The Impacts of Family Size on Investment in Child Quality

Julio Cáceres-Delpiano

ABSTRACT

Using multiple births as an exogenous shift in family size, I investigate the impact of the number of children on child investment and child well-being. Using data from the 1980 US Census Five-Percent Public Use Micro Sample, 2SLS results demonstrate that parents facing a change in family size reallocate resources in a way consistent with Becker's Quantity & Quality model. A larger family generated by twins in a later birth reduces the likelihood that older children attend private school, reduces the mother's labor force participation, and increases the likelihood that parents divorce. The impact of family size on a measure of child outcome, such as grade retention, is less clear. The results indicate that for both measures of child investment and child well-being, the 2SLS estimates are statistically distinguishable from OLS estimates, indicating an omitted variables bias in the single equation model.

I. Introduction

The relationship between family size and children's outcomes is conventionally addressed in what is known as the "Quantity-Quality" model (QQ) (Becker 1960; Becker and Lewis 1973; Becker and Tomes 1976). Becker's QQ model is a model of investment where households decide the level of resources allocated per child (quality). The model assumes these investments lead to higher levels of child quality, but the direct implication of the model is a tradeoff between child investment and the number of children in the family.

Julio Cáceres-Delpiano is a professor of economics at the Universidad Carlos III, 28093 Getafe Madrid, SPAIN. *The author would like to thank Jonah Gelbach, Seth Sanders, Rodrigo Soares and Jeffrey Smith for their comments and advice. He also wants to thank Roberto Alvarez, Juan Jose Diaz, Eugenio Giolito, Hoda Makar, Alexandra Jabin, Ye Zhang and three anonymous referees for helpful comments and discussions. Finally, he wants to thank the participants at the 17th Annual Congress of the European Society for Population Economics Society (June 13–15, 2003, New York City), participants at the Inter-University Student Conference (IUSC), University of Pennsylvania, Philadelphia (2004), and the participants in the seminars at University of Maryland, Universidad Carlos III, and University of Bern for their comments and advice. The usual disclaimers apply. The data from this article are available from the author from March 2007 through February 2010 at jcaceres@eco.uc3m.es.*
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In the empirical literature, however, the negative influence of family size on child outcomes has often been studied but the direct influence on investments in children has received little attention. Often scholastic achievements (Rosenzweig and Wolpin 1980a; Blake 1981; Hauser and Sewell 1986; Hanushek 1992; Hill and O' Neill 1994; Black, Devereux and Salvanes 2005; Conley and Glauber 2005) or cognitive development (Belmont and Morolla 1973; Wolfe 1982) are used as measures of child quality. In general these studies find that children from larger families have lower academic performance than children from smaller families. A second line of research has used labor outcomes, such as wages or labor force participation as measures of quality (Duncan 1968; Wachtel 1975; Brittain 1977; Olneck and Bills 1979; Kessler 1991). The main assumption behind these studies is that child quality is directly linked to future labor market success. Therefore, children from households with more siblings would be more likely to have lower wages and lower labor force participation. These studies find little evidence of an impact of family size on wages or labor force participation.

A more direct test of the QQ model would be to examine whether the inputs are affected by exogenous shocks to family size. Focusing on inputs is a more powerful test than using outcomes since inputs are one step closer to assessing the effects of family size in the causal chain and reducing the chance of Type II errors. Outcomes such as educational attainments or future labor market outcomes are produced with many inputs, home production being one of them. In fact, the introduction of home production and therefore the division of time between home and market activities introduces an additional ambiguity to the overall impact of family size; parents facing an exogenous increase in family size may reduce market based investment in children while at the same time increasing home based investment. To some degree this substitution may offset some of the lower levels of market based investment that come from resource constraints that parents with larger families face.[1]

Rosenzweig and Wolpin (1980a) and Black, Devereux and Salvanes (2005) examine educational outcomes and use an identification strategy similar to the one I use. Rosenzweig and Wolpin who are the first to use twin births as an exogenous shock to the cost of child investment, find that family size has a negative impact on education for a small sample of Indian children. Black, Devereux and Salvanes, using the same source of variation in family size but with richer data and different unit of observations, find no impact of number of siblings on education for a sample of Norwegian individuals.

This paper advances the literature by using data from the United States to make the distinction explicit between variables that measure child investments and those that measure child outcomes such as the traditionally used measures of educational outcomes. While educational outcomes can be easily linked to child well-being, they do not necessarily reflect the allocation of resources by parents or other household members. Following Rosenzweig and Wolpin (1980a, 1980b), I use multiple births as a source of variation in family size to measure impacts on child investments and child

1. Different channels through which quantity might act on child well-being can be proposed, making the overall impact of family size on child welfare even more ambiguous. For example, Zanjonc (1976) formalizes an alternative relationship. Family size does not matter per se but, rather, the predominant interaction within family's members does.

outcomes. In particular, and similar to Black, Devereux, and Salvanes (2005), I make use of an event of multiple births on the second or higher birth order as an exogenous shock to family size. The results of the paper show that parents who have experienced an exogenous change in family size reallocate resources consistent with Becker's QQ model. An additional younger sibling reduces the likelihood that older siblings attend a private school, reduces their mother's labor force participation, and increases the likelihood that their parent's divorce. In contrast to the results linking family size to investments, I find little evidence that an exogenous change in family size affects educational achievement such as grade retention. This suggests that while larger families induce parents to rearrange child inputs, parents do this in a way that may not affect child outcomes. I also find evidence that single equation estimates of the quantity/quality tradeoff in both the child investments and child well-being models are subject to omitted variable bias. In nearly all cases, the 2SLS estimates of the impact of family size on child investments and outcomes are statistically distinguishable from their OLS counterparts.

The paper is organized as follows. Section II explains the empirical methodology used to address the problem of identification, and describes how the variables and samples have been constructed providing a descriptive analysis. Section III presents the results, and Section IV, the conclusions.

II. Data and Empirical Methodology

The primary data for this paper are the 1980 Census Five-Percent Public Use Micro Sample (PUMS). The following bivariate regression model represents a simpler version of the causal relationship I want to estimate, $y_i = \alpha + \gamma n_i + \varepsilon_i$, $i = 1, \ldots, T$, where y_i represents a measure of child investment (inputs into the production of child quality) or a measure of child well-being, n_i represents family size, and i indexes observation.

The distinction between inputs and outcomes is essential for my analysis and as a result, I estimate models with two different sets of outcomes. The first group includes variables that I associate with child investment (inputs for child quality). These variables reflect allocation of resources to children. The second group are variables that I associate with child well-being (outputs for child quality), and they are not necessarily able to capture changes in allocation of resources by household members because they represent the result of a variety of different types of inputs.

I define four measures of inputs to child quality. While their relationship with child well-being is not always clear, these measures are under the control of the parents and reflect allocation of resources to children. The first variable, *Attends Private School*, is a dummy variable that takes a value equal to one if a child is between six and 16 years of age and attends a private institution or church-related school, and zero otherwise. Numerous authors have demonstrated that educational outcomes are better for students who attend private school.[2] Although there is some question about whether this reflects is causation or correlation.

2. For example, see Evans and Schwab 1995.

The second and third measures of investment are the mother's labor force participation and weekly usual hours of work. As mentioned earlier, the impact of the mother's labor force participation on child well-being is ambiguous. Working mothers may spend less time with their children but have more income that could be allocated to child investment. Independent of this ambiguity, an important aspect of these two variables is the information provided about the substitution of market goods by home production.

The fourth measure of child investment, the dummy variable *Divorce*, takes a value one if the child's mother is currently divorced, separated, or is in her second or higher marriage, and zero otherwise.[3] To ensure that I capture the impact of increasing family size on family structure, I restrict the sample for this outcome to children who were born while their parents were married. Because of data limitations in the Census PUMS, and for the reason that I use children between six and 16 years of age as unit of observation, I have a proxy of grade retention as the only variable that measures child well-being. I define the variable *Behind* as a dummy variable that equals one if the child's highest completed grade is lower than the mode of highest grade completed by age in years, quarter of birth and state, and zero otherwise.[4] *Behind* identifies whether children are progressing in school with their cohort and is a measure of educational attainment. Children who repeat a grade are often at risk of dropping out of high school.

The number of children in a family, n_i, is defined as the number of children younger than 18 years old that have the same nonstepmother. This number of children in the home can be lower than the number of children ever born since I do not observe older siblings who are no longer living at home. In order to mitigate this problem, for those children with a mother older than 30, I restrict the sample to children living in families where the number of children ever born is equal to the total number of children in the home. I also delete families where it is not possible to identify the biological mother in the household. This restriction avoids the problem where blended families may have two children with the same age and quarter of birth that "look" like twins in the data but have different mothers.

The impact of family size on the different outcomes is measured by γ. The intuition of Becker's Quality and Quantity model suggests that OLS estimates of this equation may be subject to an omitted variable bias since the $\text{cov}(n_i,\varepsilon_i)$ is not zero.[5] Following Rosenzweig and Wolpin (1980a 1980b), I use multiple births as a source of variation

3. Empirical evidence has long shown that children of divorced parents have lower achievement than children from intact families. See Manski, McLanahan, and Sandefur (1992); Haveman and Wolfe (1995); Ginther and Pollak (2003), among others.

4. The idea of using as reference the mode by age and state is to capture the heterogeneity in the rules about when a child can start school. These rules differ among states and they are usually a function of the quarter of birth of the child.

5. For the simplest bivariate case where child quality depends only on family size, we may expect that OLS overestimates the tradeoff. Families that have more children are not only families that face a higher shadow price for child quality but are also families with a higher relative preference for family size over child quality. Simultaneously, families with fewer children are the ones with a lower price for child quality but are also the ones with a higher preference for child quality reinforcing the impact on child quality where this last impact is captured by ε. However, for a more general case where child quality depends not only on family size, more assumptions are required to sign the bias.

in family size. Specifically, I use the event of multiple births on the second or higher birth as an exogenous change in family size. Women who experience a multiple birth have some ability to adjust their subsequent fertility. For example, a mother who would like four children may simply quit having children if on her third birth she delivers twins. Given the limited size of families in the United States, however, multiple births will shift the number of children for most families. Therefore, multiple births would not only provide a shift in the number of children in the family but also should be orthogonal to the child quality preferences.[6]

Following Bronars and Grogger (1994) and Angrist and Evans (1998), I identify multiple births by exploiting the fact that the 1980 census reports age in years as of April 1, 1980 (the first day of the second quarter) plus the quarter of birth. If two or more children in the household have the same age, quarter of birth, and nonstepmother, I assume that these children are twins. Because multiple births are rare, I need a large sample in order to have adequate statistical power which is provided by the 5 percent census sample. Using the algorithm outlined above, I classify 1.78 percent of these children as multiple births of which 1.75 percent are twins (Table 1).[7]

However, the way that I use multiple births limits the sample I use in the analysis. I restrict attention to the oldest child in the household who is not a multiple birth child but has at least one younger sibling. These children are all from families that planned on having a second child, but may not have banked on having a third. More important, by focusing our attention on the oldest child, we examine children affected by multiple births through family size rather than through others factors directly related to being part of a multiple birth. For example, among twins and higher order multilebirth children—that is, triplets, quadruplets, etc.—rates of low birth weight and infant mortality are four to 33 times higher compared with singleton births. Moreover, twins and other higher order multiple births are more likely to suffer life-long disabilities when they survive (National Vital Statistics Report 1999). Therefore, the sample is restricted to oldest siblings in the household that are not from a multiple birth, since being part of a multiple birth or being a younger sibling of twins or other higher order multiple birth is conditional on the occurrence of multiple births in the household (post-treatment).

6. There are two types of twins, the most common of the multiple births: identical (monozygotic) and fraternal (nonidentical, dizygotic). Identical twins have the same genetic makeup and their incidence is the same in all races, ages groups and countries (3.5 per 1,000 births). The occurrence of fraternal twins, unlike identical twins, varies, and there are several risk factors that may contribute. First, the incidence is higher among the Afro-American population. Second, nonidentical twin women give birth to twins at rate of 1 set per 60 births, which is higher than the rate of 1 of every 90 births, at the national level. Fourth, women between 35 to 40 years of age with four or more children are three times more likely to have twins than a woman younger than 20 without children. Finally, multiple births are more common among women who utilize fertility medication. Given the period under analysis (where fertility drugs are not an issue), the factors that most concern us, in our case, are the hereditary factors for which I cannot control (*American Society for Reproductive Medicine* 2004). However, there is no prior information that women are acting differently based on this hereditary information or that hereditary factors are associated to a particular group of the population.

7. These percentages are quite close to numbers reported by the National Vital Statistical Service (NVSS) showing that 1.95 percent of births over the 1962 to 1968 period were twins and 1.86 percent of births were for the period 1971 to 1979.

Table 1
Multiple Births Frequency. Complete Sample of Children

Type of Birth	Frequency	Percentage
Singletons	2,613,524	98.22
Twins	46,668	1.75
Triplets	699	0.03
Quadruplets	8	0.00
Quintuplets	5	0.00
Total	2,660,904	100.00

Despite the fact that the orthogonality assumption is nontestable, the random nature of multiple births, the choice of the observational unit under analysis (oldest child in the household who does not belong to a multiple birth), the selection of the 1980 U.S. Census as data set,[8] the inclusion of other variables that are correlated with the incidence of multiple births such as age of the mother, race, and mothers' education (Table 2), as well as the analysis of the impact of twinning in a specific birth make it more likely that this assumption holds.

To study potential heterogeneity in the impact of the number of children, I construct two subsamples: oldest children with one or more siblings and oldest children with two or more siblings.[9] For the first of these subsamples the instrument is defined as mb_{i2}, and takes a value equal to one if the second birth in the family is a multiple birth and zero otherwise. For the subsample of children who belong to families with three or more children, the instrument is defined as mb_{i3}, and takes a value equal to one if the third pregnancy in the household is a multiple birth and zero otherwise.

8. Heckman (1997) calls attention to the role of the heterogeneity and the sensitivity of IV to assumptions about how individuals internalize this heterogeneity in their decisions of being part of the treated group (that is the selection of family size). Imbens and Angrist (1994) have shown that IV estimates can be interpreted as "Local Average Treatment Effects" (LATE) in a setting with heterogeneity in the impacts and with individuals that act recognizing this heterogeneity. Although multiple births can be considered a random event, it has been shown that the use of fertility drugs increase the likelihood of this event. In addition, it can be argued that the use of fertility drugs could be associated with households with a higher preference for children and their quality. Under this last assumption, the LATE estimate associated with multiple births would be measuring the average impact for this specific group of households rather than the impact of family size for a more representative group of households. In fact there is broad acknowledgement that the rate of multiple births has increased in the last two decades, which has been jointly attributed to a higher use of fertility drugs and a change in the timing of the first birth. A closer look at the evolution of the twin ratio (total twin births over total number of births, per 1000), reveals that the explosive increase in multiple births did not begin until 1985 (Martin and Park 1999). Therefore, because we are working with children who were younger than 18 years old in 1980—that is born between 1962 and 1980—it seems reasonable to rule out that multiple births were mainly associated with households that had been using fertility drugs and therefore with a greater preference for children quality.

9. Specifically, the samples are defined in terms of numbers of births. The definition with number of children makes no difference for the sample of families with two or more children, because it does not include twins at first birth, but it changes the composition slightly of the sample of households with three or more children.

Table 2
Mean Differences Between Children Who Do Not Have Twin Siblings and Those Who Do

	2+			3+		
	$X(mb_2 = 0) = \bar{X}_{2,0}$	$X(mb_2 = 1) = \bar{X}_{2,1}$	$\bar{X}_{2,0} - \bar{X}_{2,1}$	$X(mb_2 = 0) = \bar{X}_{2,0}$	$X(mb_2 = 1) = \bar{X}_{2,1}$	$\bar{X}_{2,0} - \bar{X}_{2,1}$
Age	9,467	9,503	–0,037	11,097	11,136	–0,039
			[0,054]			[0,075]
Mother's age	31,666	32,190	–0,524**	32,556	32,657	–0,101
			[0,071]			[0,104]
Mother's years of education	12,316	12,425	–0,110**	11,916	11,844	0,072
			[0,032]			[0,053]
Number of siblings	2,511	3,340	–0,829**	3,393	4,288	–0,895**
			[0,011]			[0,016]
White	0,788	0,771	0,017**	0,739	0,690	0,049**
			[0,005]			[0,009]
Black	0,100	0,125	–0,024**	0,125	0,164	–0,039**
			[0,004]			[0,007]
Asian	0,019	0,013	0,006**	0,019	0,014	0,004
			[0,002]			[0,003]
Hispanic	0,084	0,080	0,004	0,107	0,122	–0,015*
			[0,004]			[0,007]

Standard errors in brackets; * significant at 5 percent; ** significant at 1 percent.
2+ and 3+ stand for the samples of children living in families with two and three or more children, respectively.
$\bar{X}(s)$: sample mean for the subset *s*.

Table 3 presents the descriptive statistics for the different samples and variables used in the analysis. For the variables used as inputs to child quality I find that when the sample is restricted to larger family sizes there is a reduction in the proportion of students attending private or church-related schools (14.7 percent to 12.1 percent),[10] and lower maternal labor force participation (50.7 percent to 45.1 percent). It does not appear that constraining the sample to bigger family size affects the "probability" of divorce. We also observe that there is an increase in the proportion of children we define as *Behind* (5.4 percent to 8.8 percent) when we constrain the sample to bigger family size.

III. Results

Table 4 presents the first stage regression of the number of children on multiple births with and without covariates. The top half of the table provides the results for the sample of families with two or more children, while the bottom half reports the results for families with three or more children. The point estimates for the impact of multiple births in the second pregnancy (*mb*2) are between 0.78 and 0.87 depending on samples. The impacts of multiple births in the third pregnancy (*mb*3) are slightly higher, but not statistically different than the impacts of multiple births in the second pregnancy. For both *mb*2 and *mb*3 the *t*-statistics are over 45. Children who belong to families with multiple births either in the second or third pregnancy have on average almost one sibling more than other children.

The finding that multiple births in the third pregnancy have a slightly larger impact on family size than in the second pregnancy is likely related to the fact that the sample of households with two or more children include some households whose desired family size is not being affected by multiple births. For these households multiple births in the second birth affect only the timing of the third or fourth child. However, when the sample is restricted to households with three or more children, the likelihood that multiple births are changing family size is higher.

Table 5 presents OLS and 2SLS estimates of the impact of the number of children on the four variables that I characterize as inputs and the one variable that I define as measure of well-being. In general OLS results support the conventional wisdom that more siblings in a family have a negative impact on educational outcomes. For the dummy variable *Behind*, OLS estimates reveal an increase of 1.1 to 1.7 percentage points in the probability of having a grade lower than the mode by age and state. For the group of outcomes that I consider closer to investment measures, however, OLS results are less intuitive. On the one hand, the results for maternal labor force participation and hours at work are consistent with previous studies that have detected a statistically significant and negative impact of childbearing on these outcomes. On the other hand, however, the OLS estimate for the number of children variable in the "Private School" equation shows that, contrary to the prediction of the QQ model, the number of children has a positive impact on the probability of attending private

10. These proportions are similar to the 13 percent nationwide enrollment in private institutions for the year 1980 in grades K–12 (*Digest of Education Statistics*).

Table 3
Descriptive Statistics: Oldest Children Who Do Not Belong to a Multiple Birth

		All Mothers		Younger Mothers ≤ 32		Older Mothers > 32	
	All	2+	3+	2+	3+	2+	3+
Age	7.829	9.467	11.098	7.342	8.991	12.218	13.129
	[4.802]	[4.086]	[3.514]	[3.375]	[3.067]	[3.188]	[2.603]
Mother's age	30.668	31.671	32.557	27.986	28.676	36.443	36.299
	[6.112]	[5.356]	[4.871]	[3.234]	[2.882]	[3.454]	[3.174]
Mother's years of education	12.407	12.317	11.915	11.924	11.404	12.825	12.409
	[2.408]	[2.412]	[2.482]	[2.197]	[2.263]	[2.577]	[2.581]
Number of children	1.985	2.519	3.401	2.433	3.346	2.629	3.455
	[0.978]	[0.815]	[0.746]	[0.738]	[0.682]	[0.892]	[0.799]
White	0.792	0.788	0.738	0.761	0.686	0.824	0.788
Black	0.100	0.100	0.126	0.120	0.163	0.075	0.089
Asian	0.019	0.019	0.019	0.014	0.013	0.025	0.024
Hispanic	0.082	0.084	0.107	0.096	0.125	0.069	0.090
Multiple births at second pregnancy	0.006	0.009	0.024	0.008	0.026	0.010	0.022
Multiple births at third pregnancy	0.002	0.003	0.009	0.003	0.009	0.004	0.010
Multiple births	0.009	0.014	0.037	0.012	0.038	0.016	0.036
Behind cohort	0.041	0.054	0.088	0.018	0.040	0.101	0.137
Mother's LFP	0.538	0.507	0.451	0.464	0.398	0.562	0.503
Mother's hours at work	16.008	14.777	12.745	13.243	10.923	16.771	14.507
	[18.449]	[18.063]	[17.453]	[17.756]	[16.870]	[18.262]	[17.822]
Private school	0.170	0.147	0.121	0.151	0.106	0.142	0.134
Parents divorced	0.233	0.210	0.215	0.217	0.239	0.202	0.196
Number of observations	1,005,388	679,851	241,421	400,028	123,126	279,823	118,295

Standard deviation between brackets. The standard deviations for proportion is not presented. 2+ and 3+ stand for the samples of children living in families with two and three or more children, respectively.

Table 4
Impact of Multiple Births on Number of Children at Home

	All		Younger Mothers ≤ 32		Older Mothers > 32	
	Unconditional	Conditonal (a)	Unconditional	Conditonal (a)	Unconditional	Conditonal (a)
2+						
Multiple births at second pregnancy	0.836**	0.835**	0.868**	0.868**	0.779**	0.796**
	[0.009]	[0.009]	[0.011]	[0.011]	[0.014]	[0.014]
Number of observations	679,851	679,851	400,028	400,028	279,823	279,823
R^2	0.01	0.15	0.01	0.16	0.01	0.13
3+						
Multiple births at third pregnancy	0.890**	0.878**	0.918**	0.908**	0.859**	0.849**
	[0.014]	[0.013]	[0.019]	[0.018]	[0.020]	[0.019]
Number of observations	241,421	241,421	123,126	123,126	118,295	118,295
R^2	0.01	0.11	0.02	0.12	0.01	0.09

Robust standard errors in brackets; + significant at 10 percent; * significant at 5 percent; significant at 1 percent.
(a) Covariates in the model are dummies by age (measured in quarters), state of residence, mother's education, race, mother's age and sex.
2+ and 3+ stand for the samples of children living in families with two and three or more children, respectively.

Table 5
OLS and 2SLS Estimates of Child Input and Output Equations. Parameters Estimates [Standard Errors] and {Hausman Test Statistic}

	2+				3+				
	Sample Mean	OLS	IV		Sample Mean	OLS	IV	IV (b)	
Behind cohort	0,05	0.011**	0.002	{9,0}	0,09	0.017**	0.010	0.005	{1,4}
		[0.000]	[0.003]			[0.001]	[0.006]	[0.004]	
Mother's LFP	0,51	–0.107**	–0.053**	{46,3}	0,45	–0.087**	–0.045**	–0.047**	{14,7}
		[0.001]	[0.008]			[0.001]	[0.011]	[0.008]	
Mother's hours at work	14,78	–3.578**	–1.935**	{43,0}	12,75	–2.798**	–1.245**	–1.293**	{17,1}
		[0.026]	[0.252]			[0.044]	[0.378]	[0.259]	
Private school	0,15	0.011**	–0.012*	{22,0}	0,12	0.015**	0.005	–0.000	{1,6}
		[0.001]	[0.005]			[0.001]	[0.008]	[0.005]	
Parents divorced	0,21	–0.026**	0.015*	{35,0}	0,22	–0.017**	0.013	0.012	{7,5}
		[0.001]	[0.007]			[0.001]	[0.011]	[0.008]	

Robust standard errors in brackets; + significant at 10 percent; * significant at 5 percent; significant at 1 percent.
The Durbin–Wu–Hausman test statistic is for the null hypothesis that OLS and 2SLS are identical. The test is distributed as chi-squared with one degree of freedom and 95 percent critical value of 3.84. Other covariates in the model are dummies by age (measured in quarters), state of residence, mother's education, race, mother's age, and sex.
(a) The sample includes all older siblings previous to a multiple birth.
2+ and 3+ stand for the samples of children living in families with two and three or more children, respectively.

school by approximately 1 to 1.5 percentage point, and OLS estimates for divorce suggest that more children reduce the probability of getting divorced by approximately 2.6 percentage points for the sample of households with two or more children, and by 1.7 percentage points for the sample of households with three or more children.

Using multiple births as source of variation, the findings reveal the lower power (Type II error) that we face when testing the QQ model based on investment outcomes rather than direct measures of investment. The 2SLS estimates do not show any statistically significant impact of number of children on the dummy variable *Behind* in any of the samples in Table 5. On the other hand, the group of variables that I relate to child investment shows results consistent with Becker's model. First, the estimates for outcomes related to mother's employment confirm a negative and statistically significant impact of family size but lower than OLS estimates. Second, using multiple births as a source of variation, the results for the probability of attending a *Private School* or of *Divorce* reveal a completely different impact of family size from the OLS analysis. An exogenous increase in the number of children generated by a multiple birth reduces the probability of attending a private school by approximately 1.2 percentage point for children who live in families with two or more children. Therefore, treating family size as exogenous, as the OLS analysis does, produces an inconsistent estimate and faulty inference. The positive coefficient on the number of children in the OLS model may be due to the fact that many private schools are religious schools, and more religious families are both more likely to have larger families and enroll their children in these private schools.

When I use multiple births as a source of variation in family size, I find that an additional child increases the probability of divorce by a statistically precise 1.5 percentage points in the sample of households with two or more children. Differences with OLS estimates might come from the fact that more stable families are the ones that choose to have more children, or in other words, in order to have more children couples need more time together. This finding, given previous evidence that shows that children with divorced parents have lower achievements than children who live in traditional nuclear families, suggests that probably one of the channels through which family size is impacting child well-being may be through family structure.[11] Moreover, the Durbin–Wu–Hausman test[12] shows that 2SLS estimates for family size impact on almost all outcomes and samples are statistically different from the OLS estimates.

In order to analyze the robustness of the previous results and to study potential differences in treatment associated with multiple births,[13] I divide the sample by the mother's age: 32 years old or younger, and older than 32 years. Table 6 presents the

11. Brown and Flinn (2002) propose an alternative channel. An increase in family size makes getting divorced more likely because the lower investment in child quality reduces the cost of splitting up. The reduction in the cost comes from the reduction in utility that parents perceive at the moment of getting divorced since they spend less time with their children. Then they would perceive less consumption of child's quality, which is an argument in the utility function. Simultaneously, because of the higher probability of divorce, parents will have a weaker incentive to invest in their children.

12. In a framework with heterogeneity in the impact of family size, the interpretation of the Durbin–Wu–Hausman test is not straightforward. OLS and 2SLS estimates would measure a potential tradeoff between family size and child investment in different parts of the distribution (Heckman and Vytlacil 2001).

13. We do not observe the desired family size but, instead, the current number of children which a family has at the time of the census. While multiple births are likely to increase family size for women who experience

Table 6
OLS and 2SLS Estimates of Child Input and Output Equations. Heterogeneity by the Mother's Age

	Younger Mothers (≤ 32)				Older Mothers (> 32)			
	2+		3+		2+		3+	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Behind cohort	0.007**	–0.001	0.011**	0.011+	0.014**	0.006	0.021**	0.011
	[0.001]	[0.003]	[0.001]	[0.006]	[0.001]	[0.007]	[0.001]	[0.011]
Mother's LFP	–0.121**	–0.068**	–0.092**	–0.069**	–0.096**	–0.034**	–0.084**	–0.022
	[0.001]	[0.010]	[0.002]	[0.015]	[0.001]	[0.012]	[0.002]	[0.017]
Mother's hours at work	–3.658**	–2.312**	–2.675**	–1.650**	–3.597**	–1.454**	–2.897**	–0.851
	[0.036]	[0.308]	[0.063]	[0.481]	[0.038]	[0.421]	[0.060]	[0.587]
Private school	0.004**	–0.003	0.009**	0.021*	0.017**	–0.021**	0.019**	–0.010
	[0.001]	[0.007]	[0.001]	[0.010]	[0.001]	[0.008]	[0.001]	[0.011]
Parents divorced	–0.029**	0.012	–0.019**	0.023	–0.025**	0.018+	–0.018**	0.006
	[0.001]	[0.009]	[0.002]	[0.017]	[0.001]	[0.010]	[0.002]	[0.015]

Robust standard errors in brackets; + significant at 10 percent; * significant at 5 percent; significant at 1 percent. Other covariates in the model are dummies by age (measured in quarters), state of residence, mother's education, race, mother's age, and sex.
2+ and 3+ stand for the samples of children living in families with two and three or more children, respectively.

results for the sample of children with "younger mothers" (32 years old or younger) for whom the desired family size has not necessarily been reached, and the results for the sample of children with "older mothers" for whom it is more likely that the desired family size has been reached. This analysis shows that in qualitative terms our previous results are robust to division by the mother's age and what is important is that these results are not just driven by the sample of families with younger mothers for whom it is more likely that multiple births are only changing the timing of children.

Finally, Table 7 presents analysis by race. I find that the previous results are robust to the division of the samples between Whites and NonWhite families. Conley and Glauber (2005) using sex composition as a source of variation in family size find the number of children having a positive impact on the probability of attending private school for the sample White children but negative for the Non-White sample. In order to reconcile these differences we need to remember that IV in a context of heterogeneity must be interpreted as a Local Average Treatment Effect (*LATE*).

IV. Conclusion

This paper uses U.S. census data to show that families allocate resources in a way consistent with Becker's QQ model. An exogenous increase in family size causes parents to rearrange child investment (quality) in the household. When we go one step further in the causal chain, however, the results do not support a negative impact of number of children in the family on the variables that are a more direct measure of child outcomes, such as educational attainments. These results are consistent with models of household production where families facing an exogenous change in family size reallocate different types of child investment in order to minimize the impact on child wellbeing. Consistent with this view, Bianchi (2000) using time diary data finds that parents who face an increase in the cost of time protect time spend with their children; mothers seek ways to maximize time with children by working part-time or to exit from the labor force for some years when their children are young and mothers spend less time in housework, volunteer work or leisure. While larger families are costly, this paper provides evidence that parents are able to reallocate resources to mitigate effects on children.

a twin birth later in life, multiple births earlier in a woman's life might only affect the timing of their third (fourth) child for the sample of households with two (three) or more children. Even if I constrain the sample to households for whom multiple births affect family size I will not be able to avoid the double treatment (increment in number of children and reducing the timing), but at least I ensure that the results are not driven only by changes in timing. I have already showed that the event of multiple births affects family size not only for older mothers but also for younger mothers. Nevertheless, the shift in family size may have a different impact in the short run, when the desired family size has not been reached, than the one it would have in the long run when it has been reached or is close to being reached.

Table 7
OLS and 2SLS Estimates of Child Input and Output Equations. Heterogeneity by Race

	White				Non-White			
	2+		3+		2+		3+	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Behind cohort	0.008**	0.002	0.013**	0.009	0.016**	0.001	0.022**	0.012
	[0.001]	[0.004]	[0.001]	[0.008]	[0.001]	[0.007]	[0.002]	[0.011]
Mother's LFP	–0.114**	–0.052**	–0.090**	–0.058**	–0.087**	–0.057**	–0.080**	–0.017
	[0.001]	[0.008]	[0.002]	[0.014]	[0.001]	[0.016]	[0.002]	[0.020]
Mother's hours at work	–4.078**	–2.029**	–2.932**	–1.222**	–2.579**	–1.640**	–2.458**	–1.361*
	[0.032]	[0.292]	[0.056]	[0.470]	[0.044]	[0.492]	[0.070]	[0.623]
Private school	0.023**	–0.011+	0.028**	0.012	–0.011**	–0.012	–0.005**	–0.007
	[0.001]	[0.006]	[0.001]	[0.011]	[0.001]	[0.010]	[0.001]	[0.010]
Parents divorced	–0.026**	0.014+	–0.017**	0.006	–0.019**	0.022	–0.013**	0.032
	[0.001]	[0.007]	[0.002]	[0.013]	[0.002]	[0.018]	[0.003]	[0.023]

Robust standard errors in brackets; + significant at 10 percent; * significant at 5 percent; significant at 1 percent. Other covariates in the model are dummies by age (measured in quarters), state of residence, mother's education, mother's age, and sex.
2+ and 3+ stand for the samples of children living in families with two and three or more children, respectively.

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