Assessing the Smooth Rise in Mothers' Employment as Children Age

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We study the trajectory of maternal employment as children age and assess the factors underlying the smooth increase in mothers' employment as their youngest child ages. Our results indicate that the rising employment profile is largely not associated with falling child care costs, changes in nonlabor income, or marital dissolution as children age. Differences in educational attainment and wage opportunities are related to some of the increase in employment when children are under 4 years old but do not explain any after that age. We discuss explanations for the rising pattern of mothers' employment that might be consistent with our results.

I. Introduction

A wide range of policies aim to increase employment rates among low-skilled people, particularly mothers because of their relatively low rates of employment and their relatively high use of social welfare benefits.[1] Despite these policies, mothers' employment rates are significantly below those of fathers and childless women.[2] However, mothers' employment

[1] The Earned Income Tax Credit is the largest cash transfer program for low-income Americans, but benefits are conditional on employment. The Personal Responsibility and Work Opportunity Reconciliation Act of 1996 contained a number of reforms that conditioned benefits on employment or employment-related activities, such as job search. There are also an array of tax deductions and direct subsidies at the federal and state levels to subsidize child care expenses to encourage parents to work.

[2] For example, in our data, which we describe below, the employment rate of fathers in 2010 was 90 percent and that of mothers was 64 percent.
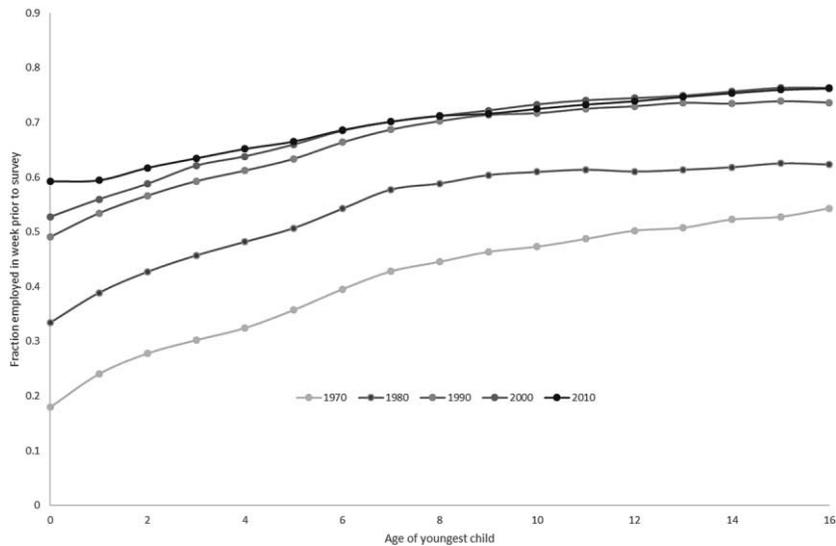
Figure 1.—Mothers' employment rate by age of youngest child, 1970–2010.

rates change significantly and with a marked pattern as their children age, a fact noted in Mincer (1962). Figure 1 shows mothers' employment rates in the week before each survey by the age of her youngest child separately for each decennial census from 1970 to 2010.[3] In 1970, 18 percent of mothers whose youngest child was less than 1 year old worked, and 54 percent of mothers whose youngest child was 16 years old worked. The gradient is less steep, but still present, in 2010. Employment rates rise from 59 percent among mothers whose youngest child is less than 1 year old to 76 percent among mothers whose youngest is 16. The increase in maternal employment as children age is surprisingly smooth; it is not driven by rapidly increasing employment rates in the first few years after a child is born or sharp increases after a child is of school age. The pattern of employment observed in figure 1 indicates that most mothers will eventually work and that by the time their youngest child is age 16 their rates of employment will be much closer to those of fathers and childless women.

Our paper studies the factors underlying mothers' rising employment trajectory. It builds on a long literature at the intersection of labor supply and family economics. Browning (1992) documents trends similar to those in our figure 1 for 1970 and 1985 and provides the most comprehensive recent survey of the theoretical issues and empirical analyses underlying the relationship between children's ages and their mothers' employment. Since female labor force participation has been rising and maternity leave has become more common, our first contribution is to pro-

[3] Our data and sample construction are described in more detail in Sec. II. We use the 2008–12 five-year American Community Survey (ACS) and refer to it as 2010 or the "2010 ACS."

vide an updated description of how mothers' employment rates change as their children age, how this pattern has changed between 1970 and 2010, and whether the pattern differs by socioeconomic characteristics.

Then, guided by a basic model of labor supply, we investigate whether several of the most cited theoretical determinants of labor supply can explain the rising employment profile in figure 1, some of which have been previously explored and some not. In particular, we assess whether the rising employment trajectory is altered when we control for changes in household composition, including the number of children and mothers' marital status; changes in mothers' nonlabor income, including the earnings of her spouse; changes in the composition of women entering employment at different ages, as measured by their education and wage opportunities; changes in fathers' employment; and changes in child care costs as children age.

An additional contribution of our paper is a new assessment of whether children's transition to school has particularly important effects on maternal employment. Reaching school-starting age is associated with a decrease in the cost of child care and the time demands on parents (or other caregivers). There is a broadly held, popular perception that child care costs greatly inhibit mothers' employment.[4] The academic literature, however, is quite mixed as to whether child care costs are a substantial barrier to employment. Our analysis builds on a strand of this literature that assesses whether mothers' employment rates rise when their children become eligible for public school. We assess the reduced-form effect of children reaching the school transition ages of 5 and 6 on mothers' employment by evaluating whether there is a discontinuous change in mothers' employment at ages 5 and 6 vis-à-vis the trend in employment as children age.

Our analysis indicates that differences across women in educational attainment and wage opportunities are associated with some of the increase in employment when children are under 4 years old but do not explain any after that age, when much of the increase occurs. Moreover, mothers' employment trajectory is well described by a quadratic polynomial in the age the youngest child, with little evidence of noticeable deviations at the ages when children transition into school. Our results indicate that the youngest child reaching school-starting age is associated with a 1–1.5 percentage point increase in the mother's employment rate, which reflects a roughly 2 percent effect relative to the baseline employment rate. Overall, however, much of the rise in mothers' employment is not related to the characteristics that we consider, including important determinants of labor supply, such as household composition and nonlabor income, or to maternal age or birth cohort. Our analysis indicates that much of this labor force participation behavior of mothers is driven by factors not com-

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[4] See, e.g., the articles by Quart (2013) and DeSilver (2014).

monly part of the theoretical or policy discussions. These results highlight that more work is needed to understand the determinants of maternal employment decisions as their children age. This is particularly important as researchers continue to study the dramatic evolution of female labor force participation over the past few decades and the reasons behind the stalling of this progress since the 1990s (Blau and Kahn 2013).

II. Mothers' Employment Rises Steadily as Children Age

We begin by documenting a number of important facts about the relationship between maternal employment and a child's age. The data for our analysis come from the 1970, 1980, 1990, and 2000 United States decennial censuses and the 2010 ACS.[5] Our sample includes all mothers who have a child aged up to 16 in the household. We limited the sample of mothers to those aged 22–56 who were aged 14–48 when they gave birth to their children. Employment is measured in the week before the survey, which for the 1970–2000 censuses is April 1. The ACS is a year-round survey, and the actual timing of the survey within the year is unknown.[6] The averages underlying the figures in this section are presented in an appendix. Mothers who have a job but are temporarily absent from work (e.g., on maternity leave) are classified as employed.

We follow an existing literature and relate mothers' employment rates to the age of the youngest child and conduct our analysis separately by year.[7] Younger children require more supervision, and thus it is likely that the age of the youngest child is a more important correlate of mothers' employment decisions. Nevertheless, the age of the youngest child is correlated with whether there are other children in the household, their ages, and whether a mother will have children in the future. We explore the roles of these variables further in Section IV.

As mentioned in Section I, figure 1 shows the unadjusted, average employment rates for mothers in this sample separately for each survey year. In each year there is a smooth, positive increase in mothers' employment with the age of the youngest child. The rise in employment is clearly present both in early years after a child is born and in years after a child is

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[5] Specifically, in 1970 we pool the 1 percent Form 1 State sample, the 1 percent Form 2 State sample, the 1 percent Form 1 Metro sample, and the 1 percent Form 2 Metro sample. Each of these is a 1 percent random sample of the population. In 1980 and 1990 we use the 5 percent State samples. In 2000 we use the 5 percent sample. As noted above, we use the 2012 five-year ACS, which pools 1 percent samples from 2008–2012, and refer to it as 2010. Data were acquired from the Integrated Public Use Microdata Series (IPUMS)-USA (Ruggles et al. 2015).

[6] Seasonality in outcomes may mean that the ACS results are not directly comparable with the census results, so we do not emphasize any particular results from the ACS in isolation from the census results.

[7] Increasing maternal employment across mothers' birth cohorts would mean that the pattern of employment by child age is flatter in a cross section than within a maternal cohort followed over time. Our regressions in Sec. IV indicate that controlling for mothers' birth cohort does not substantively affect our estimated child age effects.

enrolled in school. In 1970, the employment rate rises by 36 percentage points as the child ages from zero to 16. Only 21.6 of the 36 percentage point rise occurs by age 6. Fifteen percentage points of the rise occurs between ages 10 and 16, when children are becoming increasingly independent and require less child care. Although the overall increase in employment is smaller in 2010, it is still the case that nearly half of the rise occurs after children are 6 years old.

Another distinctive feature of figure 1 is that the employment rates of mothers of children under 5 have increased steadily from one period to the next, although the increases were far greater between 1970 and 1990. The gradient of mothers' employment with respect to the age of the youngest child has diminished over time. In 1970, mothers' employment increases by over 36 percentage points. In 2010, employment increases by 17 percentage points. This pattern reflects the fact that employment rate of new mothers has been rising over time, from 18 percent in 1970 to 59 percent in 2010, perhaps aided by expanded parental-leave availability.[8] Note that despite the gradient weakening over time, we still find a smooth rise in mothers' employment in the later years. This is in contrast with Kleven, Landais, and Søgaard (2018), who show that in Denmark, women's labor force participation dips after childbirth and recovers by age 2 and that there is no increase in employment at older ages.

A final important feature of the figure is that the increase in maternal employment as children age does not change noticeably at any particular age, even as children transition into school age, when the need for child care falls dramatically with the availability of free public school. If the largely free child care associated with school enrollment is an important contributing factor to the overall rise in mothers' employment, we would expect to see sharp employment changes beginning with mothers of 5- and 6-year-olds, because about half of 5-year-olds are enrolled in kindergarten and nearly all 6-year-olds are enrolled in either kindergarten or first grade. Analyses below focus in more detail on whether there is evidence for a break in the trend increase in mothers' employment when children reach school-starting age.

These broad patterns of mothers' employment by the age of the youngest child are also present when we stratify the sample by mothers' education and marital status. Figure 2 shows average employment rates in 1970 and 2010, separately for women who have at least some college education (21 percent of the sample in 1970 and 64 percent in 2010) and women who have a high school degree or less education. The gradient in child age is present for both more- and less-educated women. In 1970, both the level and the slope of employment are fairly similar between more- and less-educated women. In 2010, the employment rates between the

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[8] Olivetti and Petrongolo (2017) provide an overview of the impact of parental leave and other family-friendly policies on women's employment.
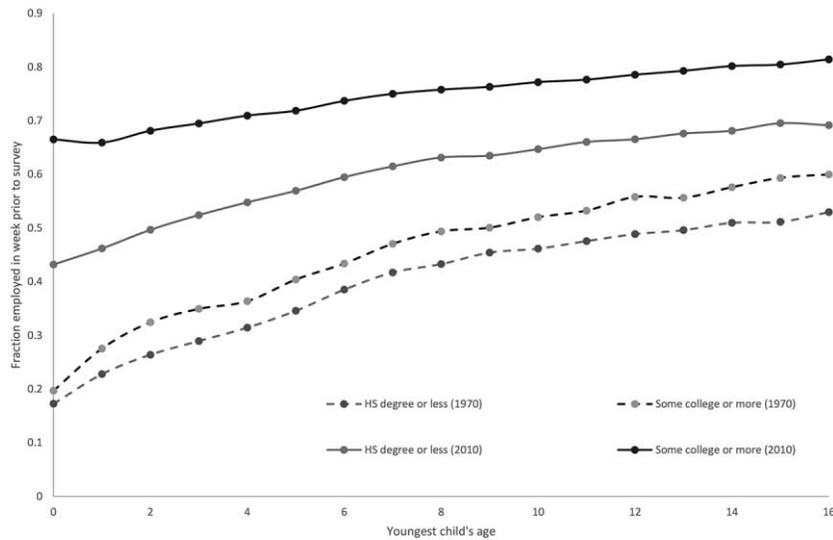
Figure 2.—Mothers' employment rate by child age and mother's education, 1970 and 2010. HS: high school.

groups converge slightly when children are under 10 years old, which re-flects the fact that more-educated women are more likely to work when their children are younger and that less-educated women enter the labor market more gradually. Figure 3 shows employment rates in 1970 and 2010 by marital status. The fraction of the sample that is married is 91 percent in 1970 and 79 percent in 2010. While there is a slightly faster rise in em-

Figure 3.—Mothers' employment rate by age of youngest child and mother's marital status, 1970 and 2010.

ployment at earlier ages for unmarried women than for married women, the gradient and smooth increase are present for married and unmarried women in both years.
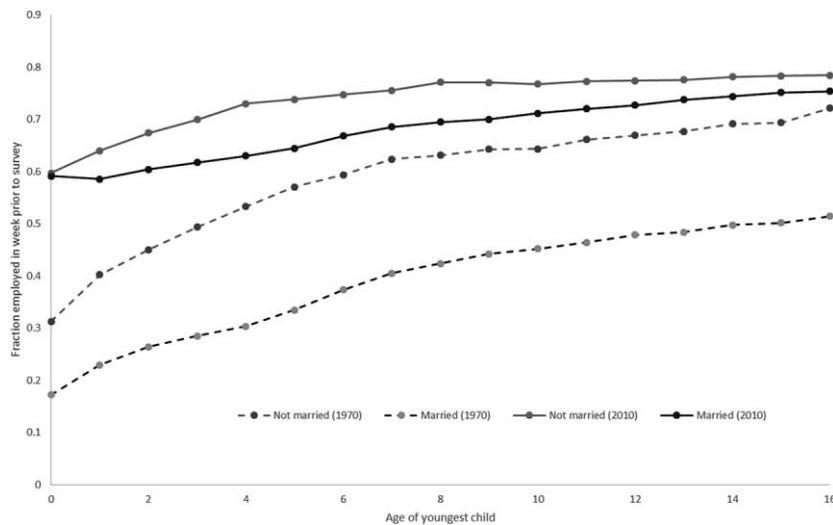
Our focus thus far on the extensive margin of employment conceals some changes in the intensive margin of hours of work. Figure 4 shows averages of three measures of employment in 2010: whether a mother reports that her usual weekly hours are 40 or more (full-time employment), whether she reports working 20 hours or more, and whether she is employed at any hours (the definition used in figs. 1–3). Employment at 40 or more hours per week rises from 37 to 51 percent, while employment at 20 or more hours rises from 55 to 72 percent. Also, there is little convergence between the part-time and full-time employment lines, indicating that while some mothers enter the labor market first at part time and then switch to full time, such switching is not very prevalent.

We supplement these descriptive patterns with evidence from mothers in the 2003–15 cross sections of the American Time Use Survey (Hofferth, Flood, and Sobek 2015). Individuals in these surveys were randomly selected from recent participants in the Current Population Survey. Individuals report on time spent during a particular 24-hour period. We assess how time use changes as children age by running a series of regressions of the form

$$y_{it}^{j} = \text{Child's Age}_{it} + \text{Mother's Age}_{it} + X_{it}'\beta + e_{it}, \qquad (1)$$

where y_{it}^{j} is the total number of minutes mother i reports spending on activity j in year t; Child's Age$_{it}$ is a set of fixed effects for the youngest
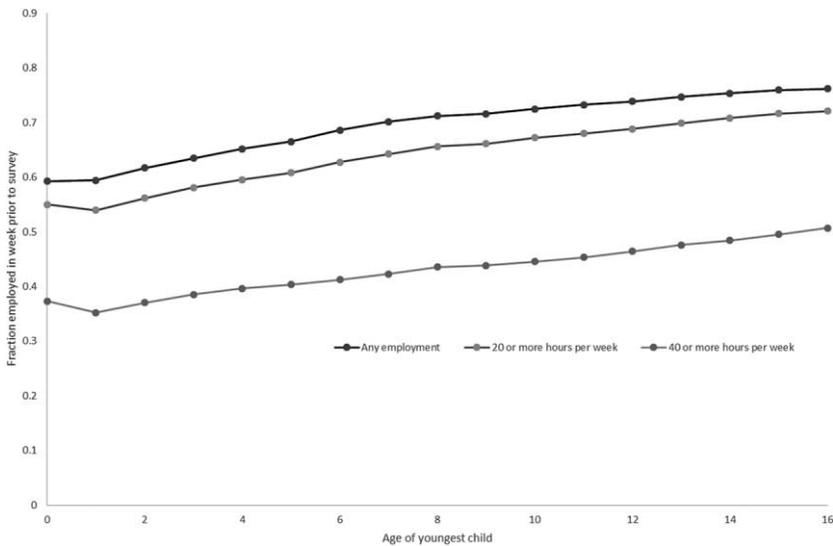

Figure 4.—Mothers' employment rate by age of youngest child and intensity of employment, 2010.
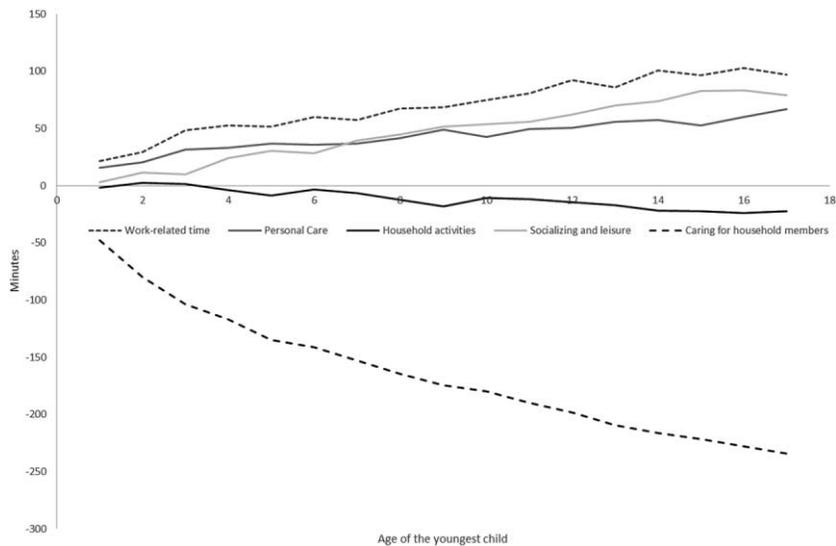
Figure 5.—Relationship between age of the youngest child and mother's daily time use, from 2003–15 American Time Use Survey (Hofferth, Flood, and Sobek 2015).

child's age and ranges from 0 to 18; Mother's Age$_{it}$ is a set of fixed effects for the mother's age; and X_{it} represents fixed effects for the calendar year, calendar month, day of the week, and whether the day was a holiday. Figure 5 graphs the estimated fixed effects for child age (where a child under 1 year old is the reference group) for five different types of activities.

As children age, mothers' time caring for children declines fairly steadily. We define this time as any time the mother reports caring for any household members, with children present during the activity, including travel time. Mothers whose youngest child is 12 years old spend about 200 fewer minutes per day caring for children, compared to mothers who have a child under 1.[9] Time on work and work-related activities increases by nearly 100 minutes, on average, per day. Time on socializing/leisure and time on personal care increase by about 60 and 50 minutes, respectively. Time on household chores is largely unchanged.

The maternal employment and time-use profiles in figures 1–5 provide a set of facts to be explained. Specifically, maternal employment increases steadily at about the same rate throughout the range of child ages, and this general pattern is observed among mothers who have different levels of education and marital statuses and among mothers in each period from 1970 to 2010. There is also considerable growth in maternal employment after children start school and only modest evidence of a break

[9] This is not a result of other time spent with children crowding out time spent caring for children, as total time spent with children falls by even more.
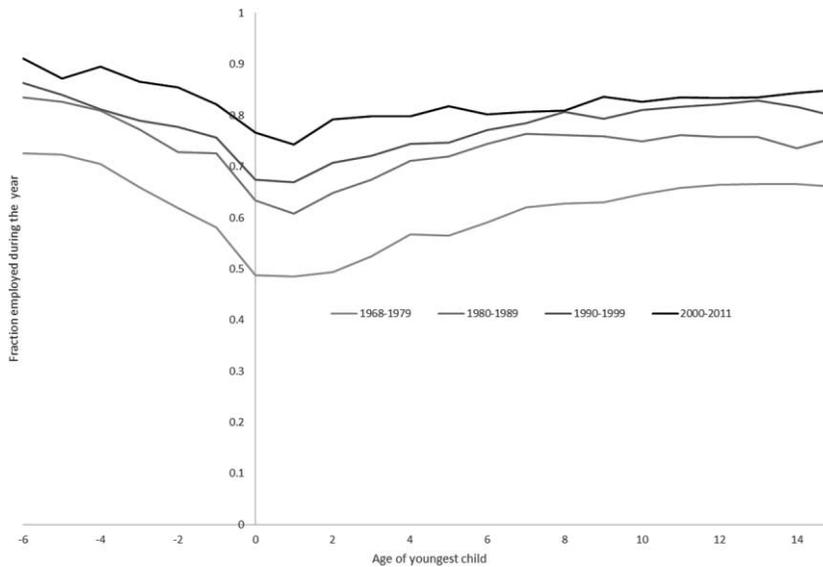
Figure 6.—Mothers' employment rate by age of youngest child and year, from PSID.

in the age profile of maternal employment at school-entry ages. Most importantly, the steady increase in employment with child age suggests that the causal determinants of maternal employment are changing relatively continuously throughout childhood.

Next, we turn to longitudinal data from the Panel Study of Income Dynamics (PSID) to shed light on patterns that cannot be studied with cross-sectional data. The PSID is a longitudinal study that began in 1968 and has surveyed individuals, their families, and their offspring annually through 1997 and biennially since then. We selected a sample of 10,769 women who are aged 22–56 at the time of a survey round, are classified as either a household head or wife, and have at least one child. Employment in the PSID is measured as a respondent having worked any positive hours in the year.[10] Figure 6 shows average maternal employment rates from 6 years before the youngest child is born until this child is 15 years old, stratified by time period. Employment rates fall in the years before the youngest child's birth, since many of these mothers exit the labor force when they have their first child (as documented in Goldin and Mitchell 2017). Employment patterns after the birth of the youngest child are largely similar to what we found in the census/ACS samples. In particular, mothers' employment rates tend to rise steadily as their children age, and this rise has become less steep over time.

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[10] We use the full sample of families in the PSID, although our broad conclusions are similar if we restrict the sample to the Survey Research Sample. We do not use weights in our analysis, although this also does not affect our conclusions.

The rising employment rate as children age is largely driven by mothers who did not work in the year before their child's birth. As the employment rates in the year before birth increase over time, postbirth employment also increases and the slope of the employment trajectory flattens, as we document in figures 7 and 8. Figure 7 shows mothers' employment rates by the age of the youngest child for the full PSID sample and separately for whether the mother worked in the year before the youngest child's birth. Among mothers who worked in the year before the youngest child's birth, the employment rate falls to about 80 percent in the year the child is born and then slowly rises to 90 percent as the child ages (which is also the average employment rate in the second through sixth years before the child's birth). Among mothers who do not work in the year before the youngest child's birth, employment rates rise fairly rapidly after their child is born, reaching 50 percent when the child is 6 and nearly 70 percent when the child is 16.[11]

Figure 8 shows maternal employment rates in the year before the youngest child's birth, the year of birth, and the year after birth, separately by the year of the child's birth. Maternal employment rates in each of the three years rise across successive child birth cohorts. Thus, over time, the primary change is that more mothers are working before their children's birth, which in turn leads to higher employment rates immediately after birth and a shallower employment trajectory as children age.

A last issue that cannot be ascertained with the census/ACS data is whether the pattern of employment in figures 1–5 reflects differences in the timing of permanent returns to employment or whether there is substantial churning in and out of employment with a general upward trend. This distinction is important for identifying potential causes of the pattern of rising employment rates of mothers by age of child. If churning is important, it implies that the causal factors work to both increase and sometimes decrease employment. Changes in family structure could potentially produce such a pattern, but the pattern would seem inconsistent with, for example, wage opportunities or child care costs driving the employment pattern. If the pattern of rising employment is due to an increasing proportion of mothers making permanent returns to work, then the causal factors are likely to change in only one direction.

To shed light on whether mothers' employment is persistent or intermittent, figure 9 graphs employment rates of mothers by the age of the youngest child, separately for three groups of women: those who worked when their youngest child was between 1 and 3 years old, those who did not work at all when their child was between 1 and 3 but returned to work when the child was between 4 and 7, and those who did not return to work until their child was between 8 and 16 years old. Employment rates tend

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[11] These figures use an unbalanced panel of mothers. The broad patterns are similar if we use a balanced panel of mothers who remain in the sample from the year before the youngest child's birth until the child is 7.
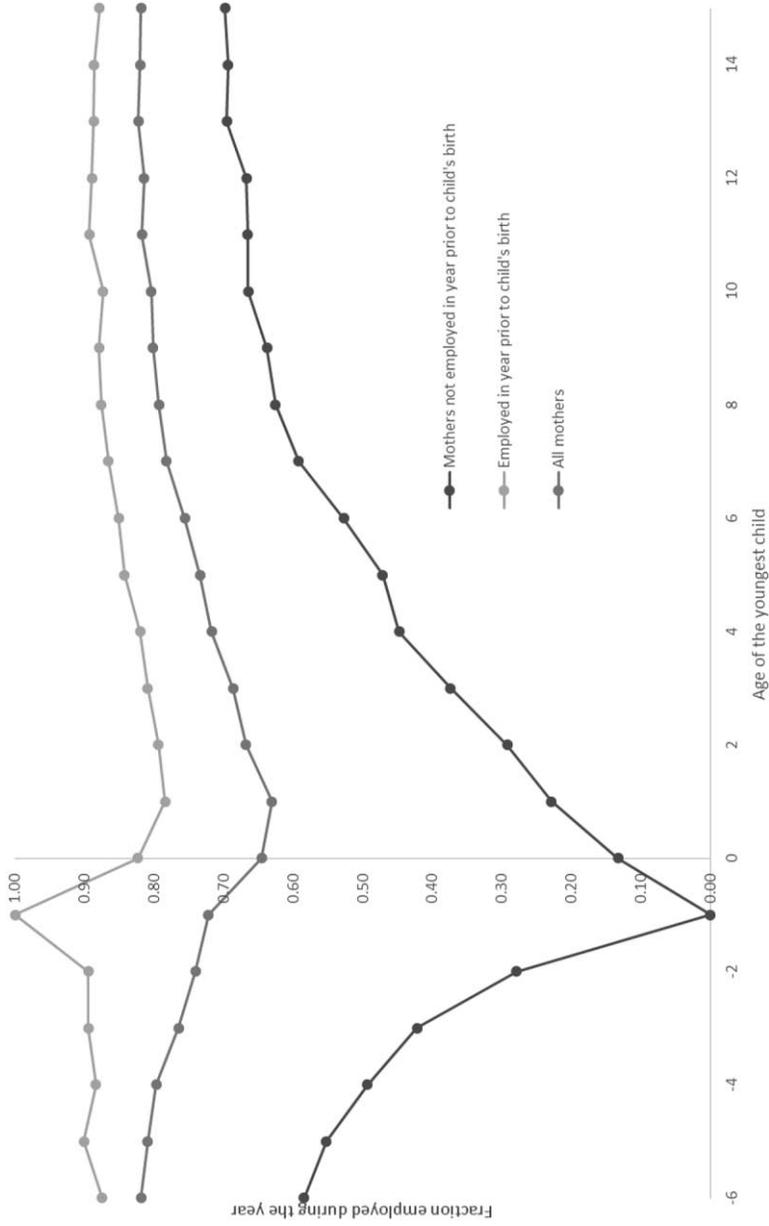
Figure 7.—Mothers' employment rate by age of the youngest child and employment status in the year before that child's birth, from PSID.
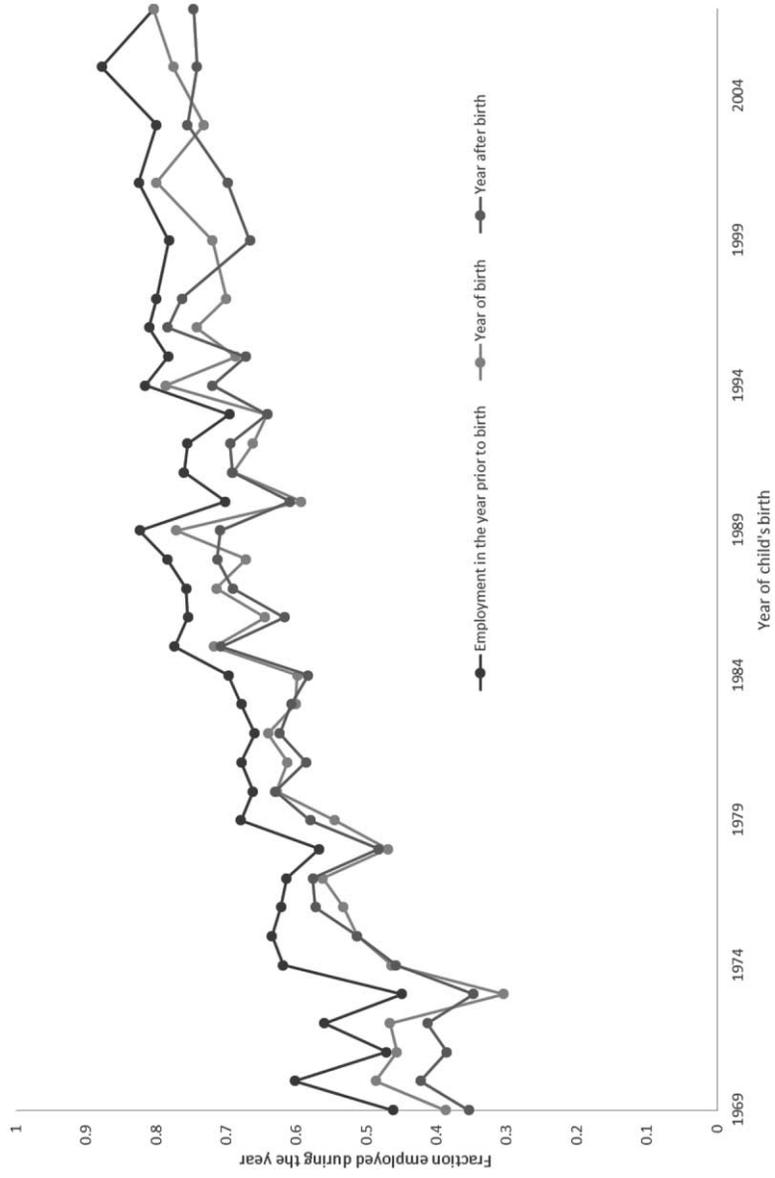
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Figure 8.—Maternal employment rate by year of child's birth, from PSID.

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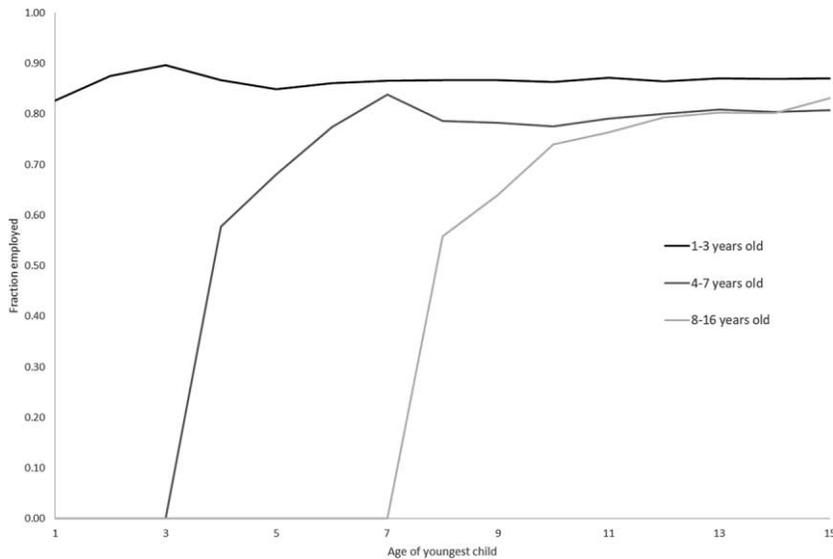
Figure 9.—Employment rate of mothers by age of youngest child, by child's age when mother entered the labor market, from PSID.

to be high for each group once they reenter the labor market. For the first group, employment rates are steady at about 86 percent. Among those who enter when their children are between 4 and 7, employment rates after their child is 7 are fairly steady around 77 percent. That is, once mothers reenter the market, in any given year about three-quarters work. While there may be some amount of labor market churning, when mothers reenter the labor market they largely stay in it.

III.   A Framework to Understand Why Mothers' Employment Changes as Children Age

In this section, we present a model of mothers' labor supply that highlights the roles of child care costs, wages, and the reservation value of not working, and we use the model both to interpret the descriptive patterns presented in the previous section and to frame our empirical investigation of the roles of child care costs and wages. Intuitively, a mother works if the wage net of child care costs and other costs of employment is greater than her reservation value of not working. The reservation value reflects a mother's desire for leisure, time with her children, and her productivity in home production.

Specifically, in our model women make a one-time choice about when (and whether) to enter the labor market after the birth of a child, which is consistent with the evidence presented in figure 9. If a woman works, she earns a wage of w_i and pays child care costs c_t. We assume that the mother uses child care only if she works. Women are indexed by i; time and the

child's age are indexed by t. For simplicity, we assume that wage opportunities vary across women but are fixed over time.[12] We assume that, conditional on the child's age, child care costs are the same for all women. Here we assume that each woman has only one child, but in our empirical work below we consider the effect of family size on mothers' employment. Finally, we focus our theoretical discussion on the extensive labor supply margin (the decision of whether or not to work at all). In our empirical work below we also examine the choice of hours of work.

In this framework, a mother enters the labor market if the net wage, $w_i - c_t$, is greater than a reservation value of γ_{it}. This reservation value reflects heterogeneity across women in their productivity at home, including taking care of children, and their preferences for working and for being with their children. Variation across women in wage opportunities or in the reservation value γ_{it} will lead to different choices about when to enter the labor market. Declines in either child care costs or γ_{it} as children age will also lead women to enter the labor market at different times. There is a large literature on the effects of child care costs on maternal employment, which we discuss in more detail in Section V. Less is known about the various factors that may lead the reservation value γ_{it} to change over time.

A number of factors will likely lead the reservation value γ_{it} to fall as children get older ($\gamma_{is} \geq \gamma_{it}$ for $s < t$), thereby incentivizing mothers to enter the labor market. Mothers' productivity at home falls as children become relatively more independent and require less supervision (Gronau 1974; Browning 1992). Market goods and activities, such as education, art lessons, and sports, become better substitutes for maternal time, which reduces the value that mothers place on staying out of the labor force, since less of that time is spent with their children as they age. Or, as Browning (1992) suggests, time spent with young children may be more exhausting than time spent with older children.[13] The reservation value may also change over time because of changes in family structure.

We use the model to guide our empirical analyses below. The model predicts that variation across women in wage opportunities, productivity at home, and the strength of preferences not to work in the market (or changes in these variables over time) will create variation across women in when they choose to work. However, assessing the explanatory power of these factors is difficult because we do not observe wage opportunities for nonworkers or mothers' productivity at home or preferences. There-

[12] To the extent that human capital among mothers who do not work depreciates, mothers whose skills depreciate more rapidly will tend to reenter the labor market sooner than mothers who possess skills that depreciate more slowly. One reason more-educated mothers reenter the labor market when their children are younger is that their human capital may depreciate more quickly.

[13] Hotz and Miller's (1988) model indicates that the money cost of children rises as they get older, which is not in our model but would also provide an incentive for increased work.

fore, we assess the roles of marital status, number of children in the home, and education, since they are likely correlated with these theoretical determinants. Although we do not explicitly model nonlabor income, it should be clear from traditional theory that nonlabor income (such as from assets and the wage income of a spouse, if she takes it as fixed when she makes her own employment decisions) generates an income effect and reduces the probability that women with greater nonlabor income will work.

Finally, the model also implies that maternal employment will increase as children transition from ages 4 to 7 and become eligible for free public school. Public school decreases the demands on mothers' time (which reduces γ_{it}) and reduces the overall cost of child care.[14] Our analysis in Section V studies this directly.

Our model ignores several potentially important factors. We have assumed that mothers make their labor supply decisions independent of their spouse's choices. A number of studies indicate that our assumption is too strong (see, e.g., Cherchye, De Rock, and Vermeulen 2012). To assess the potential role of spouses' employment and time allocation on mothers' employment, in figure 10 we graph the estimated child age effects from a model of fathers' time use that is analogous to the one we estimated for mothers in equation (1).[15] This figure indicates that, like that of mothers, fathers' time caring for children falls as children age. Unlike that of mothers, however, fathers' time at work does not change. Rather, they shift time toward leisure and socializing. We further verify this in figure 11, which plots average employment rates of fathers from the census/ACS by the age of the youngest child. These indicate that fathers' employment rates are essentially stable as children age and are therefore unlikely to be related to the pattern of mothers' employment.

We also ignore job search and labor demand factors. We assume that mothers find employment as soon as they desire to work. In unreported tabulations we find that mothers' unemployment rate (i.e., she does not have a job but is actively looking for one) falls by a few percentage points with the age of the child. This means that the employment trajectories slightly understate the trajectory in labor force participation, although we do not believe that any of our substantive conclusions are affected by our choice to look at employment rather than labor force participation.

IV.   Do Demographic and Socioeconomic Characteristics Explain the Increase in Mothers' Employment as Children Age?

In this section, we assess whether the pattern of maternal employment as children age is altered when we control for changes in a mother's marital status, number of children living in the home, nonlabor income, or

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[14] This prediction ignores any income effect that results from a decrease in the price of child care, which would reduce labor supply.
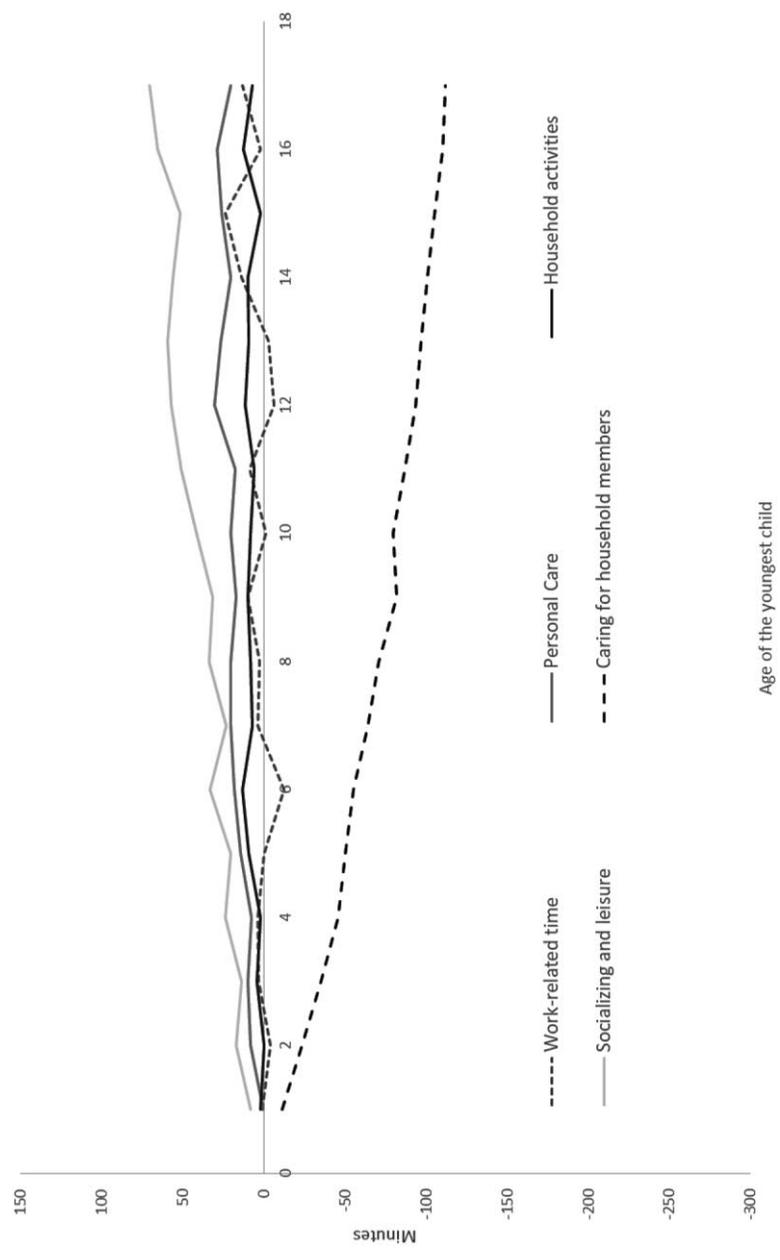[15] This sample includes fathers who live with the child.

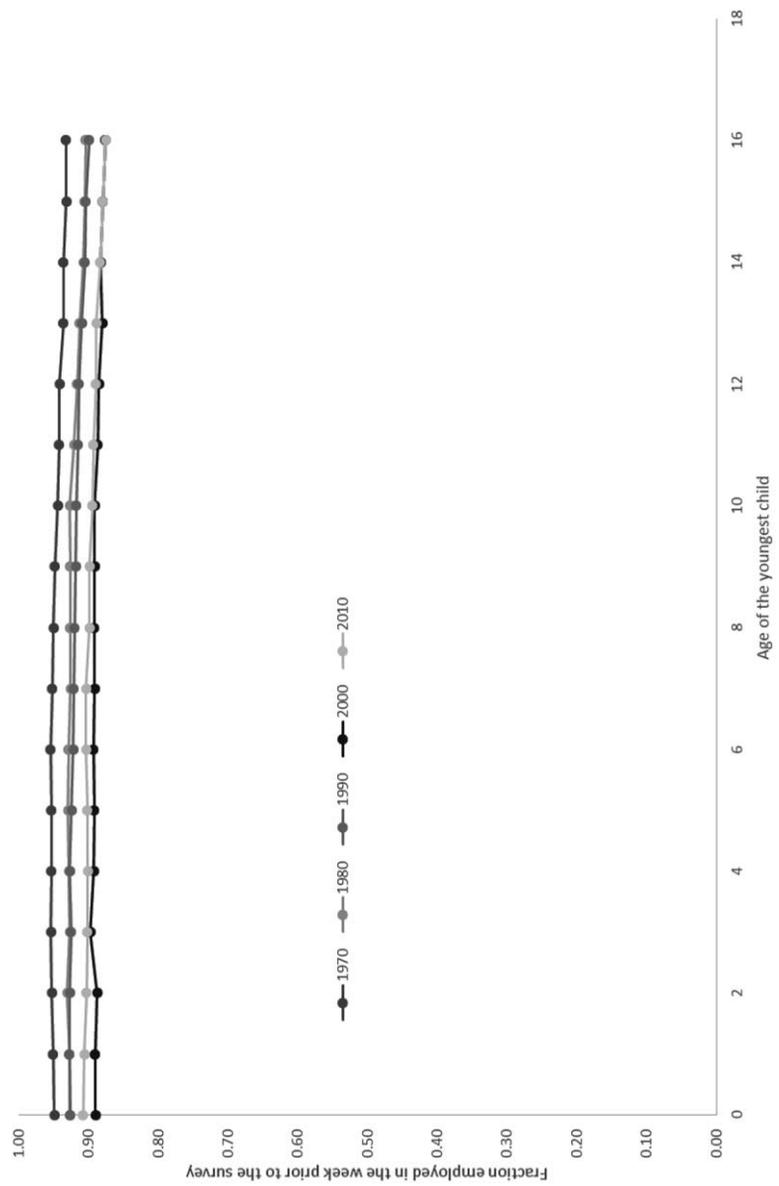Figure 10.—Relationship between age of the youngest child and father's daily time use.

Figure 11.—Fathers' employment rates by the age of youngest child, 1970–2010.

TABLE 1
Means of Selected Characteristics by Age of the Youngest Child and Year

Child Age (years)	1970	1980	1990	2000	2010
	A. Mother Is Married (%)				
0	94.9	92.7	89.8	87.7	84.5
5	90.5	83.6	81.5	78.2	77.8
10	89.2	81.5	79.4	77.0	76.7
16	86.1	82.0	78.0	75.7	74.3
	B. Presence of Multiple Children in the Home (%)				
0	75.2	67.2	68.1	69.0	67.8
5	86.4	76.3	75.9	74.8	76.5
10	84.4	79.2	75.3	74.5	75.8
16	49.8	59.7	50.8	48.4	49.8
	C. Nonlabor Income (2009 $)				
0	50,676	47,335	50,376	55,459	54,540
5	56,075	49,268	49,272	53,869	57,177
10	61,853	55,596	52,268	57,175	59,715
16	64,726	65,336	60,284	61,427	61,035
	D. Some College or More Education (%)				
0	27.4	41.2	56.2	56.2	68.8
5	19.4	31.7	50.4	50.4	64.1
10	19.3	30.1	48.0	49.2	62.3
16	19.5	26.4	43.8	47.1	57.4

Note.—Data are from the 1970–2000 decennial census and the 2012 American Community Survey, as described in the text.

educational attainment.[16] In table 1, we document that these variables change as children age and therefore can potentially explain why mothers' employment rises as her children age. Panel A, for example, shows the fraction of mothers in our sample who are married, by year and the age of the child (for children who are infants and aged 5, 10, and 16). In 1970, the marriage rate among mothers of infants is 95 percent, while the rate among mothers of 16-year-olds is 88.4 percent. There is a similar pattern in the other years. Marital dissolution may lead to an increase in maternal employment as children age (Johnson and Skinner 1986).

Mothers' rising employment may also reflect the conclusion of childbearing. Panel B of table 1 indicates that, in 1970, 75.2 percent of mothers of infants have at least one other child under age 17 in the home, while 95 percent of mothers of 10-year-olds have at least one other child in the home. The number of children in the home varies with child age because,

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[16] We measure the mother's nonlabor income as her total family income less her own wage income, which implicitly assumes that the presence and earnings of a spouse are assumed to be exogenous when she makes her own labor supply decisions. More generally, the spirit of the analysis in this section is that we assume that all of these characteristics are exogenous and assess whether their inclusion in the regression alters the coefficients on the child age effects.

on the one hand, mothers of very young children, on average, have not yet completed their fertility; mothers of older children, on the other, are more likely to have had additional children move out of the home.

The pattern of maternal labor supply may also reflect changes in mothers' nonlabor income. Panel C of table 1 indicates that nonlabor income tends to be higher among mothers of older children, although the differences are not large. Finally, Panel D of table 1 indicates a clear relationship between mothers' education and child age. For example, in 2010, 43.7 percent of mothers of infants and 29.6 percent of mothers of 16-year-olds have a college degree or more education. In a cross section, mothers of infants are younger, and therefore born more recently, than mothers of 16-year-olds. Rising educational attainment across mothers' birth cohorts gives rise to this distinct pattern of educational attainment by child age. We address mothers' cohort effects below by controlling for age in our regressions.

To assess whether controlling for these variables alters the pattern of maternal employment, we use a regression model of maternal employment on fixed effects for her age and the age of her child and then add other variables to the model to assess whether the child age effects change. Specifically, for each year, we estimate the regression models of the form

$$\text{Employed}_{it} = \text{Child's Age}_{it} + \text{Mother's Age}_{it} + X'_{it}\gamma_t + e_{it}, \quad (2)$$

where Employed_{it} is an indicator of whether the mother of child i is employed in year t in the week before the survey; Child's Age_{it} is a set of fixed effects for the age of the youngest child in year t and ranges from 1 to 16—the omitted category is that the youngest child is zero (<1 year old); Mother's Age$_{it}$ is a set of fixed effects for the mother's age in year t; and X_{it} represents other variables, such as mothers' education or the log of nonlabor income, that we add to the model. Controlling for mothers' age in a cross section captures both age effects and birth cohort effects. To economize on space, we report only the coefficients on age 5, 10, and 16 indicators.

Table 2 shows the results, with separate panels for each census year. The covariates in column 1 are mother's age and child age.[17] Columns 2–5 control sequentially for mother's marital status (indicators for whether she is separated, divorced, married, or single); the number of children under age 17 in the home; the log of mother's nonlabor income (total family income minus the mother's wage and salary income); and mother's educational attainment (indicators for whether the mother does not have a high school degree, has a high school degree, has some college, or has a college degree). Column 6 controls for all of these variables together.

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[17] Mother's age (and hence birth cohort) is correlated with her employment status but does not explain any of the child age effects.

TABLE 2
REGRESSION ESTIMATES OF MOTHERS' EMPLOYMENT BY THE AGE OF THE YOUNGEST CHILD

Chile Age (years)	(1)	(2)	(3)	(4)	(5)	(6)
	A. 1970 (Sample = 782,126)					
5	.1966***	.1954***	.1942***	.1962***	.2069***	.2092***
	(.0027)	(.0027)	(.0028)	(.0027)	(.0027)	(.0027)
10	.3541***	.3510***	.3458***	.3530***	.3657***	.3640***
	(.0031)	(.0031)	(.0032)	(.0031)	(.0031)	(.0031)
16	.4770***	.4649***	.4492***	.4719***	.4888***	.4679***
	(.0036)	(.0036)	(.0037)	(.0036)	(.0036)	(.0037)
Adjusted R^2	.064	.069	.065	.078	.068	.090
	B. 1980 (Sample = 1,071,786)					
5	.1729***	.1720***	.1664***	.1710***	.2050***	.2011***
	(.0026)	(.0026)	(.0026)	(.0026)	(.0026)	(.0026)
10	.3204***	.3172***	.3033***	.3159***	.3631***	.3494***
	(.0027)	(.0027)	(.0028)	(.0027)	(.0027)	(.0027)
16	.4275***	.4165***	.3800***	.4195***	.4726***	.4338***
	(.0030)	(.0030)	(.0031)	(.0030)	(.0030)	(.0031)
Adjusted R^2	.048	.051	.055	.055	.069	.084
	C. 1990 (Sample = 1,171,135)					
5	.1229***	.1228***	.1167***	.1202***	.1574***	.1480***
	(.0024)	(.0024)	(.0023)	(.0024)	(.0023)	(.0023)
10	.2139***	.2131***	.1932***	.2084***	.2709***	.2456***
	(.0026)	(.0026)	(.0026)	(.0026)	(.0026)	(.0026)
16	.2810***	.2764***	.2223***	.2712***	.3485***	.2882***
	(.0028)	(.0028)	(.0028)	(.0028)	(.0028)	(.0028)
Adjusted R^2	.033	.034	.047	.034	.070	.083
	D. 2000 (Sample = 1,183,609)					
5	.1087***	.1085***	.1038***	.1052***	.1371***	.1288***
	(.0023)	(.0023)	(.0023)	(.0023)	(.0023)	(.0023)
10	.1972***	.1959***	.1823***	.1899***	.2438***	.2224***
	(.0025)	(.0025)	(.0025)	(.0025)	(.0025)	(.0024)
16	.2553***	.2496***	.2100***	.2410***	.3148***	.2614***
	(.0026)	(.0027)	(.0027)	(.0027)	(.0026)	(.0027)
Adjusted R^2	.033	.034	.045	.035	.072	.084
	E. 2010 (Sample = 1,094,245)					
5	.0381***	.0376***	.0317***	.0327***	.0710***	.0595***
	(.0025)	(.0025)	(.0024)	(.0025)	(.0024)	(.0024)
10	.1136***	.1119***	.0951***	.1020***	.1661***	.1366***
	(.0026)	(.0027)	(.0026)	(.0026)	(.0026)	(.0026)
16	.1821***	.1755***	.1301***	.1599***	.2524***	.1821***
	(.0027)	(.0028)	(.0027)	(.0028)	(.0027)	(.0028)
Adjusted R^2	.021	.021	.039	.025	.057	.081
	Controls					
Marital status	No	Yes	No	No	No	Yes
Number of children	No	No	Yes	No	No	Yes
Nonlabor income	No	No	No	Yes	No	Yes
Education	No	No	No	No	Yes	Yes

Note.—Regression estimates from the 1970–2000 decennial census and the 2012 American Community Survey, as described in the text. All models control for mother's age.
*** Significant at the 0.001 level.

Given the potential endogeneity of many of these covariates, our goal is not to infer the causal effect of these characteristics on mothers' employment but rather to assess how controlling for these measures—and, indirectly, the unobservables they are correlated with—changes the pattern of mothers' employment by child age.

The pattern of results in table 2 points to several conclusions. Controlling for mothers' marital status tends to slightly reduce the child age effects, consistent with marital dissolution leading some women to enter the labor market. But since most mothers' marital status does not change, it perhaps is not surprising that the changes in the child age effects are quite modest. Controlling for the number of children in the home reduces some of the mothers' employment gradient. The child age effects are about 10–40 percent smaller in column 3 than in column 1, with larger differences in more recent years and larger differences for the age-10 and age-16 effects. Adding a control for log of nonlabor income leads to relatively smaller estimates of the child age effects as well, although the effect is less pronounced than when controlling for number of children.

Controlling for education increases the child age effects, in some cases by as much as 50 percent. This is to be expected, since, in a cross section, mothers of younger children are more educated than mothers of older children, as discussed above, and more-educated mothers are more likely to be employed. (This pattern is strengthened when we also control for mothers' age, since mothers of younger children gave birth at older ages.) Below we use the PSID to better understand the relationship between education and the employment gradient.

Finally, in column 6, we control for all of the variables simultaneously. The effects of education and the number of children/nonlabor income apparently offset one another. Except for one estimate that is smaller in column 6 than in column 1, the estimates in column 6 are similar to or larger than those in column 1. Thus, controlling for household composition, nonlabor income, and education collectively does not explain the unconditional pattern of mothers' employment by child age. Of course, it is still possible that unobserved variation in women's earning opportunities that are not correlated with education or other factors related to household composition and nonlabor income yet are orthogonal to the measures we controlled for in table 2 drive the pattern of mothers' employment instead.

We next turn to an analysis that uses the PSID, which lets us address two shortcomings with cross-sectional data: first, we can directly assess the degree to which the employment gradient reflects different choices by more- and less-educated mothers. Second, we shed light on the role that differences in wage opportunities play in explaining the employment gradient. To answer the first question, we use the PSID to calculate the first year that a woman is employed after her youngest child is born. We then run a regression of an indicator that her highest level of education is a

high school degree or less on indicators for the child's age in the year she first worked, her own age, and year. Figure 12 plots the coefficients on the child age indicators along with the 95 percent confidence interval. The omitted child age is 1.[18]

The estimates in figure 12 reveal that mothers' education is positively associated with employment when the child is between 1 and 4 years old but that the association fades away at older ages. That is, women who do not work when their youngest child is between 1 and 3 but do work when that child is 4 are about 14 percentage points more likely to have a high school degree or less education, compared to mothers who worked when their youngest child is 1 year old. After about age 4, the propensity to have a high school degree or less education is essentially the same regardless of the age at which the mother enters the labor market.

Our analysis in figure 12 indicates that, at least after the child is about 4 years old, the rising employment profile is not driven by women with different levels of education making different choices. What drives the relationship between maternal education and the decision to work among mothers whose youngest child is under 4 remains unclear. It could be that more-educated mothers have higher earnings and therefore face a higher opportunity cost of not working, have human capital from prior work experience that deteriorates faster with time out of the labor market, have stronger preferences for work, and are more likely to have paid maternity leave that facilitates short-term leaves of absence, among other potential explanations. In any case, the figure makes it clear that the rising employment pattern after age 4 is driven by factors that are uncorrelated with maternal education.

We conclude this section by studying the relationship between a mother's wages and her youngest child's age when she returns to the labor market. To do this we regress the log hourly wage that a woman earned in the first year that she entered the labor market after her youngest child was born on indicators for child age, mother's age, year, and indicators for her educational attainment (i.e., no high school degree, high school degree, some college, or college degree).[19] Figure 13 plots the coefficients on the child age indicators and the 95 percent confidence intervals. Mothers who do not work when their youngest child is 1 but do work when their child is 2 have residual wages that are about 19 percent below those of women who work when their youngest child is 1. Women who do not work when their child is 1 or 2 but do work when the child is 3 earn 26 percent less than women who work when their child is 1. The

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[18] We drop observations when the child is less than 1 because our measure of whether a mother worked during the year would not distinguish between employment before or after the child's birth.

[19] Average hourly earnings is a constructed variable in the PSID, calculated as total annual earnings divided by annual hours worked.
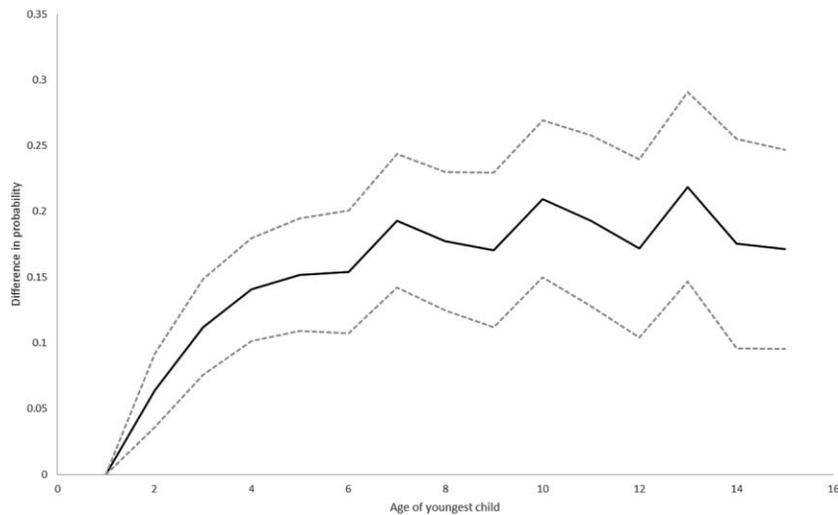
Figure 12.—Regression estimates of the propensity to have a high school degree or less education on child's age in the first year that a mother enters the labor market, from PSID. The solid line shows the coefficients on the indicators for the age of the youngest child; the dashed lines show the 95 percent confidence intervals.

lower residual wage of later entrants is remarkably stable among women who return to work when their child is between 3 and 15.[20]

The association between residual wages and the youngest child's age among mothers who return to work when their children is under 3 years old could reflect a number of factors. As with our earlier results on maternal education, the pattern could reflect that more-productive women earn higher wages and choose to enter the labor market sooner after they complete their fertility, that human capital deteriorates markedly during this period, or that residual wages are correlated with other factors, including preferences for work. Our goal is not to unpack these potential explanations, although we do note that if there is a wage penalty for women who are out of the labor market, our results suggest that it does not appear to grow after the first few years.

Our evidence shows that until a child is around 3 or 4 years old, women with less education and lower residual wages enter the labor market later than those with more education and higher wage opportunities. Similar to the results for education, the lack of an association between accepted wages and when mothers enter the labor market after the child is about

[20] These PSID estimates are not sensitive to the particular controls we used, to stratifying the analysis by time period, or to using a balanced sample of mothers who appear in most or all years.
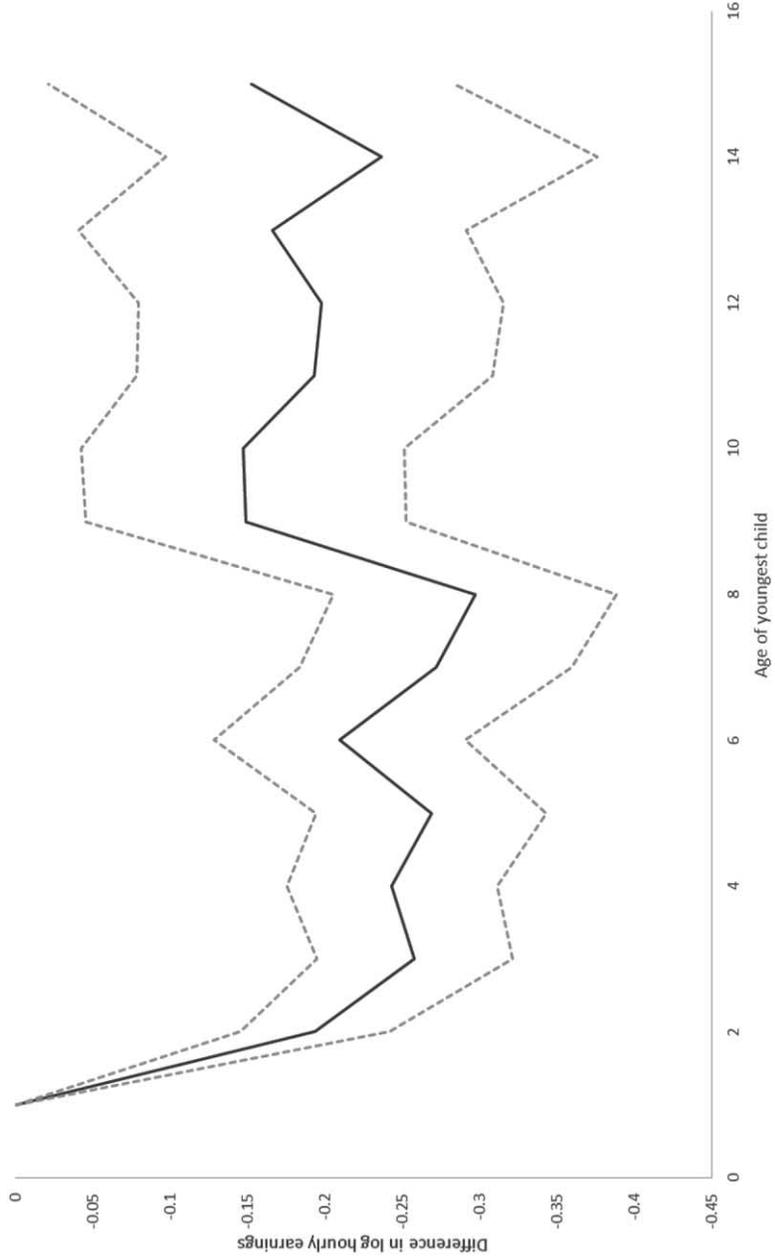
Figure 13.—Regression estimates of log hourly earnings differential in the first year that a mother enters the labor market, from PSID. The solid line shows the coefficients on the indicators for the age of the youngest child; the dashed lines show the 95 percent confidence intervals.

3 years old indicates that variation in wage opportunities does not explain mothers' rising employment rates after the first few years following birth.

V.   Could Children's Transition to School Age Explain the Rise in Mothers' Employment?

As part of our assessment of how mothers' employment evolves with the youngest child's age, we also seek to understand the role that the transition to school plays in this overall trajectory. Children's school start is a pivotal time in the child's life but also one for the rest of the family (Holmes and Rahe 1967). The transition to school is associated with a significant drop in the need for child care. Although the specific age eligibility for free public school depends on the child's birth date relative to the school-starting cutoff date in the child's state of residence, very few 4-year-olds are eligible for free full-day public school, whereas all 7-year-olds are eligible. Given that there is a substantial drop in the need for child care around these school transition ages, understanding how mothers' employment changes during this period can shed light on the importance of the need for child care and child care costs in explaining mothers' employment trajectory.

We begin by assessing how child care spending changes as children age. Child care costs tend to fall as children age, both because the per-unit cost of care in formal child care settings tends to fall and because fewer children need child care as they age. We demonstrate this in figure 14, which uses data from the PSID Family Interview modules from 1998 to 2014 to show the fraction of families who report spending anything on child care and the average amount spent per year (including zeros for those who spend nothing), by the age of the youngest child.[21] Just over half of families with children aged 2–4 have positive child care expenditures, and average spending is just above $2,500 per year. Child care spending falls dramatically among children over 4 years old, as they become eligible for free public school. As the youngest child ages from 4 to 7, average spending on child care falls to about $1,000 per year. Child care spending falls in a fairly smooth fashion beyond that.

Our analysis of the effect of children reaching school age relates broadly to the large, but unsettled, literature on the effect of child care costs on employment: in their extensive reviews of the literature at the time, Blau (2003) and Blau and Currie (2006) reported a range of estimates of the elasticity of mothers' employment with respect to the price of child care of between 0.06 and −1.26 (Blau 2003) and between 0.06 and −3.60 (Blau and Currie 2006). More-recent studies that relied on arguably more credible

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[21] Average spending is expressed in 2014 dollars. The questionnaire does not collect information on spending by type of child arrangement or separate child care expenses by child. The first data point combines all children under 2 years old.
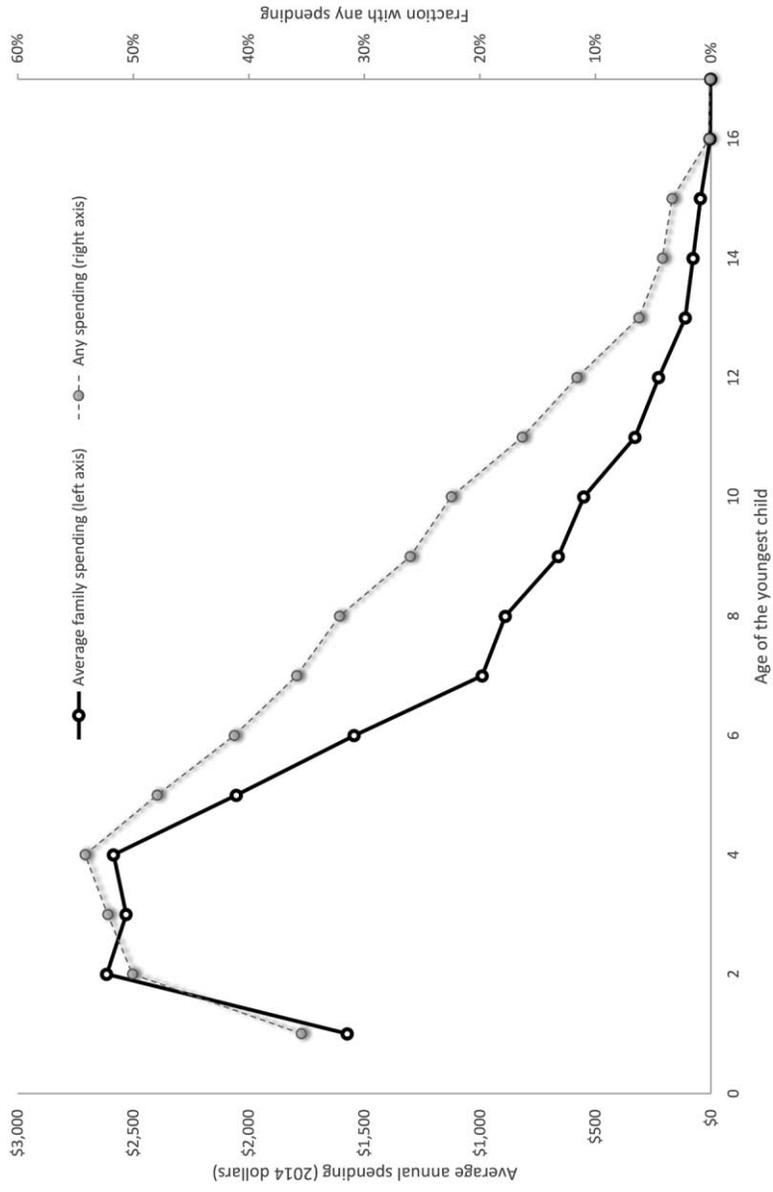
Figure 14.—Child care spending by age of the youngest child, from PSID, 1998–2014. Data on average family spending include zeros for families who have no child care expenses.

research designs that stem from policy changes or experiments also yield mixed evidence.[22]

Our assessment of the effect of transition to school age is more closely related to those of Gelbach (2002) and Fitzpatrick (2012), who study the effect of public school enrollment and school-age eligibility on mothers' labor supply. Gelbach uses the 1980 decennial census and instruments children's enrollment status with their quarter of birth. Fitzpatrick (2012) builds on Gelbach's method by using a restricted-access version of the 2000 decennial census that contains children's exact day of birth and uses a regression discontinuity design to compare employment rates among mothers whose children are born on opposite sides of the school-starting cutoff.

Unlike these two authors, we are not interested in identifying the effect of children's enrollment in school or the effect of their age eligibility for school.[23] Instead, we seek to assess the reduced-form effect of children reaching school age on mothers' employment. Some children become eligible for school at age 5, while others do so at age 6. Regardless of when exactly a child starts school, most will transition to school between the ages of 5 and 6, so we estimate the reduced-form effects of children turning 5 years old as well as those of children turning 6 years old.[24]

The reduced-form effect of children reaching school age is important and interesting for two reasons. First, this effect allows us to assess whether the need for child care and child care costs around the school-starting age

[22] For example, Havnes and Mogstad (2011) examined the effect of an increase in subsidized child care in Norway in the 1970s and found no effect of this policy on mothers' labor supply. Lundin, Mörk, and Öckert (2008) found that a policy that placed a cap on child care prices in Sweden had no effect on mothers' labor supply. Michalopoulos, Lundquist, and Castells (2010) reported that a child care subsidy for near-poor women in Cook County (Chicago), Illinois in 2004–05 had no effect on mothers' labor supply. Fitzpatrick (2010) studied the introduction of universal prekindergarten in Georgia and Oklahoma and found no effect on maternal employment. Some recent studies found that a reduction in child care costs raises mothers' employment rates. Cascio (2009) studied the introduction and expansion of free kindergarten in the United States during the 1960s and 1970s and estimated that this type of free child care was associated with a 12 percent increase in employment of single mothers with young children. Baker, Gruber, and Milligan (2008) and Lefebvre and Merrigan (2008) reported that a $5 per day child care subsidy in Quebec in the late 1990s was associated with a 15 percent increase in mothers' labor force participation, mostly among married mothers. Other recent work that has found positive effects of early childhood programs on mothers' labor supply include Sall (2014), Bauernschuster and Schlotter (2015), and Brewer et al. (2015).

[23] Indeed, the data in our paper, including the decennial censuses of 1990 and 2000 and the ACS, are ill suited for isolating the effect of becoming eligible for school on mothers' employment because they do not contain quarter of birth, so it is not possible to identify when exactly a child becomes eligible for school.

[24] We also note that mothers' employment response associated with the transition to school need not be instantaneous, either because of labor market frictions or because a mother's net utility from working still remains below the utility from not working for a number of years. So, as with the larger literature that studies the employment effects of child care subsidies or of school entry just discussed, our analysis is best thought of as capturing a short-run response that may be smaller than the longer-run response. It is also possible that mothers may respond in advance of the child's transition to school, as school-starting age is predictable.

TABLE 3
SCHOOL ENROLLMENT RATES BY YEAR AND AGE OF CHILD

Age (years)	1970	1980	1990	2000	2010
4	.194	.474	.494	.656	.704
5	.612	.808	.781	.876	.920
6	.928	.990	.986	.991	.995

Note.—Tabulations from the 1970–2000 decennial census and the 2012 American Community Survey, as described in the text.

are potentially important drivers of the general upward trend in mothers' employment as children age. If the need for child care significantly affects employment, there should be a discrete change in employment among mothers across these ages once we control for the general upward trend in employment as children age. Second, it answers the policy-relevant question of what would the effect be of a child care subsidy given to parents of 5-year-olds.

We evaluate the reduced-form effects of the youngest child reaching school age separately by year. Table 3 shows preschool and school enrollment rates by age and year.[25] It shows that enrollment among 4-year olds, who are almost exclusively in nursery or preschool, increases substantially, from 19.4 percent in 1970 to 69.6 percent in 2010. Enrollment among 5-year-olds increases from 61.2 percent in 1970 to 91.3 percent in 2010. Given the rising rate of enrollment of children in nursery and preschool over this period, one may expect the effect of becoming eligible for school on employment to decline over time, as preschool enrollment potentially frees up mothers to work ahead of the transition to school. However, this need not occur if most nursery/preschool programs are half-day programs, in which case women still need child care for the rest of the day.

To obtain estimates of the effect of the youngest child reaching school age on mothers' employment, we estimate regression models of the following form, separately by year:

$$\text{Employed}_{it} = \beta_{0t} + \beta_{1t}(\text{Age}_{it} = 5) + \beta_{2t}(\text{Age}_{it} = 6) + \beta_{3t}(\text{Age}_{it} \geq 7)$$

$$+ \beta_{4t}f(\text{Age}_{it}) + X'_{it}\beta_{5t} + e_{it}, \tag{3}$$

where Employed_{it} is a measure of employment for the mother of child i in year t, such as an indicator that the mother was employed in the week before the survey, and $(\text{Age}_{it} = 5)$, $(\text{Age}_{it} = 6)$, and $(\text{Age}_{it} \geq 7)$ are indicators that the mother's child is age 5, 6, or 7 years or older. The child's age, independent of her transition to school, may influence the mother's labor supply decision. This seems likely, given the rising rate of mothers' employment before age 4, seen in figure 1, as well as the small, positive

[25] The decennial census and the ACS record whether a child is enrolled in school, including nursery and preschool. It does not contain information on whether a child attends a day care center or has another source of care outside of the home.

increase in mothers' employment at the more granular level of the child's quarter of birth.[26] It is important to capture the general rise in mothers' employment as children age when isolating the discontinuous changes in mothers' employment associated with the transition to school age, and we do so by using $f(\text{Age}_{it})$, which is a quadratic in the child's age. The variable X_{it} is a vector of other characteristics of the mother and includes dummy variables indicating her age; indicators for whether she has less than a high school degree, a high school degree, some college, or a bachelor's degree or more; dummy variables for whether the mother is white, black, Hispanic, or of another race/ethnicity; dummy variables indicating whether the mother is married, separated/divorced/widowed, or never married; dummy variables indicating the number of own children in the household (1, 2, 3, 4 or more); and state fixed effects. The coefficients β_{1t}, β_{2t}, and β_{3t} capture the difference in mothers' employment when children are 5, 6, or 7 years old or older, respectively, relative to the employment rate that would be predicted by the quadratic in child's age.[27]

Table 4 shows the estimates of the deviation from the trend in mothers' employment when her youngest child is age 5, 6, or 7 or older, separately for the years 1970, 1980, 1990, 2000, and 2010. The age-5 coefficient in 1970 is -0.0021 and has a standard error of 0.0026. The age-6 effect is 0.0089, with a standard error of 0.0029. That is, employment among mothers who have a 6-year-old child is 0.89 percentage points higher, relative to the quadratic trend in child's age. In brackets below each coefficient and standard error, is the average employment rate of mothers who have a 6-year-old. In 1970, this mean is 30.6 percent, so the 0.89 percentage point effect reflects a 2 percent increase in overall employment rate. The age-6 effect in 2010 is 0.0119, with a standard error of 0.0023, and the mean employment rate of mothers who have a 6-year-old is 68.6 percent. The 1.19 percentage point age-6 effect in 2010 also represents a 2 percent increase relative to the average employment rate among mothers whose youngest is 6 years old. Although there has been an increase in nursery and preschool enrollment over time, the age-6 estimates for each of the years in table 4 are not statistically different from each other. Generally, the age-5 and age-6 effects are quite small in magnitude, both in absolute levels and relative to the overall employment rates, and are not always statistically different from zero. These small effects of children reaching school age indicate that falling child care costs around

[26] Tabulations of employment by child's age measured in quarters are available upon request.
[27] We include the indicator that the child is 7 or older for two reasons: first, since we allow unrestricted employment effects at children's ages 5 and 6, we do not want to restrict the intercept of the polynomial at older ages to being the same as that between birth and age 4. Second, because age is measured at the time of the survey (which is April for the decennial census files and could be any point in the year for the ACS files), some 7-year-olds in the data are in their first year of school. For both of these reasons, we expect β_{3t} to be positive but not necessarily reflect the effect of school entry.

TABLE 4
REGRESSION ESTIMATES OF CHANGES IN MOTHERS' EMPLOYMENT WHEN CHILDREN ARE SCHOOL-STARTING AGE, YOUNGEST CHILD

Age (years)	1970	1980	1990	2000	2010
5	−.0021	−.0077**	−.0051*	−.0010	.0034
	(.0026)	(.0024)	(.0021)	(.0020)	(.0021)
	[.3570]	[.5068]	[.6335]	[.6597]	[.6651]
6	.0089**	.0036	.0035	.0044*	.0119***
	(.0029)	(.0026)	(.0023)	(.0022)	(.0023)
	[.3950]	[.5423]	[.6635]	[.6850]	[.6861]
7 and over	.0127***	.0095***	.0040	−.0023	.0138***
	(.0030)	(.0026)	(.0023)	(.0023)	(.0024)
	[.4852]	[.6076]	[.7209]	[.7372]	[.7345]
Observations	845,742	1,222,718	1,376,440	1,437,940	1,349,868

Note.—Regression estimates from the 1970–2000 decennial census and the 2012 American Community Survey, as described in the text. Standard errors are in parentheses. Mean employment rates are in brackets.

* $p < .05$.
** $p < .01$.
*** $p < .001$.

TABLE 5
REGRESSION ESTIMATES OF CHANGES IN MOTHERS' EMPLOYMENT WHEN CHILDREN
ARE SCHOOL-STARTING AGE, YOUNGEST CHILD

Age (years)	1980	1990	2000	2010
	A: Employed and Usually Work 20 or More Hours per Week			
5	.0007	.0031	.0041	.0054*
	(.0024)	(.0022)	(.0021)	(.0022)
	[.4221]	[.5500]	[.5883]	[.6079]
6	.0099***	.0086***	.0108***	.0140***
	(.0026)	(.0024)	(.0023)	(.0024)
	[.4519]	[.5742]	[.6132]	[.6273]
7 and over	.0259***	.0214***	.0114***	.0209***
	(.0026)	(.0024)	(.0024)	(.0025)
	[.5276]	[.6492]	[.6768]	[.6841]
Observations	1,222,718	1,376,440	1,437,940	1,349,868
	B. Employed and Usually Work 40 or More Hours per Week			
5	.0065**	.0069**	.0094***	.0049*
	(.0022)	(.0021)	(.0022)	(.0022)
	[.2831]	[.3668]	[.4108]	[.4032]
6	.0103***	.0075**	.0064**	.0073**
	(.0024)	(.0024)	(.0024)	(.0025)
	[.2991]	[.3795]	[.4204]	[.4123]
7 and over	.0146***	.0150***	.0062*	.0122***
	(.0024)	(.0024)	(.0024)	(.0025)
	[.3417]	[.4413]	[.4757]	[.4619]
Observations	1,222,718	1,376,440	1,437,940	1,349,868

Note.—Regression estimates from the 1980–2000 decennial census and the 2012 American Community Survey, as described in the text. Standard errors are in parentheses. Mean employment rates are in brackets.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

these ages are unlikely to substantively explain the employment gradient with respect to children's age.

In table 5, panels A and B report results in which the dependent variable is an indicator that a mother is employed and reports that she usually works, respectively, 20 or more or 40 or more hours in a typical week.[28] We find that there are generally small, positive, and statistically significant effects of school age on both the probability that the mother works 20 or more hours and the probability that she works 40 or more hours. The effect of a child being 6 on whether his or her mother works at least 20 hours a week is 0.99 percentage points in 1980 and 1.4 percentage points in 2010. The age-6 effects on whether the mother works 40 or more hours a week are 1.03 percentage points in 1980 and 0.73 percentage points in 2010. The age-6 effects are larger than the age-5 effects in most cases.[29]

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[28] The number of hours per week is reported only in the 1980 and later census/ACS files.
[29] In results not reported, we also estimated the age-5 and age-6 effects separately by mothers' education and marital status. Here too we find generally positive, sometimes statistically significant age-5 and age-6 effects that are small in magnitude. The largest effect indicates a 2.2 percentage point increase in married mothers' employment when the youn-

VI. Conclusions

We study the trajectory of mothers' employment as their children age. We document that mothers' employment rises steadily as the youngest child ages and that the gradient has become less steep between 1970 and 2010, a period over which both female labor force participation and leave taking after childbirth have expanded considerably. Much of the rise in employment as children age is concentrated among women who did not work before the birth of their child. Thus, the decline in the gradient reflects the fact that an increasing fraction of mothers work before the birth of their child, many of whom do not leave the labor market after giving birth.

We assess the factors underlying the smooth rise in mothers' employment as their children age. Our analysis indicates that controlling for family size and structure does not alter the relationship between maternal employment and the age of her youngest child. Changes in the number of children in the home are associated with some of the employment gradient after children are about 5 years old, but marital status and nonlabor income explain very little. While more-educated women are more likely to work in the first four years after their youngest child is born, maternal education does not explain any of the rise in employment after age 4. Similarly, there is no relationship between residual wages and the timing of work after children are about 3 years old.

We also show that the transition of the youngest child to school at ages 5 and 6 had, at best, minor effects on employment. In 1970, only 19 percent of 4-year-olds were enrolled in preschool, and yet mothers' employment rates changed very little (relative to the trend) when these children entered school. In later years, the transition to school age had less potential to affect maternal employment because enrollment rates in nursery and preschool were higher, as were maternal employment rates more generally. These results are consistent with other research that argues that child care costs or the time required to care for children are generally not important barriers to employment.[30] We also document significant growth in maternal employment after school entry and throughout the child's teenage years, when the costs of child care are relatively low and few children are observed in child care even among mothers who work (Giannarelli and Barsimantov 2000; Laughlin 2013). This suggests that factors other than child care costs are driving these maternal employment patterns.

So what else could explain the pattern? It is possible that other unobserved factors related to household composition and nonlabor income that are orthogonal to the measures we controlled for in table 2 drive

gest child is 6. There are no clear patterns in the size of effects either over time or across the various subgroups.

[30] See, e.g., Blau and Currie (2006) on the elasticity of employment with respect to child care costs. Browning (1992, 1458) suggests that changes in mothers' time with children as they age are small and thus are unlikely to explain the rising employment trajectory.

the pattern of mothers' employment instead. Alternatively, it is possible that unobserved variation in women's earnings opportunities that is orthogonal to education and the residual wages we estimate may explain some of the employment trajectory after children are 3 or 4 years old. Given that we have controlled for the first-order measures of family structure, nonlabor income, and earnings opportunities, it would be somewhat surprising if alternative measures (in better data, for instance) would explain a substantial part of the employment trajectory but, of course, this is something that we cannot test with the data we have.

Using time-diary data, we documented that as children age, mothers' time with children slowly and steadily declines. One possibility is that women's valuation of nonmarket time and what we loosely refer to as productivity at home decreases steadily as children age. As young children age, they require less intensive supervision. Older children increasingly spend less time at home and more time with friends, playing sports, or participating in other activities. Moreover, market alternatives to mothers' care are increasingly available. As Browning (1992) posits, mothers' labor supply may also be increasing in child's age simply because they prefer to have children at home when they are infants or because time spent with infants may be more exhausting than the same number of hours spent with an older child. Although we are unable to directly test these explanations in our data, the findings of our paper suggest that these might be potentially important determinants of mothers' employment decisions.

Much of the rise in mothers' employment as their children age is not related to the most cited determinants of labor supply. In fact, our results indicate that the decision about when to enter the labor market among many women appears to be unrelated to their wage opportunities. This indicates that important factors that influence mothers' labor force participation are missing from our theoretical and policy discussions. In particular, a better understanding of the factors influencing the timing of employment among mothers may lead to a better understanding of the types of policies that are more likely to be successful and their welfare implications.

Appendix

TABLE A1
MOTHERS' EMPLOYMENT RATES BY CHILD AGE, YEAR, AND MATERNAL EDUCATION

Age of Youngest Child (years)	All Mothers					High School Degree or Less		Some College or More	
	1970	1980	1990	2000	2010	1970	2010	1970	2010
0	.179	.334	.491	.528	.592	.173	.432	.197	.665
1	.240	.389	.534	.560	.594	.228	.462	.276	.659
2	.278	.427	.566	.588	.617	.264	.497	.324	.681
3	.302	.457	.593	.621	.634	.289	.524	.349	.695
4	.324	.482	.612	.638	.652	.314	.548	.364	.709
5	.357	.507	.633	.660	.665	.346	.569	.404	.719

TABLE A1 (*Continued*)

Age of Youngest Child (years)	All Mothers					High School Degree or Less		Some College or More	
	1970	1980	1990	2000	2010	1970	2010	1970	2010
6	.395	.542	.664	.685	.686	.385	.595	.434	.737
7	.428	.577	.687	.701	.702	.417	.615	.471	.750
8	.445	.588	.703	.712	.712	.433	.631	.494	.758
9	.463	.604	.714	.722	.716	.454	.635	.501	.763
10	.473	.609	.717	.733	.725	.462	.647	.520	.772
11	.487	.614	.725	.741	.733	.476	.660	.532	.776
12	.502	.610	.730	.745	.739	.489	.665	.558	.786
13	.508	.613	.736	.749	.747	.496	.676	.556	.793
14	.523	.618	.734	.756	.753	.510	.681	.576	.802
15	.527	.625	.739	.763	.760	.511	.695	.593	.805
16	.543	.623	.736	.763	.762	.530	.691	.600	.814

Note.—Data are from the 1970–2000 decennial census and the 2012 five-year American Community Survey, as described in Sec. I and n. 5.

TABLE A2
Mothers' Employment Rates by Youngest Child's Age, Year, Marital Status, and Hours of Work

Child Age (years)	Married		Not Married		Employed, with Usual Weekly Hours Greater Than		
	1970	2010	1970	2010	0	20	40
0	.172	.592	.313	.597	.592	.550	.373
1	.230	.585	.402	.640	.594	.540	.352
2	.264	.604	.451	.674	.617	.561	.370
3	.285	.618	.493	.699	.634	.581	.385
4	.303	.630	.533	.730	.652	.595	.396
5	.335	.644	.571	.738	.665	.608	.403
6	.373	.668	.594	.747	.686	.627	.412
7	.405	.686	.624	.756	.702	.643	.423
8	.424	.695	.631	.771	.712	.656	.435
9	.442	.700	.643	.771	.716	.661	.438
10	.452	.712	.644	.767	.725	.672	.446
11	.464	.720	.661	.773	.733	.680	.453
12	.479	.727	.669	.774	.739	.688	.464
13	.484	.737	.677	.776	.747	.699	.476
14	.498	.744	.691	.782	.753	.708	.484
15	.502	.752	.694	.783	.760	.716	.496
16	.514	.754	.721	.785	.762	.721	.507

Note.—Data are from the 1970 decennial census and the 2012 five-year American Community Survey (ACS), as described in Sec. I and n. 5 in the text. Employment rates by usual hours of work refer to data from the 2012 five-year ACS.

References

Baker, Michael, Jonathan Gruber, and Kevin Milligan. 2008. "Universal Childcare, Maternal Labor Supply, and Family Well-Being." *J.P.E.* 116 (4): 709–45.

Bauernschuster, Stefan, and Martin Schlotter. 2015. "Public Child Care and Mothers' Labor Supply—Evidence from Two Quasi-experiments." *J. Public Econ.* 123:1–16.

Blau, David. 2003. "Child Care Subsidy Programs." In *Means-Tested Transfer Programs in the United States*, edited by Robert A. Moffitt, 443–516. Chicago: Univ. Chicago Press.

Blau, David, and Janet Currie. 2006. "Pre-school, Day Care, and After-School Care: Who's Minding the Kids?" In *Handbook of the Economics of Education*, vol. 2, edited by Eric Hanushek and Finis Welch, 1163–278. Amsterdam: North-Holland.

Blau, Francine D., and Lawrence M. Kahn. 2013. "Female Labor Supply: Why Is the United States Falling Behind?" *A.E.R.* 103 (3): 251–56.

Brewer, Mike, Sarah Cattan, Claire Crawford, and Birgitta Rabe. 2015. "The Impact of Free, Universal Pre-school Education on Maternal Labour Supply." Working paper.

Browning, Martin. 1992. "Children and Household Economic Behavior." *J. Econ. Literature* 30 (3): 1434–75.

Cascio, Elizabeth. 2009. "Maternal labor supply and the introduction of kindergartens into American public schools." *J. Human Resources* 44 (1): 140–70.

Cherchye, Laurens, Bram De Rock, and Frederic Vermeulen. 2012. "Married with Children: A Collective Labor Supply Model with Detailed Time Use and Intrahousehold Expenditure Information." *A.E.R.* 102 (7): 3377–405.

DeSilver, Drew. 2014. "Rising Cost of Child Care May Help Explain Recent Increase in Syay-at-Home Moms." Fact Tank, Pew Research Center. Published April 8. Accessed August 24, 2015. http://www.pewresearch.org/fact-tank/2014/04/08/rising-cost-of-child-care-may-help-explain-increase-in-stay-at-home-moms/.

Fitzpatrick, Maria Donovan. 2010. "Preschoolers Enrolled and Mothers at Work? The Effects of Universal Prekindergarten." *J. Labor Econ.* 28 (1): 51–85.

———. 2012. "Revising Our Thinking about the Relationship between Maternal Labor Supply and Preschool." *J. Human Resources* 47 (3): 583–612.

Gelbach, Jonah B. 2002. "Public Schooling for Young Children and Maternal Labor Supply." *A.E.R.* 92 (1): 307–22.

Giannarelli, Linda, and James Barsimantov. 2000. "Childcare Expenses of America's Families." Occasional Paper no. 40, Urban Institute, Washington DC.

Goldin, Claudia, and Joshua Mitchell. 2017. "The New Life Cycle of Women's Employment: Disappearing Humps, Sagging Middles, Expanding Tops." *J. Econ. Perspectives* 31 (1): 161–82.

Gronau, Reuben. 1974. "The Effect of Children on the Housewife's Value of Time." *J.P.E.* 81 (2): S168–S199.

Havnes, Tarjei, and Magne Mogstad. 2011. "Money for Nothing? Universal Child Care and Maternal Employment." *J. Public Econ.* 95 (11–12): 1455–65.

Hofferth, Sandra L., Sarah M. Flood, and Matthew Sobek. 2015. "American Time Use Survey Data Extract Builder: Version 2.5" [data set]. IPUMS Time Use. College Park: Univ. Maryland and Minneapolis: Univ. Minnesota. doi:10.18128/D060.V2.5.

Holmes, T. H., and Rahe, R. H. 1967. "The Social Readjustment Rating Scale." *J. Psychosomatic Res.* 11:213–18.

Hotz, V. Joseph, and Robert A. Miller. 1988. "An Empirical Analysis of Life Cycle Fertility and Female Labor Supply." *Econometrica* 56 (1): 91–118.

Johnson, William R., and Jonathan Skinner. 1986. "Labor Supply and Marital Separation." *A.E.R.* 76 (3): 455–69.

Kleven, Henrik, Camille Landais, and Jakob Egholt Søgaard. 2018. "Children and Gender Inequality: Evidence from Denmark." Working paper no. 24219 (January), NBER, Cambridge, MA.

Laughlin, Lynda. 2013. "Who's Minding the Kids? Child Care Arrangements: Spring 2011." Current Population Report no. P70–135. Washington, DC: US Census Bur.

Lefebvre, Pierre, and Philip Merrigan. 2008. "Child-Care Policy and the Labor Supply of Mothers with Young Children: A Natural Experiment from Canada." *J. Labor Econ.* 26 (3): 519–48.

Lundin, Daniela, Eva Mörk, and Björn Öckert. 2008. "How Far Can Reduced Childcare Prices Push Female Labour Supply?" *Labour Econ.* 15 (4): 647–59.

Michalopoulos, Charles, Erika Lundquist, and Nina Castells. 2010. *The Effects of Child Care Subsidies for Moderate-Income Families in Cook County, Illinois.* OPRE 2011-3. Washington, DC: Office of Planning, Research and Evaluation, Administration for Children and Families, US Department of Health and Human Services.

Mincer, Jacob. 1962. "Labor Force Participation of Married Women: A Study of Labor Supply." In *Aspects of Labor Economics.* Princeton, NJ: Princeton Univ. Press.

Olivetti, Claudia, and Barbara Petrongolo. 2017. "The Economic Consequences of Family Policies: Lessons from a Century of Legislation in High-Income Countries." *J. Econ. Perspectives* 31 (1): 205–30.

Quart, Alissa. 2013. "Crushed by the Cost of Child Care." *The New York Times*, August 17. Accessed August 24, 2015. http://opinionator.blogs.nytimes.com/2013/08/17/crushed-by-the-cost-of-child-care/.

Ruggles, Steven, Katie Genadek, Ronald Goeken, Josiah Grover, and Matthew Sobek. 2015. Integrated Public Use Microdata Series (IPUMS). Version 6.0. Minneapolis: Univ. of Minnesota.

Sall, Sean. 2014. "Maternal Labor Supply and the Availability of Public Pre-K: Evidence from the Introduction of Prekindergarten into American Public Schools." *Econ. Inquiry* 52 (1): 17–34.