2016 election year, however, presidential candidates from both the Republican and Democratic parties campaigned with universal pre-kindergarten as a part of their platforms. The increasing public support is also evidenced by the fact that a few places such as New York City, Oklahoma, and Georgia have recently enacted universal pre-kindergarten programs.

Despite the relevance of the issue in the current policy sphere, the impacts and implications of broad-based childcare programs on maternal labor supply still remain relatively unknown (Fitzpatrick 2010; Baker et al. 2008). Public financing of such programs can be costly if they merely lead to a substitution of one form of childcare arrangements to another without any net increase in total childcare utilization, maternal employment, or the well-being of families (Havnes and Mogstad 2011; Baker et al. 2008). Moreover, there is a little agreement on what age public schooling should be extended to and the policies vary widely from country to country (Goux and Maurin 2010). Given that the modern institution of public schooling was developed before women entered the workforce on a massive scale, the current public debate on the expansion of universal childcare also pertains to how to improve the provision of public schooling in the context of the rise of dual-earner households.

This study is informed by a recent large-scale reform that universalized childcare subsidies in South Korea and evaluates the impact of universally available, highly subsidized childcare on

1. See Williams and Boushey (2010) for an excellent exposition on the work-family conflict experienced by different income groups in America. Echoing Skocpol (2000), they categorize the income groups as: professional- managerial, low income, and working families or "the Missing Middle".

parents' labor force participation and family life satisfaction. In response to the growing concern over women's low labor market attachment, compounded by low total fertility rates and an aging population, the Korean government has introduced reforms between 2009 and 2013 that expanded the childcare subsidy across all income groups. Fully subsidized childcare was made available by 2012 to all parents of children aged 0 to 5. By 2013, it was extended to parents of 3- and 4-year-old children. Partial childcare subsidies for 5-6 year olds became available by 2012.

I apply a non-temporal difference-in-differences model to analyze the effect of the reform on parents' employment outcomes. South Korea has a centralized governance structure, and generally there is not a variation in the timing of the rollout of a large-scale program like this one across geographical boundaries. Because tuition coverage varied by child's birth cohort and eligibility thresholds, I use these two dimensions as the two sources of the identifying variation to implement difference-in-differences regression models. To do so, I determine each household's annual eligibility as well as annual tuition coverage rate using a nationally representative panel data set that provides rich information on household income and assets.

To the best of my knowledge, the present study is the first to estimate the causal impact of the large-scale South Korean reform. There are only a handful of countries around the world that have enacted nationally-mandated universal childcare to begin with, and the past studies that examined the effect of universal childcare were conducted in the context of traditionally strong welfare states such as Norway, Germany, France, and Canada where female LFP tend to be high compared to other countries. Few studies such as Nollenberger and Rodrıguez-Planas (2015) have analyzed the maternal employment effect of universal care in the context of low female LFP. The present study adds to this small but growing body of international literature.

2 Literature Review

2.1 Past Research on Universal Childcare

Past studies on the effect of universal childcare programs on maternal employment can be traced to research on the impact of childcare subsidies, which are generally thought to increase a parent's work incentive by lowering the cost of employment (Blau 2003). See Choi and Jung (2017) for a review of prior literature on childcare subsidies and expansion of public schooling.

It is worth mentioning that in the United States public day care has been negatively associated with welfare, which in turn has hindered the establishment of a publicly available universal program that other developed countries around the world have adopted (Morgan 2001; Skocpol 2000). The current American system consists of two major types of programs: tax credits such as the Dependent Care Tax Credit (DCTC) that subsidize private day care for the middle class families and targeted childcare subsidies/preschool for lower income families such as Head Start (McCabe and Popp Berman 2016; Morgan 2001). Morgan (2001) explains that such a bifurcated structure is a product of the political environment of the 1960-70s; a bipartisan coalition that was formed to sponsor a bill that would establish universally available day care system was eventually

unsuccessful, disintegrating over ideological and racial tensions; instead legislators relied on tax code to extend childcare tax credits, which provided a less controversial means deliver childcare support.[2]

Previous evaluation studies, which often examine policy innovations enacted in countries outside the U.S., have produced generally positive but still mixed results on the maternal employment effect. Baker et al. (2008) examine Quebec's 1997-2000 expansion of full-time kindergarten to all 5-year-olds and its universal childcare program available to all children under age 4 at an out-of-pocket cost of $5 per day. Goux and Maurin (2010) investigate France's introduction of publicly financed pre-kindergarten in the mid-1990s that extended enrollment to children as young as 2-3 years old. Nollenberger and Rodrıguez-Planas (2015) study an early 1990s reform that led to a large-scale expansion of full-time pre-kindergarten for 3-year-olds in Spain. Berlinski et al. (2011) explore an Argentinian preschool reform in the early 1990s and Schlosser (2005) looks at the case of Israel's 1999 policy change. Bauernschuster and Schlotter (2015) consider a German preschool expansion that took place in 1996. To elicit a causal relationship, these studies either exploit the individual countries' age cut-off rules or the geographical variation in the administration of the policies. All of these studies generally find an increase in women's employment from children's enrollment in preschool; the local average treatment effect sizes vary from a 5 to 14 percentage point increase in maternal labor force participation.

However, not all studies have generated such substantial effects. The effects of universal childcare have also been found to have little influence on maternal employment. Havnes and Mogstad (2011) examine the effect of the 1975 Kindergarten Act, which introduced a staged expansion of universal childcare to 3-6-year-olds in Norway, a country that is known for have the most generous family policies. Despite a strong correlation, they find almost no causal impact of childcare and maternal labor supply. It has to be noted though that the study period were the years that immediately followed the reform when childcare coverage was relatively low (e.g. below 30%) and childcare slots were heavily rationed. Unlike Gelbach (2002) whose work using the 1980 Census offers evidence of the significant maternal labor supply effect on children's public kindergarten enrollment for both married and single mothers, Fitzpatrick (2010) finds that married mothers living in Georgia in 2000 did not change their employment behaviors when the state's universal prekindergarten program was implemented. She concludes that pre-kindergarten enrollment no longer has a bearing on mothers on the margin between participating and not participating in the labor force because mother's LFP rates in 2000 was already high compared to those in 1980, the study setting for Gelbach (2002).

This mixed set of evidence can be due to any number of reasons. For example, as Fitzpatrick (2010) points out, the composition of population studied may be different. Differences in institutional settings, study periods, or economic climates can also lead to different behavioral responses. Nollenberger and Rodrıguez-Planas (2015) observe that few studies have analyzed the maternal

2. She argues that tax deductions are designed benefit families in the middle or upper-middle income group. See Morgan (2001) for the origin of the current configuration of American childcare policy.

employment effect of universal care in the context of low female labor participation, low labor demand, and inadequate formal care arrangements. More research that examines universal childcare in different contexts is needed before an academic consensus is reached. The present study adds to this recently growing body of international literature. To the best of my knowledge, the present study is the first to estimate the causal impact of the childcare reforms that recently took place in Korea.

In South Korean literature, researchers seem to agree that there is a lack of research on the topic (Park et al. 2009; Kim and Hong 2013). Kim and Hong (2013) provide a comprehensive review of past studies. Lee (2014) is the single study I could find that utilizes a quasi-experiment design. Using the National Survey of Childcare and Education, Lee (2014) studies the impact of childcare subsidy reforms for 0 to 2-year-olds between 2009 and 2012. The study finds no effect on maternal labor supply.[3]

3 Universal Childcare Reform

3.1 Expansion of Childcare Subsidies

Of particular growing social concern in South Korea are women's low labor market attachment, low total fertility rates, and an aging population. The official childcare policy guidelines clearly reflect the Korean government's major efforts to address to these issues – the stated objectives of the universal childcare reform intend to improve women's LFP by lowering the cost of childcare, reverse the declining trend in fertility, and provide high-quality care and education to young children (Ministry of Health & Welfare 2009-2013)[4].

The central government enacted a series of expansions between September 1, 2009 and 2013, which rapidly universalized childcare[5]. Eventually, the existing childcare subsidies were extended to all parents of 0 to 4-year olds by 2012-2013; all parents of this age group were eligible to receive full tuition coverage for formal childcare services. In 2012, every parent of kindergarten-age children (i.e., ages 5-6) were eligible for partial tuition coverage independent of their income. This final part of the expansion process was announced early 2012 and implemented rather swiftly, most likely due to political factors.

3. The author's treatment group is 0 to 2-year-olds and the comparison is 3-4-year-olds. However, the childcare subsidy was also expanded for the latter group and thus the author does not seem to present the comparison groups in a convincing manner.

4. See also the following comment made by the Welfare Minister at the outset of the reform: "The development of childcare policies have centered on accommodating changes in social environments due to women's labor force participation. For 0 to 2-year-olds, it is up to the parents to decide whether to enroll them at daycare or raise them at home, but the government determined that daycare is better to help women with employment." – Chaemin Lim, Minister of Health and Welfare, at press briefing on January 18, 2010 (Transcript available at: https://www.yna.co.kr/view/AKR20120118083600002)

5. In 2004, the government implemented subsidized childcare for households with incomes near or below the poverty line; households with 120 percent or less of the poverty threshold had 100 percent tuition of daycare covered for their 0 to 6-year-old children. Partial coverage was made available for other low income households. Households with incomes close to the poverty threshold received partial coverage that range from 20 to 80 percent for 0 to 4-year-old children. This group did not receive a kindergarten subsidy.

In Figure 1, I present a visual summary of the universalization process. I divided children's age into three groups by the timing of the expansions: ages 0 to 2, ages 3 to 4, and age 5. Note that 6 year old children that did not enroll in the primary school are also included in this age 5 group per official policy guidelines.

Essentially, the subsidies were offered on a sliding scale by eligibility thresholds and by child's age until the full expansion took place in 2012-2013. Whereas the pre-reform subsidies served as a welfare program for low income families whose household income fell below or was slightly above the poverty threshold, the reform extended the subsidies to the middle class and subsequently to the rest of the income distribution.

In this figure, the tuition coverage is expressed in terms of percentages as in parts (a), (b), and (d). Note that Childcare Guidelines does not publish the tuition coverage rate (%) for 5-year-olds, only subsidy levels are provided likely due to political factors. This probably reflects the fact that the kindergarten program remains highly controversial because tuition has never been fully covered although the government initially advertised it as "free." Initially the subsidy was supposed increase substantially each year, but this has yet to take place. Based on a government report that published the average tuition levels in the study period, I converted the subsidies into percentages (Ministry of Health & Welfare 2012).

Because to the uncertainty surrounding the exact scope of the beneficiaries and the plan's rapid expansion especially in 2012-2013, the reform was arguably an exogenous shock from the viewpoint of individual families. In May 2009, about a year into the then-newly elected conservative Lee's presidency, a new mid-to long-term childcare plan, I-Sarang Plan, was announced and took into effect in September in the same year. The major goal was to include more middle class families. Revisions followed annually afterwards and the plan back pedaled on numerous occasions. In the first few revisions that were subsequently produced, any plans regarding full universalization were not documented at all. The I-Sarang Plan superseded another long-term plan that had been set in place until 2010 by the previous progressive administration. Earlier official policy documents do not mention any plan to universalize the policy.

Figure 2 shows that public expenditures in in early childhood education grew substantially over the reform years. Both the central government and local governments make a contribution. The total spending by both the central and local governments more than doubled. Most of the growth came from local governments; about 60% of the contribution is made by regional governments and their expenditures surged about five times. The central government's spending increased two and half folds, most of which was driven by childcare subsidies. According to OECD statistics, Korea spent $5,200 per child in 2013, which places itself above the EU average, after the Scandinavian countries, Luxembourg, France, and Netherlands[6] (OECD 2017).

6. Norway and Luxembourg spent about $11,300 per child, France $6,800, and Netherlands $5,400. The EU average was $4,500 per child

3.2 Eligibility Rules

Before the subsidies became universalized, parents' eligibility was determined by threshold schedule that changed each year. A set of thresholds were placed over a range of values determined by a formula that combines household income, assets, and debts. I will henceforth call it "income/assets". More specifically, it is a combination of earnings and assets where the latter consists of the net value of assets – after region-adjusted basic deductions and debts are accounted for – and are then multiplied by an assortment of adjustment rates. This conversion scheme essentially annualizes the net value of assets and produces a combined monthly value of income and assets. In Table A1 in the appendix section, I provide a brief overview of the formula[7]. (Ministry of Health & Welfare 2009-2013).

I present the eligibility threshold schedules that I gathered from the annual Childcare Guidelines in Table A2 in appendix. The thresholds divide the household "income/asset" levels into the following categories: 30th, 50th, 60th and 70th "percentile" groups. It is important to note that these groups are decided on a rather arbitrary basis and does not reflect the actual percentiles over a representative distribution. As an illustration, I provide the distribution of "income/assets" from my sample for 2009 in Figure A1 along with the eligibility thresholds for that year. Each bar in the figure represents a centile and thus it is easy to see that the thresholds are placed lower spots on the distribution than the actual percentiles from the sample. Thus far I have not come across studies or policy documents that discuss the selection process of the threshold schedules and how they are compare to the universe of "income/assets".

In adddition, the schedule changed every year in a somewhat unpredictable manner. For example, the thresholds remained exactly the same in 2009 as the previous year. In other years, however, the thresholds changed by 9 to 37 percentage points. This suggests that it would have been difficult for parents to predict how the thresholds might change in relation to their income, assets, and debts.

Because of the deductions and adjustments made to various components of their assets and debts, it is likely to have been difficult for parents to estimate their household "income/assets" level. Even if they estimated their household's "income/assets", say from the previous year's receipt of the subsidies, thresholds changed almost every year. Therefore, it would have been difficult to determine the level of eligibility until the subsidies became universalized.

The application procedure for the subsidy is as follows: parents submit an application at a local district office or social welfare desk online, which gives designated administrators consent to access the national database[8] of individual taxpayers and households created to accurately determine a family's eligibility for various government programs for efficient service delivery. The most recent "income/assets" information from the past 3 to 6 months is applied to determine eligibility. Once

7. Huh et al. (2013) provides a more detailed overview and history as well as an evaluation of the current conversion regime.

8. Social Security Information System (SSIS) integrates income and asset data from various government agencies such as the National Health Insurance Service, National Pension Service, National Tax Service, and Employment Agency for the Disabled.

determined, parents receive a voucher in the form of a credit card, which can be used at childcare centers or kindergartens.

3.3 Provision of Childcare

The formal childcare and kindergarten education is a unique mixture of private and public provision and price is heavily regulated by the central government. The central government uniformly determines tuition levels each year, which effectively creates price ceilings. Most formal childcare and kindergarten education is administered by private providers. About 5 to 7 percent of the daycare and pre-K services are provided publicly and about 50 percent for Kindergartens[9] (Ministry of Health & Welfare 2016).

In general, publicly provided services are thought to be of better quality, but private providers form powerful interest groups to show strong opposition to the expansion of public childcare programs. To account for the quality differences, the government has established the common curriculum for 3 to 5-year-olds known as "Nuri Curriculum" and has provided subsidies to daycare centers and private kindergartens since 2006[10]. The subsidy level paid directly to daycare providers by the government had remained constant in the reform period (Cho 2008; Ministry of Health & Welfare 2009-2013).

4 Data

4.1 Korea Welfare Panel Survey (KOWEPS)

The main source of data came from the Korea Welfare Panel Survey (KOWEPS). A nationally representative sample of 7,072 households were first surveyed in 2006 and have been interviewed annually since. As of spring 2019, the most recent survey year available is 2016. The survey focuses on collecting information on the utilization of social services and welfare programs.

The data's major strength is its richness in respondents' income and asset information. The survey makes available most of the information that is required to estimate households' eligibility groups gauge eligibility during the reform period. More than 40 variables can be matched to the broad "income/asset" formula scheme given in Table A1 required to determine household eligibility. The survey is one of the few data sets available that provides earnings and wealth information at this detailed of a level[11]. Finally, the earnings and wealth information is self-reported. The enumerators interview respondents in May or earlier, right before tax returns are due each year to minimize any recall bias.

9. Public schooling begins with primary school and neither kindergarten nor pre-kindergarten are mandatory.
10. See Cho (2008) for a detailed discussion this specific feature of the childcare market.
11. The other data set that provides income and asset information is the National Survey of Tax and Benefit (NaSTaB). I have determined that KOWEPS provides important advantages relative to NaSTaB. First, the former contains more information that is required to calculate "income/asset." Second, the former offers relatively a larger sample size than the latter; the number of households with youngest child under age 5 is about 400 per year. I contacted government organizations such as National Health Insurance Sharing Service and National Pension Service and was informed that access to information on income and assets is not granted at all.

4.2 Summary Statistics

I use the data from the 5-9th waves, which contain information from 2009 to 2013. I restrict my sample to two-parent families with at least one child; each child is between the ages of 0 and 17[12] over the reform period, 2009-2013. This restriction provides me an unbalanced panel with 1,940 households and 6,110 observations for 5 years.[13]

I provide descriptive statistics in Table 2. I divided my sample families into two groups. In the first group, the youngest child was aged 0 to 5 during the reform period. This group includes 1,089 individuals and 3,380 observations. I focused on the youngest child since I may be introducing endogeneity if there were any younger children present other than the one I am referencing. In the second group, the youngest child and the siblings, if they were any, were aged 7 to 17 (i.e. born 1990-2000) during the reform period. The second group has 851 families and 2,730 observations.

In the surveys, families with young children were asked about childcare costs, childcare subsidy utilization, and the amount of receipt related to the reform. I reported their response in Figures 2-4. When compared to the institutional features of the reform described in the earlier section, they can serve as a quality check for the data.

A couple of interesting points emerge from these figures. First, monthly childcare costs decreased by 35 percent from 2009 to 2013 (Figure 2a). The drop is larger for 0-2 year olds than other ages, which is consistent with an earlier study that showed that the reform was most successful for 0-2 year olds in terms of cutting childcare costs. In contrast, there is little change for 5-year-olds, which probably reflects the fact that tuition coverage has remained low. Second, Figure 3 shows that subsidy utilization almost doubled overall from 45 to 80 percent and the rate remained at a similarly high rate after the reform had ended. When broken down by age group (Figure 3b), utilization rates for infants (ages 0-1) are lower than other ages, which reflects parents' strong lack of preference for daycare centers. Figure 4 shows that the amount of annual subsidy receipt increased by almost six fold over the reform period. The increase is larger for 1 to 3-year-olds and is lowest for 5-year-olds. When subsidy receipt and utilization (Figures 3c and 4c) are broken down by "income/asset group", the rates for higher "income/assets" groups increased more slowly since these groups became eligible at a later time in the reform period. Although not reported in this paper, the reform was highly popular among parents of young children; 90% reported they are satisfied.

5 Research Design

5.1 Non-temporal Difference-in-Differences

In a hypothetical, idealized experimental setting in which varying levels of childcare subsidies were randomly given to different groups of families in the population, then a simple difference in group means in maternal employment would produce an average treatment effect. This is not how

12. Ages 18 is the final year of secondary education.
13. I use the income and asset information from the 2008 survey to estimate eligibility in 2009.

the universal childcare reform unfolded in 2009-2013 even if there were some features that might have constituted an exogenous shock from the viewpoint of individual families.

Because the reform was a staged expansion process between 2009 and 2013, each birth cohort from a particular "income/asset" group were eligible to receive a unique sequence of tuition coverage for formal childcare services. I further detail this institutional feature in Table A3 in appendix.

Below I provide a stylized summary in a 2×2 table that characterizes the families that were affected by the reform. The table is divided by "income/assets" and child's birth cohort, the two dimensions along which the expansion process was implemented. Along the first dimension, I group families into "low" and "middle/high" "income/assets." Because the reform essentially transformed a welfare program designed for low-income households into a broad-based one that included both middle-class and other high-income households ("middle/high"), "low" households were not affected by the reform since they were previously recipients of childcare subsidies. Along the second dimension, I divide households into "young" and "old" by child's age. If the youngest child's age was between 0 and 5 during the reform, the family would be grouped into "young." If the child's age is over 7, the family is included in "old". Because the child in the latter group was too old to receive childcare subsidies, this group was not affected by the reform. Only the households that fall into both "young" and "old" became new recipients through the expansion process and thus were affected by the reform.

Table 1: Stylized View on the Type of Families Affected by the Reform

		Eligibility group	
		Low	*Middle/High*
Child's age in year t	*Young*	Already eligible	Affected
	Old	Not Affected	Not Affected

Figure 1 shows that the level of the subsidy varied by eligibility thresholds and a child's age. Therefore, eligibility groups and child's age in year t are the two sources of identifying variation that are used to estimate the effects of the reform. To evaluate the effect of the reform, I implement a non-temporal difference-in-differences research design (henceforth DiD) in a panel data framework. The more typical state and year difference-in-differences research design is not applicable to South Korea's centralized governance structure. This design addresses endogeneity that arises when estimating the effect on maternal employment from the decreased cost of childcare; mothers (or parents) usually make decisions on childcare and employment simultaneously.

Because the effect of the reform will be identified off of "income/assets" groups across birth cohorts, the primary specification is as follows:

$$Y_{icgt} = \theta_c + \theta_g + \theta_t + \beta \times \widehat{coverage}_{ctg} + \theta_i + X_{it} + \epsilon_{igct} \tag{1}$$

where for person i, whose youngest child was born in birth cohort c, in "income/assets" group

g, and in year t between 2009 and 2013. Y_{igt} is an outcome of interest such as parents' labor market participation, wages, or family life satisfaction measures. The treatment represented by $\widehat{coverage}_{ctg}$ is each household's eligible tuition coverage rate by the youngest child's cohort and eligibility group, and over time.

The panel feature of my data allows to accounts for endogeneity by including a full set of eligibility groups and birth cohorts as well as individual fixed effects. The fixed effects expressed as θ_c, θ_g and θ_i are differenced out using the vectors of a child's birth cohort, eligibility group, and individual heterogeneity. The parameter of interest is β and ϵ_{igct} is the error term. The coefficient β is the average effect of the reform on those families that received any tuition coverage. Covariates, X_{it} include the following variables: the number of children, a binary indicator of whether there is at least one co-resident grandparent, and a binary indicator of whether the family lives in an urban or rural place. Year dummies, θ_t are included not only to control for macroeconomic factors, but also to account for the fact that childcare cash allowances[14], which had been previously available only to low income households, were extended across all income groups in 2013.

The identifying assumption implies that in the absence of reform, the potential outcomes are mean independent of the actual implementation status of the reform, conditional on θ_g and θ_c, which is commonly known as the parallel trends assumption. This is not a testable assumption. I account for any remaining group-specific and time-varying confounders at the *eligibility group*×*year* level.[15]

5.2 Defining Treatment: Tuition Coverage Rate

My research design requires determining tuition coverage, $\widehat{coverage}_{ctg}$, each household was entitled to receive between 2009 and 2013. To estimate the eligible coverage rate, I first evaluated each household's "income/assets" level based on the information available from KOWEPS.

I then determined each household's eligible group for a given year based on the published thresholds Table A2. The thresholds divide households into the following: 0-30th, 30-50th, 50-60th, 60-70th and 70-100th groups. When the subsidy was further extended to a certain percentile group, then any threshold below that group was no longer published. The yellow highlighted cells in Table A2 indicate that they were originally left empty for the same reason. For estimation purposes, I computed the hypothetical threshold numbers by adding the year-to-year differences in other income groups.

Then I evaluated the eligibility group for each household. It was jointly determined each year by family size and "income/assets" levels. I used the previous year's "income/asset" to compare against the thresholds in a given year to determine which group each household belonged. This was done for two reasons. First, parents could apply for the subsidy any time in a given year, but eligibility was determined by information available in the past 3 to 6 months.

14. Since 2013, any parents who decides not to use formal childcare are eligible for childcare allowances.

15. My estimates are robust to the inclusion of this interaction. I do not examine the *"income/assets"*×*year* level because its variation is at the level of the treatment and would soak much of the variation.

Second, contemporaneous earnings and assets can be endogenous to the main outcome of interest, employment. In sum, each household's group for a given year t can be summed as follows: $Eligibilitygroup_t = f(Eligibilitygroup_{t-1}, familysize_t, threshold_t)$. Finally, I predicted a household's tuition coverage rate, $\hat{coverage}$, for a given year per Figure 1. As can be seen, tuition coverage varies by age group (e.g., ages 0 to 2, 3 to 4, and 5), eligibility thresholds, and over time.

6 Results

Tables 3-9 report estimates of β from the non-temporal DiD regression with respect to a variety of outcomes including parental employment, work hours, wages, childcare costs and family life satisfaction. The dependent variables are indicated in the panel headings.

6.1 Effects of the Reform on Parent's Work and Wages

Tables 2 and 3 report linear probability model estimates of the effects of universal childcare reform on parents' employment.[16] The standard error of the effect estimates are adjusted for heteroskedasticity and autocorrelation. It is well-known that nominal standard errors are underestimated in DiD regressions when within-cluster error correlation is not controlled. Because the number of clusters in this study is small (i.e. there are 5 "income/asset" groups and 22 birth-year cohorts.), I did not use a variance matrix that allowed for clustering at the "income/asset" group or a child's birth cohort level. I address this issue further in Section XX.

In Table 2, Column (1) reports estimates from equation (1) for mothers, but without individual fixed effects. The regression implies that the reform increased maternal employment by 7.1 percentage points. When unobserved individual heterogeneity is accounted for in Column (2), the effect size is reduced to 6.1 percentage points. The statistical significance is retained. A 6-percentage points increase is substantial given that only 42.3% of mothers with young children were employed between 2009 and 2013 (Table 1).

Table 3 reports estimates from the models on fathers' employment. As a comparison, individual fixed effects are not included in Column (1) but are included in Column (2). In either column, the coefficients are close to zero and statistically insignificant. We could view these coefficients on fathers as placebo estimates. These contrasting results between women and men are plausible given that the trends in male LFP rates across different age groups remained fairly stable whereas female LFP rates increased substantially during the reform period for ages 30 to 34 in particular. This can be seen in Figure 6. The figures are based on macro labor statistics available from the Economically Active Population Survey (EAPS). In Figure 5, women aged 30 to 34 experienced a substantial gain of 6.6 percentage points in LFP (i.e. from 50.1 to 56.7). Given that the average age of mothers in the sample whose youngest child was aged 0 to 5 was 34, the estimates reported in

16. I follow the usual definition of employment used in government statistics: employment includes anyone who worked for pay or profit or participated in a certain numbers of hours of unpaid work in a family operated business. The reference period in the survey was the last day of each year.

Tables 2 and 3 seem to agree with the official labor statistics.

In Columns (3)-(7) in Tables 2 and 3, I divide the sample by education levels or the number of children. Fathers do not show any heterogenous response when grouped either way. On the other hand, the employment response is notably large (i.e. a 7.2 percentage point increase) for women with some college or less. In contrast, it seems the reform did not have any employment effect on women who are college graduates. This is consistent with the findings from Choi and Jung (2017) that mothers with relatively low levels of schooling tend to be more responsive to a child's school enrollment, presumably out of economic need. Because there is a strong cultural preference for mothers spending time with infants and toddlers, the number of high socioeconomic status (SES) mothers may be minimizing labor supply even if the opportunity cost of staying home increased from subsidized formal childcare. When I regroup the sample by spouse's level of education, the same pattern is preserved for both women and men (not shown in Tables 2 and 3). The high rate of educational assortative marriage makes this result plausible.

When the sample is divided by the number of children, women with either one or three or more children responded strongly to the reform. Receiving full-tuition coverage resulted in a 7.3 and 13.5 percentage points increase, respectively, in maternal employment for these two groups. In my data, the number of children and household income assets do not seem to be correlated (i.e. correlation is 0.009)[17] and I am cautious to make the same argument I made about education levels since having more than two children does not seem to be related to SES. It could be that mothers with three or more children decided to work due to the lowered cost of childcare and because they did not expect to have another. Perhaps the same explanation can hold for mothers with one child since the recent fertility rate is about 1.2 births per woman.

Tables 5-6 present estimates of the effects of the reform on parent's hours of work. In Column (1), the coefficient on the treatment variable indicates that women increased their relative hours conditional on working by 138.9 hours, which is equivalent to 3.5 weeks based on a 40-hour work week. I look at total hours (i.e. including people who did not work as 0) and the coefficient decreases from 138.9 to 70.7 hours. This estimate is noisy and the statistical significance goes away. This seems to suggest that women who were already working increased their hours considerably whereas new participants in the labor force increased hours by a small amount. It is a well-known fact that women who experienced career interruptions from childrearing tend to work part-time or temporary jobs when they return to the workforce.

The same broad pattern emerges as I divide the sample by education levels or the number of children in Columns (3)-(8); women who were working previously worked longer hours whereas the new workers increased their paid work hours by only a small amount. In Column (3), the sample was restricted to women with education backgrounds of some college or less. Here women noticeably increased their relative hours by 224, which is roughly equivalent to 5.6 additional work eeks. Column (4) seems to suggest that total hours increased by 102.3 hours, which is about

17. In Choi and Jung (2017), the number of children and SES were strongly and negatively correlated (correlation was -0.46), but the study period was over the period spanned 980 to 2000.

2.6 additional weeks, but the coefficient is barely insignificant. College graduate mothers also increased their relative hours by 151.4, but this coefficient is barely insignificant. As in Table 2, another group that shows a strong work response is women with 3 or more children. The last column shows that these women increased total hours by 252.9, which translates to about 6.3 additional weeks. This is the only group that the effects on relative and total hours are not much different from each other. This seems to suggest that new workers in this group worked many more hours compared to others.

Table 5 reports the effects of the reform on father's hours of work. Column (1) suggests that men increased their relative hours conditional on working by 85.0 hours, which translates to 2 additional work weeks. In Column (2), the coefficient is reduced slightly from 85.0 to 66 hours, and the estimate is no longer statistically significant. Table 5 follows the same format as Table 4. The most notable pattern is that the large and statistically significant effects on both total and relative hours come from fathers who are college graduate (Columns (5)-(6)) and fathers with less than three children (Columns (7)-(8)). These two groups are roughly the same group of families whose coefficients for mothers were not statistically significant in Tables 4 and 2 assuming that the education levels of men and women divide the sample roughly the same. This seems to suggest that if women did not increase labor supply (as college graduates women or mothers with two children), then their spouse increased their hours. I do not have a good explanation about whether this is to compensate to hours not working when the opportunity cost of staying home has increased.

Tables 6 and 7 present estimates of the reform on parent's hourly earnings. For both men and women, it seems the reform did not change their earnings.

6.2 Effects on Childcare Costs

Tuition coverage for 0 to 2-year-olds are thought to be successful in defraying education expenses for families; using the National Survey of Childcare and Education, Lee et al. (2015) finds that the childcare costs of 0 to 2-year-olds have decreased from about $150 to less than $3 per month. However, some policy researchers argue that the current subsidy program for 0 to 2-year-olds is not economically efficient since the utilization rate is relatively higher than female labor force participation. Park et al. (2009) and Kim and Hong (2013) note that the effect on maternal employment effect has been low and asked researchers to examine this topic. It is in this spirit the present study puts forth its research question. This study may inform current policy debates in thinking about the effectiveness of subsidies that are no longer means tested; the debate continues to this day that about the heavy burden the funding scheme for childcare subsidies places a heavy burden on local governments.

6.3 Effects of the Reform on Family Life Satisfaction

I take advantage of emotional well-being variables that are available from the KOWEPS data. This line of inquiry echoes Glass et al. (2016), in their comparative study of 22 OECD countries, who argue that child-care is a stressor, but the level of stress or happiness changes by the degree

of generosity of work-family policies. There are three measures of family life satisfaction that participants were asked to answer using a on a seven-point scale, from highly unsatisfied to highly satisfied. I recoded them as binary variables where the value was 1 if they answered satisfied in some way. The three measures are: "Satisfied with overall family life"; "Satisfied with relationship with spouse"; and "Satisfied with relationship with children." Tables 8 and 9 report the effects of the reform on these outcomes.

Table 8 suggests that the reform had small but positive effects for mothers; receiving full-tuition coverage increased satisfaction with overall family life and on the relationship with their spouse by about 4 percentage points. Given that about 80% of mothers with children aged 0 to 5 answered they were satisfied with family life (Table 1), this is a modest change. Column (3) reports that college graduate mothers' overall family life satisfaction rose by 10.3 percentage points. The largest gain is shown among this group mothers which is interesting to note because this group previously showed little work response in terms of employment and hours. Perhaps this is because increased formal childcare utilization relieved them from care-related stress.

Table 9 suggests that the reform also had small but positive effects on overall family life satisfaction for men. Similar to women, the largest gain is among fathers who showed little response in employment and work hours. In this case, the corresponding group is men with three or more children. Column (5) suggests that these men's overall family life satisfaction rose by 10.7 percentage points. It seems that the reform had an impact on emotional well-being measures, but the effect was also mediated by hours of work.

6.4 Effects of the Reform by Child's Age Group

In Table 10, I explore whether the reform had differential effects on the outcomes according to child age group. The sample is restricted to parents with children aged 0 to 5, and I divide child's age by 0 to 2, 3 to 4, and 5. The reference group is 0- to 2 year olds. The differential effects compared to this reference group is the sum of coefficients on the interaction term and on the corresponding age group dummy variable. Column (1) reports that compared to mothers of 0- to 2 year olds, receiving fully subsidized childcare increased employment by 7 percentage points (i.e. 0.010-0.033) for mothers of 3- to 4- year olds. In addition, receiving a kindergarten subsidy (which covers about 50% of tuition) actually decreased employment for mothers of 5-year-olds by 3 percentage points (i.e. (-0.120+0.058)/2). Column (3) reports that compared to mothers of 0- to 2-year olds, total hours increased by 57.4 hours (i.e. 142.038-212.64) for mothers of 3- to 4-year olds, which is roughly equivalent to working 1.4 additional weeks. In contrast, total hours decreased by 157.4 hours (i.e. -212.640+55.258) for mothers of 5-year-olds compared to mothers of 0- to 2-year olds. This is perhaps not surprising. As discussed in Section 2.2, the kindergarten subsidies covered only about half of the average tuition and thus the reform might not have reduced the cost of kindergarten enough for mothers of 5-year-olds to increase labor supply.

Column (5) reports that compared to fathers of 0- 2-year olds, receiving 50% subsidized childcare increased employment by 1.7 percentage points (i.e. (0.096-0.062)/2) for fathers of

5-year-olds. Further investigation shows that the gain comes from fathers with less than three children, similar to Columns (7) and (8) in Table 5.

This was especially controversial because of its timing; this gave people an impression that the incumbent administration and was trying to attract votes in the time leading up to the 2012 presidential election.

7 Conclusion

South Korea is among a handful of countries that have implemented universal childcare, but to the best of my knowledge, no previous studies have examined the causal impact of this recent reform. This paper evaluates the effect of the universal childcare reform on parents' employment, hours of work, wages, and family life satisfaction. My findings suggest that the universal childcare reform increased maternal employment by 4 percentage points. In contrast, the reform did not change paternal employment. These results seem to be aligned with the official labor statistics that show that during the reform period women between the ages of 30 to 34 experienced a substantial gain in labor force participation whereas LFP trends for men across prime working age groups remained stable.

Moreover, women with relatively low levels of schooling (i.e. some college or less) showed a statistically significant and substantial employment response whereas women with relatively high levels of schooling did not have any. This is consistent with the findings from previous studies such as Choi and Jung (2017) and Cascio (2009) that showed evidence that mothers with relatively low levels of schooling tend to be more responsive to a child's school enrollment, most likely out of economic need. Given that the subsidy utilization rate grew significantly over the reform period (Figure 3), it may be the case that because of the cultural preference for mothers to spend time with infants and toddlers, highly-educated or high SES women opted for formal childcare without necessarily increasing their labor supply.

For hours of work, both women and men increased their relative hours conditional on working, but the effects on total hours tend to be much smaller and statistically insignificant. This seems to suggest that parents who were already working increased their hours considerably as a result of the reform whereas new participants in the labor force increased their hours by a small amount. In some sense, this result is positive because the childcare subsidy might have reduced the cost of childcare for working parents to the extent that it led them to work more. But for stay-at-home mothers in high SES families, in particular, the reform might have merely led to a substitution of mothers' direct care with formal childcare without increasing their labor supply.[18]

When the differential effects of the reform were examined across child's age groups, it seems that the employment and hours response was largest among mothers of 3- to 4-year olds and smallest among mothers of 5-year-olds. This is plausible because the kindergarten subsidies covered only

18. Unfortunately the KOWEPS data does not provide information on parents' time spent on children; otherwise this point could have been empirically examined.

about half of the average tuition and the reform might not have made the cost of kindergarten substantially low enough for induce an increase in mothers of 5 year olds's labor supply. As seen in Figure 3, the subsidy utilization especially for infants are relatively lower than other ages and thus the subsidies did not exert an effect on maternal employment by means of lowering the cost of childcare.

Speaking narrowly from the point of maternal labor supply, these results seem to suggest that it may be more efficient to not extend the subsidy to families that have top income because their utilization of the subsidy may not lead to increased maternal labor supply especially if the mothers are not already working. That mothers of 3- to 4-year olds showed the largest employment and hours response suggests that spending more resources on programs for 3-to 5-year old children may be more efficient; mothers of 0-to 2-year olds may not prefer formal childcare over home/informal care enough to generate their employment response. Because the reform has generated an unprecedented level of mass utilization of formal childcare, future studies can examine the education outcomes of the children who received the subsidies from a young age.

Advocates of universal childcare tend to argue that although a broad-based program is more expensive, it can reach the targeted children from low income families better than the current targeted program can. They further claim that these children benefit from "peer effects" from having a more diverse group of classmates, which can lead to positive learning spillovers. The overall quality of the program would increase as the universal approach would remove the stigma linked to welfare and parents from higher income groups are likely to have more political power when demanding a higher quality care and education for their children (Barnett 2010).

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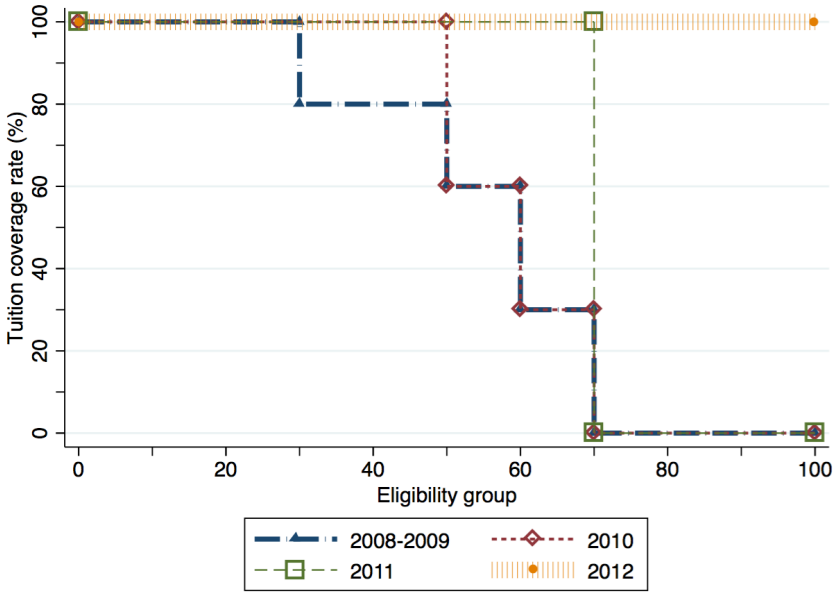
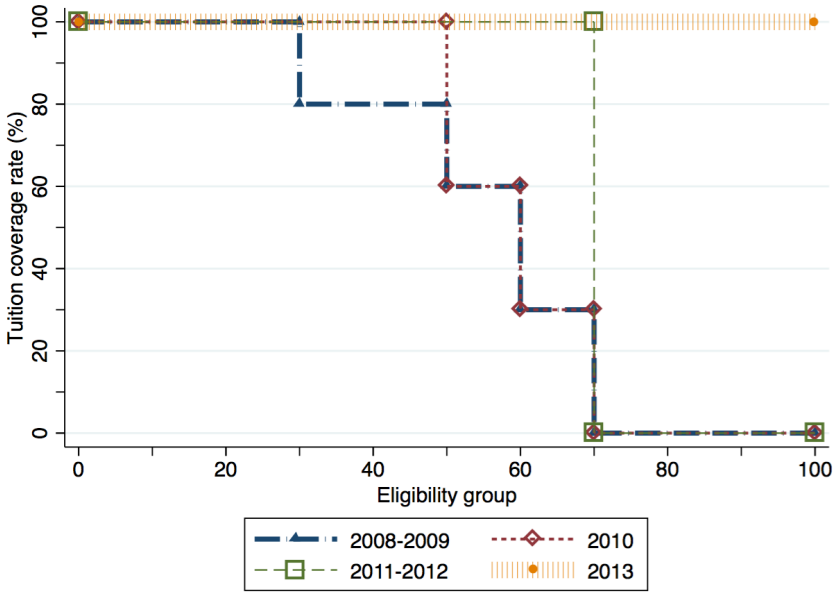
Figures and Tables

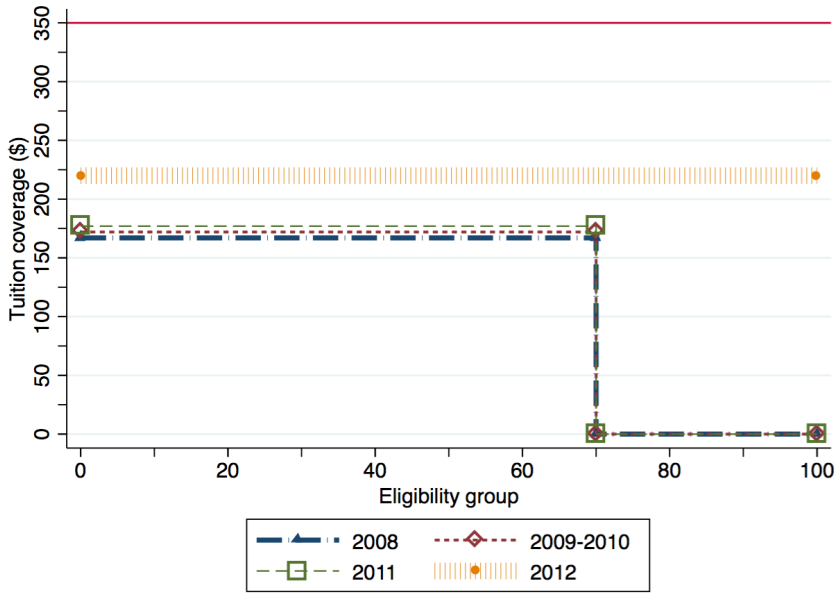
Figure 1: Public Childcare Expansion between 2009 and 2013

(a) Ages 0-2

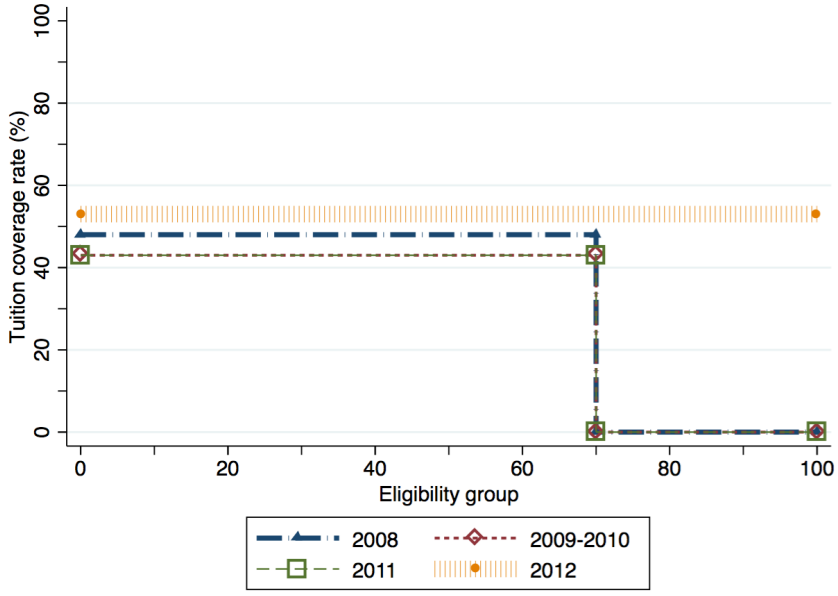


(b) Ages 3-4





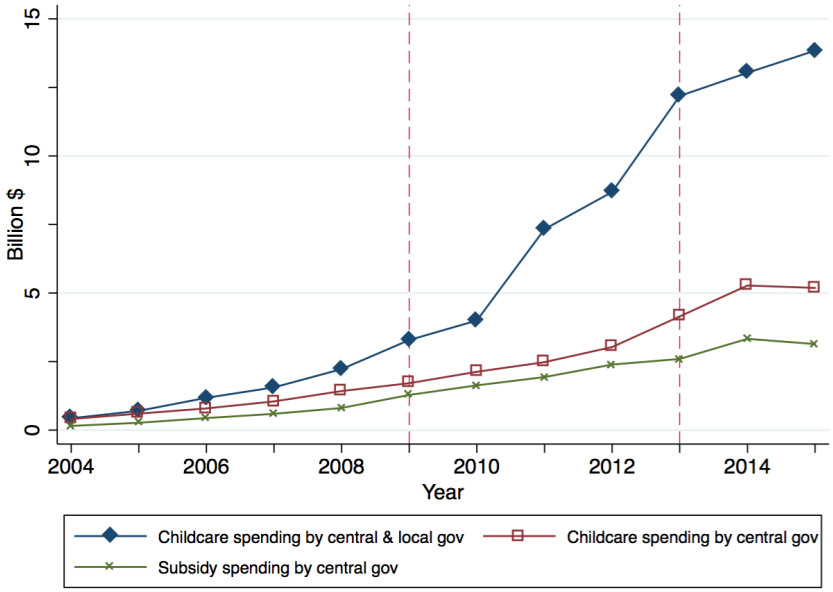
(c) Age 5 (in subsidy amount)



(d) Ages 5 (in subsidy rate)

Notes: Author's own visualization. Data from the 2008-2013 Childcare Guidelines.. In subfigure(c), the maximum y value of $350 serves as a benchmark to indicate the average tuition. In subfigure (d), I provide the subsidy levels in percentage by dividing them by the average; the Guidelines does not publish tuition coverage rate (%) for 5-year-olds unlike that for 0-4 year olds. For the ease of interpretation, I converted the annual subsidy amount to dollars at $\$1 = 1,000 KRW$. The USD is stronger and the actual dollar amount would be about 13% smaller than what is reported in this figure

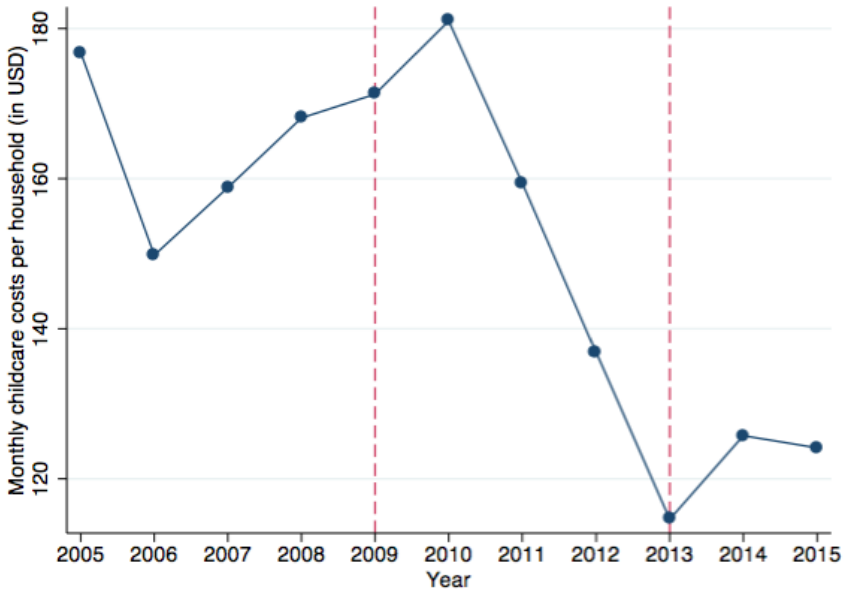
Figure 2: Public Expenditure in Early Childhood Education



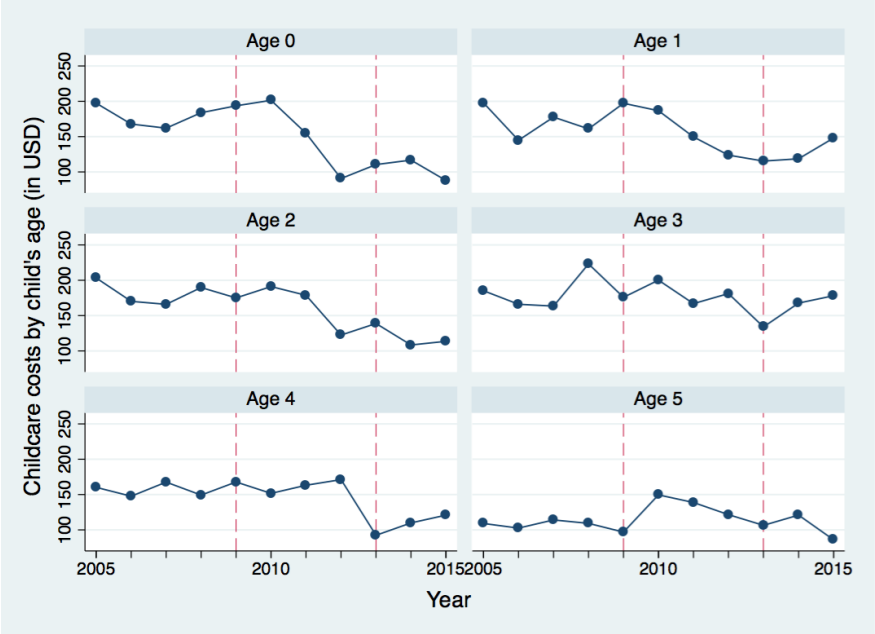
Notes: Data from Annual Childcare Statistics published by Ministry of Health and Welfare. The two dashed vertical lines indicate the reform period. For the ease of interpretation, I converted expenditures to dollars at $1 = 1,000 KRW. The USD tends to be stronger and the actual dollar amount would be about 13% smaller than what is reported in this graph.

Figure 2: Monthly Childcare Costs per Household

(a) 0-5-year-olds



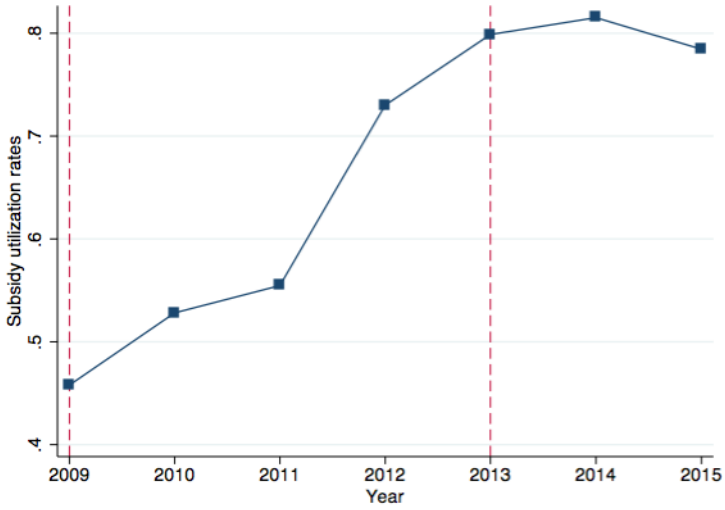
(b) By age group



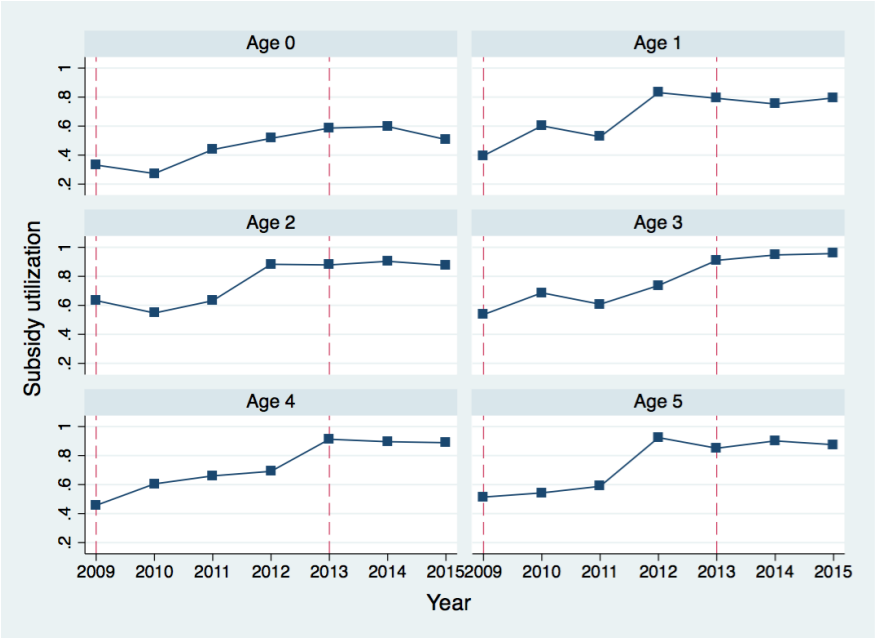
Notes: Data is based on the sample of two-parent families with the youngest children aged less than 19. The 2 red vertical lines indicate the reform period.

Figure 3: Childcare Subsidy Utilization Rate

(a) 0-5-year-olds



(b) By age group

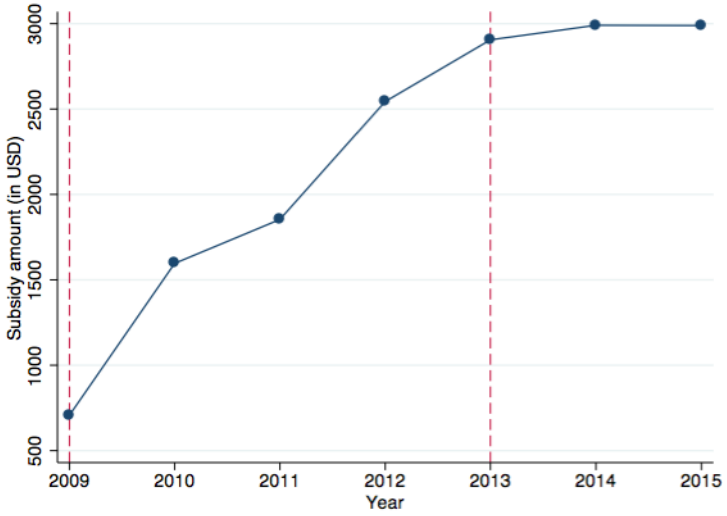


(c) By "income/asset group

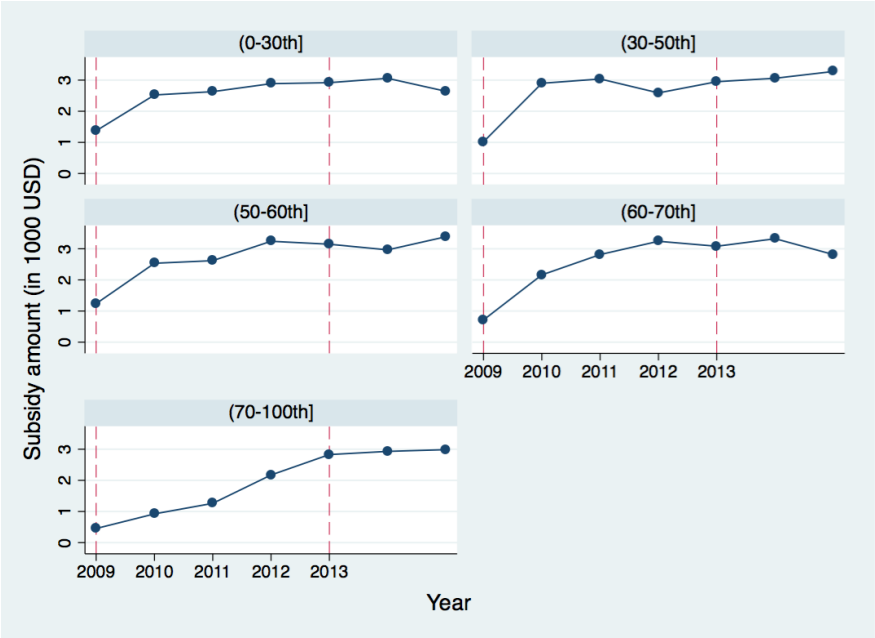
Notes: Data is based on the sample of two-parent families with the youngest child aged less than 6. The 2 red vertical lines indicate the reform period.

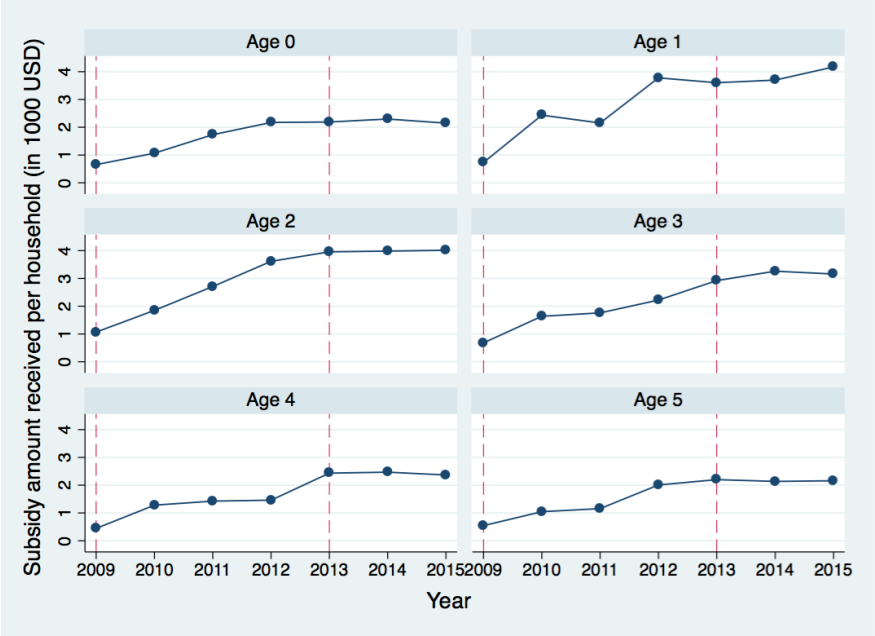
Figure 4: Amount of Childcare Subsidy Received Annually per Household

(a) 0-5-year-olds



(b) By "income/asset group



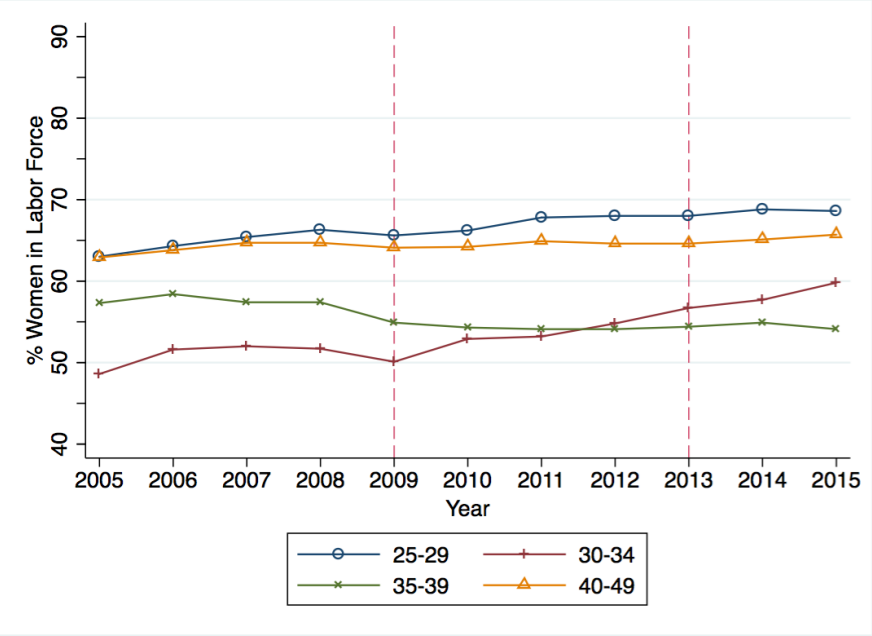


(c) By age group

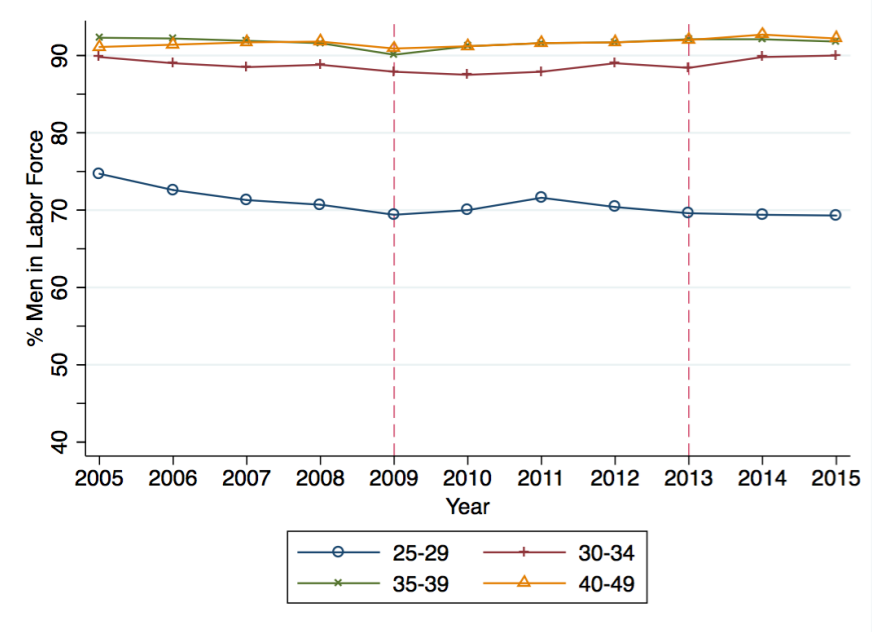
Notes: For the ease of interpretation, I converted the annual subsidy amount to dollars at $1 = 1,000 KRW (the actual exchange rates in the last 5 years have hovered between 1,010 and 1,250 KRW.). Data is based on self-reported values. Data is based on the sample of two-parent families with the youngest child aged less than 6. The 2 red dashed vertical lines indicate the reform period.

Figure 5: Labor Force Participation Rate by Sex and Age Using EAP Surveys

(a) Women's LFP by age group

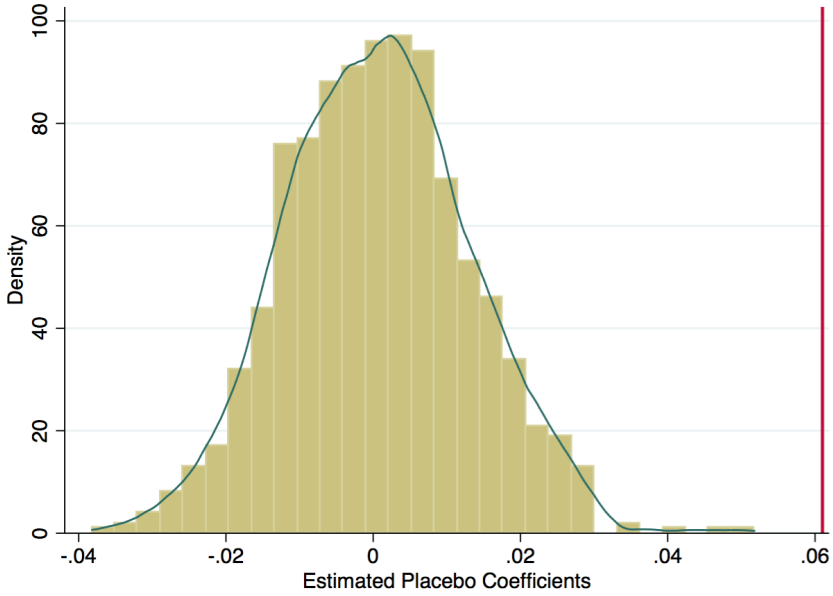


(b) Men's LFP by age group



Notes: Data from Economically Active Population Survey from 2000-2015. The 2 red vertical lines indicate the reform period.

Figure 6: Permutation Test



Notes: The graph presents a kernel density plot of the distribution of 1000 estimates of the effects of the subsidy expansion on maternal employment. The estimates are the result of randomly assigning tuition coverage after running the primary specification (including individual fixed effects). The red line refers to $\hat{\beta} = 0.061$ from Table 2.

Table 2: Summary Statistics for Parents with Children Under 18, 2009–2013

Variables	Youngest child age 0-5		Youngest child age 7-17	
	Mean	SD	Mean	SD
Mother				
Age	34.19	4.01	43.10	4.18
Education (years)	14.09	1.90	13.04	2.29
Employment				
Employed	0.42	0.49	0.68	0.47
Hours worked per day	7.89	2.56	8.75	2.76
Days worked per year	217.21	79.81	252.80	65.98
Permanent job	0.21	0.41	0.25	0.43
Temporary job	0.15	0.35	0.26	0.44
Self-employed	0.03	0.18	0.11	0.32
Family-operated enterprise	0.03	0.17	0.06	0.24
Annual earnings ($)	7,419.89	12,136.24	12,872.24	16,767.82
Satisfaction with family life scale				
Satisfied with overall family life	0.71	0.46	0.65	0.48
Satisfied with relationship with spouse	0.66	0.47	0.57	0.50
Satisfied with relationship with children	0.85	0.36	0.77	0.42
Father				
Age	37.41	4.69	46.28	4.17
Education (years)	14.37	2.14	13.58	2.74
Employment				
Employed	0.97	0.16	0.94	0.24
Hours worked per day	9.86	2.35	9.87	2.49
Days worked per year	265.51	42.50	263.65	52.49
Permanent job	0.68	0.47	0.55	0.50
Temporary job	0.13	0.33	0.16	0.36
Self-employed	0.16	0.37	0.23	0.42
Family-operated enterprise	0.00	0.05	0.01	0.09
Annual earnings ($)	38,105.89	23,829.87	40,472.19	34,602.66
Satisfaction with family life scale				
Satisfied with overall family life	0.80	0.40	0.69	0.46
Satisfied with relationship with spouse	0.80	0.40	0.69	0.46
Satisfied with relationship with children	0.88	0.32	0.76	0.43
Household				
Number of children	1.93	0.74	1.96	0.54
At least one grandparent	0.11	0.31	0.07	0.26
Resides in urban area	0.93	0.26	0.94	0.23
Annual earnings ($)	45,696.11	26,879.15	52,846.16	37,176.13
N	3,380		2,730	
# Households	1,089		851	

Notes: Data from the 5-9th waves of KOWEPS. The individual-level longitudinal sampling weight (i.e., *wsl*) are applied. *Hours worked* and *Days worked* were coded as 0 if the individual is not working. For the ease of interpretation, I converted earnings to dollars at $1 = 1,152 KRW. This rate is based on the average of annual exchange rates over 2009–2013, taken from the Federal Reserve Economic Data (FRED).

Table 3: Effects of Universal Childcare Reform on Mother's Employment

	Dependent variable: Employed (=1)						
	All women		Education		# Children		
			Some college or less	College graduate or more	1	2	3+
Coverage rate	0.071***	0.061***	0.084***	0.063*	0.052	0.034	0.132***
(SE)	(0.021)	(0.022)	(0.029)	(0.030)	(0.041)	(0.031)	(0.008)
"Income/assets" group fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Birth cohort fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual fixed effects	No	Yes	Yes	Yes	Yes	Yes	Yes
R squared	0.100	0.768	0.746	0.840	0.816	0.788	0.787
N	6,100	6,100	4,482	1,618	2,148	3,253	699
# Households	1,927	1,927	1,432	495	973	1,146	257

Notes: $***p < 0.01, **p < 0.05, *p < 0.1$. Heteroskedasticity and autocorrelation adjusted standard errors are used.
Covariates include: *number of children*, *at least one co-resident grandparent*, and *urbanicity of the region of residence*.

Table 4: Effects of Universal Childcare Reform on Father's Employment

	Dependent variable: Employed (=1)						
	All men		Education		# Children		
			Some college or less	College graduate or more	1	2	3+
Coverage rate	0.012	-0.006	-0.017	0.000	-0.014	0.001	-0.024
(SE)	(0.011)	(0.011)	(0.016)	(0.014)	(0.027)	(0.012)	(0.031)
"Income/assets" group fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Birth cohort fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual fixed effects	No	Yes	Yes	Yes	Yes	Yes	Yes
R squared	0.052	0.581	0.587	0.585	0.641	0.614	0.643
N	6,100	6,100	3,815	2,285	2,148	3,253	699
# Households	1,927	1,927	1,228	699	973	1,146	257

Notes: $***p < 0.01, **p < 0.05, *p < 0.1$. Heteroskedasticity and autocorrelation adjusted standard errors are used.
Covariates include: *number of children*, *at least one co-resident grandparent*, and *urbanicity of the region of residence*.

Table 5: Effects of Universal Childcare Reform on Mother's Hours of Work

	Dependent variable: Annual hours									
	All women		Education				# Children			
			Some college or less		College graduate or more		2 or less		3 or more	
	Hours > 0	Hours ≥ 0	Hours > 0	Hours ≥ 0	Hours > 0	Hours ≥ 0	Hours > 0	Hours ≥ 0	Hours > 0	Hours ≥ 0
Coverage rate	138.898*	70.703	224.041*	102.329	151.343	41.006	127.878	56.474	277.613	252.855**
(SE)	(78.708)	(50.179)	(116.956)	(64.170)	(102.887)	(75.679)	(87.351)	(55.391)	(233.000)	(129.197)
"Income/assets" group fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Birth cohort fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R squared	0.712	0.775	0.706	0.766	0.727	0.841	0.719	0.780	0.735	0.807
N	3,306	6,100	2,389	4,482	917	1,618	2,922	5,401	384	699
# Households	1,252	1,927	928	1,433	324	495	1,143	1,769	158	257

Notes: $***p < 0.01, **p < 0.05, *p < 0.1$. Heteroskedasticity and autocorrelation adjusted standard errors are used.
Covariates include: *number of children*, *at least one co-resident grandparent*, and *urbanicity of the region of residence*.

Table 6: Effects of Universal Childcare Reform on Father's Hours of Work

	Dependent variable: Annual hours									
	All men		Education				# Children			
			Some college or less		College graduate or more		2 or less		3 or more	
	Hours > 0	Hours ≥ 0	Hours > 0	Hours ≥ 0	Hours > 0	Hours ≥ 0	Hours > 0	Hours ≥ 0	Hours > 0	Hours ≥ 0
Coverage rate	84.964*	65.838	27.719	-13.602	166.929**	162.89**	104.546**	95.693*	-208.967	-209.421
(SE)	(44.849)	(49.826)	(60.956)	(68.435)	(69.539)	(81.162)	(47.651)	(54.015)	(148.291)	(162.549)
"Income/assets" group fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Birth cohort fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R squared	0.637	0.632	0.655	0.650	0.592	0.592	0.719	0.634	0.689	0.710
N	5,821	6,100	3,612	3,815	2,209	2,285	5,147	5,401	678	704
# Households	1,879	1,927	1,193	1,228	686	699	1,725	1,769	252	259

Notes: $***p < 0.01, **p < 0.05, *p < 0.1$. Heteroskedasticity and autocorrelation adjusted standard errors are used.
Covariates include: *number of children*, *at least one co-resident grandparent*, and *urbanicity of the region of residence*.

Table 7: Effects of Universal Childcare Reform on Mother's Hourly Earnings

	All women		Education		# Children		
			Some college or less	College graduate or more	1	2	3+
Coverage rate	-0.021	0.002	0.078	-0.138	0.014	-0.016	-0.210
(SE)	(0.050)	(0.053)	(0.065)	(0.084)	(0.094)	(0.076)	(0.147)
"Income/assets" group fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Birth cohort fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual fixed effects	No	Yes	Yes	Yes	Yes	Yes	Yes
R squared	0.102	0.820	0.802	0.561	0.847	0.786	0.787
N	3,306	3,306	2,389	917	1,174	1,751	384
# Households	1,252	1,252	928	324	594	716	158

Notes: $***p < 0.01, **p < 0.05, *p < 0.1$. Heteroskedasticity and autocorrelation adjusted standard errors are used.
Covariates include: *number of children*, *at least one co-resident grandparent*, and *urbanicity of the region of residence*.

Table 8: Effects of Universal Childcare Reform on Father's Hourly Earnings

	Dependent variable: Log hourly earnings						
	All men		Education		# Children		
			Some college or less	College graduate or more	1	2	3+
Coverage rate	0.027	-0.020	0.012	-0.044	-0.050	0.007	0.014
(SE)	(0.027)	(0.029)	(0.035)	(0.048)	(0.057)	(0.040)	(0.074)
"Income/assets" group fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Birth cohort fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual fixed effects	No	Yes	Yes	Yes	Yes	Yes	Yes
R squared	0.209	0.758	0.742	0.743	0.827	0.771	0.800
N	5,821	5,821	1,195	2,209	2,017	3,130	674
# Households	1,879	1,879	3,612	680	944	119	251

Notes: $***p < 0.01, **p < 0.05, *p < 0.1$. Heteroskedasticity and autocorrelation adjusted standard errors are used.
Covariates include: *number of children*, *at least one co-resident grandparent*, and *urbanicity of the region of residence*.

Table 9: Effects of Universal Childcare Reform on Mother's Family Life Satisfaction

	All women	Education		# Children	
		Some college or less	College graduate or more	2 or less	3 or more
Satisfied with family life overall (1)	0.042*	0.024	0.103***	0.047	0.024*
(SE)	(0.022)	(0.028)	(0.037)	(0.024)	(0.076)
Satisfied with relationship with spouse (2)	0.047*	0.051	0.056	0.048*	0.071
(SE)	(0.024)	(0.030)	(0.056)	(0.025)	(0.075)
Satisfied with relationship with children (3)	0.006	0.011	-0.012	-0.001	0.049
(SE)	(0.016)	(0.019)	(0.031)	(0.017)	(0.051)
"Income/assets" group fixed effects	Yes	Yes	Yes	Yes	Yes
Birth cohort fixed effects	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes	Yes	Yes
R squared (1)	0.501	0.500	0.478	0.511	0.540
R squared (2)	0.560	0.550	0.578	0.571	0.571
R squared (3)	0.458	0.467	0.421	0.453	0.571
N	6,014	4,409	1,605	5,322	692
# Households	1,906	1,416	491	1,749	256

Notes: $***p < 0.01, **p < 0.05, *p < 0.1$. Heteroskedasticity and autocorrelation adjusted standard errors are used.
Covariates include: *number of children, at least one co-resident grandparent,* and *urbanicity of the region of residence.*

Table 10: Effects of Universal Childcare Reform on Father's Family Life Satisfaction

	Dependent variable: Family life satisfaction scales (=1)				
		Education		# Children	
	All men	Some college or less	College graduate or more	2 or less	3 or more
Satisfied with family life overall (1)	0.034*	0.047	0.019	0.029	0.107*
(SE)	(0.021)	(0.031)	(0.025)	(0.022)	(0.068)
Satisfied with relationship with spouse (2)	0.018	0.010	0.020	0.003	0.509
(SE)	(0.021)	(0.033)	(0.027)	(0.022)	(0.076)
Satisfied with relationship with children (3)	-0.004	-0.002	-0.016	0.001	-0.028
(SE)	(0.015)	(0.021)	(0.021)	(0.015)	(0.057)
"Income/assets" group fixed effects	Yes	Yes	Yes	Yes	Yes
Birth cohort fixed effects	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes	Yes	Yes
R squared (1)	0.521	0.527	0.468	0.527	0.591
R squared (2)	0.560	0.503	0.498	0.509	0.076
R squared (3)	0.457	0.474	0.401	0.464	0.494
N	6,014	3,812	2,288	5,401	699
# Households	1,906	1,229	700	1,769	257

Notes: $***p < 0.01, **p < 0.05, *p < 0.1$. Heteroskedasticity and autocorrelation adjusted standard errors are used.

Covariates include: *number of children*, *at least one co-resident grandparent*, and *urbanicity of the region of residence*.

Table 11: Differential Effects of Universal Childcare Reform by Child's Age Group

	Women				Men			
Dependent variable	Employed	Hours > 0	Hours ≥ 0	Earnings	Employed	Hours > 0	Hours ≥ 0	Earnings
Coverage x Age 3 to 4	0.101***	51.145	142.038*	0.137	0.005	23.494	31.388	0.012
(SE)	(0.035)	(127.320)	(75.265)	(0.098)	(0.020)	(70.198)	(82.722)	(0.040)
Coverage x Age 5	0.058	-418.190	55.258	0.173	0.096**	-108.172	161.747	0.034
(SE)	(0.084)	(315.375)	(186.195)	(0.215)	(0.046)	(200.834)	(224.230)	(0.120)
Age 3 to 4	-0.033	-150.97	-84.653	-0.094	0.047	-32.872	-40.775	-0.016
(SE)	(0.030)	(112.618)	(62.578)	(0.088)	(0.044)	(60.029)	(67.306)	(0.038)
Age 5	-0.120**	-24.63	-212.640**	-0.310**	-0.062	25.834	-70.117	-0.050
(SE)	(0.049)	194.1817	(106.519)	(0.135)	(0.129)	(121.795)	(133.941)	(0.072)
"Income/assets" group fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Birth cohort fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R squared	0.765	0.706	0.767	0.487	0.467	0.640	0.608	0.764
N	3,375	1,426	3,375	3,375	3,375	3,274	3,375	3,375
# Households	1,078	586	1,078	1,078	1,078	1,074	1,078	1,078

Notes: $***p < 0.01, **p < 0.05, *p < 0.1$. The reference group is 0 to 2 year olds. The differential effects compared to this reference group is the sum of coefficients on the interaction term and on the corresponding age group dummy variable. Only families with child aged 0 to 5 are included. Heteroskedasticity and autocorrelation adjusted standard errors are used.
Covariates include: *number of children*, *at least one co-resident grandparent*, and *urbanicity of the region of residence*.

Appendix

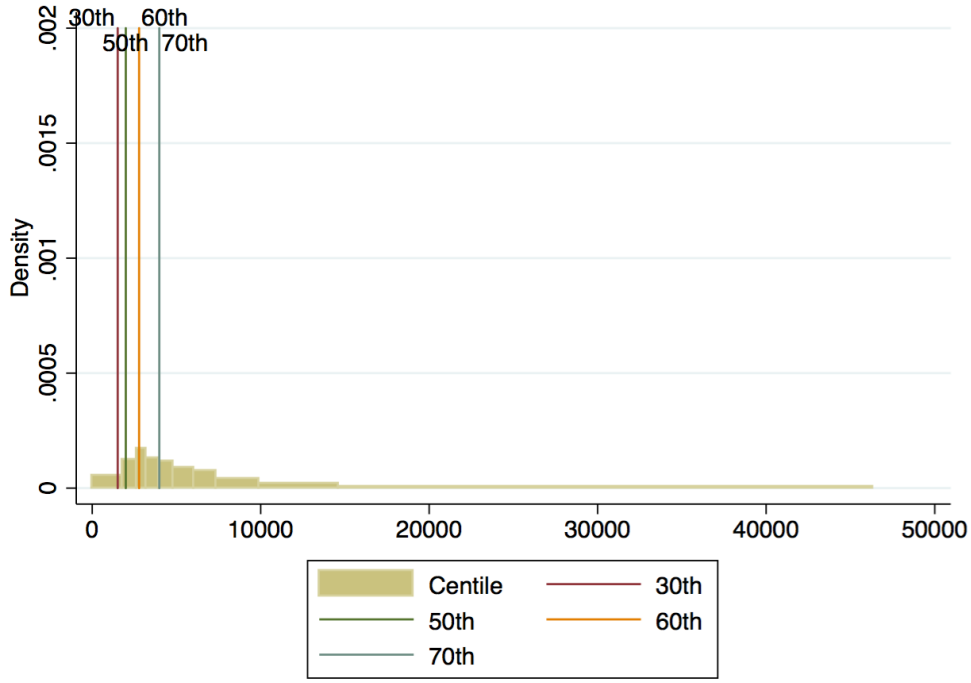
Determining Household "Income/asset" Level

Table A1: Income and Asset Conversion Scheme

Component	Type	Example	Adjustment Rate	Conversion
Income	Market income	Wage/salary, Business Income (net profit), Property Income (i.e. Rental Income, Interest & Dividend, Pension from Private Plans)	None	None
	Transfer Payment[2]	Social Insurance (i.e. Employment Insurance, Public Pension, Workers' Compensation, and Other Assistance)	None	None
Asset	Property	Residential/commercial Property, Licenses, Deposit on Rented Properties[3], Capital (e.g. Machinery, Farming Equipment, Fisheries), Livestock[4]	4.17%/3	(Property -Minimum Asset Deduction[5]-Debt) × Adjustment Rate
	Financial Asset	Bank Deposits, Bonds, Stocks, Tradable Private Membership	6.26%/3	(Financial asset -Minimum Asset Deduction -any remaining debt) × Adjustment Rate
	Car Value	Car[6]	100%/3	Car × Adjustment Rate
Debt	Debt	Loans, Deposit Received		
Total "income/assets" = Income + Converted Assets				

[1] Based on Childcare Guidelines (2009-2012), which detail examples of each component. Note that this scheme is specific to the childcare subsidies. I also referenced the formula used to determine the eligibility for the National Minimum Living Standard Guarantee program to accurately determine which information available from KOWEPS should be included. For example, some type of social assistance is not supposed to be included in the formula.
[2] Private cash transfer not counted.
[3] If the respondent lives in the property, then adjustment factor (0.95) is multiplied.
[4] Valued above 1000 KRW
[5] Varies by large metropolitan, small/medium metropolitan, and rural areas
[6] Car value determined by Korea Insurance Development Institute and Ministry of Health and Welfare. Cars valued more than 20,000 KRW counted (based on Table 1 from Huh et al. (2009)).

Figure A1: "Income/asset Distribution and Thresholds in 2009"



Notes: The graph represents the distribution of 99% of "income/assets." Each bar represents a centile. The x-axis measures the levels of household "income/assets" in USD. For the ease of interpretation, I converted expenditures to dollars at $1 = 1,000 KRW. The USD tends to be stronger and the actual dollar amount would be about 13% smaller than what is reported in this graph. Data is based on the sample of two-parent families with children aged less than 18.

Eligibility Thresholds

Table A2: Eligibility Threshold Schedule in 2008-2012

Year	"Income/asset" group	Family size				
		3	4	5	6	7
2008	0-30th	123	151	178	205	235
	30-50th	178	199	210	230	260
	50-60th	250	278	294	322	352
	60-70th	357	398	420	460	490
	70-100th	-	-	-	-	-
2009	0-30th	123	151	178	205	235
	30-50th	178	199	210	230	260
	50-60th	250	278	294	322	352
	60-70th	357	398	420	460	490
	70-100th	-	-	-	-	-
2010	0-30th	169	210	257	291	321
	30-50th	224	258	289	316	346
	50-60th	294	339	380	415	445
	60-70th	378	436	488	534	564
	70-100th	-	-	-	-	-
2011	0-30th	207	254	306	345	375
	30-50th	262	302	338	370	400
	50-60th	332	383	429	469	499
	60-70th	416	480	537	588	618
	70-100th	-	-	-	-	-
2012	0-30th	245	298	355	399	429
	30-50th	300	346	387	424	454
	50-60th	370	427	478	523	553
	60-70th	454	524	586	642	672
	70-100th	-	-	-	-	-

Notes: Based on Childcare Guidelines (2009-2012). Unit in 1,000 KRW; or simply multiply by 10 to convert to USD. Yellow highlighted cells (or shaded cells in black and white print) indicate that they were originally left empty in the Guidelines as the expansion of subsidies no longer required to set thresholds for groups already being covered. For the estimation purpose, I computed by the hypothetical threshold numbers by adding the year-to-year differences in other income groups.

Determining Tuition Coverage Rate

Table A3: Sequence of Tuition Coverage Rate Received by Eligibility Thresholds

(a) 70-100th Percentile

70-100th Percentile	2009	2010	2011	2012	2013
Born in 2003	Age 5 0	Age 5* 0			
Born in 2004	Age 4 0	Age 5 0	Age 5 0		
Born in 2005	Age 3 0	Age 4 0	Age 5 0	Age 5 0.43	
Born in 2006	Age 2 0	Age 3 0	Age 4 0	Age 5 0.53	Age 5 0.53
Born in 2007	Age 1 0	Age 2 0	Age 3 0	Age 4 0	Age 5 0.53
Born in 2008	Age 0 0	Age 1 0	Age 2 0	Age 3 0	Age 4 1
Born in 2009	Age 0 0	Age 0* 0	Age 1 0	Age 2 1	Age 3 1
Born in 2010		Age 0 0	Age 0 0	Age 1 1	Age 2 1
Born in 2011			Age 0 0	Age 0 1	Age 1 1
Born in 2012				Age 0 1	Age 0 1
Born in 2013					Age 0 1

(b) 60-70th Percentile

60-70th Percentile	2009	2010	2011	2012	2013
Born in 2003	Age 5 0.43	Age 5* 0.43			
Born in 2004	Age 4 0.3	Age 5 0.43	Age 5 0.43		
Born in 2005	Age 3 0.3	Age 4 0.3	Age 5 0.43	Age 5 0.43	
Born in 2006	Age 2 0.3	Age 3 0.3	Age 4 1	Age 5 0.53	Age 5 0.53
Born in 2007	Age 1 0.3	Age 2 0.3	Age 3 1	Age 4 1	Age 5 0.53
Born in 2008	Age 0 0.3	Age 1 0.3	Age 2 1	Age 3 1	Age 4 1
Born in 2009	Age 0 0.3	Age 0* 0.3	Age 1 1	Age 2 1	Age 3 1
Born in 2010		Age 0 0.3	Age 0 1	Age 1 1	Age 2 1
Born in 2011			Age 0 1	Age 0 1	Age 1 1
Born in 2012				Age 0 1	Age 0 1
Born in 2013					Age 0 1

50-60th Percentile	2009	2010	2011	2012	2013
Born in 2003	Age 5 0.43	Age 5* 0.43			
Born in 2004	Age 4 0.6	Age 5 0.43	Age 5 0.43		
Born in 2005	Age 3 0.6	Age 4 0.6	Age 5 0.43	Age 5 0.53	
Born in 2006	Age 2 0.6	Age 3 0.6	Age 4 1	Age 5 0.53	Age 5 0.53
Born in 2007	Age 1 0.6	Age 2 0.6	Age 3 1	Age 4 1	Age 5 0.53
Born in 2008	Age 0 0.6	Age 1 0.6	Age 2 1	Age 3 1	Age 4 1
Born in 2009	Age 0 0.6	Age 0* 0.6	Age 1 1	Age 2 1	Age 3 1
Born in 2010		Age 0 0.6	Age 0 1	Age 1 1	Age 2 1
Born in 2011			Age 0 1	Age 0 1	Age 1 1
Born in 2012				Age 0 1	Age 0 1
Born in 2013					Age 0 1

(c) 50-60th Percentile

30-50th Percentile	2009	2010	2011	2012	2013
Born in 2003	Age 5 0.43	Age 5* 0.43			
Born in 2004	Age 4 0.8	Age 5 0.43	Age 5 0.43		
Born in 2005	Age 3 0.8	Age 4 1	Age 5 0.43	Age 5 0.53	
Born in 2006	Age 2 0.8	Age 3 1	Age 4 1	Age 5 0.53	Age 5 0.53
Born in 2007	Age 1 0.8	Age 2 1	Age 3 1	Age 4 1	Age 5 0.53
Born in 2008	Age 0 0.8	Age 1 1	Age 2 1	Age 3 1	Age 4 1
Born in 2009	Age 0 0.8	Age 0* 1	Age 1 1	Age 2 1	Age 3 1
Born in 2010		Age 0 1	Age 0 1	Age 1 1	Age 2 1
Born in 2011			Age 0 1	Age 0 1	Age 1 1
Born in 2012				Age 0 1	Age 0 1
Born in 2013					Age 0 1

(d) 30-50th Percentile

30-50th Percentile	2009	2010	2011	2012	2013
Born in 2003	Age 5 0.43	Age 5* 0.43			
Born in 2004	Age 4 0.8	Age 5 0.43	Age 5 0.43		
Born in 2005	Age 3 0.8	Age 4 1	Age 5 0.43	Age 5 0.53	
Born in 2006	Age 2 0.8	Age 3 1	Age 4 1	Age 5 0.53	Age 5 0.53
Born in 2007	Age 1 0.8	Age 2 1	Age 3 1	Age 4 1	Age 5 0.53
Born in 2008	Age 0 0.8	Age 1 1	Age 2 1	Age 3 1	Age 4 1
Born in 2009	Age 0 0.8	Age 0* 1	Age 1 1	Age 2 1	Age 3 1
Born in 2010		Age 0 1	Age 0 1	Age 1 1	Age 2 1
Born in 2011			Age 0 1	Age 0 1	Age 1 1
Born in 2012				Age 0 1	Age 0 1
Born in 2013					Age 0 1

(e) 0-30th Percentile

Notes: *Age adjusted by the eligibility rule from the Childcare Guidelines. If a 6-year-old was not enrolled in the primary school, she/he was eligible for the subsidy as a 5-year-old.