Low-skilled Immigration and Parenting Investments of College-educated Mothers in the United States: Evidence from time-use data[1]

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April 12, 2012

Abstract

This paper uses several decades of time-diary surveys to assess the impact of low-skilled immigration, through lower prices for commercial child care, on parental time investments. Using an instrumental variables approach that accounts for the endogenous location of immigrants, we find that low-skilled immigration to the United States has contributed to substantial reductions in the time allocated to basic child care by college-educated mothers of non-school age children, allowing these mothers to dedicate more time to educational child care activities. Understanding the factors driving parental time investments on children is crucial for policy-making aimed at reducing inequality.

JEL Codes: J61, J22, J13
Key words: Parental Time Investment, Immigration, Child Care, Education Gradient, Time Use.

[1] The authors would like to express their thanks for the financial support provided by the Economic and Social Research Council (Grant Number RES-060-25-0037) and the Spanish Ministry of Education and Science (Project SEJ2005-06522 and ECO2009-10818), and for comments from participants at the Hispanic Economic Issues Conference at the Federal Reserve Bank of Atlanta in November 2010, at the 2010 Southern Economic Association meeting, at the 2011 Southern California Conference on Applied Microeconomics and at the 2011 European Society of Population Economics meeting. Correspondence: Almudena Sevilla-Sanz, University of Oxford, Department of Economics, Manor Road Building, Manor Road, Oxford O1 3UQ (UK). Phone: +44 (0)1865 2 81740. Fax: +44 (0)1865 2 86171. Email: almudena.sevilla@economics.o.ac.uk.

The most valuable of all capital is that invested in human beings; and of that capital the most precious part is the result of the care and influence of the mother.

Alfred Marshall (1890), Paragraph VI.IV.11.

1. Introduction

This paper examines how low-skilled immigration, via its effect on the cost of household services, may have impacted the allocation of time to child care of mothers in the United States. Child care is an important component of parental time. Unlike other types of home production, such as cleaning the house windows or maintaining a tidy home, child care, and some types of child care in particular (such as educational and recreational child care), can prove particularly important for a child's posterior intellectual and social development (*e.g.* Hill and Stafford 1974, Leibowitz 1974, Del Boca et al. 2010). Given the importance of intergenerational transmission of human capital in explaining children's life outcomes, understanding the factors driving parental time investments on children and how their impact varies according to the educational attainment of mothers and fathers is crucial from a child development perspective and for policy-making aimed at reducing inequality.

A few papers show how large increases in low-skilled immigration over the past decades (in excess of 40 percent for the 1970-2000 time period) allowed for a substantial reduction in the price of locally-traded goods and services that are immigrant-intensive in the United States. For instance, Cortés (2008) shows that the low-skilled immigration wave of the 1980-2000 resulted in an important reduction in the price of an agglomerate of non-traded goods and services by a city average of 9-11 percent. Immigrants are overrepresented in the child care sector and immigrants employed in child care are excessively low-skilled, as noted by Blau (2003) and Helburn and Howes (1996).[2] Furtado and Hock (2009) find that the low-skilled immigration wave of the 1980-2000 in the United States contributed to lower cost and increased availability of child care services. In particular, it led to a 13.5 percent reduction in the median wage of workers employed in those services –the wage bill accounting for 60 to 80 percent of the operating expenses at formal and home-based childcare centers (Helburn and Howes 1996, Blau and Mocan 2002) and possibly more in informal childcare providers. More importantly, the increase in low-skilled immigration between 1980 and 2000 also reduced the wages of childcare workers at the 75th percentile by 9 percent. As such, the

[2] Blau (2003) further notes that child care is one of the easiest occupations to enter. Regulations concerning the qualifications of child care workers are inexistent at the federal level. At the state level, the regulations are often minimal and, in those states where they are tougher, the vast majority of child care is unlicensed. Furtado and Hock (2009) report that in the year 2000, low-skilled immigrants with no post-secondary education represented 9.3% of child care workers, versus 6.2% of the workforce in the non-household services occupations.

impact of low-skilled immigration was not only felt among child care workers employed in what we might think of as low-quality child care centers less likely to be servicing high-skilled mothers, but also among child care workers in the higher income spectrum potentially servicing highly-educated parents.[3] This is expected if, as noted by Blau and Currie (2004), the alternative to high quality child care is not home care but, rather, lower quality child care. In that case, lower quality child care ends up serving as a substitute to higher quality child care and reductions in the price of low quality child care will impact the demand for high quality child care and, ultimately, its price.

Using a time use model in the tradition of Becker (1965) and Gronau (1977), we show that lower prices for domestic services induce some mothers able to afford commercial child care services to reduce the time allocated to providing child care with a close market substitute, as is often the case with *basic* child care consisting of bathing, feeding, or changing diapers. Owing to their ability to finance market-provided child care services and the higher opportunity cost of their time, the aforementioned effect is more likely to take place among high-skilled or college-educated mothers.

We test these hypotheses using historical time use data from the American Heritage Time Use Surveys (AHTUS), which expand from the 1970's to the first decade of the 21st century. The main instrument of all the surveys is an activity diary in which respondents record what they do for a consecutive period of 24 hours, which provides a high quality measure of time dedicated to child care activities. To identify a casual effect of low-skilled immigration on maternal time investments in children, we instrument for low-skilled immigrant concentration using information on the historical distribution of immigrants of a particular country as a predictor of current immigrant location choices (Card 2001).

We find that increases in low-skilled immigration to the United States lowered the time allocated to basic child care activities (as well as to home production) by college-educated mothers by approximately half an hour per week and, in turn, led to increases in their time dedicated to recreational and educational child care activities by approximately a quarter of an hour per week. These findings suggest that child care services provided by low-skilled immigrants may serve as a good substitute for basic maternal child care and routine housework activities, but not for other types of child care activities involving English

[3] As noted by Hotz and Kilburn (1991), Blau and Hagy (1998) and Blau and Currie (2004), high-income women may demand a better quality of care. If low-skilled immigrants are more likely to be employed in low-quality child care centers, one might be concerned that the influx did not impact the price of child care to be paid by highly-educated mothers.

proficiency or a certain level of human capital, such as reading. We further show that these effects are unique to college-educated mothers with non-school age children.

This paper adds in important ways to three different strands of literature. First, it contributes to the literature on the impact of low-skilled immigration. Most of the earlier literature examined the potential negative impact of low-skilled immigration on the employment and wages of natives (Card 2001, Borjas 2003). More recently, the interest has shifted to the positive potential effects of immigration on the cost of household services (Cortés 2008, Furtado and Hock 2009) and on labor supply and fertility (Cortés and Tessada 2010, Furtado and Hock 2010, Farré *et al*. 2011). In this paper, we examine for the first time its impact on parenting investments. Our findings complement those from Cortés and Tessada (2010), who using a different data source find that low-skilled immigration to the United States increased the hours worked and reduced the time dedicated to housework of women with a professional degree or Ph.D. Likewise, we provide empirical evidence of one of the channels by which low-skilled immigration has reduced the work-fertility tradeoff facing educated women in the United States as argued by Furtado and Hock (2010) –namely through the reduction of some types of child care and the time dedicated to home production.

Second, we also contribute to a recent but growing literature exploring the impact of child care utilization on the resources received by children and, in particular, on the time and type of parental care. This is important because, as pointed out by Baker *et al.* (2008), in order to evaluate how child care subsidies affect child development, we must look at whether the substitution of parental care for commercial child care results in an increase or decrease in the net resources received by children. However, these studies lack information on the time or the type of parental care. We fill this gap in the literature by providing direct evidence of the kind of trade-offs that college-educated mothers face in terms of their use of time. Particularly, we find that following a reduction in the price of market child care services triggered by an increase in low-skilled immigration, these mothers compensate reduction in basic child care activities by raising the time allocated to more stimulating educational and recreational activities with their children.

Lastly, our findings inform about the mediating role that low-skilled immigration may have had on the trends in the educational gradient in parental time. A series of papers have recently documented that more educated women devote more time to child care activities than low educated women (Sayer *et al*. 2004, Guryan *et al*. 2008) and that this differential has increased over time in the United States (Ramey and Ramey 2009). The mechanisms behind these secular patterns are, however, still not well-understood. We find that low-skilled

immigration inflows may have helped to counteract the diverging patterns in basic child care time among native mothers with different skills, while contributing to a widening of the education gradient in education child care.

The paper is organized as follows. Section 2 describes the theoretical framework from which we derive some testable hypotheses regarding the impact of low-skilled immigration on the child care patterns of mothers in the United States. Section 3 and Section 4 describe the data and inform on some trends in time use, respectively. Section 5 discusses the methodology and Section 6 presents the findings. Finally, Section 7 summarizes our results and concludes the paper.

2. Theoretical Framework

We rely on a simple time-use model in the tradition of Becker (1965) and Gronau (1977), according to which a mother allocates her time to three competing time uses: market work, leisure, and child care. The main purpose of the model is to explain the differential impact that low-skilled immigration may have on mothers' child care provision depending on their educational attainment and the type of child care at hand. We assume that mothers derive utility from well-cared-for children (c) and leisure (l):[4]

$$U = U(c) + V(l) \qquad (1)$$

where U and V are concave and increasing utility functions in c and l respectively.

Well-cared-for children contribute to maternal utility in various ways. For example, children may increase the enjoyment that mothers derive from spending time with their children. Alternatively, well-cared-for children may increase maternal utility through other venues noted in the literature. For instance, mothers may altruistically care about their children and consider time with their children as an investment in their children's human capital. Parents may also care selfishly about their children's future earnings potential; perhaps hoping that they may be able to help them out at an older age (Guryan *et al*. 2008). More important to us is the fact that well-cared-for children require parental time and/or the use of market-provided child care services. We can formalize this idea using a production function for well-cared-for children that calls for the use of market-provided child care services (x) and parental time (h):

$$c = c(x, h) \qquad (2)$$

[4] For a specific functional form, see Aguiar and Hurst (2007). The model can be easily extended to include other forms of home production and leisure.

where c takes the usual form of an increasing and concave function of x and h.

Mothers maximize the utility function in equation (1) subject to the production function in equation (2), as well as time and budget constraints. Specifically, they have a total time endowment of 1 that they can use in the labor market (L), taking care of children (h), and/or leisure (l). They also face the following budget constraint: $px = w(1-h-l)$, where w is the market wage and p is the cost of market-provided child care services.

For an interior solution (*i.e.*, as long as $x>0$), the first order conditions yield the following relationship:

$$\frac{c'_h}{c'_x} = \frac{w}{p} \qquad \text{for } w \geq \overline{w} \quad (3)$$

Equation (3) states that the marginal rate of substitution between parental child care time (h) and commercial child care (x) must equal their relative prices.[5]

The first prediction of the model is that the degree to which the demand for market-provided child care rises with immigration depends on the degree to which maternal and commercial child care are substitutable. In terms of Equation (3) this prediction implies that, for the same reduction of maternal child care time, mothers will need to be compensated with a bigger decrease in the price of those market child care services (p) with few substitutes in the market. The degree to which maternal and commercial child care can be considered substitutes depends on the kind of child care in question. Low-skilled immigrant child care workers may be in a better position to provide basic child care consisting of changing diapers, bathing, dressing up and feeding children rather than to provide educational or recreational child care involving reading in English or taking the child to activities with other English-speaking children and parents. Therefore, an increase in low-skilled immigration is expected to alter the maternal provision of basic child care to a greater extent than the provision of other forms of child care.

The second prediction from this simple model is that a decline in the price of child care services (p) brought about by an increase in low-skilled immigration raises the demand

[5] In this simple set up, changes in the cost of child care services do not affect the consumption of leisure since we have assumed separability between leisure (l) and well-cared-for children (c) in the utility function. Therefore, if maternal child care time (h) drops among college-educated mothers as low-skilled immigration rises, the time constraint dictates that the labor supply (L) of those mothers should rise with low-skilled immigration. Nevertheless, one could relax the assumption of separability between leisure and well-cared-for children in the utility function, in which case the extent to which leisure would change would depend on the degree of substitution between leisure and well-cared-for children. If, for example, leisure and well-cared-for children are complements, *e.g.* better cared-for children require more leisure time spent with them, leisure may increase as the cost of raising well-cared-for children drops, and labor supply might not increase as much. Therefore, the extent to which leisure and labor supply change remains an empirical question.

of commercial child care services (x) and reduces maternal time (h) among college-educated mothers as long as h and x are substitutes in the production of children. This prediction follows from the fact that, as noted by Cortés and Tessada (2010) for household production services, commercial child care services (x) are only used by women with a wage ($w \geq \overline{w}$) that is high enough relative to the cost of market-provided child care services (p).[6] These women are more likely high-skilled or college-educated mothers; therefore, equation (3) only applies to them. A lower p is also expected to make market-provided child care services affordable to some mothers who previously were unable to pay for it. However, once again, college-educated mothers with lower wages (perhaps they were starting their careers) that are, nevertheless, closer to the required threshold $\overline{w}$ to purchase commercial child care services are more likely to fall within that group. Overall then, via the aforementioned channels, an increase in low-skilled immigration is expected to reduce the time allocated to basic child care by college-educated mothers.[7]

3. Data

We use the American Heritage Time Use Study (AHTUS), a harmonized dataset that covers five decades and over five time use surveys running from 1965 to 2003. Table B1 in Appendix B describes the five surveys in the AHTUS as well as the harmonization exercise. The main instrument of all the surveys is an activity diary in which respondents record what they do for a consecutive 24-hour period. Each day of the week is equally represented in the survey. The methodological literature (*e.g.* Robinson and Juster 1985, Juster 1985) shows that diary estimates of time spent on different domestic activities provided by time surveys are more accurate than responses to questionnaire items.[8] Similarly to retrospective questions on expenditure, time use information gathered this way runs into recall problems, which are accentuated due to the limited arithmetic facility and the difficulty of individuals to assess the appropriate reference period limits. Thus, the same way money expenditure diaries have become the gold standard in the consumption literature, so have time-use diaries become the preferred method to gather information on time spent on market work, non-market work and leisure. Most studies documenting long term trends in how individuals use their time are now

[6] See case no. 2 in Appendix A to see the relative magnitude of the relative wage threshold $\overline{w}$.

[7] As in Cortes and Tessada (2010), within the group of mothers who are already purchasing commercial child care services, those with lower salaries will reduce their own child care provision by more than those with higher salaries when the cost of market-provided child care services (p) falls.

[8] For example, in a recent experiment, Hiddle *et al*. (2010) determined the reliability and validity of time use data over more traditional self-report surveillance systems for assessing sedentary and physical activity behavior by successfully matching the results from the diary to those from an accelerometer.

based on these data sets, including recent studies for the analysis of trends in time use and in child care (*e.g.* Guryan *et al*. 2008, Aguiar and Hurst 2007, Bianchi *et al*. 2006, Robinson and Godbey 1999).

Our primary sample of analysis includes observations from the AHTUS survey years 1975-76, 1992-94, and 2003. We do not include respondents from the 1965-66 AHTUS since it is too close to the year our instrument refers to (*i.e.* 1960). Additionally, we are unable to use the 1985-86 AHTUS because it does not contain any information on the state of residence of the respondent, which is crucial for our identification strategy.

Mothers between 21 and 55 years of age who have completed a 24-hour time diary are our group of interest. Following previous work by Furtado and Hock (2010), we focus our attention on non-Hispanic mothers. As noted by these authors, the restriction addresses important differences in social norms and peer effects when it comes to childrearing. More importantly for us is the fact that it allows us to obtain a closer estimate of what the impact of low-skilled immigration might have been on the child care practices of non-immigrant mothers given that the AHTUS lacks information on the individual's immigrant status and the bulk of low-skilled immigrants came from Latin America. Additionally, since the channel by which low-skilled immigration may be impacting the provision of child care by mothers is through the reduction in the cost of commercial child care services, we pay special attention to mothers of non-school age children. After all, enrollment in public school, which starts at six years of age, may be thought of as inexpensive child supervision (Gelbach 2002).[9]

Our variable of interest is the time mothers report spending on child care. Many of the tasks constituting child care can be purchased in the market, and so economists often include child care as another form of housework (*e.g.* Burda *et al*. 2008). Parents, however, report that spending time with their children is among their more enjoyable activities together with leisure activities, especially when compared with other standard home production activities (*e.g.* Juster 1985, Robinson and Godbey 1999, Guryan *et al*. 2008, Krueger *et al*. 2009). As a result, in sharp contrast with the negative education and income gradient researchers have observed for the amount of time allocated to home production and leisure (*e.g.* Robinson and Godbey 1999, Aguiar and Hurst 2007), child care appears to rise with education and income (*e.g.* Hill and Stafford 1974, Sayer *et al*. 2004, Kimmel and Connelly

[9] Nevertheless, we also perform various robustness checks including Hispanic mothers and mothers of older children. Our main conclusions follow.

2007, Guryan *et al*. 2008). In sum, parents view time caring for children as fundamentally different from either home production or leisure and more like an investment.

We follow the usual practice in the time use literature and conceptualize time investment in children as the total time during which any form of child care is reported by the respondent as the primary activity during the designated day. Primary child care activities, however, cannot be equalized with time that parents spend with children. Indeed, there is some evidence that child care reported as the primary activity significantly underreports total child care time (*e.g.* Budig and Folbre 2004, Folbre and Bittman 2004, Bianchi *et al*. 2006). As pointed out in Folbre and Yoon (2007), humans are multitasking beings whose activities often elude clear categorization. Two other ways to measure child care in time diary surveys is to look at the so-called secondary activity and at the information on who else is present when the activity takes place. In particular, for each primary activity, the respondent is asked a question about "what else" he or she is doing. This so-called secondary activity often includes child care. Respondents are also asked who the activity is done with. Multiple individuals could be listed, including a child. Unfortunately, information on secondary activities or complementary information on who else is present while the activity is taking place is not perfectly comparable across the AHTUS surveys and is entirely missing for the 1990s, with no secondary information for the 2000s survey. Nevertheless, because primary child care time requires direct interaction with the child, it is important in itself as it is considered to be the most stimulating for children (see Guryan *et al*. 2008).[10]

Inspired by the classification used in Aguiar and Hurst (2007), we distinguish two broad types of child care within primary *child care*: *basic child care* and *educational/recreational child care*. The former includes the physical care of children (bathing, dressing, feeding, changing diapers), organizing and planning for children and, overall, looking after children. The latter includes activities such as reading to children, teaching children, attending meetings at a child's school, playing games with children, playing outdoors with children, attending a child's sporting event or dance recital, going to the zoo with children, and taking walks with children.[11]

[10] In contrast to time spent with children reported as primary activity in the diary, Guryan *et al*. (2008) use the most recent American Time Use Survey (ATUS) and find that total time spent in the company of a child is the same for low and highly educated mothers. This finding is interpreted by the authors as suggestive that highly-educated parents view child care as an investment in which it is important to devote their active attention.

[11] Specifically, basic child care includes the following categories in the AHTUS files: 33=care of infants, 34=general care of older children, 35=medical care of children and 39=other child care. Educational and recreational child care includes the following categories in the AHTUS files: 36=play with children, 37=supervise child or help with homework and 38=read to, talk with the child. We exclude travel time related to child care activities from our child care definitions as we lack information on whether the latter is associated

Aguiar and Hurst (2007) note that there is some ambiguity about whether child care is treated consistently across all surveys. Robinson and Godbey (1999) raise several concerns about the comparability of 1993 child care measures to the measures of child care in the other surveys. Egerton *et al*. (2006) also caution against making comparisons between the 1993 and 2003 time-use surveys. To allow for more meaningful comparisons we focus on two broad classification of child care activities, *i.e.* basic and educational/recreational child care, to avoid biases from changes in the classification of time-use activities over time (with some activities disappearing and new activities emerging- just as in the case of expenditure diary categories in expenditure surveys). As Aguiar and Hurst (2007) point out however, to the extent that low and highly educated individuals are affected by data collection methods in the same way, the differential impact that low-skilled immigration might have on child care according to maternal educational attainment in any given year should remain unaffected. We further include survey fixed-effects in the regression analysis to address any changes in survey methodologies.

4. Some Descriptive Statistics on Child Care Trends

Table 1 displays the trends in child care practices of mothers with children under the age of 6 during the past three decades by mother's educational attainment. We distinguish by mothers' educational attainment and separate basic from educational and recreational child care. A few findings are worth discussing. First of all, the probability of engaging in basic child care stayed fairly constant during this period despite decreasing between the 1970s and the 1990s and increasing back up between the 1990s and the 2000s. Note that this probability is not equal to 100 percent, even for mothers with young children as the ones considered herein. This is mostly due to the fact that our measures of child care exclusively refer to primary child care time as opposed to overall time with children. In fact, a sensitivity check using the *Multinational Time Use Study* (MTUS), which covers over 60 time-use diary datasets from 22 countries since 1965, reveals very similar patterns, with an average probability of 92 percent that a mother with children between the ages of 0 and 5 engages in child care time, whether basic or educational/recreational. In contrast, just as the literature has found for mothers with children between the ages of 0 and 18 living in the household (Ramey and Ramey 2009), we find that the likelihood of engaging in educational and

to a so-called basic or recreational/educational child care activity. However, our key findings are robust to its inclusion among basic or recreational/educational child care activities (see Table C1 in Appendix C).

recreational child care rose by nearly 80 percent among mothers with non-school age children over the time period under consideration.

Second, college-educated mothers spent more time than their less educated counterparts in both basic and educational or recreational child care throughout the time period under examination. Furthermore, while all mothers increased the time allocated to both types of child care, the increase in educational and recreational child care was especially large among college-educated mothers. Among them, educational and recreational child care rose by 338 percent –from 1.6 hours/week to 7 hours/week, as opposed to the 241 percent increase experienced by their less educated counterparts. In contrast, less educated mothers increased the time dedicated to basic child care by 42 percent, whereas their college-educated counterparts raised it by approximately 26 percent.

In sum, the likelihood of engaging in educational/recreational child care, along with the time allocated to both types of child care, significantly rose over the time period under analysis for all mothers. Nevertheless, the increase in educational/recreational child care was particularly noticeable –even more so among college-educated mothers. In what follows, we explore the role that immigration, through its effect on lowering the price of domestic services, may have had in shaping the time allocated to different types of child care according to mothers' educational attainment.

5. Methodology

5.1. Model Specification and Testable Hypotheses

We are interested in examining the impact that low-skilled immigration, through its reduction of the price of household services, has had on the child care time allocation of mothers of non-school age children in the United States. Because we lack detailed information on the price of household services for the time period under analysis at a disaggregate level, we follow the literature and estimate a reduced-form equation where the main explanatory variable is the share of low-skilled immigrants at the region-decade level. As mentioned in the Introduction, the justification for this analysis stems from the already existing evidence on how low-skilled immigration reduced the price of non-traded goods and, in particular, domestic and child care services in the United States (*e.g.* Cortés 2008, Furtado and Hock 2009). These authors show that a higher share of low-skilled workers and, in particular, immigrant workers, lowered the price of domestic services, including child care, and increased its availability. Lower prices and higher availability of market-provided child care services should, in turn, induce mothers to purchase those services and reduce their child

care time, other things equal. We thus look at how low-skilled immigration may be impacting the time allocated to different types of child care by mothers' education in the United States via its demonstrated impact on the price of domestic services. We model the impact of low-skilled immigration on the time dedicated by college-educated mothers of non-school age children to child care by:

$$(1) \qquad CC_{ist} = \alpha_{ist} + \beta * Share_{st} + X'_{ist}\chi + \phi_s + \varphi_t + \varepsilon_{ist}$$

where *i* stands for the individual woman, *s* indicates the state of residence, and *t* the time (in our case decade) to which the observation refers to. CC_{ist} stands for the type of child care time at hand. The vector X_{ist} contains individual level information, such as age, a dummy variable for whether the respondent is white, the number of adults living in the household, the number of children under the age of 6, the age of the youngest child, and dummy variables indicative of whether the time use referred to a week day and whether the diary was collected during the summer months. The vectors ϕ_s and φ_t refer to the state and time (or survey) fixed-effects, respectively. We allow the disturbance term to be correlated across individuals (and over time) in the same state. Table B2 in Appendix B contains the means and standard deviation for these regressors.

Our key regressor is the variable $Share_{st}$, which stands for the share of low-skilled (*i.e.* non-college educated) immigrant workers in the labor force in state *s* and time *t*. As such, the estimated coefficient β informs about the impact that an increase in the share of low-skilled immigrant workers has on the child care patterns of college-educated women. As shown in the first row of Table 2, this share, which we construct using Census data to minimize any attenuation biases,[12] increased from an average of 4.2 percent in 1970 to almost 6.1 percent by the year 2000.[13] The first three columns of Table 2 also reveal the state-level variability in the share of low-skilled immigration over the time period under consideration. For instances, while California displays the largest share of low-skilled immigrants by the year 2000 (followed by New York and Florida), it is not among the three states experiencing the major growth spurs in low-skilled immigration between the 1970s and the 2000s. Rather,

[12] As noted by Aydemir and Borjas (2006), measurement error in a key regressor (*e.g.* share of immigrants) in analyses relying in a spatial correlations approach are likely to result in a significant attenuation bias. Therefore, instead of using the AHTUS data, we rely on the Census to construct our share.

[13] As a robustness check, we try other definitions of this share. In particular, because the overwhelming majority of workers in domestic services are low-skilled women, we also construct an alternative share given by the number of low-skilled immigrant women in the state and decade in question divided by the female labor force. The main findings (available from the authors upon request) were robust to the alternative definitions of the share.

states like Georgia, North Carolina and Texas witnessed increases in low-skilled immigration of over 200 percent (in Georgia and North Carolina these increases were above 700 percent), whereas some large immigrant states, like New York, did not experience a significant change in their low-skilled immigrant shares. Finally, some states, like Maine, Massachusetts, Michigan, Ohio or Pennsylvania, saw their share of low-skilled immigrants fall.

The last three columns of Table 2 also display alike figures for the share of low-skilled female immigrants –an alternative share used in the main analysis as a robustness check on the basis that the vast majority of low-skilled immigrants employed in child care are likely to be female. Percentage wise, the average increase in this share over the time period under consideration is rather similar to the one displayed by the share of low-skilled immigrants (*i.e.* in the order of 45 percent). Likewise, Georgia, North Carolina and Texas are the three states experiencing the largest increase in that share between the 1970s and the 2000s.

As noted earlier in the discussion of our model, not all child care services are good substitutes for parental child care. Time spent reading a book might not be easily substitutable, even more so if low-skilled immigrant nannies are not proficient in English. As such, some college-educated mothers might take advantage of cheaper child care services and reduce the time they spend on basic child care, but not the time spent on educational and recreational activities. Thus, we estimate Equation (1) separately for each type of child care.

Likewise, we estimate Equation (1) separately for mothers with less than college education and mothers with at least some college. As previously discussed, the impact of a low-skilled immigrant shock is likely to vary with mothers' educational attainment. Among less educated mothers, a higher share of low-skilled immigrant workers may actually reduce employment opportunities and, consequently, the opportunity cost of taking care of the children themselves. Hence, the coefficient β may be either positive or non-statistically different zero. In contrast, among college-educated mothers –more likely to serve as complements to low-skilled immigrant workers, a higher share of low-skilled immigrant workers may actually increase their employment opportunities and, in turn, the opportunity cost of staying home taking care of non-school age children. Furthermore, these mothers are more likely to the ones to be able to afford market-provided child care services. Therefore, we would expect $\beta < 0$ for college-educated mothers when basic childcare is the dependent variable.

5.2. Econometric Challenges

The estimation of equation (1) poses a major challenge. Because immigrants are not randomly distributed across the United States but, rather, choose to locate in thriving states where mothers (and, even more so, college-educated mothers) are more likely to be at work and request child care services, low-skilled immigration is likely to be endogenous to the time spent on child care. OLS estimates are thus likely to suffer of a downward bias, particularly among college-educated women for whom the opportunity cost of their time rises during an economic boom. To deal with this problem, we instrument for the location of immigrants using information on the historical distribution of immigrants of a given country. Specifically, following Furtado and Hock (2010) and inspired in other studies in the literature that rely on the propensity of new immigrants to locate in areas where they have country networks as a justification for their choice of instruments (*e.g.* Bartel 1989, Massey *et al*. 1993, Munshi 2003, Card 2001, Cortés 2008, Cortés and Tessada 2010, among many others), we construct the following instrument:

$$(2) \qquad \sum_{c} \frac{immigrants_{cs1960}}{immigrants_{c1960}} * \Delta Lowskill\ immigrants_{ct}$$

where the sub-index c stands for immigrants' country of origin in the 1960 Census. The share $\frac{immigrants_{cs1960}}{immigrants_{c1960}}$ represents the fraction of all immigrants from country c living in state s in 1960. The second term ($\Delta Lowskill\ immigrants_{ct}$) represents the net change in the number of low-skilled (or non-college educated) immigrants in the labor force from country c between 1960 and time t, where t refers to 1970, 1990 and 2000. Both terms are constructed using Census data.[14]

For the above to be a valid instrument, it needs to be related to mothers' child care patterns only through the allocation of low-skilled immigrants across states. Note that the empirical analysis already includes state and time dummies. Therefore, we already control for state specific characteristics and for overall economy-wide trends over the time period under consideration. Yet, as noted by Cortés (2008) and Furtado and Hock (2010), it still has to be the case that: (a) the initial distribution of immigrants is uncorrelated with differential changes in relative economic conditions affecting the demand for child care services states 10 to 40 years later, and (b) differential economic changes among states should not affect the overall inflow of low-skilled immigrants to the United States. To increase the likelihood that they are met, we include some additional controls.

[14] We get similar results when using the stock of low-skilled immigrants, as opposed to the flow of low-skilled immigrants, in the construction of the instrument. See Table C2 in Appendix C.

First, we address the possibility that regions where immigrants migrated to in 1960 were economically booming regions that would have experienced an increased in the demand for market child care services by college-educated mothers (perhaps as they become more likely to join the labor market ranks) regardless of immigrant concentration. To alleviate this concern, in an alternative specification (what we will refer to as specification (2) in what follows), we also include in equation (1) information on two variables intended to reflect an economically booming region: (a) the share of working age women with a college degree in each state in 1960, and (b) the share of working age women with at least a college degree who participate in the labor force in each state in 1960. Both controls are also interacted with time dummies to account for differences in initial conditions at the state-level potentially correlated over time.

Additionally, we foresee the possibility that our instrument could be capturing labor demand shocks to industries that have been persistently important in those states attracting most immigrants in our sample. It is worth noting however that much of the increase in the share of low-skilled immigrants in the 1960s resulted from the implementation of guest worker programs, such as the Bracero program spanning from 1942 to 1964, which recruited only male workers less likely to be employed in child care services (Gonzalez 2006, Gonzalez and Fernandez 2003). Nevertheless, in the alternative specification, we also include information on the following three variables, constructed for each state using 1960 data and intended to capture labor demand shocks to industries in the states where immigrants reside: (a) the share of the labor force employed in the high-skilled services sector, (b) the share of the labor force employed in the low-skilled services sector, and (c) average hourly wages for people with at least a college degree. All three regressors are also interacted with the time dummies to, again, capture state-level differences in initial conditions that are correlated over time.

A final concern worth discussing is whether natives are responding to the location choices made by immigrants and migrating internally to regions where they do not compete with immigrants. Note, however, that even if that is the case, they are most likely less educated natives fearing labor market competition, not the college-educated mothers we are primarily focusing on. Furthermore, if labor mobility dissipates the effects of immigration flows, our estimates should work as lower bound estimates of the total impact of low-skilled immigration on the child care time of college-educated mothers.

6. Findings

6.1. Immigration and the Time Use of Non-Hispanic Mothers of Young Children

Table 3 shows the OLS and IV results from estimating equation (1) for our main sample of college-educated non-Hispanic mothers of non-school age children and using the share of low-skilled immigrants as our key regressor. We present two different OLS specifications. The first specification in Column [1] coincides with equation (1), whereas the second specification in Column [2] adds the state-time controls discussed in the previous section. These included: the share of working-age women with college in each state in 1960, the share of working-age women with at least a college degree who participate in the labor force in each state in 1960, the share of the labor force employed in the high-skilled services sector, the share of the labor force employed in the low-skilled services sector and average hourly wages for people with at least a college degree. All these additional regressors are also interacted with survey fixed-effects for the 1970s, 1990s, and 2000s decades.

Differences in the coefficients between the first and second OLS specifications are minimal. The same is true for the IV specifications with and without aggregate controls. Therefore, column [3] displays the results of estimating specification [2] using IV methods. The second to last row in Table 3 shows that the instrument is a very good predictor of the share of low-skilled immigrants. The associated F-statistic is 20.92, which allows us to reject the null of a weak instrument (see Stock and Yogo, 2005).[15]

The estimates in Table 3 show that low-skilled immigration appears to have a differential impact on the child care provision of college-educated mothers of non-school age children depending on the type of child care at hand. In particular, in line with the predictions of the model, the 2 percentage point increase in the share of low-skilled immigrants taking place between the 1970s and 2000 lowered the time allocated by college-educated mothers to basic child care by a little bit more than half an hour per week. In contrast, the same increase in the share of low-skilled immigrants raised the time allocated to educational and recreational child care by college-educated mothers by a quarter of an hour. IV estimates are larger than OLS estimates in all specifications, suggesting that OLS estimates may be biased downwards as a result of immigrants tending to locate in regions experiencing a higher growth rate and college-educated mothers in those regions reducing the time allocated to various types of child care.[16]

[15] Additionally, the estimated coefficient for the IV in the first-stage regression is positive and highly significant with a t-statistic equal to 39.31.

[16] The decrease in basic child care and the increase in educational and recreational child care that followed the rise in low-skilled immigration had a net effect of reducing child care time by about 20 minutes per week.

Similar results are obtained using the share of low-skilled female immigrants as our key regressor.[17] As displayed in Table 4, the 0.8 percentage point increase in the share of low-skilled female immigrants taking place between the 1970s and the 2000s lowered the time allocated to basic child care by college-educated mothers of non-school age children by 0.68 hours/week (about 40 minutes/week), while it increased their time spent on educational and recreational child care activities by 0.3 hours/week (or 18 minutes/week). Given the similarity of the results, we will follow previous U.S. studies in this literature (such as Cortés and Tessada 2010 or Furtado and Hock 2010), and use the share of low-skilled immigrants for the remainder of the analysis.

A second prediction from the model is that low-skilled immigration had a differential impact on the child care provision of mothers of age children depending on their educational attainment. Table 5 shows the OLS and IV results from estimating equation (1) for our main sample of non-college educated non-Hispanic mothers of non-school age children. The model specifications are the same ones from Table 3. The 1970-2000 increase in the share of low-skilled immigrants raised the likelihood of engaging in basic child care by these less-educated mothers by approximately 1 percentage point and the time devoted to basic child care activities by 0.75 hours/week (or 45 minutes/week). Yet, it had no statistically significant impact on the educational or recreational child care. Although we do not model labor market displacement effects in our simple time use model, this finding suggests that immigration may have exerted a downwards pressure on the employment of less-educated mothers through greater competition in the labor market. This hypothesis is, in fact, confirmed by Cortés and Tessada (2010), who find that low-skilled immigration during 1980-2000 lowered the labor force participation of women with a high-school education or less in the United States.[18] Under such circumstances, less educated mothers may have chosen to stay at home and take care of the children themselves.

[17] The last two rows in Table 4 show that the instrument is a very good predictor of the share of low-skilled female immigrants as well. The associated coefficient is positive and statistically significant (with a t-statistic of 29.21) and the F-statistic is 11.774.

[18] Likewise, focusing on Spain, Farré *et al.* (2011) find that the effect of low-skilled immigration in increasing female labor supply dies out as less educated native women are added to the sample.

6.2. Robustness Checks

To check that results are unique to college-educated mothers of young children, we run a battery of robustness checks that look at mothers of older children and a sample of college-educated fathers. We also check the robustness of our previous findings to alternative sample definitions, including Hispanic college-educated mothers and excluding states that underwent the biggest immigration shock during this period. Third, we look at alternative time use activities that may be complementary to child care.

6.2.1. Low-skilled Immigration and Child Care of Mothers and Fathers

School attendance can play the role of an alternative form of child care, so we do not expect immigration to have much of an impact on the child care time allocation of non-Hispanic college-educated mothers of school-age children. Indeed, as shown by the IV estimates in Column 3 of Table 6, while negative, the 2 percentage point increase in the share of low-skilled immigrants of the period 1970-2000 had no statistically significant impact on the time allocated to child care by this new sample of mothers. In fact, immigration appears to have slightly increased, although by a non-economically significant amount, the likelihood of engaging in basic child care.[19] Therefore, increases in low-skilled immigration leads to reductions in the provision of basic child care that are specific to college-educated mothers of non-school age children.

We also re-estimate our models using an analogous sample of fathers. Since, relative to mothers, fathers dedicate significantly less time to basic child care (see third column in Table B3 in Appendix B), we do not expect low-skilled immigration to further lower the basic child care provision of college-educated men. Furthermore, if the provision of child care by parents is not independent and mothers are spending less time in basic child care and more in educational and recreational child care, we might observe the opposite patterns among fathers.[20] Table 7 displays the results for fathers with non-school age children. The 2 percentage point increase in low-skilled immigration of the 1970-2000 period appears to have raised the likelihood of providing basic child care (by 4.44 percentage points) and lowered the time dedicated to educational and recreational child care (by 0.27 hours/week or 16 minutes/week) by non-Hispanic fathers of non-school age children. Hence, once more, increases in low-skilled immigration appear to have led to reductions in the provision of basic child care that are specific to high-skilled mothers of non-school age children.

[19] As can be seen from Table B3 in Appendix B, this likelihood stood at 61 percent for college-educated mothers in the 1970s.
[20] A household model would be required to explain fathers' child care provision.

6.2.2. Alternative Sample Definitions

We first re-estimate the models in Table 3 using all mothers of non-school age children, including Hispanic mothers that were excluded in order to better assess the impact that immigration may have had on native mothers.[21] Table 8 shows that our main findings are robust to this sample definition. The low-skilled immigration shock of the 1970-2000 period significantly lowered the time dedicated by college-educated mothers to basic child care by 0.65 hours/week (or 39 minutes/week), whereas it increased the time allocated to educational and recreational child care by 0.15 hours/week (or 9 minutes/week). The effects represent a 6.5 percent decrease and a 9 percent increase, respectively, from its values in the 1970s (fourth column in Table A2).

Second, as noted in Table 2, three states –Georgia, North Carolina and Texas– experienced increases in the share of low-skilled immigrants of over 200 percent during the time period under examination. One might be concerned about the possibility that these states are driving the impact that increases in the share of low-skilled immigrants appear to have had on the provision of child care by college-educated mothers of young children. Table 9 shows the results when states experiencing the largest increases of low-skilled immigrants over the 1970-2000 time period are excluded from the sample. As in Table 3, we continue to find that the 2 percentage point increase in the share of low-skilled immigrants taking place between the 1970s and 2000 lowered the time allocated by college-educated mothers to basic child care by slightly more than half an hour per week (specifically, by 37 minutes/week), while it raised the time allocated to educational and recreational child care by college-educated mothers by approximately a quarter of an hour (or, precisely, by 17 minutes/week).

6.2.3. Complementary Impacts of Low-skilled Immigration

Because low-skilled immigrant child care workers may help with other tasks around the home, a final type of robustness check consists in examining how low-skilled immigration has impacted the time dedicated to housework by college-educated mothers of non-school age children. If home production and child caring are two complementary tasks carried out by low-skilled immigrants employed as nannies, we would expect low-skilled immigration to have significantly reduced the time dedicated by college-educated mothers of non-school age children to home production. Table 10 displays the results from this analysis.

[21] Note that, if immigrants are primarily Hispanic, changes in maternal child care patterns could be due to the changing sample composition (after all, Hispanics and immigrants have higher childbearing rates) as opposed to the changing child care provision of native mothers following an increase in low-skilled immigration.

The 2 percentage point increase in low-skilled immigration between 1970 and 2000 lowered the time allocated to housework by college-educated mothers of non-school age children anywhere between 0.37 hours/week (22 minutes/week) among non-Hispanic college-educated mothers and half an hour per week if we include Hispanic mothers in the sample.[22] Smaller effects are found for college-educated mothers with older children, for whom the same immigration shock lowered the time dedicated to home production by 0.2 hours/week (12 minutes/week). In contrast, just as we found for basic child care, the low-skilled immigration shock of the 1970-2000 may have exerted a downwards pressure on the employment and earnings of less-educated mothers and, in turn, raised the time dedicated by these mothers of non-school age children to housework by 0.63 hours/week (or 38 minutes/week). Finally, low-skilled immigration had no significant impact on the time dedicated to home production by fathers.

7. Summary and Conclusions

Previous work has shown that low-skilled immigration to the United States allowed for a substantial reduction in the price of locally traded goods and services in the United States (Cortés 2008) and, more specifically, on the cost of market-provided child care, food and housekeeping services in large metropolitan areas (Furtado and Hock 2009). Based on those findings, Cortés and Tessada (2010) show that low-skilled immigration to the United States led to increases in hours worked conditional on being employed among native college-educated women in the United States. In turn, Furtado and Hock (2010) show how low-skilled immigration also increased the fertility of non-Hispanic native college graduates in the United States and reduced the work-fertility tradeoff faced by educated urban American women.

We go one step further and examine how low-skilled immigration, via its impact on the cost of household services, may have impacted the allocation of time to child care of college-educated mothers in the United States. Using historical time use data and an instrumental variables approach that accounts for the endogenous location of low-skilled immigration, we find that low-skilled immigration to the United States had a differential impact on the child care provision of mothers depending on their educational attainment and on the type of child care at hand. In particular, low-skilled immigration contributed to reductions in the time allocated by college-educated mothers of non-school age children to

[22] Table B4 in Appendix B displays the means and standard deviations corresponding to the likelihood of engaging in housework and of the time dedicated to such an activity for the various samples being considered.

basic child care and allowed for increases in the time dedicated to educational and recreational child care. Therefore, while mothers of young children increased the time allocated to child care between the 1970s and the 2000s, those increases were smaller for basic child care activities and larger for educational and recreational activities among college-educated mothers residing in states with a higher share of low-skilled immigrants.

Our findings underscore the opportunity costs faced by high-skilled mothers of young children when providing child care and how low-skilled immigration appears to have helped these mothers with the provision of basic child care and allowed them to raise the time dedicated to other potentially more stimulating forms of child care, as in the case of recreational and educational child care. In addition to informing about low-skilled immigration impacts beyond employment, wages and fertility, learning about the impact that increases in low-skilled immigration might have had on the time allocated by parents to various types of child care is important because some types of child care can prove particularly important for the child's posterior intellectual and social development. This is a crucial policy question with important consequences for the intergenerational transmission of economic status, and may help to better understand the parent-child correlations extensively documented in the literature (see Black and Devereux (2011) for a literature review on Intergenerational Mobility). Our work highlights the need for further research on the determinants of the time mothers spend on child care activities and how the latter impacts children outcomes depending on mothers' educational attainment.

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Table 1
Child Care Trends of Mothers with Children Ages 0-5

	All	College Degree	Less than College
		p(Basic Child Care>0)	
1970s	0.878	0.937	0.855
	(0.016)	(0.028)	(0.021)
1990s	0.764	0.802	0.713
	(0.015)	(0.018)	(0.025)
2000s	0.888	0.901	0.86
	(0.006)	(0.007)	(0.012)
		Basic Child Care Time	
1970s	8.433	10.06	7.802
	(0.568)	(1.120)	(0.613)
1990s	8.166	8.426	7.813
	(0.515)	(0.708)	(0.725)
2000s	12.168	12.691	11.059
	(0.222)	(0.281)	(0.360)
		p(Educational Child Care>0)	
1970s	0.309	0.34	0.296
	(0.024)	(0.044)	(0.028)
1990s	0.293	0.339	0.231
	(0.021)	(0.028)	(0.033)
2000s	0.555	0.598	0.464
	(0.009)	(0.011)	(0.016)
		Educational Child Care Time	
1970s	1.613	1.626	1.608
	(0.416)	(0.821)	(0.447)
1990s	2.943	3.273	2.496
	(0.377)	(0.519)	(0.528)
2000s	6.526	7.02	5.476
	(0.163)	(0.206)	(0.262)
Observations	3740	2362	1378

Notes: Sample is women between 21 and 55 years old with at least one child between 0 and 5 years old and who have a complete 24-hour diary. Child care measures are in hours per week. Standard errors are in parentheses.

Table 2
Trend in the Share of Low-Skilled Immigrants

Shares:	**Low Skilled Immigrant Share**			**Low-skilled female immigrant share**		
Decades:	**1970s**	**1990s**	**2000s**	**1970s**	**1990s**	**2000s**
U.S.	**0.042**	**0.048**	**0.061**	**0.017**	**0.02**	**0.025**
Alabama	0.004	0.006	0.015	0.002	0.003	0.006
Arizona	0.041	0.058	0.103	0.016	0.023	0.036
Arkansas	0.005	0.008	0.024	0.003	0.004	0.009
California	0.078	0.157	0.186	0.03	0.06	0.073
Colorado	0.021	0.026	0.057	0.009	0.011	0.021
Connecticut	0.084	0.051	0.064	0.034	0.024	0.028
Florida	0.068	0.087	0.112	0.028	0.038	0.049
Georgia	0.005	0.016	0.049	0.002	0.007	0.016
Illinois	0.056	0.051	0.071	0.02	0.02	0.028
Indiana	0.015	0.009	0.02	0.007	0.004	0.007
Iowa	0.01	0.007	0.016	0.004	0.004	0.006
Kentucky	0.003	0.006	0.014	0.002	0.003	0.005
Louisiana	0.012	0.013	0.017	0.006	0.006	0.007
Maine	0.044	0.019	0.018	0.018	0.009	0.009
Maryland	0.027	0.031	0.05	0.012	0.015	0.023
Massachusetts	0.08	0.056	0.069	0.035	0.026	0.032
Michigan	0.04	0.016	0.023	0.014	0.007	0.009
Minnesota	0.019	0.009	0.021	0.009	0.005	0.009
Mississippi	0.006	0.005	0.011	0.003	0.003	0.004
Missouri	0.013	0.008	0.016	0.006	0.004	0.007
Nebraska	0.013	0.01	0.027	0.006	0.005	0.01
New Jersey	0.085	0.074	0.102	0.035	0.034	0.044
New York	0.113	0.085	0.112	0.045	0.038	0.049
North Carolina	0.005	0.011	0.041	0.002	0.004	0.013
Ohio	0.028	0.011	0.014	0.011	0.006	0.006
Oregon	0.029	0.031	0.062	0.012	0.012	0.023
Pennsylvania	0.029	0.014	0.019	0.012	0.006	0.009
South Carolina	0.006	0.009	0.022	0.002	0.005	0.008
Tennessee	0.003	0.007	0.02	0.001	0.004	0.007
Texas	0.031	0.073	0.105	0.011	0.026	0.037
Utah	0.034	...	0.048	0.012	...	0.018
Virginia	0.015	0.027	0.046	0.008	0.013	0.02
Washington	0.046	0.039	0.066	0.02	0.017	0.028
West Virginia	0.006	0.004	0.006	0.002	0.002	0.003

Source: 1970, 1990 and 2000 Census data.

Table 3
Child Care Time of College-educated Mothers and the Share of Low-Skilled Immigrants
(Mothers with Children 0-5)

Model Specification:	OLS		IV
	[1]	[2]	[3]
Independent Variable:	**p(Basic Child Care>0)**		
Low-skilled Immigrant Share	0.052	0.052	0.437
	(0.199)	(0.201)	(0.454)
Independent Variable:	**Basic Child Care**		
Low-skilled Immigrant Share	-25.679***	-25.679***	-30.510***
	(3.579)	(3.603)	(3.780)
Independent Variable:	**p(Educational Child Care>0)**		
Low-skilled Immigrant Share	0.089	0.089	0.658
	(0.352)	(0.354)	(0.647)
Independent Variable:	**Educational Child Care**		
Low-skilled Immigrant Share	9.972**	9.972**	12.715*
	(4.082)	(4.110)	(6.593)
First Stage F-stat.			20.917
N	2362	2362	2362

Notes: Specification [1] coincides with equation (1) in the text. Specification [2] includes the additional aggregate state-time controls described in the text. Specification [3] is analogous to specifications [2], but is estimated using the IV described in the main text. Child care time is measured in hours per week. We allow the disturbance term to be correlated across individuals (and over time) in the same state. Standard errors are in parentheses. * denotes significance at the 10% level, ** at the 5% level and ***at the 1% level.

Table 4
Child Care Time of College-educated Mothers and the Share of Low-Skilled Female Immigrants
(Mothers with Children 0-5)

Model Specification:	**OLS**		**IV**
	[1]	**[2]**	**[3]**
Independent Variable:	**p(Basic Child Care>0)**		
Low-skilled Female Immigrant Share	-0.041	-0.041	1.205
	(0.469)	(0.472)	(1.323)
Independent Variable:	**Basic Child Care**		
Low-skilled Female Immigrant Share	-61.382***	-61.381***	-84.040***
	(12.342)	(12.428)	(14.639)
Independent Variable:	**p(Educational Child Care>0)**		
Low-skilled Female Immigrant Share	0.108	0.108	1.812
	(0.852)	(0.858)	(1.879)
Independent Variable:	**Educational Child Care**		
Low-skilled Female Immigrant Share	27.803***	27.803***	35.023*
	(9.415)	(9.481)	(20.589)
First Stage F-stat.			11.774
N	2362	2362	2362

Notes: Specification [1] coincides with equation (1) in the text. Specification [2] includes the additional aggregate state-time controls described in the text. Specification [3] is analogous to specifications [2], but is estimated using the IV described in the main text. Child care time is measured in hours per week. We allow the disturbance term to be correlated across individuals (and over time) in the same state. Standard errors are in parentheses. * denotes significance at the 10% level, ** at the 5% level and ***at the 1% level.

Table 5
Child Care Time of mothers with less than a College Degree and the Share of Low-Skilled Immigrants
(Mothers with Children 0-5)

Model Specification:	**OLS**		**IV**
	[1]	**[2]**	**[3]**
Independent Variable:		**p(Basic Child Care>0)**	
Low-skilled Immigrant Share	0.461***	0.461***	0.391***
	(0.113)	(0.114)	(0.122)
Independent Variable:		**Basic Child Care Time**	
Low-skilled Immigrant Share	31.588***	31.584***	37.539***
	(9.391)	(9.507)	(12.202)
Independent Variable:		**p(Educational Child Care>0)**	
Low-skilled Immigrant Share	0.41	0.41	0.894
	(0.440)	(0.445)	(0.555)
Independent Variable:		**Educational Child Care**	
Low-skilled Immigrant Share	-5.756	-5.758	12.158
	(10.913)	(11.048)	(19.007)
First Stage F-stat.			12.034
N	1378	1378	1378

Notes: Specification [1] coincides with equation (1) in the text. Specification [2] includes the additional aggregate state-time controls described in the text. Specification [3] is analogous to specifications [2], but is estimated using the IV described in the main text. Child care time is measured in hours per week. We allow the disturbance term to be correlated across individuals (and over time) in the same state. Standard errors are in parentheses. * denotes significance at the 10% level, ** at the 5% level and ***at the 1% level.

Table 6
Child Care Time of College-educated Mothers and the Share of Low-Skilled Immigrants
(Mothers with Children 0-18)

Model Specification:	**OLS**		**IV**
	[1]	**[2]**	**[3]**
Independent Variable:	**p(Basic Child Care>0)**		
Low-skilled Immigrant Share	0.176***	0.176***	0.236***
	(0.032)	(0.032)	(0.073)
Independent Variable:	**Basic Child Care**		
Low-skilled Immigrant Share	-9.516***	-9.516***	-6.48
	(2.438)	(2.446)	(4.051)
Independent Variable:	**p(Educational Child Care>0)**		
Low-skilled Immigrant Share	0.116	0.116	0.305
	(0.158)	(0.158)	(0.266)
Independent Variable:	**Educational Child Care**		
Low-skilled Immigrant Share	1.589	1.589	2.214
	(2.525)	(2.533)	(2.960)
First Stage F-stat.			19.533
N	5233	5233	5233

Notes: Specification [1] coincides with equation (1) in the text. Specification [2] includes the additional aggregate state-time controls described in the text. Specification [3] is analogous to specifications [2], but is estimated using the IV described in the main text. Child care time is measured in hours per week. We allow the disturbance term to be correlated across individuals (and over time) in the same state. Standard errors are in parentheses. * denotes significance at the 10% level, ** at the 5% level and ***at the 1% level.

Table 7
Child Care Time of College-educated Fathers and the Share of Low-Skilled Immigrants
(Fathers with Children 0-5)

Model Specification:	**OLS**		**IV**
	[1]	**[2]**	**[3]**
Independent Variable:	**p(Basic Child Care>0)**		
Low-skilled Immigrant Share	1.417***	1.417***	2.220**
	(0.390)	(0.393)	(1.024)
	Basic Child Care		
Low-skilled Immigrant Share	7.745	7.744	18.835
	(5.996)	(6.052)	(14.090)
	p(Educational Child Care>0)		
Low-skilled Immigrant Share	-0.061	-0.061	0.363
	(0.351)	(0.354)	(0.570)
	Educational Child Care		
Low-skilled Immigrant Share	-10.535***	-10.535***	-13.057***
	(3.762)	(3.797)	(3.891)
First Stage F-stat.			19.337
N	1813	1813	1813

Notes: Specification [1] coincides with equation (1) in the text. Specification [2] includes the additional aggregate state-time controls described in the text. Specification [3] is analogous to specifications [2], but is estimated using the IV described in the main text. Child care time is measured in hours per week. We allow the disturbance term to be correlated across individuals (and over time) in the same state. Standard errors are in parentheses. * denotes significance at the 10% level, ** at the 5% level and ***at the 1% level.

Table 8
Child Care Time of College-educated Mothers and the Share of Low-Skilled Immigrants
(Mothers with Children 0-5, including Hispanics)

Model Specification:	**OLS**		**IV**
	[1]	**[2]**	**[3]**
Independent Variable:	**p(Basic Child Care>0)**		
Low-skilled Immigrant Share	0.128	0.128	0.386
	(0.191)	(0.192)	(0.324)
	Basic Child Care		
Low-skilled Immigrant Share	-25.352***	-25.352***	-32.029***
	(3.149)	(3.170)	(6.441)
	p(Educational Child Care>0)		
Low-skilled Immigrant Share	-0.085	-0.085	0.345
	(0.323)	(0.325)	(0.486)
	Educational Child Care		
Low-skilled Immigrant Share	5.209**	5.209**	7.191*
	(2.535)	(2.552)	(4.179)
First Stage F-stat.			20.167
N	2576	2576	2576

Notes: Specification [1] coincides with equation (1) in the text. Specification [2] includes the additional aggregate state-time controls described in the text. Specification [3] is analogous to specifications [2], but is estimated using the IV described in the main text. Child care time is measured in hours per week. We allow the disturbance term to be correlated across individuals (and over time) in the same state. Standard errors are in parentheses. * denotes significance at the 10% level, ** at the 5% level and ***at the 1% level.

Table 9
Child Care Time of College-educated Mothers and the Share of Low-Skilled Immigrants
(Mothers with Children 0-5, excluding Georgia, North Carolina, and Texas)

	OLS		IV
	[1]	**[2]**	**[3]**
Independent Variable:	**p(Basic Child Care>0)**		
Low-skilled Immigrant Share	0.149	0.149	0.402
	(0.193)	(0.194)	(0.337)
Independent Variable:	**Basic Child Care Time**		
Low-skilled Immigrant Share	-27.660***	-27.660***	-30.526***
	(4.249)	(4.283)	(3.590)
Independent Variable:	**p(Educational Child Care>0)**		
Low-skilled Immigrant Share	0.258	0.258	0.656
	(0.331)	(0.334)	(0.480)
Independent Variable:	**Educational Child Care Time**		
Low-skilled Immigrant Share	8.342*	8.343*	13.980*
	(4.414)	(4.448)	(7.722)
First Stage F-stat.			34.2156
N	2139	2139	2139

Notes: Specification [1] coincides with equation (1) in the text. Specification [2] includes the additional aggregate state-time controls described in the text. Specification [3] is analogous to specifications [2], but is estimated using the IV described in the main text. Child care time is measured in hours per week. We allow the disturbance term to be correlated across individuals (and over time) in the same state. Standard errors are in parentheses. * denotes significance at the 10% level, ** at the 5% level and ***at the 1% level.

Table 10
Housework Time and the Share of Low-Skilled Immigrants

Sample:	**College-educated Mothers (Children 0-5)**		
Independent Variable:	**p(Housework>0)**		
Low-skilled Immigrant Share	0.093	0.093	0.211
	(0.107)	(0.108)	(0.203)
Independent Variable:	**Housework Time**		
Low-skilled Immigrant Share	-19.585***	-19.584***	-16.788**
	(4.902)	(4.937)	(7.507)
N	2362	2362	2362
First Stage F-stat.			21.41
Sample:	**Less than College-educated Mothers (Children 0-5)**		
Independent Variable:	**p(Housework>0)**		
Low-skilled Immigrant Share	0.055	0.055	0.481
	(0.233)	(0.235)	(0.529)
Independent Variable:	**Housework Time**		
Low-skilled Immigrant Share	21.552**	21.550**	27.717**
	(9.069)	(9.180)	(12.603)
N	1378	1378	1378
First Stage F-stat.			12.034
Sample:	**College-educated Mothers (Children 0-18)**		
Independent Variable:	**p(Housework>0)**		
Low-skilled Immigrant Share	-0.088	-0.088	0.128
	(0.077)	(0.078)	(0.241)
Independent Variable:	**Housework Time**		
Low-skilled Immigrant Share	-7.768***	-7.768***	-8.587***
	(2.572)	(2.580)	(2.812)
N	5233	5233	5233
First Stage F-stat.			19.553
Sample:	**College-educated Fathers (Children 0-5)**		
Independent Variable:	**p(Housework>0)**		
Low-skilled Immigrant Share	-0.419***	-0.419***	-0.389***
	(0.119)	(0.120)	(0.145)
Independent Variable:	**Housework Time**		
Low-skilled Immigrant Share	-8.707***	-8.707***	-4.937
	(2.836)	(2.863)	(5.390)
N	1813	1813	1813
First Stage F-stat.			19.337
Sample:	**College-educated Mothers Inc. Hispanics (Children 0-5)**		
Independent Variable:	**p(Housework>0)**		
Low-skilled Immigrant Share	0.003	0.003	0.073
	(0.049)	(0.050)	(0.096)
Independent Variable:	**Housework Time**		
Low-skilled Immigrant Share	-24.929***	-24.929***	-22.742***
	(4.818)	(4.849)	(5.970)
N	2576	2576	2576
First Stage F-stat.			20.167

Notes: Specification [1] coincides with equation (1) in the text. Specification [2] includes the additional aggregate state-time controls described in the text. Specification [3] is analogous to specifications [2], but is estimated using the IV described in the main text. Child care time is measured in hours per week. We allow the disturbance term to be correlated across individuals (and over time) in the same state. Standard errors are in parentheses. * denotes significance at the 10% level, ** at the 5% level and ***at the 1% level.

Appendix A: A Model of Child Care Provision

A mother's maximization problem is given by:

$$\begin{aligned} &\max_{x,l,h} U(c) + V(l) \\ &st: \\ &c = c(x,h) \\ &\lambda : px = w(1-h-l) \qquad \text{(A.1)} \\ &1 = L + l + h \\ &x,h,l,L \geq 0 \end{aligned}$$

<u>*Case 1: Mother purchases child care services*</u> ($x^* > 0$): Substituting the first constraint into the utility function yields the first order conditions:

$$h: U_c^{'} c_h^{'} - \lambda w = 0 \qquad \text{(A.2)}$$

$$x: U_c^{'} c_x^{'} - \lambda p = 0 \qquad \text{(A.3)}$$

$$l: V_l^{'} - \lambda w = 0 \qquad \text{(A.4)}$$

It is easy to see that dividing (A.2) by (A.3), we get Expression (3). Likewise, dividing (A.4) by (A.3) we get Expression (4), just as and dividing (A.4) by (A.2) we get expression (5):

$$\frac{V_l^{'}}{U_c^{'} c_x^{'}} = \frac{w}{p} \qquad (4)$$

$$\frac{V_l^{'}}{U_c^{'} c_h^{'}} = 1 \qquad (5)$$

Equations (4) and (5) state that the marginal rate of substitution of leisure (*l*) for either commercial child care (*x*) or maternal child care time (*h*) must be equal to the corresponding price ratio. In other words, the extra utility (via increases in well-cared for children *c*) from additional units of either commercial child care (*x*) or maternal child care (*h*) that is needed to compensate for a one-unit marginal reduction in the consumption of leisure (*l*), should be equal to the marginal rate of exchange between leisure and commercial child care on the one hand, and leisure and maternal child care on the other hand.

<u>*Case 2: Mother does not purchase child care services*</u> ($x^* = 0$): If this is the case, then Equation (A.3) does not hold with equality, but as follows:

$$x: U_c^{'} c_x^{'} - \lambda p < 0 \qquad \text{(A.3)'}$$

Dividing (A.3)' by (A.2) yields inequality (3)':

$$\frac{c_h^{'}}{c_x^{'}} > \frac{w}{p} \qquad (3)'$$

which shows that for low enough wages with respect to the price of commercial child care (*w/p*), commercial child care becomes too expensive and it is optimal to minimize the use of commercial child care services and, instead, raise the provision of maternal child care.

Appendix B
Table B1: AHTUS Description

Study aims, target populations, and sample restrictions

Survey years	Organizing Aims and Considerations	Target Population	Sampling Restrictions
1965-1966	Comparability with the Multinational Comparative Time-Budget project collected in 12 countries	The national working age population (19-64) of the USA (excluding families where all members worked as farmers)	Only people aged 19 to 64 (with a few older diarists), and one person per household (Alaska, Hawaii, and some smaller, rural states excluded)
1975-1976	Measure national accounts and changes in time use over the year	The national adult population	People aged 18 or older and one person plus spouse if present per household
1985	Determined how people used their time and to compare diaries collected by post-out/post-back, phone, and face-to-face interview	The national population beyond secondary school age not living in institutions	People aged 12 or older living in private households with phones (Alaska, Hawaii, and some smaller, rural states excluded)
1992-1994	The study measured time use and exposure	The national population living in private residences	1 person of any age living in sampled private households with phones (Alaska and Hawaii excluded)
2003	The study follows a sub-sample of the CPS for a 9th wave to facilitate the study of national accounts	The national population not living in military bases or institutions	1 person aged 15 or older in the household

Relevant points in time from the sample designs

Survey years	Fieldwork Period	Sampling of Days of the Week	When Activities Were Recorded
1965-1966	15 November -15 December 1965; 1 January - 18 February 1966; 7 March - 20 May, 1966	2/7ths of diaries were stamped for collection on a weekend day; 5/7ths were stamped for collection on a weekday	A two-stage tomorrow approach, diaries left behind for completion on diary day
1975-1976	Wave 1: 9 October 1975 – 22 November 1975; Wave 2: 6 February 1976 - 28 March 1976; Wave 3: 2 May 1976 - 19 July 1976; Wave 4: 4 September 1976 - 26 October 1976	The study aimed to collect one diary on a Sunday, one on a Saturday, and two on different weekdays from each sample member.	Diaries covered the previous 24 hour day
1985	Whole year of 1985	Mail-out after phone calls.	Diaries to be completed on a specified day in the subsequent week
1992-1994	September 1992 – October 1994	Phone calls were attempted on all days of the week.	Diaries covered the previous 24 hour day
2003	Whole year of 2003	Half of diaries were collected on weekday, half on weekend days.	Diaries covered the previous 24 hour day

Sample designs and response rates

Survey years	Sample Frame	How Sample Drawn	Response Rate
1965-1966	Jackson, Michigan and surrounding townships, and a national sample	Jackson – random selection; National multi-stage clustered area sampling of clusters containing around 4 addresses; one individual per household	82 % in Jackson; 74 % in the national sample
1975-1976	Private households	Stratified, clustered and probability selection within strata. One individual was sampled per household. Data was also collected from spouses where present.	72 % in the first wave; 44.9 % responded to all four waves
1985	Adults 18 years or over, living in houses with telephones in the contiguous United States.	Stratified and clustered, random-digit dialing, with only private residences pursued for an interview. Information on the household collected by telephone.	55.2 % overall, 51 % for mail back sample
1992-1994	Potential phone numbers within lists of area codes	Random-digit dialing, only private residences pursued for interview. The person who would next have a birthday completed the diary.	63 %
2003	The CPS sample	A random sub-sample of the CPS, with the over-sampling of small states dropped but families with children over-sampled. Half of the diaries are collected on week days, the other half on weekend days	57.8 %

Source: Fisher *et al*. (2007).

Table B2
Means and Standard Deviations of Other Variables Included in the Analysis

Variables	All Mothers	College Educated Mothers	Non-College Educated Mothers
Age	32.706	33.663	31.065
	(0.110)	(0.127)	(0.196)
White dummy	0.81	0.845	0.751
	(0.006)	(0.007)	(0.012)
Number of adults	1.951	1.979	1.904
	(0.010)	(0.011)	(0.019)
Number of children under 5	1.109	1.143	1.049
	(0.012)	(0.014)	(0.020)
Age youngest child	2.307	2.242	2.42
	(0.027)	(0.035)	(0.045)
Summer dummy	0.153	0.159	0.144
	(0.006)	(0.008)	(0.009)
Weekday dummy	0.484	0.485	0.484
	(0.008)	(0.010)	(0.013)
N	3740	2362	1378

Notes: Sample is women between 21 and 55 years old with at least one child between 0 and 5 years old and who have a complete 24-hour diary. Standard deviations are in parentheses.

Table B3
Child Care Trends for Alternative Samples

	Less than College-educated Mothers (Children 0-5)	College-educated Mothers (Children 0-18)	College-educated Fathers (Children 0-5)	College-educated Mothers Inc. Hispanics (Children 0-5)
		p(Basic Child Care Time>0)		
1970s	0.855	0.609	0.377	0.935
	(0.021)	(0.026)	(0.041)	(0.028)
1990s	0.713	0.578	0.421	0.807
	(0.025)	(0.017)	(0.039)	(0.017)
2000s	0.86	0.756	0.669	0.897
	(0.012)	(0.007)	(0.012)	(0.007)
		Basic Child Care Time		
1970s	7.802	5.639	2.814	9.92
	(0.613)	(0.624)	(0.693)	(1.123)
1990s	7.813	5.166	3.208	8.642
	(0.725)	(0.412)	(0.665)	(0.693)
2000s	11.059	8.088	5.332	12.577
	(0.360)	(0.158)	(0.206)	(0.270)
		p(Educational Child Care Time>0)		
1970s	0.296	0.314	0.2	0.334
	(0.028)	(0.029)	(0.041)	(0.044)
1990s	0.231	0.244	0.203	0.324
	(0.033)	(0.019)	(0.040)	(0.027)
2000s	0.46-4	0.473	0.424	0.582
	(0.016)	(0.007)	(0.012)	(0.011)
		Educational Child Care Time		
1970s	1.608	1.703	1.019	1.594
	(0.447)	(0.451)	(0.622)	(0.801)
1990s	2.496	2.402	2.862	3.151
	(0.528)	(0.298)	(0.597)	(0.494)
2000s	5.476	4.691	4.201	6.723
	(0.262)	(0.114)	(0.185)	(0.193)
N	1378	5233	1813	2576

Notes: Sample is individuals between 21 and 55 years old and who have a complete 24-hour diary. Child care is measured in hours per week. Standard deviations are in parentheses.

Table B4
Housework Trends for Alternative Samples

	All (Children 0-5)	College-educated Mothers (Children 0-5)	Less than College-educated Mothers (Children 0-5)	College-educated Mothers (Children 0-18)	College-educated Fathers (Children 0-5)	College-educated Mothers Inc. Hispanics (Children 0-5)
			p(Housework Time>0)			
1970s	0.974	0.983	0.97	0.975	0.66	0.983
	(0.011)	(0.019)	(0.014)	(0.014)	(0.037)	(0.019)
1990s	0.934	0.944	0.92	0.929	0.767	0.946
	(0.010)	(0.012)	(0.017)	(0.009)	(0.036)	(0.012)
2000s	0.944	0.952	0.927	0.939	0.752	0.951
	(0.004)	(0.005)	(0.008)	(0.004)	(0.011)	(0.005)
			Housework Time			
1970s	29.06	29.82	28.765	29.621	9.678	30.322
	(0.860)	(1.582)	(1.061)	(1.104)	(1.352)	(1.560)
1990s	24.498	23.783	25.466	24.627	12.988	23.849
	(0.780)	(1.000)	(1.254)	(0.730)	(1.296)	(0.962)
2000s	22.413	22.564	22.092	22.702	12.32	22.384
	(0.337)	(0.397)	(0.623)	(0.280)	(0.402)	(0.375)
N	3740	2362	1378	5233	1813	2576

Notes: Sample is individuals between 21 and 55 years old and who have a complete 24-hour diary. Housework is measured in hours per week. Standard deviations are in parentheses.

Appendix C (Not for publication)

Table C1
Child Care Time of College-educated Mothers and the Share of Low-Skilled Immigrants
(Mothers with Children 0-5, including Travel related to Child Care)

Model Specification:	**OLS**		**IV**
	[1]	**[2]**	**[3]**
Panel A: Travel included in Basic Child Care			
Independent Variable:	**p(Basic Child Care>0)**		
Low-skilled Immigrant Share	0.045	0.045	0.382
	(0.191)	(0.193)	(0.408)
Independent Variable:	**Basic Child Care Time**		
Low-skilled Immigrant Share	-25.839***	-25.839***	-35.247***
	(4.522)	(4.553)	(7.610)
Independent Variable:	**p(Educational Child Care>0)**		
Low-skilled Immigrant Share	0.089	0.089	0.658
	(0.352)	(0.354)	(0.647)
Independent Variable:	**Educational Child Care**		
Low-skilled Immigrant Share	9.972**	9.972**	12.715*
	(4.082)	(4.110)	(6.593)
Panel B: Travel included in Educational Child Care			
Independent Variable:	**p(Basic Child Care>0)**		
Low-skilled Immigrant Share	0.052	0.052	0.437
	(0.199)	(0.201)	(0.454)
Independent Variable:	**Basic Child Care Time**		
Low-skilled Immigrant Share	-25.679***	-25.679***	-30.510***
	(3.579)	(3.603)	(3.780)
Independent Variable:	**p(Educational Child Care>0)**		
Low-skilled Immigrant Share	9.812**	9.812**	7.978**
	(4.162)	(4.191)	(3.974)
Independent Variable:	**Educational Child Care**		
Low-skilled Immigrant Share	1.216***	1.216***	1.366***
	(0.254)	(0.256)	(0.308)
First Stage F-stat.			21.41
N	2362	2362	2362

Notes: Specification [1] coincides with equation (1) in the text. Specification [2] includes the additional aggregate state-time controls described in the text. Specification [3] is analogous to specifications [2], but is estimated using the IV described in the text. Child care time is measured in hours per week, and includes travel related to child care activities. We allow the disturbance term to be correlated across individuals (and over time) in the same state. Standard errors are in parentheses. * denotes significance at the 10% level, ** at the 5% level and ***at the 1% level.

Table C2
Child Care Time of College-educated Mothers and the Share of Low-Skilled Immigrants
(Mothers with Children 0-5, IV stock of low-skilled immigrants)

Model Specification:	**OLS**		**IV**
	[1]	**[2]**	**[3]**
Independent Variable:	**p(Basic Child Care>0)**		
Low-skilled Immigrant Share	0.052	0.052	0.461
	(0.199)	(0.201)	(0.469)
Independent Variable:	**Basic Child Care Time**		
Low-skilled Immigrant Share	-25.679***	-25.679***	-30.843***
	(3.579)	(3.603)	(3.843)
Independent Variable:	**p(Educational Child Care>0)**		
Low-skilled Immigrant Share	0.089	0.089	0.715
	(0.352)	(0.354)	(0.676)
Independent Variable:	**Educational Child Care Time**		
Low-skilled Immigrant Share	9.972**	9.972**	13.896**
	(4.082)	(4.110)	(6.880)
First Stage F-stat.			18.575
N	2362	2362	2362

Notes: Specification [1] coincides with equation (1) in the text. Specification [2] includes the additional aggregate state-time controls described in the text. Specification [3] is analogous to specifications [2], but is estimated using the IV using the stock of low-skilled immigrants. Child care time is measured in hours per week. We allow the disturbance term to be correlated across individuals (and over time) in the same state. Standard errors are in parentheses. * denotes significance at the 10% level, ** at the 5% level and ***at the 1% level.