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The U.S. Child Care Crisis: Facts, Causes, and Policies

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Abstract

Why does the United States lack affordable child care? I examine the long-term trend of the child care market and document a sharp price increase since the late 1990s. I show that a massive expansion of federal and state means-tested child care subsidies, which were intended to stimulate the market, instead crowded out child care supply. The evidence suggests that the subsidies discouraged home-based child care suppliers who were also working mothers. A simple calibrated equilibrium model captures the rising price, which eventually caused the female employment rate to decline. An effective policy should capitalize on the home-based care business.

Keywords: Child care market, Female labor supply, Child care subsidies

Journal of Economic Literature Classification Number: J13, J21, H24

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1 Introduction

Expensive child care in the United States is an ongoing major political and economic issue. In Barack Obama's State of the Union address in 2015[1], he referred to a young couple in Minnesota and said that *Basic childcare for Jack and Henry costs more than their mortgage, and almost as much as a year at the University of Minnesota.* Donald Trump also remarked[2] in 2019 that *In more than 60 percent of American homes, both parents work. Yet many struggle to afford child care, which often costs more than $10,000 per year. And it's devastating to families, frankly. Devastating.* Among the member countries of the Organisation for Economic Co-operation and Development (OECD), U.S. families pay the highest amount for child care relative to the family income (OECD, 2017a). The high price may significantly discourage women from working, and this may result in a declining female labor force participation rate in the U.S. (Blau and Kahn, 2013). There is a growing concern about child care and parental employment among many families and businesses, which has been termed the *child care crisis* (Schochet, 2019).

This context raises questions about the reason behind the expensive child care in the U.S. This study examines the basic statistics, market structure, and the policies of the U.S. child care market. I first summarize the time-series trends of this market using the Survey of Income and Program Participation (SIPP) from 1988 to 2011. To the best of my knowledge, this is the first study to provide hourly price and weekly hours of child care. Both are particularly crucial for distinguishing supply and demand shifts. The (net) mean real hourly expenditure on child care was mostly stable until the mid-1990s. Then, it jumped up by 29% from 1999 to 2011. For those who receive no allowance, the (gross) price increased by 40% in the same period. Subsequently, the rising costs caused the mean weekly hours of child care to decline by 23%.

I explain these facts based on apparently paradoxical policy changes. Since the late-1990s,

[1]https://obamawhitehouse.archives.gov/the-press-office/2015/01/20/remarks-president-state-union-address-January-20-2015

[2]https://www.whitehouse.gov/briefings-statements/remarks-president-trump-white-house-summit-child-care-paid-leave/

there has been a significant increase in child care subsidies for low-income families: the Child Care Development Fund and Head Start as federal programs, and state-level pre-K programs. As per my estimation, there was an increase in the fraction of working mothers receiving subsidies from 3% in 1990 to 18% in 2010. Consequently, child care costs have significantly increased among middle and high-income families while remaining stable among low-income families.

In the standard demand–supply framework, these forms of child care support are expected to lower consumer prices and to stimulate demand. However, in the U.S., these child care subsidies may unexpectedly reduce child care supply and increase its price. I observe a significant decline in the numbers of home-based child care workers, such as family daycare providers, nannies, and babysitters, since the late-1990s. These workers include low-income working mothers caring for their own and children in other families together at private residences. They chose the home-based child care business because of the cost advantage of waiving the child care fees for their own children. After the expansion of the subsidies, they became eligible for the subsidies owing to their relatively low income. Subsequently, many of these mothers placed their children in subsidized child care and moved to other higher-paying occupations.

According to the Current Population Survey (CPS), the number of child care working mothers in the home-based sector dropped by 59% between 1990 and 2010, while the proportion of the other child care workers remained unchanged. This decline in the total home-based child care supply caused an overall price increase. Time-series evidence shows that the wages of home-based care workers increased significantly due to the supply destruction. Moreover, based on the U.S. Population Census and the American Community Survey (ACS), I find cross-sectional evidence that this effect was more striking in regions with a high concentration of working mothers in the home-based child care business. It also spread out to the center-based sector by the general equilibrium effect.

This channel is further studied by a simple child care market equilibrium model. Although the empirical evidence supports the subsidy's adverse supply effects, the model also considers

the usual positive effect of subsidies on the demand side. The model theoretically shows that the downward shifts of child care supply possibly dominated the conventional positive demand effect. The crucial factor is the extent to which subsidies change the behaviors of home-based child care workers relative to the others. The model's analytical solution suggests two necessary conditions to determine this extent: non-linearity of the subsidy schedule and potential wage distribution. In other words, a significant proportion of potential home-based child-care workers' incomes must be sufficiently low around the eligibility level of the means-tested child care subsidies. Under this condition, the subsidy's discouraging effects on the supply side become more significant than the standard positive stimulus to the demand side.

I also study a quantitative version of the model. The parameters are calibrated to match data moments in 1990, that is, before the expansion of subsidies. Then, a means-tested subsidy in line with the actual policy reforms is introduced as an exogenous shock to the model. The simulation yields a 19% and 7% rise in the producer and consumer price of child care, respectively; these statistics reasonably explain the actual change between 1990 to 2010. Moreover, the model predicts a reduction in the maternal employment rate from 44.5% to 42.1%, which is also consistent with the recent trend.

I also conduct two counter-factual policy simulations: a linear-subsidy scheme for working mothers and funding to the home-based child care business. The former policy exerts a moderate demand effect that slightly reduces the consumer price by 6.3%, and raises the maternal employment rate from 44.5% to 46.2%. The latter policy is noteworthy. It creates a substantial crowding-in effect for the home-based child care sector in reverse to means-tested policies. It leads to a substantial price reduction by 20% and an increase in the maternal employment rate from 44.5% to 49.8%.

Both the data and model imply the sensitivity of the policy consequence to the economic incentives in both the demand and supply of child care services, in particular, for working mothers engaged in home-based child care. Home-based providers are generally considered as low-quality care and problematic in early-childhood education (Gupta and Simonsen, 2010). However, it is also a unique job option that allows working mothers to stay at home with

children. As the simulation predicts, capitalizing on the home-based business strengthens this advantage and sizably stimulates child care supply. Given appropriate regulation to resolve the quality of home-based care, as emphasized by the Child Care and Development Block Grant Act of 2014, monetary incentives to this business may be effective in overcoming the child care crisis.

My long-run estimates of the U.S. child care costs are related to two existing studies. Laughlin (2013) estimate *total family expenditure on all children* in several years, and Herbst (2018) provides *costs per mother's hours of work* in 1990 and 2010. My study adds long-term consistent measures of child care market equilibrium: *hours* and *hourly* costs. This study is also related to the large body of literature on the subsidized child care and maternal labor supply, for example, Gelbach (2002), Blau and Tekin (2007), Baker et al. (2008), Lefebvre and Merrigan (2008), Bernal and Keane (2011), Havnes and Mogstad (2011a), Bauernschuster and Schlotter (2015), Herbst (2017), Gathmann and Sass (2018), and Rodgers (2018). These papers focus mainly on working mothers' child care demand. By contrast, the present study emphasizes the role of the supply side: child care workers' occupational choices. My model is related to Guner et al. (2013), who study several child-related transfers in the U.S. using a rich quantitative general equilibrium model. The crucial difference is that I consider child care worker's unique incentives while Guner et al. (2013) assume that the child care work is perfectly competitive with the other occupations.

The present study also provides a possible explanation about the stagnating female employment rate in the U.S. Blau and Kahn (2013) first introduce the topic and find delayed expansion of family-friendly policies as one key factor. Albanesi and Prados (2014) explain married women's growing incentive to be homemakers by the negative income effects caused by the rise of spouses' skill premium. The present study also provides a possible underlying structural change of Fukui et al. (2018) and Albanesi (2020), who link declining female labor supply and business cycle properties.

The remainder of the paper is organized as follows. Section 2 introduces the data, estimation methods, and basic facts of the U.S. child care market. In Section 3, I provide

further evidence of rising child care costs and their relation to subsidies. Section 4 analyzes a simple static model, both analytically and quantitatively. Section 5 concludes.

2 Long-term trend of the U.S. child care market

2.1 Data source and measurement

To document long-run trends in the U.S. child care market, I use the Child Care Supplement of the SIPP, 1988–2011. This supplement is surveyed once every few years. The SIPP provides parents' child care expenditure and arrangements that capture the demand side of the child care market. The sample size of SIPP varies by year: each sample contains about 2000 to 3000 working mothers with children aged 5 years or under.

I define market child care as individual care by non-relatives, family day care home, day care center, and nursery/preschool. Market child care excludes monetary payment for care by family/relatives, because it may include a significant amount of non-monetary rewards. To maintain consistency by year, I reorganize the SIPP data as working-mother level data[3]. Each sample has variables of primary and secondary child care arrangements of first, second, and third youngest children aged 5 years or under[4]. I also define non-market child care as the care provided by children's other parent/stepparent, brother/sister, grandparent, other relative of child, care for self, and parent's care while working at home.

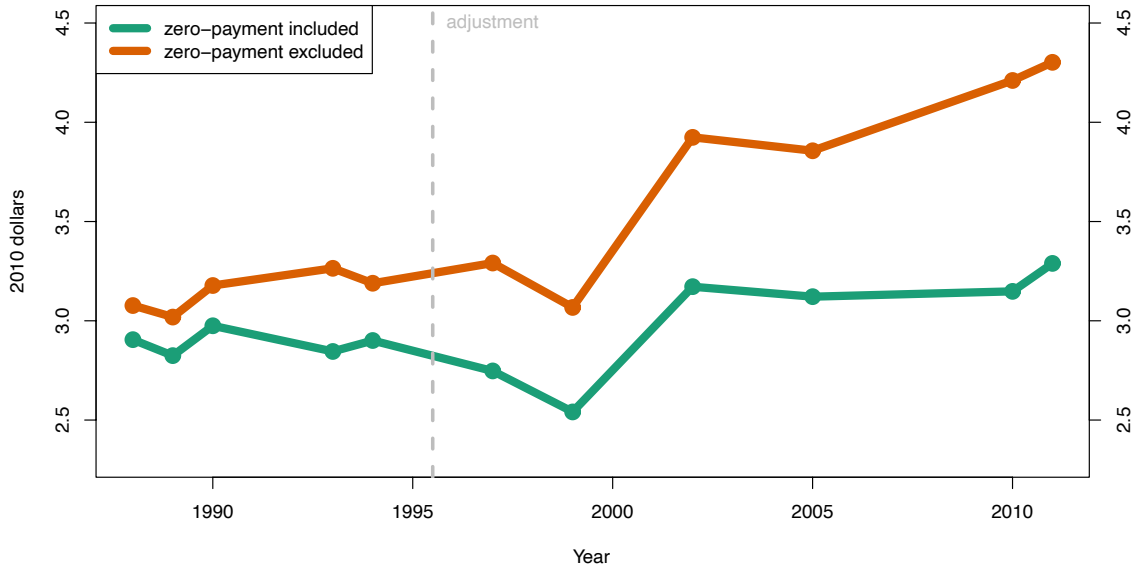
Making consistent long-run measures is challenging, because the child care hours reported in the Child Care Topical Modules of the SIPP are inconsistent over time. From 1988 to 1994, the child care expenditure is the total payment to the service. However, hours of child care are recorded as hours only while the designated parent is working[5]. The measured

[3]I exclude single fathers. Their share is only 3% among the recipients.

[4]For example, suppose a mother has four children aged 1, 3, 4, and 5, and each child is cared for by a day care center for 30 hours, a baby sitter for 10 hours, and the mother's sister for 5 hours. In this case, only hours and payments of children aged 1, 3, and 4 years of the day care center and the baby sitter are considered for the estimation of child care costs. Then, the hourly expenditure of child care of this household is measured as the sum of child care expenditures of children aged 1, 3, and 4 years, divided by a total 135 hours calculated by $(30 + 10 + 5) \times 3$. Newer surveys since 1997 contain more detailed data of at most five children and more types of care, but I adjust them to be consistent with the older surveys.

[5]For example, if a mother works for 8 hours a day and uses child care for 10 hours because of her

Figure 1: Mean real hourly expenditure on child care



hourly costs are upward biased because the denominator is shorter than the actual hours of child care usage. Since 1997, the documented hours of child care are have been changed to total hours, including before/after working time[6]. To fix the bias, I increase the hours of child care until 1994 to be consistent with the later surveys. I first estimate the aggregate linear time trend of mean hours of child care by the survey between 1997 to 2011. Then, I multiply a constant to each 1988–1994 sample's hours of child care so that the aggregated hours in 1994 match the extrapolated trend of the survey from 1997 to 2011. The estimated series possibly have an unobserved gap between 1994 and 1997 but should be consistent in the other years.

2.2 Trend of the price and hours

Figure 1 shows the mean hourly child care expenditure of children aged equal to 5 years or under. The price level is adjusted by the consumer price index to 2010 US dollars. There are two lines: one is the mean price of all the samples, and the other one excludes respondents who use the market child care but do not pay anything. Like the expansion of the means-tested child care subsidy as in Figure 2, the number of working mothers using zero or low-cost child care has increased in the 1990s. Therefore, the measure with zero-payment is interpreted as an approximated net consumer price of childcare[7], but one without zero-payment is a gross price partially excluding child care subsidies. Both prices were stable until the mid-1990s but jumped thereafter. The price with only a positive amount of payment increased by about 40%, and the net price rose by about 29% between 1999 and 2011[8].

In the 1990s, public opinion led to an expansion of both federal and state expenditures on child care for low-income families. Figure 2 outlines the major federal and state expenditure on child care subsidies. Until the Reagan tax cut in the late 1980s, the Child and Adult Care Food Program (CACFP) and the Child and Dependent Care Tax Credit (CDCTC) were dominant policies. Their subsidy schedules are approximately linear[9]. Instead, in the

commuting time, the 2-hour gap is excluded from the survey record of hours.

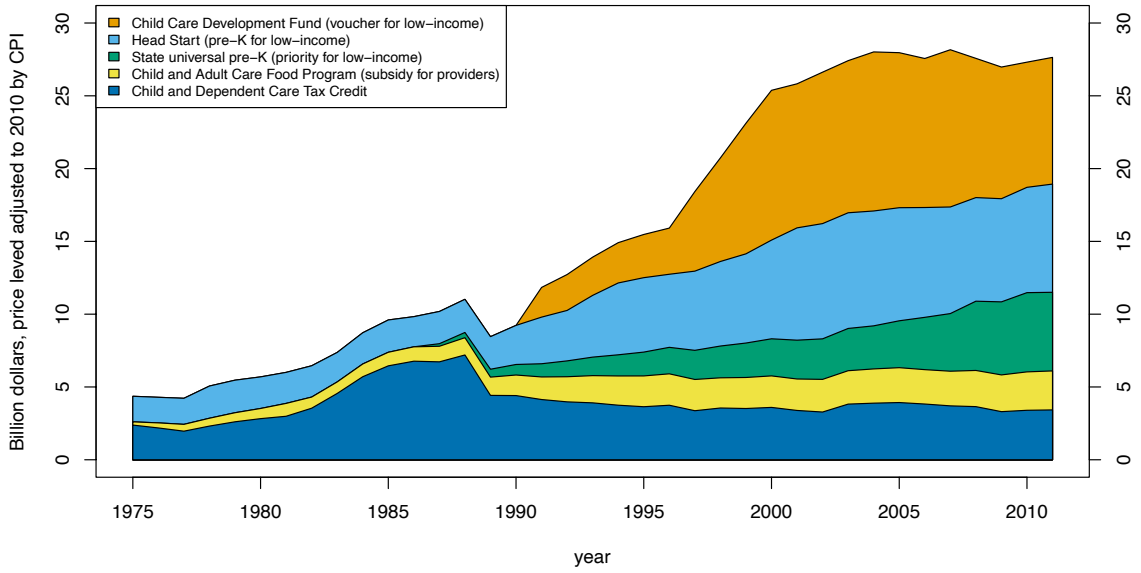
[6]The whole structure of the survey was changed. Other major differences are the inclusion of non-working mothers in the sample, the number of children covered, and the classification of child care arrangements. Since 2001, the while-working hours have again been included. However, this variable seems to have significant survey errors, as noted by Herbst (2018). It contains unbelievably many samples who answered 0 for while-working hours.

[7]The SIPP's questionnaire asks about the actual amount the respondent paid. In Figure 2, all the programs except the Child and Dependent Care Tax Credit (CDCTC) do not require prepayment before the reimbursement. Therefore, the measure can be approximately interpreted as the consumer price.

[8]Herbst (2018) shows a modest increase in child care costs. His main measure is the median costs of all children aged 0 to 14 years. Children aged older than 5 years are the majority in the sample; hence, the median price mainly captures the costs for school-aged children. However, I calculate the child care costs for children aged 5 years or under. Among the limited sample of preschool children, Herbst (2018) also finds a significant rise in the price. Another difference between our studies is that my hourly costs measure is defined as the child care expenditure divided by the hours of market child care. By contrast, Herbst (2018) divides the payment by mother's hours of work. Figure 5 shows that the composition of child care assignments shifted from market to non-market. In my definition of the hourly costs, the declining hours of market care, the denominator, also contributed to the price increase.

[9]The CACFP provides subsidized lunch for all children irrespective of income level. Under the CDCTC, the credit is 35% for all families with an adjusted gross income below $15,000. Above that level, the percentage decreases to 20% until $43,000 in family income. Rodgers (2018) finds that the impacts of the CDCTC on households may be limited because a large part of benefits from the CDCTC is transferred to

Figure 2: Real annual expenditure of child care subsidy programs



1990s, the government expanded means-tested child care subsidies for low-income families to improve early childhood education and support mothers' labor market participation. There are three major programs[10]: (i) The Child Care Development Fund (CCDF), (ii) Head Start, and (iii) Pre-K schooling offered by each state[11]. The CCDF is a federal program to provide funding for low-income working families to support enrollment in child care. This program transfers block grants from the federal government to states, territories, and tribes. The CCDF was started as part of the 1996 welfare reform law to consolidate multiple child care funding streams[12] into a single new funding stream. The funds are mainly provided as

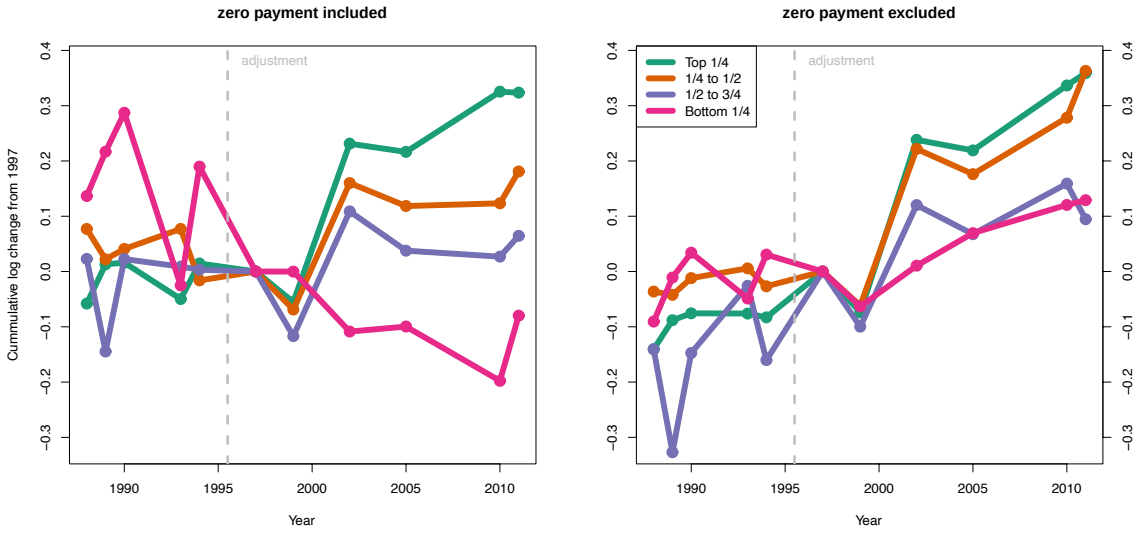
the supplier side through increases in price and wage. Note that the CACFP budget in Figure 2 excludes the expenditure for adult care.

[10]As noted by Besharov and Higney (2003), Social Service Block Grants and Temporary Assistance for Needy Families (TANF) also provide subsidies for child care. However, it is difficult to measure each program's budget, because TANF also transfers funds to other programs. The expenditures of these minor programs are relatively small, and their budgets have been nearly unchanged over time.

[11]Data source: Child Care and Development Fund Expenditure Data, Head Start Program Fact Sheet, The House Ways and Means Committee Green Book 1998, and The State of Preschool Yearbook 2003–2015 published by the National Institute for Early Education Research.

[12]Prior to 1996, the CCDF budget in Figure 2 represents the total expenditure of the preceding programs including AFDC/JOBS Child Care Program, Transitional Child Care, At-Risk Child Care Program and Child Care and Development Block Grant.

Figure 3: Cumulative log change of real hourly child care costs by family income quantile



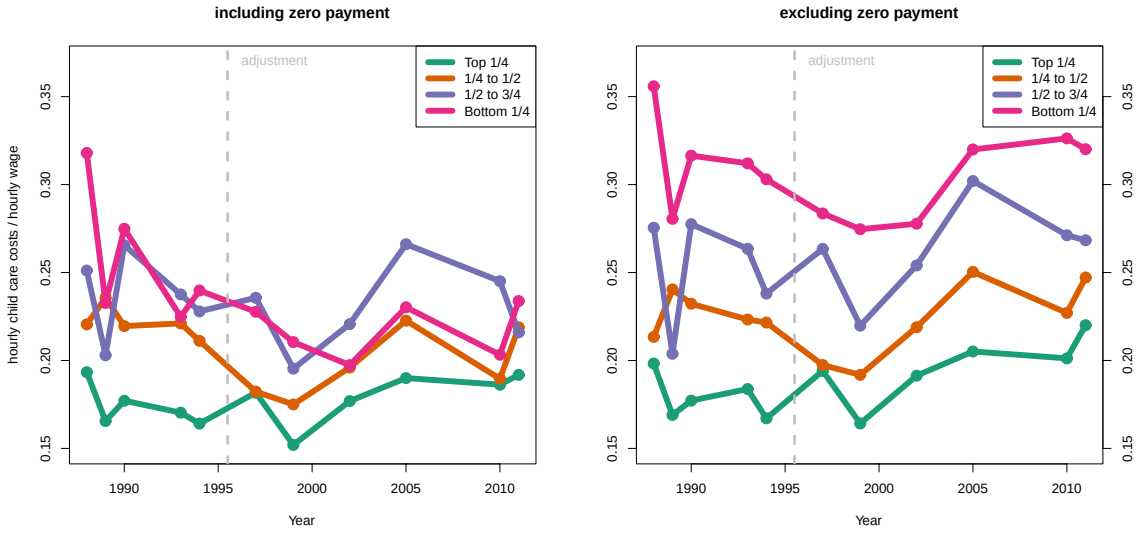
vouchers that cover nearly all costs of child care[13]. Head Start is a free federal preschool program for economically disadvantaged children begun in 1965. The fund is targeted at the supply side, that is, the program directly operates centers and schools. From 1995, Early Head Start was also started to provide education for younger children from birth to 3 years of age. State pre-K programs are subsidized educational programs for preschool-age children operated by each state. The total budget has been significantly expanded to attain the goal of providing universal pre-K: free education for all preschool children. However, only 29% was enrolled in 2015. As the CCDF and Head Start, the state pre-K programs are also means-tested in most states.

The subsidies have substantially mitigated the child care costs for low-income families. According to the enrollment statistics of the CCDF, Head Start, and Pre-K schooling, the fraction of children receiving the support increased from 3% in 1990 to 18% in 2010. Figure 3 plots the mean real hourly child care costs by family income quantile[14]. The price is

[13]In my calculation from Child Care and Development Fund Administrative Data from 2009 to 2011, 38% of the recipients pay no money. Among the others, the mean co-payment is only 13% of the total costs. These data are publically available in the Integrated Fertility Survey Series of the Inter-university Consortium for Political and Social Research.

[14]In economic models, family income is interpreted as the wealth effect. To capture the substitution effect, Figures A.1 and A.2 in the Appendix show costs classified by mother's hourly wage. The results are almost equivalent.

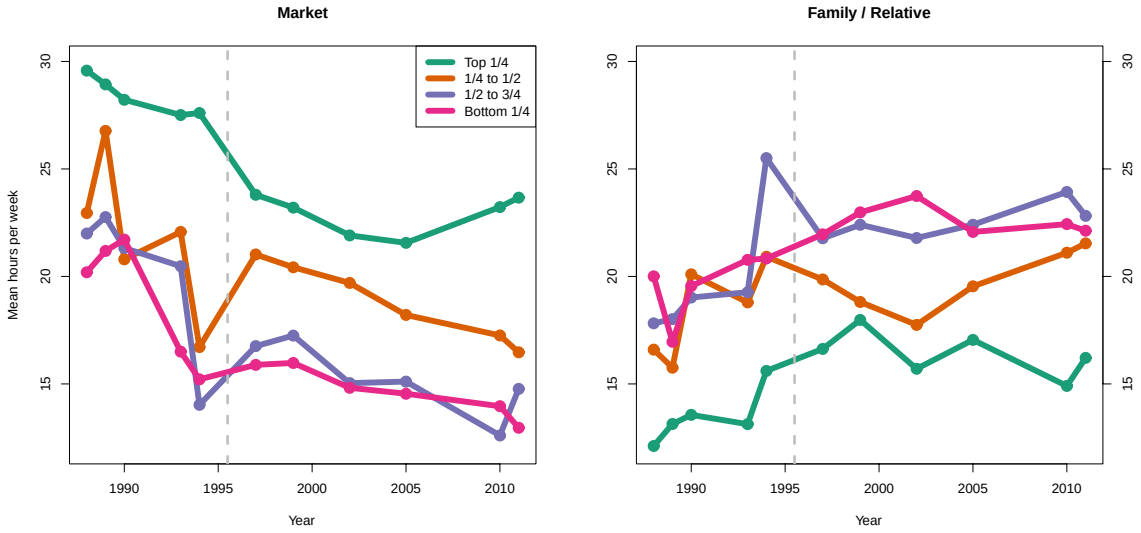
Figure 4: Hourly child care costs divided by mother's hourly wage by family income quantile



normalized in 1997, and the series shows the cumulative log differences compared to 1997. Note again that the survey structure is consistent between 1988–1994 and 1997–2011. The measure with zero-payment showes the price drop in the lowest income group, which is potentially eligible for the means-tested subsidy. Meanwhile, middle to high-income families experienced a sharp increase in the net price. If the zero-payment is excluded, all groups show similar significant rises. Hence, the price hike is a problem of all families but off-set by child care subsidies for low-income families.

Figure 4 plots the hourly price of child care per child divided by the mother's hourly wage for each group. This index can be interpreted as a kind of income tax rate. For each hour of work, a mother needs to pay this fraction of income for child care. If she has two or more children, this tax rate is multiplied. Overall, the figures show U-shaped patterns. The first decline is due to the stable child care price and rising income. Subsequently, the trend was reversed by the rapid increase in child care price. The left-diagram measures a case that zero-payment is included. It is larger for lower income groups because the mother's wage is also lower. However, the bottom income group pays a lower fraction than the second groups in the 2000s. The measure of the bottom group shows a steady trend possibly due to the expansion of the means-tested child care subsidies. If the zero-payment is excluded,

Figure 5: Weekly hours of child care



the right-hand side diagram shows a clearer U-shaped pattern in all the groups. This figure implies that the gross child care burden became heavier from the late 1990s for all income groups. The magnitude is equivalent to about 5% increase of the income tax rate for working mothers of one child.

Finally, Figure 5 plots the child care arrangement by family income. The left-hand side shows weekly hours of market child care, and the right-hand side shows non-market care provided by family and relative. The rising child care costs led parents to substitute child care from the market to the non-market. This pattern is observed among all income groups[15]. The declining U.S. trend is unique compared to the advancement of the market child care in most of OECD countries (OECD, 2017b).

[15]The timing is inconsistent from the price increase: the decline in hours started before the expansion of the subsidies. There may be another trend of increasing childcare at home, for example, fathers' help may have been increasing. It is also possibly due to the ambiguous definition of hours in the survey until 1994.

3 Means-tested subsidies and stagnant child care market.

This section further studies the source of increasing child care costs since the late-1990s. I provide empirical evidence of a channel by which the child care subsidies, which in general would stimulate the demand, instead discouraged the supply.

3.1 How means-tested subsidies reduced the child care supply

There are two types of child care providers in the U.S.: center-based care and home-based care. The former type is supplied by organizations at school-style facilities. It includes day-care centers, preschools, and nursery schools. The latter type is defined as service provided by individuals in a private environment. It comprises of family daycare homes, nannies, and baby sitters. According to the SIPP, 49% of total child care hours were provided by home-based service in 1990. Inside the home-based sector, 83% of the workers were engaged in family daycare homes, according to the 1990 Population Census.

A notable characteristics of home-based child care workers is that many caregivers are also working mothers. According to the 1990 Population Census, 51.5% of home-based child care workers had children aged under 12 years. This percentage was significantly higher than 34.1% for the center-based child care workers and 29.2% for all other occupations. The home-based worker's mean hourly wage was only \$5.5 in 1990, while that of center-based workers was \$7.6 under price levels adjusted to 2010. Interestingly, the workers' characteristics were almost the same. For example, 70.6% (71.7%) of center-based (home-based) child care workers had high school or higher qualifications. The percentages of college graduates were 8.1% and 7.6%, respectively.

This difference may be compensated by a cost advantage of the home-based business of waiving the child care fee of their own children. The traditional business model is a kind of child care at work: caring for both workers' children and those of other families' children

together in the same private environment. Child care working mothers do not need to pay for their own children's care. Their work is a casual to earn extra money while staying at home. According to the regulation database provided by Bassok et al. (2012), in 1990, a worker did not need a license to accommodate four children or fewer in all states and could care for up to six children in 46 states. There may also be non-monetary rewards. Kontos et al. (1995) report that the biggest reason for choosing a family daycare job is to stay with own children.

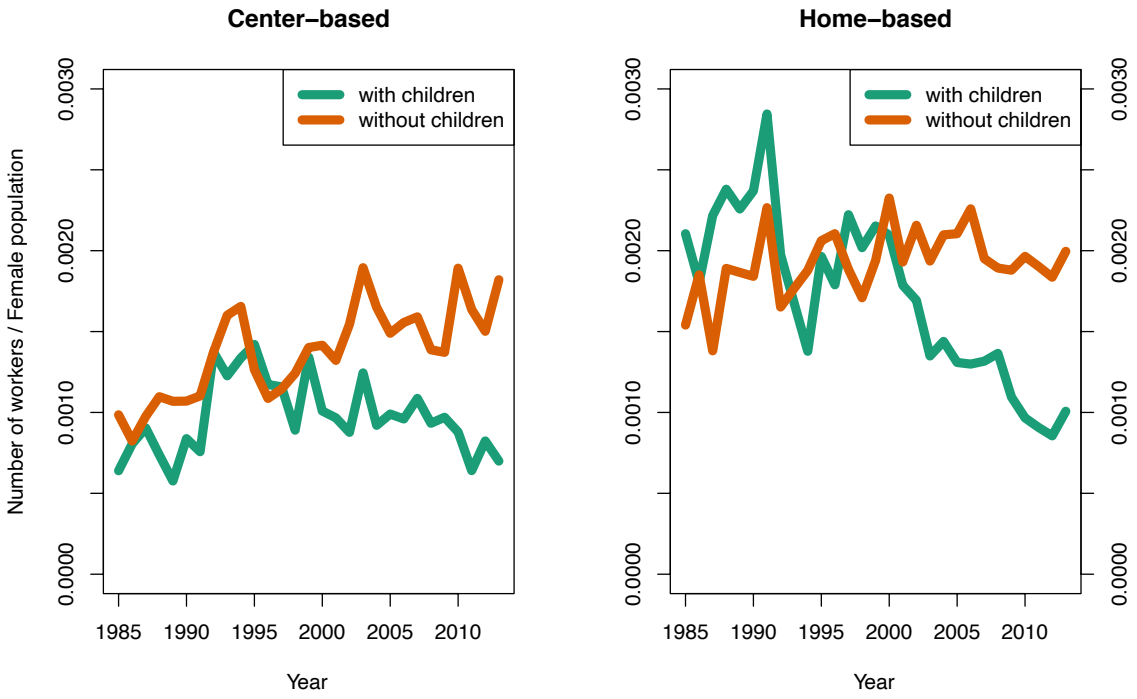
The expansion of the child care subsidies may cause a strong incentive for home-based child care workers to change their occupation. The advantage of the child care costs of worker's children made home-based child care jobs competitive with other types of jobs, although the wage was significantly lower. However, after the reform of child care support, workers had less incentive to choose the home-based care job. Due to the low wage, many child care working mothers became eligible for the means-tested subsidies. Then, they could also waive child care fees even if they worked in other relatively high-paying jobs. Consequently, many working mothers left the child care sector, and then, the declining total child care supply raised the overall price in the market.

3.2 Supportive Evidence

Here, I provide child care worker's statistics obtained from the CPS. Figure 6 shows the number of center/home-based child care workers by child status defined as having children aged under 12 years or not. There was a sharp decline in the number of working mothers in the home-based sector since the late-1990s. The number of these workers declined by 59% between 1990 and 2010. By contrast, the number of workers in the other categories was almost stable. The results shown in Figure 6 are consistent with the discouraging effect of the child care subsidy, because it affects only working mothers in the home-based sector.

The declining labor supply also changed wages. Figure 7 shows the mean real hourly wages of child care workers in the center-based and home-based sectors. The former increased by 21%, while the latter increased by 35%. As subsidies expanded, home-based workers'

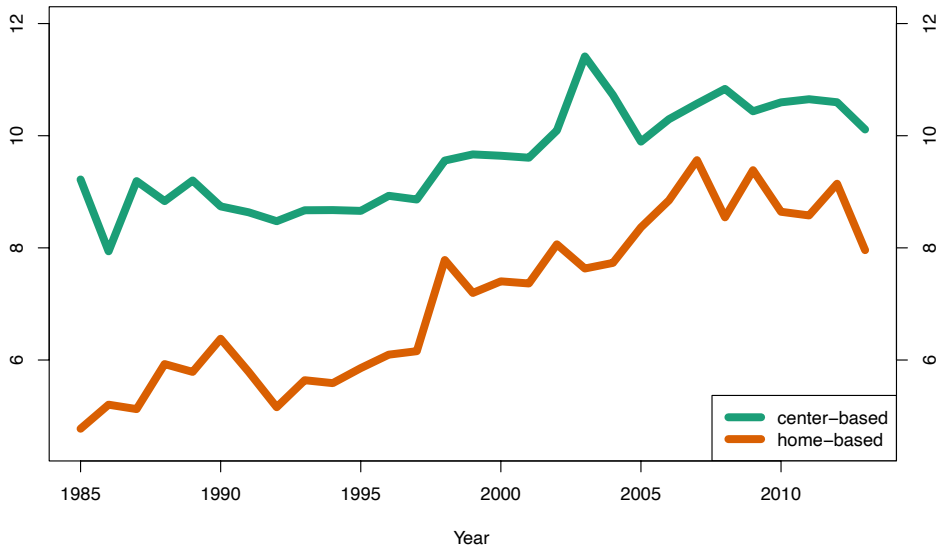
Figure 6: The number of child care workers by category and child status



This diagram plots the number of each type of child care worker given that the total female population aged between 15 and 64 years is normalized to 1 each year. The data source is the Annual Social and Economic Supplement of the CPS obtained from IPUMC CPS. I follow Bassok et al. (2012) and Herbst (2018) to decide the classification of child care occupations. Mainly, center-based child care workers are defined as child care workers employed by daycare centers or schools, and home-based child care workers are self-employed or employed by individual. Note that the IPUMC CPS's harmonized occupation variable, OCC1990, classifies many center-based workers as teacher aides from 1992 to 2002. Instead, I estimate the numbers from a non-harmonized variable, OCC, whose definition was revised in 1992, 2003, and 2011.

wages rose significantly, and the gap with center-based workers diminished. This gap possibly reflected the home-based job's cost advantage of caring for workers' children at work. The expansion of subsidies made this benefit less appealing and equalized the two wages in the labor market equilibrium. Note that the wage growth rate of the other female workers was only 6%. Therefore, the ratio of child care workers' wage to other workers' wage rose sharply. This is consistent with the growth in the child care price to the wage since the late 1990s in Figure 4.

Figure 7: Real hourly wage of child care workers by arrangement



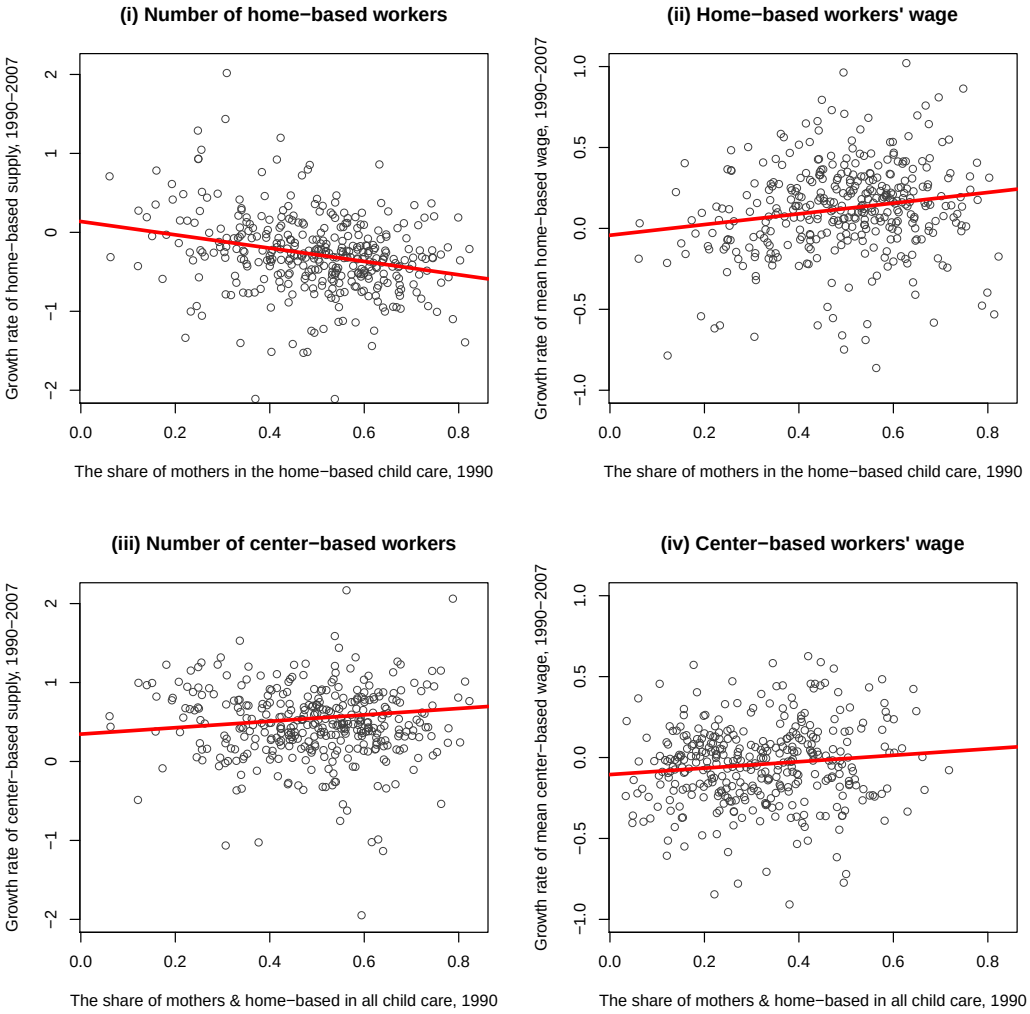
Note: the price level is adjusted by CPI to 2010 US dollar.

Cross-sectional evidence supports the declining child care supply. The above explanation predicts that a region with a larger share of working mothers in the home-based sector would experience (i) a sharper drop in the number of workers and (ii) a higher wage growth rate in the home-based child care sector. Moreover, this shock to the home-based sector may cause a larger demand shift to the center-based sector. Then, if the concentration of home-based working mothers were high, (iii) the number of center-based workers would increase more, and (iv) their wage growth rate would be higher.

These predictions are observed in Figure 8. There are four scatter plots, where each dot represents one Public Use Microdata Area (PUMA), which divides the U.S. into 543 regions. The x-axis of the top-left diagram is the fraction of working mothers having one or more children aged less than 12 years in the home-based child care sector in 1990. The y-axis is the log change in the number of total home-based child care workers per population between 1900 and 2005-2007 pooled data[16]. It shows a steep positive correlation: a higher

[16]In the ACS, 2007 is the latest year that records the uncategorized number of weeks worked last year,

Figure 8: Cross-sectional evidence



Data source: US Census in 1990 and 3-year sample of American Community Survey (ACS) in 2005–2007 available from IPUMS USA. Public Use Microdata Area with less than 30 child care workers observed in the 5% sample of 1990 US Census are eliminated.

concentration of mothers in the home-based sector was associated with a more substantial drop in the total home-based child care service. The top-right diagram keeps the same x-axis but changes the y-axis to the log change in the mean hourly wage[17] of home-based workers between 1900 and 2005–2007. A more massive drop in the home-based supply seemed to

which is required to calculate hourly wage.

[17]I show the hourly wage instead of the cross-sectional child care price directly observed in the SIPP. This is because of the SIPP's limited sample size. Given the fact that the child care is highly labor-intensive, the wage is a good proxy of the price.

lead to higher wage growth. This is consistent with the time-series evidence in Figure 7.

This structural change in the home-based sector caused a general equilibrium effect that pushed the child care demand to center-based child care. In the bottom two diagrams, the x-axes are the share of home-based child care working mothers among all the child care workers. They capture the magnitude of the occupational changes to the whole child care sector. The y-axis of the bottom-left diagram is the log change of the center-based child care workers per population. The positive correlation implies that a decline in home-based child care supply was partially covered by an expansion of center-based supply. The bottom-right diagram shows the log change in the mean hourly wage of the center-based workers. Due to the rise in the home-based child care price, parents shifted their demand to center-based. Consequently, the center-based worker's wage increased. The correlation in the center-based sector is less clear than the home-based sector, probably because it is a secondary effect through the substitution in child care demand.

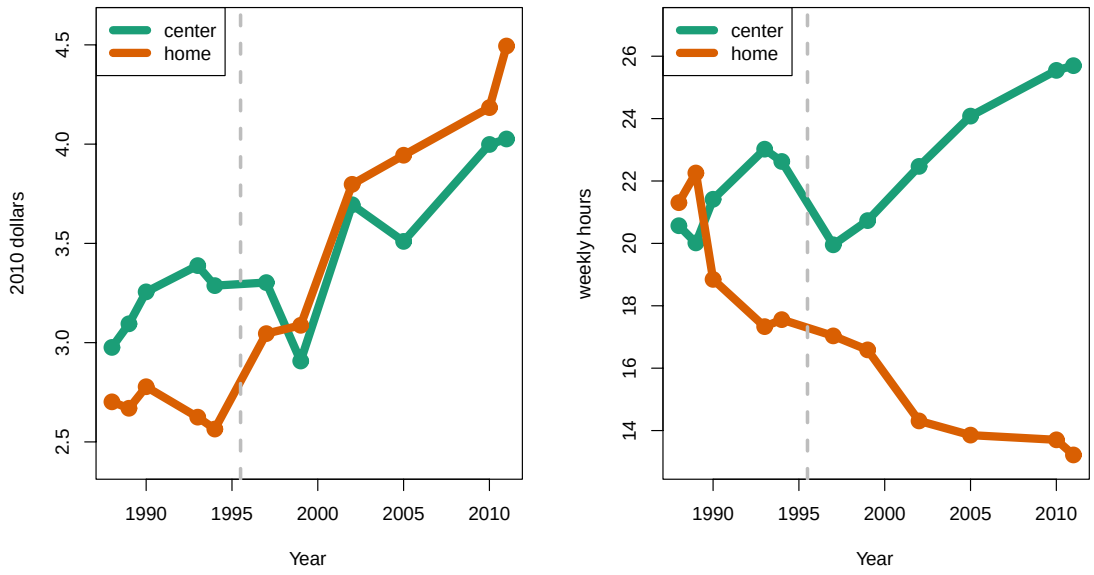
All the coefficients in Figure 8 are statistically significant at 10% or less. I also conduct a sensitivity analysis in Tables A.1 to A.4 in the Appendix[18]. All the signs are unchanged from Figure 8, but explanatory power declines in some specifications, possibly due to over-control.

This supply-side evidence is also observed from the demand side in the SIPP survey. Figure 9 shows the mean real hourly expenditure and weekly hours of child care by center/home arrangement. The home-based child care price sharply increased from the mid-1990s[19]. This corresponds to Plot (ii) of Figure 8. Moreover, by the general equilibrium effect, the center-based price also modestly rose, as shown in Plot (iv) of Figure 8. The right-hand diagram documents that the child care arrangements shifted from home-based to center-based child

[18]I first control the change in the other female worker's mean wage, because the child care worker's wage growth may be driven by state-level trend. Then, I also consider several observable characteristics of each PUMA both for the level in 1990 and the change between 1990 to 2005–2007. These are the female unemployment rate, working mother's mean wage, educational attainments, race composition, and the urbanization level.

[19]The home-based childcare price became higher than the center-based price in the 2000s. The former price is generally considered to be low-quality care. This reversal is partly because the home-based sector includes very high-quality care provided by experienced nannies. The sharp increase is robust even if nannies are excluded. Another possible explanation is that the home-based sector provides more part-time care more, which requires extra costs.

Figure 9: Hourly price and weekly hours of childcare by category



care. In line with Plots (i) and (iii) of Figure 8, there was a sharp drop in home-based hours and a small rise in center-based hours.

Some other possible factors potentially contributed to the child care price hike. A typical explanation may be the increasing demand for qualified child care by high-income families. Given the rising income inequality since the 1990s, richer families spend more on high-quality child care (Herbst, 2018). The need for expensive service may become more substantial owing to tougher competition for children's college entrance (Ramey and Ramey, 2010). This explanation is consistent with the sharper increase in child care costs of high-income groups in Figure 3. However, the price jump is also observed among middle- and low-income groups. I conduct the Blinder–Oaxaca decomposition and calculate each observable factor's contribution to the rising child care price. Figure A.4 in the Appendix shows that advancements in parent's educational status and income partially contributed to the rising price. However, there is still a large unexplained portion. Child care regulations may also limit the supply and cause the price to rise. However, there is no evidence of a large direct change in the state-level child care regulation database maintained by Bassok et al. (2012).

Monopoly power is another possible factor. Child care service is provided by relatively small organizations, but there are still large providers that may control the price. However, Figure A.3 in the Appendix shows that the share of top providers has been mostly stable over time.

4 Analytical and quantitative studies on a simple equilibrium model of the child care market

In this section, I develop a tractable model of the child care market to illustrate how child care subsidies reduce child care supply. In general, a subsidy lowers the consumer price, stimulates demand, raises the provider price, and increases the equilibrium supply. However, the evidence in Section 3 implies that the subsidy may also cause a negative supply shock through the channel of home-based child care worker's occupational choice.

The first issue addressed here is under what theoretical conditions the negative supply shock dominates the positive demand effect. The simple model used in this section reveals the importance of wage inequality and non-linearity of the subsidy schedule. If home-based workers' incomes are relatively low enough and the subsidy is highly means-tested, it leads to a larger supply-side impact.

Next, I evaluate the quantitative magnitude of the child care subsidy on its price, supply, and working mother's employment rate. The simple model's parameters are chosen to match data moments before the expansion of the subsidies. Then, the policy is introduced as an exogenous shock. I evaluate how much the model explains the actual structural change in the child care market. I also assess alternative policies.

4.1 Model

I consider a static partial equilibrium model of a child care market. There is a unit continuum of two types of women: Type A with population θ and Type B with population $1-\theta$. Their only decisions are binary occupational choices. Each Type A woman decides to work in

an office or be a homemaker. This behavior captures a child care policy's positive demand effect, which encourages more women to enter the labor market. Each Type B woman choose either office work or home-based child care job. If Type B changes her occupation from a home-based care job to office work, it causes a negative supply effect. For tractability, the homemaker option is unavailable for Type B women.

Each woman has $k > 1$ children aged 5 years or under. If a woman works in an office, she needs to purchase k units of child care services. Meanwhile, each home-based child care worker and homemaker does not pay child care costs. A home-based child care worker also takes care of z number of children from the market. The competitive child care market determines the gross child care price p. There is also a fixed supply Ω of other child care service such as daycare centers and home-based care by non-mothers. This assumption is rationalized by the observed stable labor supply of the other workers in Figure 6. The government provides a subsidy for each office worker's child care payment. The subsidy rate is a function of wage income. It is defined as $\tau(w; s)$, where w is wage and s is the parameter of the subsidy schedule.

Both office work and child care work incur the same fixed disutility δ. Labor income is used to purchase consumption good with linear utility function $u(c) = c$. The consumption good price is normalized to 1. Type A and Type B's potential wage for office work follows the distribution $F_A(w)$ and $F_B(w)$, respectively. I assume that each distribution has a density function, denoted by $f_A(w)$ and $f_B(w)$, respectively.

Optimal occupational choice and equilibrium

Type A's decision problem is defined as

$$\max_{n\in\{0,1\}} c - \delta n \quad \text{s.t. } c = \big\{w - pk[1 - \tau(w; s)]\big\}n,$$

where $n = 1$ if her choice is an office work, and $n = 0$ if it is a homemaker. The term

$pk[1-\tau(w)]$ denotes the net payment of child care services for k children. The optimal decision is

$$n_A(w;p,s) = \begin{cases} 1 & \text{if } w-\delta > pk[1-\tau(w;s)], \\ 0 & \text{otherwise.} \end{cases}$$

A Type A woman works if her utility from income w deducted by labor disutility δ is larger than the net child care price.

The decision problem of a Type B woman is written by

$$\max_{n\in\{0,1\}} c-\delta \ \text{ s.t. } c = \big\{w-pk[1-\tau(w;s)]\big\}n + (1-n)pz,$$

where $n=1$ means office work and $n=0$ is home-based child care business. Since the woman works in both cases, the labor disutility δ is irrelevant to the decision. Given the child care price p, the woman's potential income from home-based child care is pz. She does not receive the subsidy because she cares for her own children at work. The optimal decision is

$$n_B(w;p,s) = \begin{cases} 1 & \text{if } w-pk(1-\tau(w;s) > pz, \\ 0 & \text{otherwise.} \end{cases}$$

She compares the net income from office work and the income from home-based child care in making her choise..

I consider the child care market partial equilibrium in which the wage distributions and the consumption good price are given. Given the occupational decisions of Type A and Type B, the equilibrium condition is written as

$$\theta k \int n_A(w;p,s)dF_A(w) + (1-\theta)k \int n_B(w;p,s)dF_B(w) = (1-\theta)z\int [1-n_B(w;p,s)]dF_B(w) + \Omega. \quad (1)$$

The first term on the left-hand side is the demand for child care services by Type A office workers and the second term is that by Type B office workers. The right-hand side represents the child care supply by Type-B home-based providers and the others Ω. Given price p, the employment rate of Type A is defined as $\widehat{E}_A(p,s) \equiv \int n_A(w;p,s)dF_A(w)$. I focus on $\widehat{E}_A(p,s)$ rather than the total employment rate. Since Type B women always work, the total employment rate is just a linear transformation that $\theta\widehat{E}_A(p,s)+1-\theta$. Note also that $\widehat{E}_A(p,s)$ is equivalent to the labor force participation rate in this model because of the absence of unemployment. In the market equilibrium, the gross price p is determined by Equation (1) given s. Then, Type A's equilibrium employment rate is represented as $E_A(s) = \widehat{E}_A(p(s),s)$. The subsidy affects the employment rate through two channels:

$$\frac{dE_A(s)}{ds} = \frac{\partial \widehat{E}_A(p,s)}{\partial s} + \frac{\partial \widehat{E}_A(p,s)}{\partial p} \cdot \frac{dp(s)}{ds}. \tag{2}$$

The first-term represents the conventional positive demand effect by direct transfers to working mothers. The second-term corresponds to the indirect effects from the rising market child care price caused by Type B's occupational choice.

4.2 Analytical results

Linear subsidy

Before introducing a realistic means-tested policy, I first consider a linear child care subsidy. Here, I show that a linear subsidy always increases the female employment rate. In other words, non-linearity of the subsidy is necessary for the supply-side's domination.

Assume that the subsidy rate is independent from income, that is, $\tau(w;s) = s$ for all w. In this case, the parameter s defines the linear subsidy rate. The optimal decisions become

$$\begin{cases} n_A(w;p,s) = 1 & \text{if and only if } w > pk(1-s) + \delta, \\ n_B(w;p,s) = 1 & \text{if and only if } w > p[k(1-s) + z]. \end{cases}$$

Then, the equilibrium condition (1) becomes

$$\theta k\big[1-F_A\big(pk(1-s)+\delta\big)\big]+(1-\theta)k\big[1-F_B\big(p[k(1-s)+z]\big)\big] = (1-\theta)zF_B\big(p[k(1-s)+z]\big)+\Omega. \quad (3)$$

Proposition 1. $\dfrac{dE_A}{ds} > 0$ *for all* $s \in (0,1)$.

Proof. The equilibrium condition (3) can be rewritten as

$$\theta kF_A\big(pk(1-s)+\delta\big) + (1-\theta)(k+z)F_B\big(p[k(1-s)+z]\big) = \text{constant term}.$$

The implicit function theorem implies that

$$\frac{dp(s)}{ds} = \frac{\theta pk^2 f_A\big(p(1-s)+\delta\big) + (1-\theta)(k+z)pkf_B\big(p[k(1-s)+z]\big)}{\theta k^2(1-s)f_A\big(p(1-s)+\delta\big) + (1-\theta)(k+z)[k(1-s)+z]f_B\big(p[k(1-s)+z]\big)}.$$

The marginal change of the Type A employment rate is

$$\begin{aligned}
\frac{dE_A}{ds} &= \frac{\partial \widehat{E}_A(p,s)}{\partial s} + \frac{\partial \widehat{E}_A(p,s)}{\partial p}\frac{dp}{ds} \\
&= pkf_A - k(1-s)f_A\left[\frac{\theta pk^2 f_A + (1-\theta)(k+z)pkf_B}{\theta k^2(1-s)f_A + (1-\theta)(k+z)[k(1-s)+z]f_B}\right] \\
&= pkf_A\left[1 - \frac{\theta kf_A + (1-\theta)(k+z)f_B}{\theta kf_A + (1-\theta)(k+z)\big(\frac{k(1-s)+z}{k(1-s)}\big)f_B}\right] \\
&> pkf_A\left[1 - \frac{\theta kf_A + (1-\theta)(k+z)f_B}{\theta kf_A + (1-\theta)(k+z)\big(\frac{k(1-s)}{k(1-s)}\big)f_B}\right] = 0.
\end{aligned}$$

□

The intuition is simple. Suppose, on the contrary, that the Type A employment rate decreases. By $n_A(w;p,s)$, it must be associated with an increase in the net child care price. Then, the child care job becomes more attractive for Type B women. This implies a rise in the child care supply, which contradicts the equilibrium condition.

Means-tested subsidy

Actual U.S. child care subsidies are highly means-tested. The non-linearity of subsidy schedules has a distributional effect, which may affect Type B workers more than Type A workers. Here, I consider the simplest means-tested subsidy:

$$\tau(w;s) = \begin{cases} 1 & \text{if } w \leq s, \\ 0 & w > s. \end{cases}$$

An office worker with income less than or equal to s is eligible for the full subsidy. However, no amount is transferred to a woman with $w > s$. In this case, the shape parameter s defines the eligibility criterion of income. If a Type A worker's potential wage is $w \leq s$, the condition of market participation is $w - \delta > 0$. In other words, if $\delta < s$, each worker with $w \in (\delta, s]$ works in an office. Similarly, if $pz < s$, each Type B worker with $w \in (pz, s]$ chooses office work. Indeed high-skilled workers still choose office work regardless of subsidy. Then, the optimal decisions are summarized as

$$\begin{cases} n_A(w;p,s) = 1 & \text{if and only if } w \in (\delta, s] \text{ or } w > pk + \delta, \\ n_B(w;p,s) = 1 & \text{if and only if } w \in (pz, s] \text{ or } w > p(k+z). \end{cases}$$

I focus only on the case of $pz < s$ so that at least some of Type B workers receive the subsidy. However, $\delta < s$ might not be satisfied. Then, the equilibrium condition (1) becomes:

$$\begin{aligned} &\theta k\big[\max\{F_A(s) - F_A(\delta), 0\} + 1 - F_A(pk+\delta)\big] \\ &+ (1-\theta)(k+z)\big[F_B(s) - F_B(pz) + 1 - F_B\big(p(k+z)\big)\big] = (1-\theta)z + \Omega \end{aligned} \tag{4}$$

If $s < \delta$, no Type A woman receives the subsidy; hence, a marginal increase in s stimulates only Type B. Therefore, the policy causes the equilibrium child care supply and Type A's employment rate to decline. Even if $s > \delta$, this Type B's effect is still dominant under the condition below.

Proposition 2.

$$\frac{\partial E_A}{\partial s} < 0 \quad \textit{if} \quad s < \delta \quad \textit{or} \quad \frac{f_B(s)}{f_A(s)} > \left(\frac{z f_B(pz) + (k+z) f_B\big(p(k+z)\big)}{k f_A(pk+\delta)} \right) \tag{5}$$

Proof. If $s < \delta$, Equation (4) is

$$\theta k\big[1 - F_A(pk+\delta)\big] + (1-\theta)(k+z)\big[F_B(s) - F_B(pz) + 1 - F_B\big(p(k+z)\big)\big] = (1-\theta)z + \Omega$$

No Type A worker receives the subsidy; hence, $\partial \widehat{E}_A(p,s)/\partial s = 0$. By the implicit function theorem, $dp(s)/ds > 0$, which reduces $E_A(s)$. Next, consider $s > \delta$. By Equation (4),

$$\frac{dp(s)}{ds} = \frac{\theta k f_A(s) + (1-\theta)(k+z) f_B(s)}{\theta k^2 f_A(pk+\delta) + (1-\theta)(k+z)\big[z f_B(pz) + (k+z) f_B\big(p(k+z)\big)\big]}.$$

In this case, $\partial \widehat{E}_A(p,s)/\partial s = f_A(s)$ and $\partial \widehat{E}_A(p,s)/\partial p = -k f_A(pk+\delta)$. Then,

$$\frac{\partial E_A(s)}{\partial s} < 0$$

$$\Leftrightarrow \; f_A(s) - k f_A(pk+\delta) \left(\frac{\theta k f_A(s) + (1-\theta)(k+z) f_B(s)}{\theta k^2 f_A(pk+\delta) + (1-\theta)(k+z)\big[z f_B(pz) + (k+z) f_B\big(p(k+z)\big)\big]} \right) < 0,$$

$$\Leftrightarrow \; \frac{\theta k + (1-\theta)(k+z)\frac{f_B(s)}{f_A(s)}}{\theta k + (1-\theta)(k+z)\frac{z f_B(pz) + (k+z) f_B\left(p(k+z)\right)}{k f_A(pk+\delta)}} > 1,$$

which is equivalent to Equation (5). □

A marginal increase in s directly crowds out $f_B(s)$ population of Type B women, while allowing $f_A(s)$ number of Type A women to enter the labor force. Equation (5) implies that the former should be sufficiently larger than the latter, given controlling for the indirect price effect on the right-hand side.

Finally, I consider the case in which both F_A and F_B follow uniform distributions.

Collorary 1. *Suppose that $s > \delta$ and both F_A and F_B follow uniform distributions. Then,*

$$\frac{\partial E_A}{\partial s} > 0.$$

Under the uniform distribution, the model does not have enough mass of Type B workers around s, which violates Equation 5. This corollarly suggests another condition for the backfire effect of the child care subsidy: heterogeneity in wage distributions.

4.3 Quantitative evaluation of the means-tested subsidies

Although this model is simple, its parameters can be carefully calibrated by wage distributions, the female employment rate, and other child care market equilibrium characteristics. I also obtain realistic eligibility parameter s and evaluate the actual means-tested policies.

The primary calibration target is obtained from a pooled sample of Annual Social and Economic Supplement of the CPS from 1986 to 1995. I use the sub-sample of all mothers with children aged younger than or equal to 5 years. I first decide $k = 1.21$ by the mean number of those children. I assume that both F_A and F_B follow log-normal distributions. Given the observed price $p = \$2.97$ in 1990 from Figure 1, F_A's two parameters (μ_A, σ_A) and the labor disutility δ are jointly estimated by the maximum likelihood method. To eliminate the selection effect, I repeat the estimation so that the simulated results match the non-child care working mother's mean hourly wage, its standard deviation, and the employment rate. The results are $(\mu_A, \sigma_A) = (2.01, 0.41)$ and $\delta = 5.84$. On the supply side, the number of children cared for by one worker is calibrated as $z = 2.1$ by the average hourly wage of home-based child care workers divided by the child care price. Estimating F_B is challenging because potential Type B workers cannot be identified in the data. I estimate F_B to match the wage distribution of workers who worked for a home-based child care business in the previous year and changed jobs in the current year. The result is $(\mu_B, \sigma_B) = (1.90, 0.28)$. Note that F_B is more skewed to the left than F_A is; hence, the condition of Proposition 2 is possibly satisfied. The amount of other child care supply Ω is obtained from the fact that those workers' share is 79% in the CPS. Thus, the fraction of Type A, θ, is determined to simulate the equilibrium price $p = \$2.97$. The results are $\theta = 0.80$ and $\Omega = 0.47$.

Figure 10 shows comparative statics according to the eligibility level of income s of the means-tested subsidy. There are three regions divided by the two dotted black lines. In the left region, nobody receives the subsidy, because the eligibility level s is too low. In the middle region, only some of Type B workers benefit from the subsidy because of their relatively low wages. In this centeral area, as the cutoff s rises, more Type B workers change the jobs to office work—subsequently, the gross child care price increases. Since no Type A woman receives the subsidy, the employment rate declines. Therefore, the subsidy causes only a negative supply shock in the market. In the right region, the government also endows Type A workers and creates the conventional positive demand effect. This causes the consumer price to decline and encourages Type A's market participation. I estimate the actual eligibility level of the wage as \$6.00 from the Child Care and Development Fund Administrative data. Between 2009 and 2011, 29.1% of the subsidy recipients were between 50% and 100% of the poverty income level, and 25.5% of them were between 100% and 150%. However, the fraction declined to 9.9% for between 150% and 200%, and 5.9% for between 200% and 250%. Then, I define the eligibility level as \$6.00 from the mean hourly wage of working mothers who were between 125% to 150% of the poverty level observed in the CPS. Head Start imposes similar requirements: it allows children from families with income below 130% of the poverty line. The \$6.00 eligibility level is depicted as the orange dotted line in Figure 10.

Overall, this simulation reasonably explains the actual trend. The model predicts that the net price increased to \$3.18 in 2010, which is almost equivalent to \$3.15 in Figure 1. The gross price increases to \$3.54, which explains more than 60% of the observed change between 1990 and 2010. The maternal employment rate drops to 42.1%, which also captures the recent declining trend in the U.S.

4.4 Alternative policies

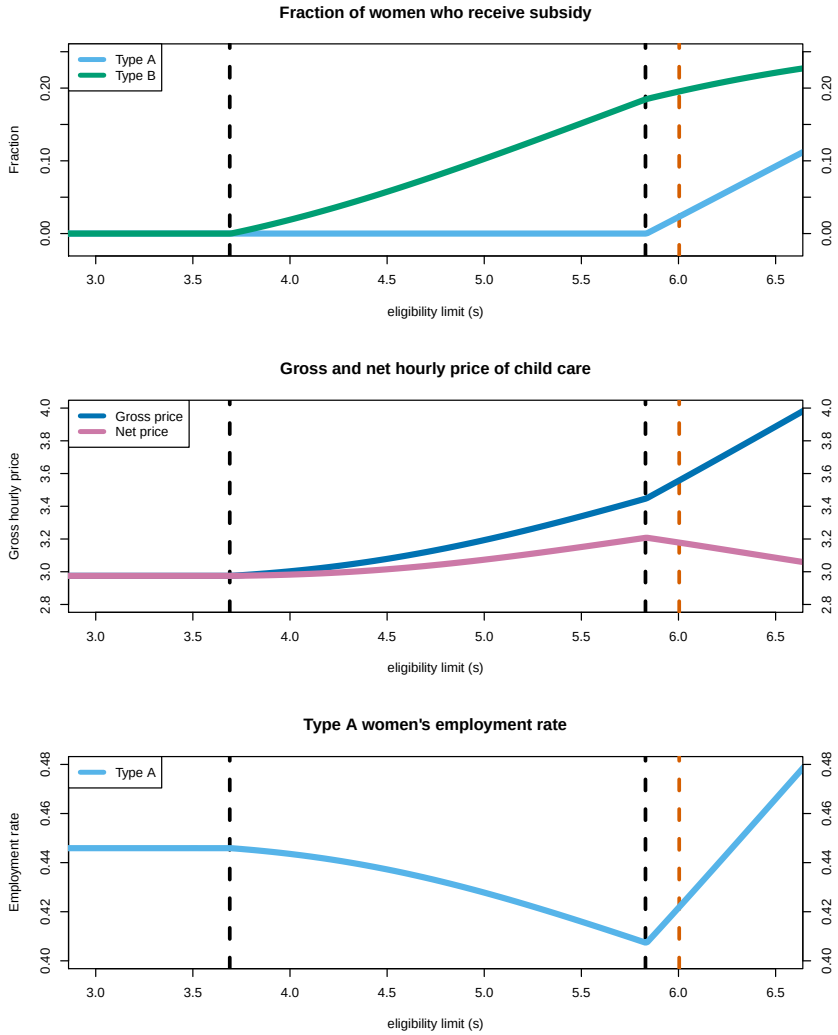
I also consider two alternative policies: a linear consumer-side child care subsidy to office workers and a linear supply-side subsidy to home-based childcare business. In these two

simulations, the government distributes the same amount of money as in the means-tested case.

Table 1 summarizes the consequences of each policy. The linear child care subsidy to office workers causes a positive effect as in Proposition 1. The consumer price declines from \$2.97 to \$2.78, and the employment rate increases from 44.5% to 46.2%. This effect is substantial, but I find a more drastic effect in the second policy. The subsidized home-based child care providers cause the consumer price to decline to \$2.37, and then the maternal employment rate increases to 49.8%. One reason for this substantial crowding-in effect is the absence of the counter-policy effects as in the benchmark means-tested case. Moreover, the subsidy is distributed only to child care workers, who are the crucial agents in the market. By comparison, the demand-side subsidies are transferred to mothers who are not on the labor market participation margin, such as Type B workers in the means-tested case and high-income mothers in the case of the linear subsidy.

Overall, this simulation suggests a sensitivity of the market to how and to whom money is distributed. Working mothers respond to the policy differently according to their occupation and income level. Even in this simple model, by the interaction of both supply and demand-side shifts, each different policy leads to a non-uniform outcome.

Figure 10: Expansion of means-tested subsidy



Note: The wage is adjusted to the price level in 2010 by the consumer price index.

Table 1: Consequences of various subsidy policies

	no subsidy	means-tested	linear mothers	linear home-based
Producer price	\$2.97	\$3.54	\$3.17	\$3.60
Consumer price	\$2.97	\$3.18	\$2.78	\$2.37
Employment rate	44.5%	42.1%	46.2%	49.8%

Note: The wage is adjusted to the price level in 2010 by the consumer price index.

5 Conclusion

This study provides new insights into the child care market in the U.S. The first contribution is that this study provides the long-term trend of price, hours, and other child care market measures. There has been a massive increase in price and a significant drop in the supply since the late-1990s. Next, I determine that a possible source of the child care crisis is the expansion of the federal and state means-tested child care subsidies since the mid-1990s. These were distributed to low-income working mothers who were also potential child care workers. By distorting their incentives, the policy unexpectedly discouraged the child care business in the home-based sector. The simple model used in this study confirms this channel from both theoretical and numerical perspectives.

The numerical analysis of this model suggests there should be a child care subsidy for the supply side, in particular, the home-based child care business. Given the same budget as the current means-tested policies, this would substantially reduce the child care price by 20% and raise the maternal employment rate from 44.5% to 49.8%. Home-based child care is a unique job option for working mothers. It allows mothers to stay at home with children and to earn some allowance. Subsidizing this business would cause a substantial crowding-in effect: more child care employment and a declining price, which would eventually encourage working mothers to participate in the labor market.

However, home-based child care is generally considered as low-quality care in terms of educational outcomes. There is some evidence that center-based child care outperforms informal care, including both market and relative/family care in terms of children's cognitive and non-cognitive skills (Bernal and Keane, 2011; Havnes and Mogstad, 2011b). Moreover, Gupta and Simonsen (2010) find negative impacts of home-based care even compared to relative/family care for boys of low-education mothers. In the U.S., home-based care's quality has gradually improved. The share of licensed providers among the family daycare homes increased from 42.1% to 54.4% in the 1990s[20]. With the Child Care and Development

[20]The number of family daycare homes is obtained from the Nonemployer Statistics for the United States. The number of licensed family daycare homes is from Hamilton et al. (2002).

Block Grant Act in 2014, the federal government has expanded the quality improvement expenditure. Such quality control may resolve the uncertainty in the educational outcomes of the home-based service, and may eventually lead to a similar crowding-in effect.

A possible avenue for future research is to evaluate the welfare and distributional implications in a rich quantitative model with detailed household behaviors, child care worker's occupational choice, fertility decision, and subsidy schemes. Such a model should also control the child care quality. Based on the empirical research on child development outcomes, the quality may be estimated as monetarized or utility value. Since the current policies conduct both monetary transfers and quality improvement activities, a cost–benefit analysis in terms of both price and quality is required. Moreover, a change in quality would stimulate both child care supply and demand. An extension of the equilibrium analysis of this study would be beneficial.

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Appendix

Supplemental Figures

Figure A.1: Real hourly child care costs by mother's hourly wage quantile

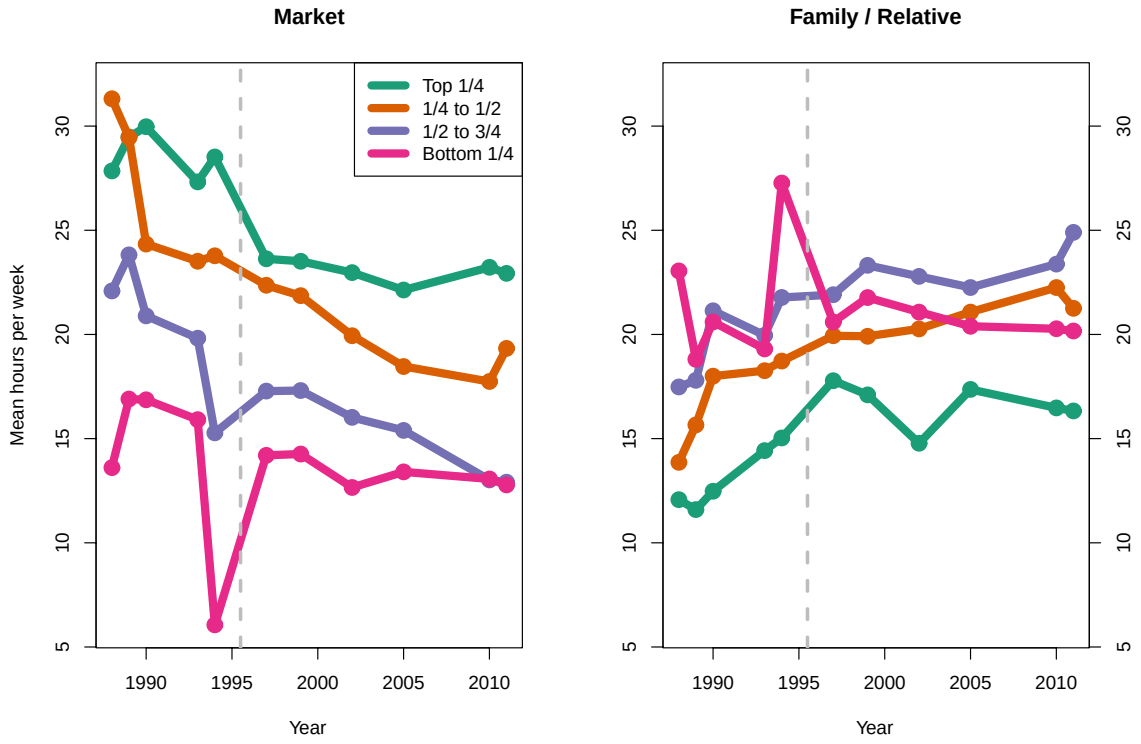


Figure A.2: Hours of child care costs by mother's hourly wage quantile

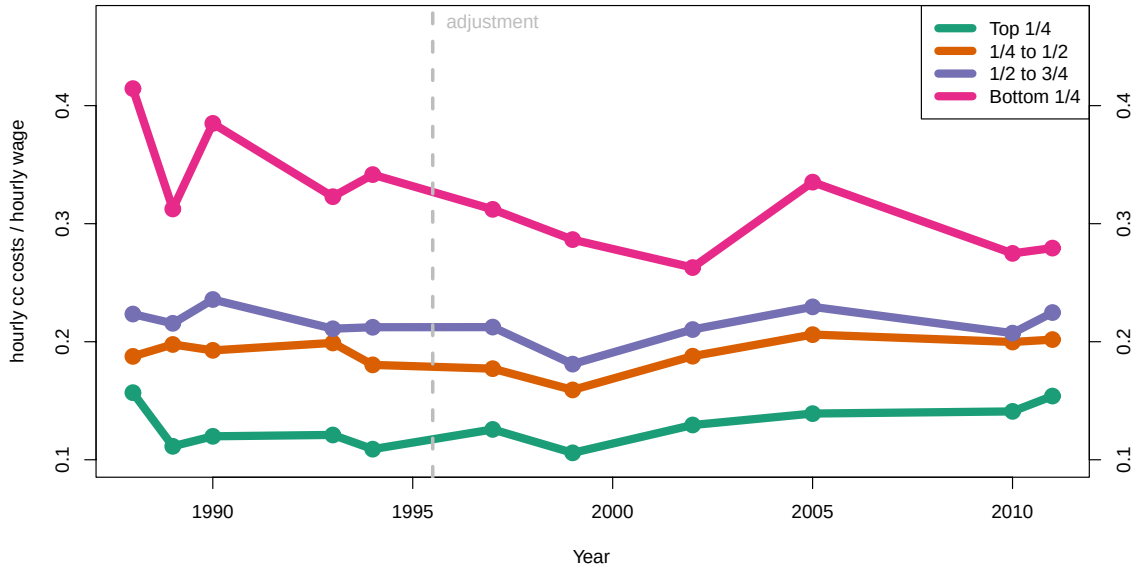
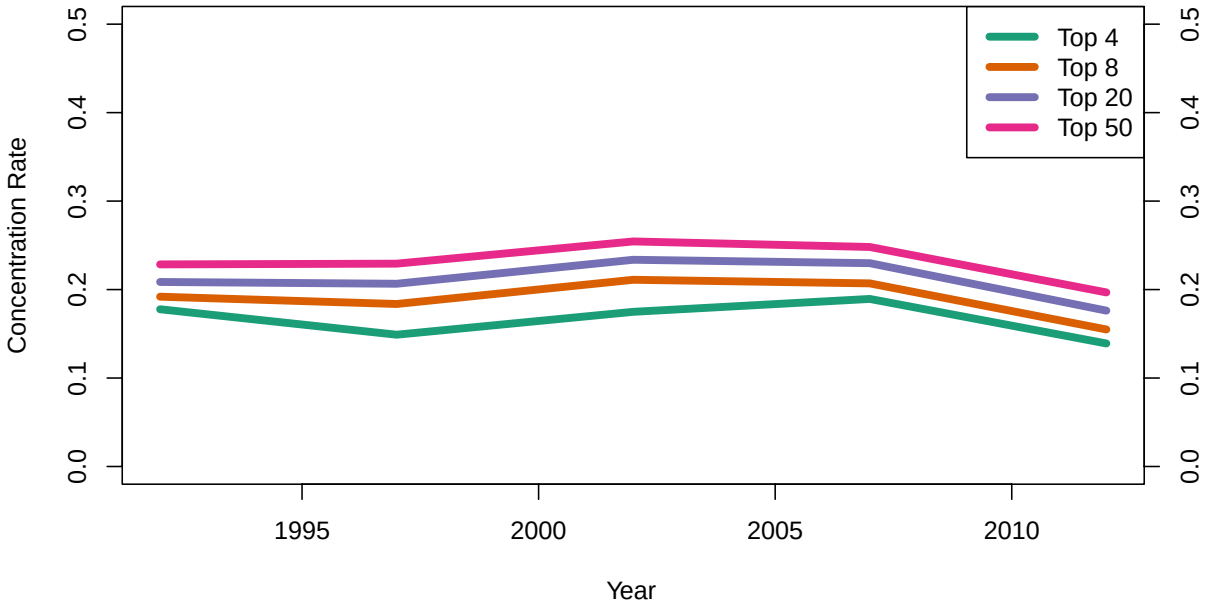


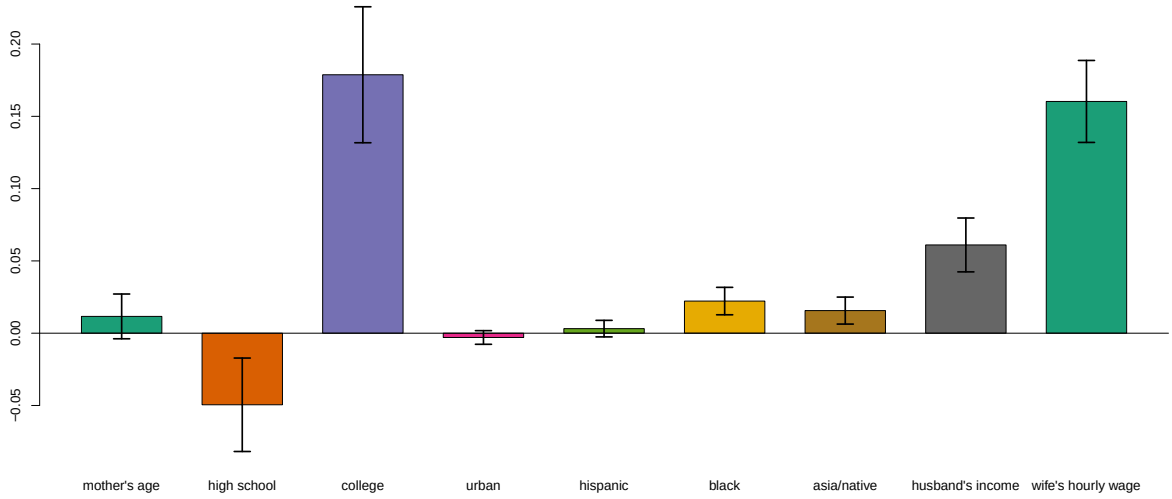
Figure A.3: The concenration rate of the largest providers in the child care industry



Data Source: Economic Census

Blinder-Oaxaca decomposition of the rise in child care price

Figure A.4: Blinder-Oaxaca decomposition of the rising child care price and hours



The child care choices potentially rely on many factors, such as household income, mother's education, race. I conduct the Blinder-Oaxaca decomposition of the change in two pooled period: 1997 and 1999, and 2010 and 2011. The increasing price is decomposed into mother's age, mother's educational status, urban/rural dummy, races, husband's income, and wife's hourly wage. From the perspective of the wife's labor supply decision, the husband's income is interpreted as a wealth effect and wife's wage causes both wealth and substitution effects. Figure A.4 summarizes the result. The major factors are college degree, husband's income, and wife's wage, which explains 18%, 6%, and 16%, respectively. This is related to the rising demand for high-quality care by richer families, as suggested by Ramey and Ramey (2010) and Herbst (2018). However, there is still a large unexplained portion.

Sensitivity of the cross sectional regression in Figure 8

I consider regressions on four dependent variables. Each one is the log difference between 1900 and 2005-2007 pooled data. The dependent variable of A.1 is the number of home-based child care workers, that of Table A.2 is the mean wage of home-based child care workers, that of Table A.3 is the number of center-based child care workers, and that of Table A.4 is the mean wage of center-based child care workers.

The main interest is the share of working mothers who have at least one child aged less than or equal to 12 years in the home-based child care sector in 1990 in Figure A.1 and A.2, and the share of these mothers in the total child care sector in Figures A.3 and A.4. For each control, I consider the log change between 1900 and 2005–2007 pooled data and the level in 1990. The controls include the mean wage of all workers except the child care workers, the unemployment rate of the PUMA area, and the mean age of working mothers who have at least one child aged less than 12 years. Moreover, I consider the fraction of working mothers whose educational attainment is highschool, 2-year college, 4-year college or more; whose race is Black, Asian, and Hispanic; and who lives in urban areas.

Table A.1: The change in the number of home-based workers due to working mother's share

	Dependent variable:				
	log diff. in the number of home-based workers				
	(1)	(2)	(3)	(4)	(5)
Work mom share in HB in 1990	−0.923	−0.927	−1.152	−0.187	−0.367
	(0.173)	(0.175)	(0.222)	(0.212)	(0.259)
log diff. in the other workers' mean wage		0.029	0.028	0.319	0.260
		(0.180)	(0.198)	(0.193)	(0.209)
log diff. in the unemployment rate			0.205		0.379
			(0.160)		(0.167)
log diff. in mother's mean age			−3.806		−2.335
			(1.606)		(1.936)
log diff. in highschool			−0.575		−0.489
			(0.406)		(0.809)
log diff. in 2-year college			0.175		0.652
			(0.195)		(0.228)
log diff. in 4-year college			−0.276		0.107
			(0.283)		(0.368)
log diff. in black share			0.031		0.049
			(0.078)		(0.077)
log diff. in asian hare			−0.116		0.024
			(0.100)		(0.102)
log diff. in hispanic share			−0.090		−0.021
			(0.062)		(0.064)
log diff. in city share			0.109		0.195
			(0.144)		(0.191)
other workers' wage in 1990				0.056	0.048
				(0.020)	(0.021)
unemp rate in 1990				8.373	16.573
				(3.016)	(4.436)
mother's mean age in 1990				0.065	0.049
				(0.024)	(0.032)
highschool in 1990				0.044	−0.070
				(0.932)	(1.340)
2-year college in 1990				2.582	4.719
				(1.554)	(2.025)
4-year college in 1990				0.166	1.354
				(0.796)	(1.660)
black share in 1990				0.872	0.657
				(0.278)	(0.322)
asian share in 1990				0.378	0.447
				(0.635)	(0.628)
hispanic share in 1990				0.607	0.640
				(0.351)	(0.434)
city share in 1990				−0.061	−0.025
				(0.075)	(0.175)
Constant	0.184	0.181	0.663	−3.848	−3.856
	(0.090)	(0.092)	(0.163)	(1.131)	(1.633)
Observations	366	366	274	366	274
R^2	0.072	0.072	0.163	0.206	0.310
Adjusted R^2	0.070	0.067	0.128	0.179	0.253

Table A.2: The change in the home-based worker's wage due to working mother's share

	Dependent variable:				
	log diff. in the home-based worker's mean wage				
	(1)	(2)	(3)	(4)	(5)
Work mom share in HB in 1990	0.399	0.349	0.506	0.273	0.418
	(0.103)	(0.104)	(0.131)	(0.133)	(0.164)
log diff. in the other workers' mean wage		0.129	0.109	0.094	0.193
		(0.107)	(0.116)	(0.121)	(0.132)
log diff. in the unemployment rate		0.142	−0.015		0.004
		(0.069)	(0.094)		(0.106)
log diff. in mother's mean age			−0.225		−0.093
			(0.945)		(1.225)
log diff. in highschool			−0.190		0.226
			(0.239)		(0.511)
log diff. in 2-year college			0.017		0.024
			(0.115)		(0.144)
log diff. in 4-year college			−0.212		−0.254
			(0.166)		(0.233)
log diff. in black share			−0.055		−0.085
			(0.046)		(0.049)
log diff. in asian hare			0.015		0.028
			(0.059)		(0.065)
log diff. in hispanic share			0.053		0.047
			(0.036)		(0.040)
log diff. in city share			−0.056		−0.227
			(0.084)		(0.121)
other workers' wage in 1990				−0.005	0.011
				(0.013)	(0.013)
unemp rate in 1990				−1.862	1.382
				(1.894)	(2.805)
mother's mean age in 1990				−0.001	0.012
				(0.015)	(0.020)
highschool in 1990				−0.484	0.567
				(0.585)	(0.848)
2-year college in 1990				1.348	1.577
				(0.976)	(1.280)
4-year college in 1990				−0.259	0.486
				(0.500)	(1.050)
black share in 1990				0.034	−0.130
				(0.174)	(0.204)
asian share in 1990				0.230	0.052
				(0.399)	(0.397)
hispanic share in 1990				−0.382	−0.197
				(0.220)	(0.274)
city share in 1990				0.016	−0.196
				(0.047)	(0.111)
Constant	−0.081	−0.096	−0.107	0.361	−0.949
	(0.053)	(0.054)	(0.096)	(0.710)	(1.032)
Observations	366	366	274	366	274
R^2	0.040	0.057	0.093	0.075	0.136
Adjusted R^2	0.037	0.049	0.055	0.044	0.064

Table A.3: The change in the number of center-based workers due to working mother's share

	Dependent variable:				
	log diff. in the number of center-based workers				
	(1)	(2)	(3)	(4)	(5)
Work mom share in 1990	0.398	0.398	0.332	0.951	0.773
	(0.173)	(0.174)	(0.215)	(0.222)	(0.262)
log diff. in the other workers' mean wage		0.003	0.078	0.282	0.177
		(0.170)	(0.176)	(0.188)	(0.197)
log diff. in the unemployment rate			−0.123		−0.067
			(0.141)		(0.156)
log diff. in mother's mean age			−2.641		−1.048
			(1.428)		(1.831)
log diff. in highschool			−0.337		−0.704
			(0.362)		(0.761)
log diff. in 2-year college			0.037		0.155
			(0.174)		(0.216)
log diff. in 4-year college			−0.328		−0.271
			(0.252)		(0.344)
log diff. in black share			0.099		0.163
			(0.070)		(0.073)
log diff. in asian hare			0.024		0.118
			(0.089)		(0.097)
log diff. in hispanic share			−0.158		−0.113
			(0.055)		(0.060)
log diff. in city share			0.217		0.187
			(0.127)		(0.179)
other workers' wage in 1990				0.030	0.023
				(0.020)	(0.020)
unemp rate in 1990				6.617	3.675
				(2.932)	(4.162)
mother's mean age in 1990				0.026	0.028
				(0.024)	(0.030)
highschool in 1990				−2.967	−1.160
				(0.904)	(1.263)
2-year college in 1990				−0.822	−1.868
				(1.518)	(1.892)
4-year college in 1990				−1.458	−0.957
				(0.781)	(1.560)
black share in 1990				−0.178	0.253
				(0.274)	(0.306)
asian share in 1990				0.928	1.293
				(0.619)	(0.591)
hispanic share in 1990				−0.236	0.341
				(0.343)	(0.408)
city share in 1990				−0.059	−0.082
				(0.075)	(0.165)
Constant	0.350	0.350	0.688	0.657	−0.223
	(0.061)	(0.065)	(0.133)	(1.106)	(1.546)
Observations	366	366	274	366	274
R^2	0.014	0.014	0.087	0.107	0.157
Adjusted R^2	0.012	0.009	0.049	0.077	0.087

Table A.4: The change in center-based worker's wage due to working mother's share

	Dependent variable:				
	log diff. in the center-based worker's mean wage				
	(1)	(2)	(3)	(4)	(5)
Work mom share in 1990	0.187	0.176	0.014	0.229	0.036
	(0.097)	(0.097)	(0.124)	(0.128)	(0.154)
log diff. in the other workers' mean wage		0.241	0.150		0.013
		(0.096)	(0.102)		(0.116)
log diff. in the unemployment rate		−0.080	0.011		−0.081
		(0.061)	(0.081)		(0.092)
log diff. in mother's mean age			−0.512		−1.225
			(0.826)		(1.079)
log diff. in highschool			−0.151		0.216
			(0.209)		(0.448)
log diff. in 2-year college			−0.043		−0.062
			(0.100)		(0.127)
log diff. in 4-year college			−0.077		0.056
			(0.146)		(0.203)
log diff. in black share			0.022		0.043
			(0.040)		(0.043)
log diff. in asian hare			−0.037		−0.065
			(0.052)		(0.057)
log diff. in hispanic share			0.029		0.024
			(0.032)		(0.036)
log diff. in city share			0.049		0.124
			(0.074)		(0.106)
other workers' wage in 1990				−0.024	−0.023
				(0.010)	(0.012)
unemp rate in 1990				−2.326	−4.126
				(1.681)	(2.451)
mother's mean age in 1990				0.018	0.008
				(0.014)	(0.018)
highschool in 1990				−0.842	0.265
				(0.519)	(0.744)
2-year college in 1990				−0.115	−0.060
				(0.873)	(1.114)
4-year college in 1990				−0.011	0.882
				(0.435)	(0.919)
black share in 1990				0.173	0.277
				(0.157)	(0.180)
asian share in 1990				0.434	0.408
				(0.355)	(0.348)
hispanic share in 1990				−0.092	0.171
				(0.197)	(0.240)
city share in 1990				−0.007	0.085
				(0.042)	(0.097)
Constant	−0.102	−0.127	−0.049	0.028	−0.288
	(0.034)	(0.036)	(0.077)	(0.635)	(0.911)
Observations	366	366	274	366	274
R^2	0.010	0.030	0.028	0.048	0.068
Adjusted R^2	0.008	0.022	−0.013	0.018	−0.009