"*Sex is a gift from God*": For whom ? Evidence from the Manila contraceptive ban

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Abstract

We analyze the tradeoff between child quantity and quality in developing countries by estimating the effect of family size on child's education in urban Philippines. To isolate exogenous changes in family size, we exploit a policy shock that occurred in the late 1990s when the mayor of Manila enacted a municipal ban on modern contraceptives. Since other comparable cities in the Manila metropolitan area where not affected by the ban, this allows us to implement a difference-in-difference estimation of the effect of family size. Our analysis relies on census and survey data and focuses on two dimensions : the effect of the ban on fertility and family size and the effect of family size on the probability for a child be held back in school. Our results indicate that the contraceptive ban lead to a significant increase in family size, which had a sizable, negative impact on child education.

Keywords: Fertility, family size, human capital investment, quantity-quality tradeoff, Philippines.

JEL Codes: J13, J18, J24, O10.

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1 Introduction

High fertility rates are often seen as a major cause of persistent poverty, especially in developing countries. At the microeconomic level, this view largely rests on the idea of a trade-off between family size and child quality introduced by Becker's fertility models (Becker, 1960; Becker and Lewis, 1973; Becker and Tomes, 1976). A rise in family size mechanically raises the cost of a given average child quality, which would induce parents to reduce per capita financial investment in their children. As a consequence, a high fertility rate should lead to lower child quality, as measured for instance by the level of child human capital (e.g. education, health), provided that family resources are important constraints in the accumulation of child human capital. The objective of the present paper is to estimate the causal effect of family size on child quality, by exploiting a peculiar policy change that occurred in the 2000s in the city of Manila, Philippines, and led to an exogenous fertility shock : the Manila contraceptive ban.

Empirically assessing the extent to which family size hinders investment in child quality raises important endogeneity issues. For a variety of reasons, families with a greater number of children might have a lower preference for child quality or a lesser endowment in key inputs of the child human capital accumulation process. Hence, a major challenge for estimating the causal effect of family size on child investment and related family choices is to isolate exogenous variations in family size. Starting with the work of Rosenzweig and Wolpin (1980), most papers in the recent literature tend to use twin birth, sex of the first child and gender composition of children as exogenous sources of variations in family size (see for instance Black, Devereux, and Salvanes (2005); Angrist, Lavy, and Schlosser (2005); Cáceres-Delpiano (2006); Conley and Glauber (2006); Ponczek and Souza (2012); Li, Zhang, and Zhu (2008)). This estimation strategy raises several issues. In particular, relying on twin births requires large data sets, given the relatively low prevalence of twin births. Furthermore, it raises the concern that twins might represent a very special form of family size increase, as discussed for instance in Rosenzweig and Zhang (2009). Most of those articles find no or a very limited effect of the household size on children's human capital.[1]

Alternatively, a handful of paper have exploited changes in governmental policies regarding family planning and fertility as a way to isolate exogenous changes in family size. This is the case in particular in China, where some authors have exploited variations (in particular at the geographic level) in the applications of the so-called One-Child policy. Qian (2010) finds that having a second child benefits rather than disadvantages the first child. Another example of this approach is given by Joshi and Schultz (2007) who

[1] Li et al. (2008) concludes to a significant trade-off between quantity and quality. However, most of estimates are non significantly different from 0. The only significant effect is for non-twins children using the twins at the first delivery event, which is dubious.

evaluate the impact of an intensive family planning and child health program in Bangladesh. The impact evaluation of the programme gives a totally different picture, with large effects of the intervention on mothers' and children's human capital. However, this paper is unable to conclude anything on the quantity for quality trade-off since the intervention affects many more dimensions than just the fertility outcomes. There is so far little evidence of Becker's quantity-quality trade-off.

Our analysis closes the gap between the two different strands of papers and concludes to strong evidence of a trade-off. We exploit changes in family planning policies that occurred around year 2000 in the Philippines to estimate the causal effect of family size on children outcomes, in particular education.The change in family planning we study is, however, somewhat unusual. In most developing countries, family planning policy has been aiming at promoting the availability of birth control methods. On the contrary, the policy change we study had the opposite effect of reducing birth control possibilities. In the late 1990s, the city of Manila enacted a municipal order that forbid the distribution of modern contraceptive methods in local health facilities. The ban was explicitly motivated by ideological consideration and can be seen as an exogenous fertility shock.

We rely on this policy change to study the effect of family size on human capital investment. This approach essentially amounts to compare the outcomes of children growing up before and after the contraceptive ban, and to relate these changes in outcomes to changes in family size induced by the contraceptive ban. Since families affected by the ban are observed about 10 years later than families not affected, we account for endogenous trends in fertility and other outcomes, by comparing the population of Manila to the population of the neighbor municipality of Quezon city, under the assumption of similar trends between Manila and Quezon. Quezon city, the former capital of the Philippines, and also part of the greater Manila metropolitan area is comparable to Manila in many respects but is politically independent of Manila city and was not subject to the contraceptive ban. We also consider a less restrictive identification strategy that exploits the fact that older mothers were less likely to become pregnant during the ban. This is exploited by a triple-difference estimator and allows for the possibility of age-specific as well as city-specific trends.

In the rest of the paper, we first document some institutional background information on fertility and family planning in the Philippines and present in more details the Manila contraceptive ban. We next discuss our identification strategy. We then turn to the empirical analysis and focus on two main issues. The first one is the estimation of the effect of the ban itself on fertility and family size. The second one is the effect of family size on the probability for a child to be held back in lower grades in school. Our analysis is based on Census data for 1995, 2000 and 2007. We also rely on survey data covering various additional outcomes such as health (Demographic and

Health Surveys collected in 1993, 1998, 2003 and 2008), fertility choices (Family Planning Surveys) and family living conditions (Annual Poverty Indicators Surveys). Our results indicate that the contraceptive ban led to a significant increase in family size, which had a sizable, negative impact on child education.

2 Fertility, contraception and the ban in Philippines

We start by describing the fertility and contraception behaviour in the Philippines, then explain how the ban was implemented and finally how we use it to identify the quantity-quality trade-off.

2.1 Fertility and contraception in the Philippines

Filipino women have a high fertility rate. On average, 40 to 49 y.o. married women have had 4.6 children. However, as shown in Table 1, this figure is as high as 5.9 for women belonging to the poorest quintile, against 3.5 for the richest ones.

Table 1: Mean children ever born to women 40-49 years by asset index quintile, 1999

Poorest	L. middle	Middle	U. middle	Richest	Total
5.9	5.2	4.9	3.9	3.5	4.6

Note: Family Planning Survey, 1999. Coverage: Filipino households.
Source: Orbeta, 2005.

This high fertility rate arises from a low usage of contraceptives. Table 2 shows that only half of women try to limit their fertility one way or another. Only a woman out of three uses a modern method. Again, this is unevenly distributed among women, with only 28% of women in the bottom quintile resorting to contraceptives against 36.5% for women from the highest quintile. This low use of contraceptives does not seem to be a choice (at least for some women) since Orbeta (2005) estimates that there is a discrepancy between actual and wanted fertility: women in the poorest quintile declare they would have liked 2 children less than what they actually have (against .5 children for the higher quintile women).

The first line of Table 3 indicates what contraceptives are used. Two thirds of women using contraception take pills; intra-uterine devices and injections are also commonly used, while condoms are hardly used, probably because most sexual intercourses take place within marriage. Striking is how

Table 2: Contraceptive methods by asset index quintile, 2002

	No method	Any method	Modern	Traditional
Total	51.2	48.9	35.1	13.8
Poorest	58.5	41.5	28.0	13.5
Lower middle	50.8	49.2	35.9	13.3
Middle	46.2	53.8	39.0	14.8
U. middle	49.6	50.4	36.8	13.7
Richest	49.9	50.1	36.5	13.6

Note: Family Planning Survey, 2002. Coverage: Filipino households. Source: Orbeta, 2005.

much women rely on public providers to access their contraceptive means. Even more striking is this difference between poor women and rich ones. Nearly 90% of the women in the poorest group who use contraceptives get them in a public hospital or a public health center. By comparison, only half of contraceptives are provided by public sources for higher quintile women. As a consequence, we expect a reduction in public provision of contraceptives to affect primarily poorest households.

Table 3: Source of modern method supply by method and asset index quintile, 2002

	Pill	IUD	Injection	Condom	Ligation	Total
	65.6%	16.8%	11.3%	6%	0.2%	100%
Philippines						
Public	65.4	74.9	92.9	41.0	72.8	70.1
Private	33.4	22.7	6.0	57.4	25.6	28.5
Poorest						
Public	87.8	86.1	96.8	78.5	84.3	87.9
Private	11.7	12.1	2.2	20.2	15.6	11.4
Richest						
Public	39.8	53.5	81.5	19.0	60.0	50.3
Private	59.2	46.0	16.4	78.0	38.9	48.6

Note: Coverage: Filipino households. Source: Our own calculation for the first line (Family Planning Survey, 2006); Orbeta, 2005 for the rest of the table (Family Planning Survey, 2002).

The family planning services have been transferred from the government to the local unit governments in 1991. There is also few national guidance on what type of services should be provided (Orbeta, 2005). As a result, households living in different places do not face the same family planning services and some may largely rely on NGOs if the local government unit does not consider contraception as a priority.

2.2 The contraceptives' ban in Manila

In 1998, Jose Livioko Atienza was elected in Manila, Philippines' capital city. He held the office until 2007 and had been before vice-mayor of Manila for 6 years. For political reasons (he partly owes his election to the support of the Catholic churches), he enacted in 2000 the Executive Order 003 which stipulates that:

> "The City promotes responsible parenthood and upholds natural family planning not just as a method but as a way of self-awareness in promoting the culture of life while discouraging the use of artificial methods of contraception like condoms, pills, intrauterine devices, surgical sterilization, and other."

For many associations, this is a de facto ban on modern contraceptives in public health facilities (Likhaan, 2007). In addition, several evidence point to the fact that NGOs and private providers have been harassed and intimidated into ceasing to provide family planning services. The government hospitals (the Dr. Jose Fabella Memorial Hospital and the Philippines General Hospital) though were not subject to the ban. However, very little information was provided to women and even acknowledging that some contraceptives were available at the hospital was considered as violating the executive order enacted by the mayor. This results in a very difficult and a more expensive access to contraceptives (either due to higher direct costs or to higher opportunity costs). The report Likhaan (2007) quotes several women in distress with the new policy:

> "I feel anxious and fearful of the chance of getting pregnant if I don't have money to buy pills, unlike before when I used to get injectables for free, which were very convenient and effective for months."

There are also some evidence that the public provision of contraceptives became scarce much before 2000. Several women attested from the fact that as early as 1997, the city of Manila had decided to substantially reduce their family planning services.

> "After the birth of my second child, [...] the attending staff [...] advised me to try DMPA, the injectable.[2] For two years

[2]Depot Medroxyprogesterone Acetate (DMPA).

> I was using DMPA. I found it not only convenient by having the injection every three months, but also cheap because at that time, I got the injectable from the health center for free. I paid only 10 pesos for the disposable needle. In 1997, the staff at the health center [...] warned me that it was going to be my last injection. "*The mayor is pro-life now and will ban all family planning supplies and services in all health centers and hospitals in Manila.*"

The estimation has to take this into account and we will confirm empirically that fertility in Manila had already increased in 2000.

By comparison, Quezon City, which borders Manila and was the Philippines' capital city until 1976, was not affected by the ban since it depends from another local government.

2.3 Identification

We use the ban on contraceptives occurring in Manila to identify the causal effect of the quantity of children on their quality. Presumably, preventing households from accessing contraceptives should impact their fertility. As a result, the implementation of the ban will result in an increase in family size.

There are of course reasons to believe that endogenous trends, both in fertility and in investment in child human capital might compromise the identification of the effect of the ban on fertility as well as the estimation of the causal effect of family size on child quality. For instance, the comparison of different cohorts of Manila women having their fertility period before or after the ban might confound the effect of the ban with an endogenous change in fertility regimes.

Our analysis relies on two different identification strategies. The first one is akin to a simple difference-in-difference strategy obtained by comparing changes in fertility and child outcomes, before and after the ban, in Manila and in the comparison city. Using a control city such as Quezon City allows to account for trends, both in fertility behavior and in schooling outcomes, assuming that trends in Manila and the comparison city are similar. The comparison city we focus on is Quezon City, which, as discussed in the next section, is quite similar to Manila. In addition, comparing the outcome before and after the ban allows to control for cities fixed effects.

The assumption that the trends would have been the same in Manila and Quezon City in the absence of the ban may not be satisfied for a variety of reasons: trends might differ, the ban might have had consequences in the schooling system (pupils enrolled in overcrowded classes are more likely to face difficulties in learning) or public provision of education or health might have changed at the same time. For those reasons, we implement a

second identification strategy, which is akin to a triple-difference[3], so as to allow for different trends between Manila and QC, or, to state it differently, to allow for some specificities of post-ban Manila. In this triple difference strategy, the identification relies on the fact that a ban of contraceptives will not have homogenous effects among all women. Since fertility decreases with age, older women are less likely to become pregnant than younger ones, conditional on not using contraceptives. At the extreme, even in the post-ban period, the effect of the ban on some women is likely to be nil. Hence any change in the outcome of their children will reflect trends in individual outcome that are (potentially) specific to Manila. Assuming that these trends are similar across all age groups of Manila women, we can identify the effect of the ban on fertility and schooling outcomes, without relying on the assumption that trends are the same in Manila and Quezon City.

3 Data and descriptive statistics

3.1 Data

The main datasets we use in the analysis are the censuses collected in 1995, 2000 and 2007. We focus on two cities: Manila, capital city in which the ban took place, and Quezon City. A map is provided in Figure 2.

We chose to compare Manila with Quezon City because the two cities are highly comparable in terms of observable characteristics (more on this below).[4] The number of observations in the census is very large since Quezon City is populated by more than 2 millions inhabitants and Manila by 1.6 millions. This will allow us to estimate the effects very precisely. However, the information collected is quite scarce. We know the household composition, whether the individuals have received some education and their education level, and some details on their activity. As a consequence, if one wants to assess the quantity for quality trade-off, one has to focus on the schooling performance.

More precisely, in 2007, Manila's inhabitants had been exposed to the ban for 7 to 10 years, depending on whether one takes the executive order's date (2000) or the date obtained in qualitative interviews (1997). In the Philippines, school starts at the age of 7, therefore only children older than 7 provide measurable outcomes. Roughly speaking, we are in the position to evaluate the impact of the ban (or the quantity-quality trade-off) on elder children. However, in the Philippines and even more so in the more developed National Capital region, all children are virtually enrolled in school.

[3]This is not a proper triple-difference since the third dimension of differentiation is continuous rather than discrete.

[4]Manila is much more comparable to QC than to any other bordering but much smaller cities.

Enrollment cannot therefore be used as an outcome measure.[5] However, we cannot focus on children who have completed their education: most of them are unlikely to have been affected by the ban (because they are too old) and if they were, their exposure was quite low. As a consequence, we focus on children who are younger than 16 and consider their current education level. Since we know their age , we are able to compute whether they are late compared to the curriculum's standards. One difficulty arises from the fact that the date of birth is not collected in the census. It is more easily explained by an example. Let us take a child who is 8 years old at the time of the census and who is enrolled in the first grade of primary school. That child might either be behind the curriculum (if s/he was born at the beginning of the calendar year) or not (if s/he was born at the end of the calendar year). As a consequence, we cannot consider that a child is behind as soon as there is a one-year discrepancy between age at enrollment in a specific grade and child's current age. Grade repetition will only be detected when there is a 2-years discrepancy and will be defined as such.

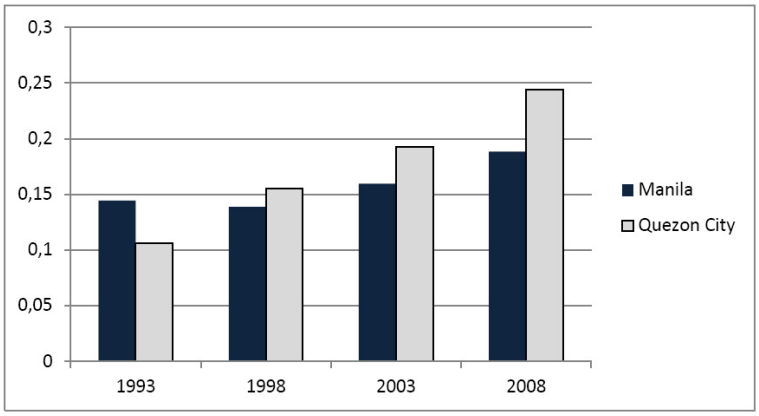
Another drawback from using the census needs to be mentioned: no filiation link is asserted in the data. We have to assume that when one couple with children is recorded, the spouse of the household head is actually the mother of the recorded children. This is not a very strong assumption since Philippines is a very Catholic country and there are very few divorces (and remarriages). For the same reason, we have to discard households where the presumed mother is not the household head's spouse. For instance, if the household head is the woman's father and there are some grand-children in the household: we cannot make sure that those children are indeed belonging to the woman or if they belong to one of her siblings. We therefore focus on "standard" households.

We also use in this paper other datasets such as the Demographic and Health Surveys collected in 1993, 1998, 2003 and 2008. Despite the small samples when we focus on Manila and Quezon City (around 300 observations for each wave), this data not only provides information on contraception and health but also has more retrospective information since the collection started in 1993. This is interesting to assess trends. In Figure 1, we compare contraception rates of women 25 to 40 y.o. depending on whether they live in Manila or in Quezon City. There is a clear increasing trend in contraceptives use in Quezon City. This trend seems to have come to a halt in 1998 in Manila with some catch up in the 2000s. As a result, Manila who had a higher contraceptive rate in 1993 lags behind as soon as 1998 and the difference gets wider as years pass. It seems clear from the figure that the restrictions placed upon contraceptives availability took place as soon as 1997 and did not wait after the enactment of the executive order.

The Annual Poverty and Income Surveys collected from 1998 allow to

[5]Child labor is also non existent in the National Capital region.

Figure 1: Contraception rates: women 25 to 40 y.o.



compare characteristics of Manila and Quezon City. Table 4 shows that the two cities do not differ in terms of school participation, women labourforce, household's income, and some housing characteristics (electricity and toilets availability). With regards to child labor, it has to be noticed that while the difference is significant, both averages are very close to zero. Other averages differ significantly though (water sanitation, type of walls). However, Manila and Quezon City seem to be very much comparable in most dimensions.

Table 4: Differences between Manila and Quezon City, APIS 1999

	Manila	Quezon City	$Pr(\|T\| > \|t\|)$
Children's school participation	0.953	0.949	0.728
Child labour participation	0.001	0.018	0.009
Women labourforce participation	0.580	0.567	0.509
6 months income (pesos)	114183	121202	0.393
Water sanitation	0.644	0.524	0.000
Electricity	0.050	0.063	0.389
Housing (walls)	0.765	0.626	0.000
Toilets	0.927	0.908	0.267

3.2 Estimation

Given that we are mainly interested in the quantity-quality trade-off and not in the effect of the ban itself, we will not only provide first-stages and reduced forms but also implement an IV strategy. In a first step, we use only the 1995 and 2007 censuses since the first one is clearly before the policy change while the second one is clearly after. We make use of the 2000 census

later on. The model to be estimated is:

$$\begin{aligned} Y &= \alpha_1 X + \beta E + u \\ E &= \alpha_2 X + \gamma Z + v \end{aligned}$$

The dependent variable Y is the children's grade repetition, the potentially endogenous variable E is the number of children in the household, the instrument Z will either be the interaction Manila $\cdot$ 2007 or the interaction Manila $\cdot$ Mother's age $\cdot$ 2007. X are exogenous covariates: child's age and its square (older children are more likely to have repeated a grade), mother's age (which affects number of children ever born to a woman), child's rank among siblings, as well as years and cities fixed effects.[6]

Y is a dummy variable (having repeated at least one grade) but for the sake of simplicity, we will estimate the model with linear probability given that we have a large number of observations. E is also a discrete number of children but we will estimate 2sls, in order to avoid any assumption on the residuals law.

Women's fertility will be measured with error. We are only able to count the number of children present in the household at the time of the census. While this approximation is probably a good one for younger mothers, measured fertility is likely to differ substantially from actual fertility if the mother is close to 50 y.o. However, the ban should not correlate with the measurement error and therefore the IV estimates should not be biased. In a second step, we will disaggregate the effect of additional children by mother's age.

Since we focus on educational outcomes of elder siblings, we restrict the sample to the 11 to 16 y.o. This sample is safer since the 7 to 10 y.o. sample could suffer from a composition bias. Indeed, if poorer families are more affected by the ban, this will induce a spurious correlation between Manila $\cdot$ 2007 and households unobservable characteristics. To understand whether this likely reflects the average effect of additional children on the whole sample of children, we need to discuss whether children born due to the ban differ from the others. Rosenzweig and Zhang (2009) show that if newborn children have significantly lower endowments than the average child and if parents reinforce endowments, then the estimated effect on the elder children is a lower bound of the average effect; the effect on the newborn children provides an upper bound. In our case, we cannot compute the effect on the children born due to the treatment, since we are unable to identify them. However, focusing on children older than 11 allows to make sure we identify the lower bound effect (provided that there is reinforcement, as in China). In our case, we expect that those new children may either receive lower endowments (if the mothers' pregnancies succeed to each other closely

[6] We also include interaction terms when Z is Manila $\cdot$ Mother's age $\cdot$ 2007.

for instance, babies' birthweight is lower) and/or lower investment (families may choose to under-invest in unwanted children).

OLS estimates will also be provided for comparison with the IV estimates. However, given that the estimated effects with IVs are Local Average Treatment Effects, we cannot infer from the comparison between OLS and IV estimates the sign of the bias. In our case, the LATE will be the impact on elder children's quality of one additional sibling for those who have been affected by the ban, meaning: for those who would have avoided an additional pregnancy in the absence of the ban but who cannot.

4 Results

4.1 First-stages and reduced forms

We start by providing evidence of the effect of the ban, both on women's fertility and on children's outcomes. Table 5 shows that the ban in itself had a quite limited effect on fertility. Looking at the first column of the table, it appears that it induced .05 additional children on average. More precisely, if we take into account the fact that women were unevenly affected depending on their age (column 2), it appears that children from 25 y.o. women got 0.19 additional siblings against 0.06 for children of 38 y.o. women.[7] The F-statistics are quite high compared to the standards. The contraceptives ban seems to be associated with poorer schooling performance (column 3). We also identify, in reduced form, an heterogenous effect of the ban by mother's age.

Incidentally, we can directly test for exclusion restrictions with the results provided in Table 5. Column 2 shows that the effect of the ban is equal to zero for 45 years old mothers[8] This is totally in agreement with biological evidence that shows that, on average, women turn infertile a bit before the age of 50. However, if we check whether 11-16 y.o. children from those women were unaffected by the ban, we fail to conclude this is the case. A test of the effect of the ban based on estimates obtained in column 4 shows that even those children were "affected by the ban".[9] This suggests that either the interaction term Manila $\cdot$ 2007 proxies for other changes than the ban or that the ban induced strong externalities on children who did not see the number of their siblings increase. The IV estimates based on that instrument will therefore have to be taken with extreme caution.

[7] The "mother's age" variable is centered: it takes the value 0 for 38 years old women. The effect of Manila$\cdot$2007 for a 25 y.o. woman is therefore $0.0664+(25-38)\cdot(-0.00944) = 0.19$.

[8] The effect of Manila $\cdot$ 2007 is equal to 0 when "mother's age" is equal to .066/.009=7, meaning for 38+7=45 years old.

[9] The effect of Manila $\cdot$ 2007 for 45 years old women is equal to $0.0237 - (45 - 38) \cdot 0.00107 = 0.016$, which is significantly different from 0 at the 1% level.

Table 5: Effect of the ban of fertility and grade retention (children 11-16 y.o.)

VARIABLES	(1) 1st stage # children	(2) 1st stage # children	(3) Reduced form Being held back	(4) Reduced form Being held back
Age	0.215***	0.215***	0.366***	0.366***
	(0.0206)	(0.0206)	(0.00447)	(0.00447)
Age squared	-0.00422***	-0.00423***	-0.0142***	-0.0142***
	(0.000763)	(0.000763)	(0.000166)	(0.000166)
Mother's age	-0.0709***	-0.0717***	-0.00403***	-0.00508***
	(0.000424)	(0.000781)	(9.22e-05)	(0.000170)
2nd child	0.638***	0.638***	0.0184***	0.0184***
	(0.00479)	(0.00479)	(0.00104)	(0.00104)
3rd or higher parity child	2.129***	2.129***	0.0648***	0.0649***
	(0.00498)	(0.00498)	(0.00108)	(0.00108)
Manila	-0.134***	-0.138***	-0.0120***	-0.0133***
	(0.00561)	(0.00590)	(0.00122)	(0.00128)
2007	0.0270***	0.0203***	-0.0326***	-0.0359***
	(0.00496)	(0.00533)	(0.00108)	(0.00116)
Manila x 2007	0.0472***	0.0664***	0.0216***	0.0237***
	(0.00774)	(0.00827)	(0.00168)	(0.00180)
Manila x Mother's age		0.00250**		0.000766***
		(0.00111)		(0.000241)
Mother's age x 2007		0.00305***		0.00173***
		(0.000986)		(0.000214)
Mother's age x Manila x 2007		-0.00944***		-0.00107***
		(0.00152)		(0.000331)
Constant	1.065***	1.066***	-2.186***	-2.183***
	(0.137)	(0.137)	(0.0298)	(0.0298)
Observations	623,251	623,251	623,251	623,251
R-squared	0.237	0.237	0.032	0.032
F-stat	37.22	38.54		

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4.2 IV

Table 6 provides OLS estimates of the "effect" of the number of children on child's quality: a higher number of children is associated with poorer schooling performance (more grade retention). However, the effect is quite small: one additional child is associated to an increase by 2% points of the

Table 6: Effect of the number of children on grade retention (children 11-16 y.o.)

VARIABLES	(1) OLS	(2) OLS	(3) 2SLS Manila x 2007	(4) 2SLS Manila x Mother's age x 2007
# of children	0.0242***	0.0242***	0.458***	0.113***
	(0.000274)	(0.000274)	(0.0794)	(0.0377)
Age	0.361***	0.361***	0.268***	0.342***
	(0.00445)	(0.00445)	(0.0198)	(0.00942)
Age squared	-0.0141***	-0.0141***	-0.0123***	-0.0138***
	(0.000165)	(0.000165)	(0.000499)	(0.000239)
Mother's age	-0.00233***	-0.00314***	0.0284***	0.00305
	(9.36e-05)	(0.000150)	(0.00564)	(0.00262)
2nd child	0.00291***	0.00295***	-0.274***	-0.0540**
	(0.00105)	(0.00105)	(0.0508)	(0.0241)
3rd or higher parity child	0.0132***	0.0134***	-0.910***	-0.177**
	(0.00122)	(0.00122)	(0.169)	(0.0802)
Manila	0.00196**	-0.00921***	0.0492***	0.00235
	(0.000836)	(0.00124)	(0.00886)	(0.00506)
2007	-0.0248***	-0.0357***	-0.0449***	-0.0382***
	(0.000824)	(0.00112)	(0.00412)	(0.00161)
Manila x 2007		0.0205***		0.0162***
		(0.00167)		(0.00257)
Manila x Mother's age		0.000257		0.000482**
		(0.000164)		(0.000201)
Mother's age x 2007		0.00130***		0.00138***
		(0.000162)		(0.000179)
Constant	-2.216***	-2.209***	-2.673***	-2.304***
	(0.0296)	(0.0296)	(0.107)	(0.0513)
Observations	623,251	623,251	623,251	623,251
R-squared	0.044	0.044		

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

likelihood to be held back by at least one grade.

By comparison, the IV estimate provided in column 3 (based on the assumption that Manila and Quezon City would have the same trends if the ban had not taken place) are very large. Given that we had already provided evidence that the assumption does not seem to hold, we will discard this estimation.

Finally, column 4 provides the result that the number of children affects the children's schooling performance. One additional child increases by 11% points the likelihood to repeat at least a grade. This effect is substantial since around 12% of children are held back by at least one grade. This effect is estimated on households who are affected by the ban, meaning: they would not have had additional children if the contraceptives had been available as usual. This has several implications. First, this sample might substantially differ from the whole sample. Poorer women may me more affected by the increase in provision cost, for instance. We endeavour to compare the compliers characteristics with the whole population characteristics but this is not yet done. Second, we estimate the effect of younger children (since the sample children were born before the ban). In that regards, it is interesting to inquire whether there is an heterogenous effect of the additional children induced by the ban: on one hand, very young children are more time-demanding to the mothers and therefore the competition for time is greater with them but, on the other hand, they may be less demanding in terms of economic resources. It is therefore of interest to check whether the effect is homogenous by age of "new" children. This is done in the next section.

4.3 Children have different effects depending on their age

The census collected in 2000 allows us to disaggregate the effect. Indeed, in 2000, households had been affected for roughly 3 years by the reduction in contraceptives availability. In 2007, it had been for roughly 10 years. We have exogenous variation affecting only the number of children younger than 3 in 2000 and affecting both the number of children younger than 3 and between 4 and 10 years of age in 2007. We are therefore in the position to identify the effect of both if we add the 2000 census children to the sample of interest. We also focus on children younger than 10 (instead of using the total number of children at home): it reduces measurement error (children younger than 10 are much more likely to have stayed at home with their parents) and, in any case, the estimated effect by IV was only the one induced by the ban and therefore the effect of adding younger children.

Table 7 shows the first-stages bearing on exclusion restrictions of Manila $\cdot$ 2000 and Manila $\cdot$ 2007 (columns 1 and 2) and on exclusion restrictions of Manila $\cdot$ Mother's age $\cdot$ 2000 and Manila $\cdot$ Mother's age $\cdot$ 2007 (columns 3 and 4). Again, the fact that Manila $\cdot$ 2000 is significantly correlated with the number of children older than 4 but younger than 10 suggests that there are specific effects of post-ban Manila (the change starting in 1997, it should not have affected the number of children born before 1997). Columns 3 and 4 indicate that the two interaction terms with mother's age predict the family size and the F-stat on excluded instruments is satisfying for the number of children older than 4 and younger than 10. However, it is a bit small for obtaining good

predictions of the number of children younger than 3.

Table 8 provides the OLS and 2SLS results of the impact of both categories of children on grade retention of elder children (11 to 16 years old). While the OLS conclude to a stronger effect of children younger than 3, it is not the case anymore when instrumenting the variables. Column 3 concludes that one additional child older than 4 increases by 18% point the likelihood of repeating at least a grade, while the effect of children younger than 3 is imprecisely estimated but lower (8% points). The estimated effect is therefore quite important. The intermediate effect obtained in the previous section can come from a confounding nil effect of younger children.

Conclusion

In this paper, we use a unique natural experiment to evaluate the quantity-quality trade-off highlighted by Becker. We find very substantial effects, contrary to what is usually found by papers who rely on twin births or same-sex instruments. Children older than 11 and younger than 16 are 11% points more likely to repeat a grade if they have one additional younger sibling. The effect is stronger when the sibling is older, suggesting that the competition for economic resources is more crucial than the competition for parental time. However, it could also be that any sibling (whatever his/her age) depletes resources and therefore the environment available to the child but that the effect has to be cumulated over years to have some substantial effect on human capital accumulated and therefore on the child's grade repetition.

Table 7: Effect of the ban on number of children younger than 3 and between 4 and 10 years of age

VARIABLES	(1) # children ≤ 3	(2) $4 \leq$ # children ≤ 10	(3) # children ≤ 3	(4) $4 \leq$ # children ≤ 10
Age	-0.0536***	0.0436***	-0.0533***	0.0437***
	(0.00608)	(0.0111)	(0.00608)	(0.0111)
Age squared	0.00145***	-0.00395***	0.00144***	-0.00395***
	(0.000226)	(0.000412)	(0.000226)	(0.000412)
Mother's age	-0.0269***	-0.0508***	-0.0284***	-0.0509***
	(0.000125)	(0.000229)	(0.000275)	(0.000503)
2nd child	-0.0347***	-0.164***	-0.0346***	-0.164***
	(0.00142)	(0.00259)	(0.00142)	(0.00259)
3rd or higher parity child	-0.0372***	-0.240***	-0.0371***	-0.241***
	(0.00147)	(0.00269)	(0.00147)	(0.00269)
Manila	-0.0321***	-0.0802***	-0.0368***	-0.0835***
	(0.00200)	(0.00365)	(0.00211)	(0.00385)
2000	-0.0111***	0.0233***	-0.0139***	0.0265***
	(0.00186)	(0.00341)	(0.00198)	(0.00362)
2007	-0.0154***	0.0225***	-0.0152***	0.0174***
	(0.00177)	(0.00323)	(0.00190)	(0.00347)
Manila x 2000	0.0189***	0.0228***	0.0223***	0.0261***
	(0.00286)	(0.00523)	(0.00305)	(0.00557)
Manila x 2007	0.00888***	0.0467***	0.00835***	0.0586***
	(0.00276)	(0.00504)	(0.00295)	(0.00539)
Manila x Mother's age			0.00284***	0.00200***
			(0.000396)	(0.000723)
Mother's age x 2000			0.00167***	-0.00162**
			(0.000371)	(0.000678)
Mother's age x 2007			0.000374	0.00217***
			(0.000352)	(0.000643)
Mother's age x Manila x 2000			-0.00213***	-0.00192*
			(0.000565)	(0.00103)
Mother's age x Manila x 2007			-0.000457	-0.00585***
			(0.000543)	(0.000992)
Constant	0.806***	1.335***	0.806***	1.335***
	(0.0405)	(0.0740)	(0.0405)	(0.0740)
Observations	903,868	903,868	903,868	903,868
R-squared	0.075	0.114	0.076	0.115
F-stat	21.89	42.88	7.933	18.34

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8: Effect of the number of children on grade retention (children 11-16 y.o.)

	(1)	(2)	(3)
	OLS	2SLS	2SLS
		Manila x 2000	Manila x Mother's age x 2000
VARIABLES		Manila x 2007	Manila x Mother's age x 2007
$\#children \leq 3$	0.0415***	-0.392**	0.0850
	(0.000634)	(0.193)	(0.167)
$4 \leq \#children \leq 10$	0.0238***	0.541***	0.180***
	(0.000347)	(0.0754)	(0.0600)
Age	0.399***	0.353***	0.394***
	(0.00362)	(0.0140)	(0.0101)
Age squared	-0.0153***	-0.0126***	-0.0147***
	(0.000134)	(0.000555)	(0.000368)
Mother's age	-0.00150***	0.0131***	0.00642
	(7.78e-05)	(0.00487)	(0.00558)
2nd child	0.0232***	0.0929***	0.0504***
	(0.000844)	(0.0112)	(0.0115)
3rd or higher parity child	0.0670***	0.175***	0.106***
	(0.000879)	(0.0163)	(0.0158)
Manila	-0.00898***	0.0186***	0.00469
	(0.00119)	(0.00473)	(0.00773)
2000	-0.0337***	-0.0505***	-0.0405***
	(0.00111)	(0.00327)	(0.00292)
2007	-0.0325***	-0.0508***	-0.0376***
	(0.00105)	(0.00482)	(0.00307)
Manila x 2000	0.00360**		-0.000899
	(0.00170)		(0.00387)
Manila x 2007	0.0203***		0.0125***
	(0.00164)		(0.00363)
Manila x Mother's age			0.000181
			(0.000368)
Mother's age x 2000			0.00204***
			(0.000271)
Mother's age x 2007			0.00131***
			(0.000180)
Constant	-2.480***	-2.821***	-2.721***
	(0.0241)	(0.149)	(0.159)
Observations	903,868	903,868	903,868
R-squared	0.042		

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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Figure 2: Metro Manila map