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The Decision to Invest in Child Quality over Quantity

Household Size and Household Investment in Education in Vietnam

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Abstract

During Vietnam's two decades of rapid economic growth, its fertility rate has fallen sharply at the same time that its educational attainment has risen rapidly—macro trends that are consistent with the hypothesis of a quantity-quality tradeoff in child-rearing. This paper investigates whether the micro-level evidence supports the hypothesis that Vietnamese parents are in fact making a tradeoff between quantity and quality of children. The paper presents new measures of household investment in private tutoring, together with traditional measures of household investments in education. It analyzes data from the Vietnam Household Living Standards Surveys and instruments for family size using the distance to the nearest family planning center. The estimation results show that families do indeed invest less in the education of school-age children who have larger numbers of siblings. This effect holds for several indicators of educational investment—including general education expenditure and various measures of private tutoring investment—and is robust to various definitions of family size and model specifications that control for community characteristics as well as the distance to the city center. Finally, the results suggest that tutoring may be a better measure of quality-oriented household investments in education than traditional measures like enrollment, which are arguably less nuanced and household-driven.

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The Decision to Invest in Child Quality over Quantity:

Household Size and Household Investment in Education in Vietnam

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1. Introduction

Over the past four decades, there has been considerable study of the relationship between household choices on the quantity and quality of children, starting with the seminal studies by Becker (1960) and Becker and Lewis (1973). The hypothesis driving the literature is that parents make tradeoffs between the number of children they bear and the "quality" of those children, which is shorthand for the amount of investment that parents make in their children's human capital. If this hypothesis is true, it has considerable implications for policies aimed at increasing economic growth and reducing poverty. For example, small family sizes and slow population growth would then be conducive to increased human capital and higher earnings (Angrist, Lavy, and Schlosser, 2010), as well as to economic development more broadly (de la Croix and Doepke, 2003; Moav, 2005).[1] Consequently, this can motivate policy makers to work on policies that assist couples to avoid unwanted births or to subsidize birth control (Schultz, 2007).

Our contributions to the literature in this paper are threefold. First, we investigate a new measure of household investment in their children, which is private tutoring—or extra classes—in mainstream subjects at schools that children are tested in. Private tutoring merits attention for several reasons. First, private tutoring may be an especially good measure of a household's decision to invest voluntarily in children's human capital – compared with enrollment, for example, which may also reflect exogenous factors such as compulsory schooling laws. Put differently, private tutoring can represent the household's (and student's)

[1] The empirical evidence on the correlation between household size and poverty appears inconclusive. For example, Lanjouw et al. (2004) argue that the common view that larger-sized households are poorer is sensitive to assumptions made about economies of scale in consumption.

extra efforts to increase human capital.[2] Second, private tutoring is now widespread in many countries, especially but not solely in East Asia,[3] and evidence indicates that it improves students' academic performance in some countries, including Germany, Israel, Japan, and Vietnam (Dang and Rogers, 2008).[4] Finally, there has been considerable debate about tutoring among policymakers. One crucial question is whether widespread availability and use of private tutoring exacerbates or helps equalize social and income inequality (Bray, 2009; Bray and Lykins, 2012), a question that is relevant to both developing and developed countries.[5] Here, the link with demography is important: if use of tutoring is correlated with both smaller family size and higher family income, this heightens the risk that it could exacerbate inequality.

Second, more generally, we improve on previous studies by providing a rather comprehensive investigation of different aspects of household investment in private tutoring for each child (i.e., at the child level), most of which have not been used before. These include participation in tutoring, household monetary investment in tutoring, and time spent both in the short term (i.e., frequency of attending tutoring classes in one year) and in the long term (i.e., number of years attending tutoring classes) on tutoring. We also go one step

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[2] Bishop (2006) emphasizes the importance of student effort on learning, and a recent study by MacLeod and Urquiola (2012) finds that it is not simply more school choice but rather student effort that can enhance educational performance.

[3] Private tutoring (or supplementary education) is a widespread phenomenon, found in countries as diverse economically and geographically as Cambodia, the Arab Republic of Egypt, Japan, Kenya, Romania, Singapore, the United States, and the United Kingdom. A recent survey of the prevalence of tutoring in 22 developed and developing countries finds that in most of these countries, 25–90 percent of students at various levels of education are receiving or recently received private tutoring, and spending by households on private tutoring even rivals public sector education expenditures in some countries such as the Republic of Korea and Turkey (Dang and Rogers, 2008).

[4] Other recent studies that find tutoring to have positive on different measures of student academic performance include student test scores and academic performance in India (Banerjee et al., 2010) and the United States (Zimmer et al., 2010). But see also Zhang (2013) for recent evidence that tutoring may benefit only certain student groups in China.

[5] For example, in a recent opinion piece in the New York Times on the widening inequality in the US, the Nobel laureate Joseph Stiglitz (2013) calls for more "…summer and extracurricular programs that enrich low-income students' skills" to help level the playing field between these students and their richer peers.

further than just looking at household investment in tutoring by considering the situation where households can make a joint decision on whether to enroll their children in school and to send them to tutoring classes.

Third, we explore the hypothesized child quantity-quality tradeoff in the context of Vietnam, a country that has undergone rapid change in fertility and educational attainment. The total fertility rate decreased steadily from 6 births per woman in the 1970s to 4 births per woman in the late 1980s and to just under 2 births per woman currently (World Bank, 2012). And over the past two decades, the average number of years of schooling for the adult population has increased rapidly, from 4 in 1990 (Barro and Lee, 2012) to 6.6 in 1998 and 8.1 in 2010 (VLSS, 1998; VHLSS, 2010).[6] The Government of Vietnam has paid much attention to family planning and has promulgated policies over the past fifty years encouraging (and in the case of government employees, requiring) families to restrict their number of children to one or two,[7] but to our knowledge, our study is the first to investigate rigorously the quantity-quality tradeoff in the context of Vietnam.

In this paper we focus on households' investment in their children rather than children's outcomes, because doing so may provide a more direct test of the quantity-quality tradeoff hypothesis (see, for example, Caceres-Delpiano (2006) and Rosenzweig and Zhang (2009) for a similar approach). In the context of Vietnam, private tutoring as a new measure of the households' investment in the quality of their children appears more appropriate than traditional measures (such as education expenditures or private school attainment) for two reasons. First, Vietnam's education system is mostly public with more or less uniform

[6] Unless otherwise noted, all estimates from the Vietnam Living Standards Surveys (VLSSs) and Vietnam Household Living Standards Surveys (VHLSSs) are authors' estimates.
[7] The GOV started with the policy of two-to-three children per family in the 1960s, and then tightened this to one-or-two children per family in 1988 to date.

tuition, and second, the market for private tutoring is well-developed, with approximately 42 percent of children age 6-18 attending private tutoring in the past 12 months.

To identify the impacts of family size on household investment in private tutoring, we use as instrument the distance to the nearest family planning center. In contrast to instruments used in most previous studies, this instrumental variable allows us to study the effects of family size for families with one child or more. Our results provide considerable support for the quantity-quality tradeoff in the Vietnamese context, in terms of both the households' financial investments in private tutoring as well as their general expenditures on education. We find that a child's number of siblings has negative and strongly statistically significant impacts on the family's investment in that child's education, and that when they are estimated through IV methods, the impacts are much larger in magnitude than in the uninstrumented results. These estimation results hold for several different measures of tutoring and are generally robust to different model specifications and definitions of family size. In particular, each additional sibling reduces the household's investments in a child's schooling as measured through a variety of indicators: it reduces education expenditure and tutoring expenditure by 0.4 and 0.5 standard deviations, respectively; it decreases the child's probability of being enrolled in tutoring by 32 percentage points; it reduces the child's enrollment and tutoring index or tutoring attendance frequency by 0.34; and it cuts the average time spent on tutoring by 74 hours and 1.4 years of tutoring.

This paper has seven sections. We provide a short conceptual framework in the next section, which is then followed with a review of the literature. The data description and the context on private tutoring are provided in Section 4. Our empirical framework and estimation results are discussed in Sections 5 and 6, and Section 7 concludes.

2. Conceptual Framework: The Quantity-Quality Tradeoff and Fertility-Related Interventions

The hypothesis of a quantity-quality tradeoff arose in response to a puzzling question: If children are a normal good, why is it that fertility does not rise as families get wealthier? The answer proposed by Becker and others is that children are indeed a normal good, but parents value both their quantity and their quality, and the tradeoffs between those two dimensions can lead to an increase in quality rather than quantity as incomes rise.

In the simplest version of the model of Becker and Lewis (1973), the parents' utility function is

$$U = U(N, Q, Z) \qquad (1)$$

where N is the number of children, Q is their average quality, and Z is a composite consumption good. Both N and Q have costs, in terms of financial outlays and parents' time. The Becker-Lewis budget constraint is non-linear in N and Q, because the marginal cost of adding a child depends on the average quality, and conversely, the cost of increasing average quality depends on the number of children:

$$M = Q\,N\,\Pi_C + Z\,\Pi_Z \qquad (2)$$

where Π_C and Π_Z are the price of the composite child and consumption goods, respectively, and M is the family's money income.

In the domain of expenditures on children (Q and N), then, this yields an optimization problem like the one depicted in Figure 1. The slope of the budget constraint is determined by the relative prices of Q and N. Figure 1 depicts a case with preference heterogeneity, in

which at any given income and price vector, Family A prefers fewer, "higher-quality" children, whereas Family B is willing to sacrifice quality in order to have more children.[8]

In the Becker-Lewis framework, changes in the relative price of quality and quantity of children will shift the curve and change the optimal number of children and the investments that parents make in them. One such relative price shift noted by Becker and Lewis is a reduction in the costs of maternity care. In the context of Vietnam, the shift on which we focus is caused by an increase in the availability of family planning services.[9] These services reduce the cost of controlling the quantity of children, which is equivalent to an increase in the price of quantity relative to quality (since parents can now choose to have fewer children) and an increase in the household's resources. We show this in Figure 1 by pivoting out the budget line.

The predicted effect of a reduction in the relative price of quality is to increase the equilibrium quality of children relative to quantity for both family types depicted in Figure 1 – from Q_A* to Q_A" and from Q_B* to Q_B", respectively. Any intervention that reduces the price of quality for one family relative to another identical family should therefore lead to a higher quality of children in the former. If the substitution effect dominates any income effect from the change in price (as in the figure), then the optimal number of children, N*, will also fall for both families.

In the empirical analysis below, we use the availability of family planning as measured by the distance to the nearest family planning center to instrument for number of children and

[8] Throughout this paper, we follow the literature by using the term "quality" of children to refer to the amount of human capital invested in them. This should not be taken as a value judgment about their worth as individuals. As noted earlier, however, higher human capital is associated with a host of other desirable development outcomes, at both the individual and societal levels.

[9] Another possible source of change can be caused by, for example, an increase in the quality of public education. If this increase allows families to move their children from private to public school, it will reduce the cost to them of improving the quality of their children in terms of human capital.

estimate the tradeoff with quality that is implicit in the indifference curve. This identification strategy is consistent with previous studies, reviewed in the next section, that also use family planning infrastructure in the community to instrument for family size.

3. Empirical Literature: Testing the Quantity-Quality Tradeoff

Our paper straddles two strands of literature: one consisting of more established studies on the quantity-quality tradeoff, and the other a small but growing number of studies on private tutoring. We will briefly review the most relevant studies in this section.

A vast literature has looked at the empirical relationship between household size and child educational attainment.[10] But one central and empirical challenge among these studies is to identify this quantity-quality tradeoff convincingly in the data, since unobserved factors that can affect both fertility and child human development outcomes exist. For example, while we can control for some of these factors in multivariate analyses by, say, including as a regressor a variable capturing parental education levels, we are still unable to control for any component of the parents' devotion to their children's education that is not correlated with parental educational attainment.

To address the endogeneity of family size, researchers have used family planning infrastructure in the community as an instrument variable (IV) to identify the impacts of family size on human capital and other welfare outcomes. Perhaps the greatest advantage of this instrument over other commonly used instruments such as twins or children sex composition is that the family-planning instrument allows us to analyze the impacts of family size on all the children in the household (or the single child, if there is only one), while using

[10] See, for example, Steelman et al. (2002) and Schultz (2008) for recent reviews.

either twins or children sex composition restricts analysis to a subset of these children.[11] Rosenzweig and Schultz (1985) appears to be the first study that uses family planning infrastructure in the community to net out the exogenous variation in family size (and its impacts on female labor supply). A later study, Klepinger, Lundberg and Plotnick (1999), uses state- and county-level indicators of abortion and family planning facilities in the US as instruments for fertility and finds that teenage childbearing has substantial negative effects on human capital (and future labor market opportunities).

Examining the well-known family planning program in Matlab area in Bangladesh, Joshi and Schultz (2007) find that family size for beneficiary households was reduced by 1.2 fewer births, which in turn led to up to one-half and one-third of a standard deviation more years of schooling, respectively, for boys and girls. Smaller family size also has positive impacts on other outcomes including child mortality rates and, interestingly, the program impacts after twenty years in action remain very similar to when it was five years old.[12] Still, despite these (and other) studies, the stock of evidence on the quantity-quality tradeoff appears far from conclusive.[13] In this paper, we take the same approach by using the distance to the nearest family planning center as the instrumental variable.[14]

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[11] Using twins as the instrument also requires a much larger estimation sample size; as a result, most previous studies that took this strategy have had to rely on population censuses.

[12] Other studies that find that family planning-related variables have important impacts on fertility include Billy and Moore (1992) for the US and DeGraff, Bilsborrow, and Guilkey (1997) for the Philippines. A more recent study by Portner, Beegle, and Christiaensen (2011) finds that access to family planning reduces completed fertility by more than one child among women without education in Ethiopia. In a related vein, Bailey (2010) finds that the birth control pill had a major impact on marital fertility in the 1960s in the US.

Besides family planning, other instrumental variables have been used as well, and include unplanned (multiple) births (Rosenzweig and Wolpin, 1980; Li and Zhu, 2009), the gender mix of children combined with parental sex preference (Angrist and Evans, 1998; Iacovou, 2001; Chun and Oh, 2002), and cultural belief in auspicious years for giving birth (Vere, 2008).

[13] For example, Angrist, Lavy and Schlosser (2010) find no tradeoff in Israel; Lee (2008) finds a weak tradeoff in Korea that gets stronger with more children. However, while Black, Devereux, and Salvanes (2005) found that controlling for birth order reduces the impacts of family size to almost zero for older Norwegian birth cohorts, they find the opposite holds for more recent birth cohorts (Black, Devereux, and Salvanes; 2010); in China, Li et al. (2008) find a negative impact of family size on children's education but Qian (2009) finds that an additional child significantly increased school enrollment of first-born children for one-child families; and in

Few papers have investigated the correlation between household size and household educational investment in their children through private tutoring. To our knowledge, the exceptions are the two papers on Korea by Lee (2008) and Kang (2011), and the former only briefly touches on tutoring. Both these papers share the same identification strategy by using the sex of the first-born child as an instrument for family size,[15] but the former implements this analysis at the household level, while the latter does so at the level of the child. Lee (2008) finds a negative impact of larger family size on household investment in education in general and tutoring in particular, but Kang (2011) finds these negative impacts to be significant only for girls.

Studies that examine the uninstrumented relationship between family size and household investment contain some hints about the quantity-quality tradeoff. Using data from an inter-censal demographic survey in 1994 for Vietnam, Anh et al. (1998) find a negative correlation between family size and children's school attendance and achievement, but the relationship holds for achievement only for the largest family sizes.[16] Dang (forthcoming) also finds a negative correlation between family size broken down by age groups and gender with

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Brazil, Ponczek and Souza (2012) find larger family size has a negative causal impact on education and positively related with girls' and boys' labor force participation, while Marteleto and de Souza (2012) find these impacts on adolescents' schooling in Brazil have turned from positive to no effect and then negative during the 1977-2009 period.

[14] Distance to services is often used as an instrument in the literature. For example, distance to college is used to identify the returns to education (Card, 1995), distance- and topography-related ability to receive broadcasts is used to instrument for the impacts of television and radio on social capital (Olken, 2009), and distance to the origins of the virus is used to estimate the response of sexual behavior to HIV prevalence rates in Africa (Oster, 2012). Gibson and McKenzie (2007) provide a related review of household surveys' use of distances measured via global positioning systems (GPS).

[15] The use of the sex of the first-born child as an IV has some limitations. First, it requires the assumption of son preference—which appears to be a weak IV, so that Kang (2011) has to rely on bound analysis to identify bounds of impacts of family size in the case of boys. Second, the assumption of son preference in turn requires the assumption that parents do not abort girls at their first childbearing; if they do, the sex of the first-born child is clearly not valid as an exogenous instrument. This concern is especially relevant to Vietnam, which has one of the highest abortion rates in the world (Henshaw, Singh, and Haas, 1999). And finally, this identification approach may only work for families with more than one child; our study makes no such restriction on family size, investigating families with between one and seven children.

[16] Note that Anh et al. (1998) restrict their analysis to children age 10 or older, since their survey collects data only on ever-married women age 15-49.

household investment in tutoring lessons, but does not investigate this in an IV framework. Reviewing the literature on correlates of tutoring that analyze household survey data for other countries, Dang and Rogers (2008) find that smaller households—like richer, more educated, and urban households—are more likely to enroll their children in tutoring. For example, the reduction in expenditure on private tutoring correlated with one more child ranges from 10 percent in Korea (Kim and Lee, 2010) to 30 percent in Turkey (Tansel and Bircan, 2006). Obviously, while these correlations appear consistent with a quantity-quality tradeoff, the results should be qualified because the studies do not control for the endogeneity of family size.

4. Data Description and Background on Tutoring in Vietnam

4.1. Data description

In this paper, we analyze data from three rounds of the Vietnam Household Living Standards Surveys (VHLSS) in 2002, 2006, and 2008, which are nationally representative surveys implemented by Vietnam's General Statistical Office (GSO) with technical assistance from the World Bank. The VHLSSs are similar to the LSMS-type (Living Standards Measurement Survey) surveys supported by the World Bank in a number of developing countries and provide detailed information on education including expenditure on tutoring as well as household demographics and consumption for 9,189 households across the country in each round. In addition to a module collecting data on household members, these surveys also have a community module that collects data on community infrastructure and facilities such as distances to schools or family planning facilities. Starting from 2002, the VHLSSs are implemented biannually and collect more data for rotating themes for each survey round; for example, the theme for the 2006 round is educational activities. These

surveys are widely used for education analysis by the government and the donor community in Vietnam.

For data on family planning facilities (and community characteristics), we use the 2002 round, since only this survey round collects data on the distance to family planning centers. Because this information is only available for rural communes, we restrict our analysis to rural households in Vietnam. The VHLSSs collect data on different households who reside mostly in the same communes, which allows us to match the commune information from the 2002 survey round to most of the households in the 2006 and 2008 survey rounds.[17] However, we focus on the 2006 round of the VHLSS for the outcome variables, since this round has the most detailed information on household investment in tutoring activities. We also supplement our analysis with data from another nationally representative survey (VHTS) focused on private tutoring that we fielded in 2008,[18] as well as data on teacher qualifications in the community from the primary school census (DFA) database.[19]

Since most children start their first grade at 6 years old, we restrict our analysis to children who are between 6 and 18 years old.[20] To address concerns about grown-up children that have already moved away from home, we consider only children who are living at home and households where the total number of children born of the same mother is equal to the number of children living in the household. We define family size as consisting

[17] This matching process is complicated by the fact that there were administrative changes resulting in changes to administrative commune codes between 2002, 2006, and 2008. For around 150 communes, we have to rely on both commune and district names (in addition to province and district codes) for matching.
[18] For details on this survey, see Dang and Glewwe (2009). We collaborated on designing the survey with other researchers, including Paul Glewwe (University of Minnesota), Seema Jayachandran (Northwestern University), and Jeffrey Waite (World Bank). The survey was administered by Vietnam's Government Statistics Office, using funding from the World Bank's Research Support Budget and the Hewlett Foundation.
[19] This database is initiated and maintained by World Bank-supported projects. For a brief description on the history and objectives for the primary school census database, see Attfield and Vu (2013).
[20] We also experimented with other age ranges such as ages 10- 18 and 12- 18. Estimation results (available upon request) are qualitatively very similar and even more statistically significant than those for the age range 6-18.

of children born of the same mother, but we also experiment with a more relaxed definition of family size that considers all children living together in the households, as well as other stricter definitions to be discussed later.

4.2. Background on tutoring in Vietnam

The current education system in Vietnam has three levels: primary, secondary, and tertiary (post-secondary). Primary education consists of grades 1 to 5, which is for children age 6 to 10. Secondary education is divided into lower secondary education, which consists of grades 6 to 9 (for children age 11 to 14), and upper secondary education, which consists of grades 10 to 12 (for children age 15 to 17). Vietnam has almost achieved universal primary education with 94 percent of Vietnamese children age 15-19 having completed primary education (VHLSS 2006). At the end of the upper secondary level (grade 12), students must obtain a satisfactory score on an examination to receive the upper secondary (high school) degree. Examinations are also used to gain admission to some specialized upper secondary schools and to colleges/universities. There is strong competition to get admitted to colleges, due to strict rationing at the tertiary level.

Table 1 lists the reasons that students take private tutoring classes, according to data from the VHTS. Tutoring classes are divided into two categories: tutoring classes organized by the student's own school, and other tutoring classes. Across the two types of tutoring, the most important reason for taking tutoring is to prepare for examinations, which accounts for almost half of all responses (42-47 percent). Other commonly cited reasons given include to catch up with the class (13-14 percent), to acquire better skills for future employment (13 percent), and to pursue a subject that the student enjoys (6-11 percent). Other reasons, such as to get childcare, to compensate for poor-quality lessons in school, or to study subjects not taught in mainstream classes, account for a smaller proportion of all responses (3-6 percent

each). The preeminence of exam preparation over other reasons for taking tutoring classes reflects the importance of examinations in the school system in Vietnam.[21]

Richer households in Vietnam spend more on tutoring classes than do poorer households, as shown in Table 2. Currently about 40 percent (= 100 - 60.4) of households in Vietnam send their children to private lessons, and the majority of them (90 percent) spend between 1 percent and 5 percent of household expenditure on tutoring classes. The percentage of households with positive expenditures on tutoring classes is only 21 percent in the poorest (1st) consumption quintile, but nearly doubles to 38 percent in the next richer quintile (2nd) and hovers around 35 percent in the top three quintiles (3rd to 5th). In terms of actual expenditure, the mean expenditure on tutoring classes by the wealthiest 20 percent of households is 15 times higher than expenditure by the poorest 20 percent of households. And more expenditure on tutoring is found to increase student grade point average (GPA) ranking in Vietnam, with a larger influence for lower secondary students (Dang, 2007, 2008).

Our calculation (not shown) using the 2006 VHLSS shows that the majority of children age 6-18 have at most three siblings, with 10 percent having no sibling, 48 percent having one sibling, 27 percent having two siblings, and 10 percent having three siblings; only five percent of these children have four siblings or more. Table 3 provides a first look at children age 6-18 that are currently enrolled in school that comprise our estimation sample, of whom 42 percent attended private tutoring in the past 12 months. They spent on average D 104,150 (equivalent to $US 6)[22] and 89 hours on these tutoring classes also in the past 12

[21] For examining our hypothesis of the quantity-quality tradeoff, we are in fact assuming that sending children to tutoring classes are completely determined by parents. If corrupt teachers force tutoring on their own students beyond parental control (see, e.g., Bray, 2009; Jayachandran, 2012), household investment in tutoring would not provide valid evidence for this tradeoff. However, the results in Table 1 suggest this concern is a minor one in the context of Vietnam. See also Dang (2011) for a general overview of the private tutoring phenomenon in Vietnam.

[22] The exchange rate was D 15,994 for $US 1 in 2006 (World Bank, 2012).

months, and had attended tutoring for 1.9 years; for those that attended tutoring in the past 12 months, the corresponding expenditure and hours spent on tutoring are D 246,590 and 215 hours. These children have 1.6 siblings on average, are mostly in secondary school (58 percent), and live an average of 8.6 kilometers away from the nearest family planning center.

5. Empirical Framework

5.1. Estimation equations

Our empirical approach first tests for multivariate correlations between family size and the education-related dependent variables and then instruments for family size in these regressions. The basic estimation equations are

$$E_{ij} = \alpha + \beta FamSize_i + \gamma Z_{ij} + \varepsilon_{ij} \quad (3)$$

$$FamSize_i = \delta + \lambda DisFam + \phi Z_{ij} + \eta_{ij} \quad (4)$$

While we focus primarily on households' investment in their children rather than the final educational outcomes of those children—which can be affected by other factors rather than household investment alone—we also look at the more traditional measures for comparison. Thus, for the first equation, the dependent variable E_{ij} includes both traditional measures and new measures of household investment in tutoring. The traditional measures include school enrollment, educational expenditure, and completed years of schooling.[23] The new measures include attendance at private tutoring classes, a combined school enrollment/tutoring index (which takes a value of 2 if enrolled in both school and tutoring, 1 if school only, and 0 if neither), frequency of tutoring attendance (which takes a value of 2 if enrolled in tutoring during both school year and holidays, 1 if either school year or holidays,

[23] For children that are currently in school, completed years of schooling is right-censored since we do not observe the final years of schooling for these children. Thus for such children (and our estimation sample), this variable represents a lower-bound estimate only.

and 0 if neither), expenditure on tutoring,[24] and the number of hours in the past year and the number of years to date spent on tutoring. Of these measures, only tutoring attendance and expenditure appear to have been used in previous studies on tutoring.

Z_{ij} is a vector of child, household, community and school characteristics that include age, gender, school level, mother's age,[25] mother's age squared, gender of the household head, head's years of schooling, ethnicity, household expenditure, and distances to the nearest primary and secondary schools. A variable indicating the number of years that remains before the last grade in the current school level is also added, since this variable was found to capture the increasing intensity of tutoring classes as students progress in school (Dang, 2007), but this variable is left out in the regression for the enrollment/tutoring index since it applies only to children currently enrolled in school.

For easier interpretation of results, we estimate equation (4) for all the outcomes above (except for expenditure and hours spent on tutoring) using an OLS model, where results can be readily read off of the estimated coefficients. For expenditure and hours spent on tutoring,[26] we use a Tobit model instead since a large number of children have zero values for these variables and subsequently provide separate estimates for the marginal effects. Let E_{ij}^* be the latent variable that represents the household's potential spending (or hours) on tutoring; we observe tutoring spending E_{ij} only when this potential spending is larger than 0, and observe zero spending otherwise. The Tobit model has the form[27]

$$E_{ij}^* = \alpha + \beta FamSize_i + \gamma Z_{ij} + \varepsilon_{ij} \qquad (5)$$

[24] For easier interpretation of results and because of the large number of zero observations, in our preferred specification we do not transform variables such as expenditures and hours spent on tutoring to logarithmic scale. Estimation results with the transformed variables are similar, however, and coefficients are slightly more statistically significant.
[25] There are more missing observations with father's age so we omit this variable.
[26] While the number of years of tutoring can also be fitted in a Tobit model, we prefer to use the OLS model for better interpretation. Estimation results using an IV-Tobit provide very similar results.
[27] For a survey on the Tobit model, see Amemiya (1984).

where $E_{ij} = 0$ if $E_{ij}^* \leq 0$ and $E_{ij} = E_{ij}^*$ if $E_{ij}^* > 0$.

It should be noted that there are two main ways to interpret the marginal impacts of the explanatory variables in a Tobit model, depending on the outcomes of interest. If we are interested in looking at the marginal effects of family size (or other explanatory variables) on household propensity to spend on tutoring classes, we can just look at the estimated coefficients in Table 6. However, if we want to know the marginal effects on households' actual (observed) spending, we should look at the marginal effects provided in Table 1.2.[28] While the former interpretation may be more relevant for forecasting the future, the latter is more commonly used and focuses on household spending at present. For our purposes, we will use the latter interpretation of the marginal effects.

We then estimate equations (3) and (4) jointly in an IV model (with 2SLS or IV-Tobit accordingly), where family size is instrumented by the distance to the nearest family planning center.

5.2. Distance to family planning center as instrument

Building on previous studies that employ family planning facilities as instruments to identify the causal impacts of family size, we use as our instrument the distance to the nearest family planning center. We believe this instrument is appropriate in the context of Vietnam in terms of exogeneity, relevance, and the exclusion restriction (which requires that this distance affect household investment solely through family size). In this section, we consider these three criteria in turn.

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[28] The marginal impacts for household propensity to spend can be calculated as $\frac{\partial E(E_{ij}^* | FamSize_i, Z_{ij})}{\partial FamSize_i} = \beta$, and the marginal impacts for household actual spending can be calculated as $\frac{\partial E(E_{ij} | FamSize_i, Z_{ij})}{\partial FamSize_i} = \beta\Phi(\frac{\alpha+\beta FamSize_i+\gamma Z_{ij}}{\sigma})$ where we also assume $\varepsilon_{ij} \sim N(0, \sigma^2)$ as in the OLS models. See, for example, Greene (2012) for more discussion on the marginal effects with the Tobit model.

Regarding exogeneity, family planning services in Vietnam were offered by a national committee on population and planning, which has usually had its administrative offices or staff down to the commune level like other government agencies to ensure their activities reach the whole population (Goodkind, 1995; Trong, 2012).[29] Family planning centers are thus spread out across the country, and their locations are exogenous to household decision on the number of children they want to have. Furthermore, we use the distance to family planning centers in 2002 to instrument for the impacts of family size on household investments in education four years later, which can help reduce any contemporaneous correlation between the former and the latter. As an additional check, we will also restrict our analysis later to a sample where the family planning centers were established five years back before 2002.[30]

For relevance and exclusion, both our conceptual framework (Section 2) and review of the literature suggest that access to family planning facilities is highly relevant to household decisions on family size, and that access to family planning facilities affects the educational outcomes of interest only through family size. Better access to family planning infrastructure would provide households with less costly options for restricting family size to the desired number of children.

[29] This national committee on population and planning has changed its name over time, but was functioning at the ministry level from 1961 to 2006, and was merged into the Ministry of Health as a General Department in 2007 (Trong, 2012).

[30] An additional concern on the exogeneity of this IV is that families could have migrated, meaning that they were not necessarily constrained by the current distance to family planning center when making their decision on giving birth. However, this concern does not apply in our context: we restrict our analysis to rural families only, and fewer than 3 percent of the total population over five years of age move in/to rural areas in Vietnam between 1994 and 1999 (Dang, Tacoli, and Hoang, 2003). Our tabulation of the 2006 VHLSS also shows that 98 percent of the population register their official residence *(hộ khẩu)* in their current community; Vietnam has a rigid household registration system under which it usually take years for households to change their official registration after moving (see, for example, Hardy (2001), so this finding indicates that few families have moved recently.

Still, in the context of Vietnam, concerns can be raised about whether estimation results using the distance to the nearest family planning center are driven by (unobserved) commune characteristics for which this variable serves as a proxy. One concern, for example, is that communes that are located in a more remote (less developed) area may also be farther away from any family planning center. In such cases, the negative impacts of household sizes on the outcome variables as instrumented by availability of family planning can be caused by the negative correlation between the general development level of the commune and these outcomes (e.g., poorer communes may spend less on their children's tutoring classes).

To address this and other concerns, Table 4 provides a number of different specifications that test for the strength of this instrument (full estimation results are shown in Table 1.1 in the Appendix) sequentially, as different commune characteristics are included in the regressions. Model 1 is the most basic model and includes only the instrument and the regional dummy variables. Model 2 adds to Model 1 the children's characteristics and their household characteristics; Model 3 adds to Model 2 the distances to the nearest primary and secondary schools and includes the variables we use for the subsequent second-stage regressions. Model 4 then adds to Model 3 basic commune characteristics such as distances to the nearest paved road, public transportation, and the post office, which are expected to capture the general economic development of the commune.

Next, to net out any effects that access to community health care has on family size (for example, inadequate health care may reduce family size through high child mortality rates), Model 5 adds to Model 3 the distance to the nearest health facilities. Given the low-technology production techniques typically used in agriculture, rural farming households in Vietnam have had to rely for the most part on manpower for their farm work, giving them

an incentive to have more children. Furthermore, government employees may be subject to a stricter enforcement of the one-to-two children rule than are farming households. Thus, in the IV terminology (see, for example, Angrist and Pischke (2009)), farming households may be the population subgroup that is affected differently by the distance to the family planning center than other population subgroups.

To address this issue, we add to Model 3 a variable indicating the share of the commune population working in agriculture in Model 6. If this addition changes significantly the estimated coefficient on the instrument, this result would suggest that the estimated impact of the distance to the family planning center on family size in Model 3 is influenced by the farming-oriented occupation structure in the commune rather than the costs of family planning. Finally, Model 7 includes all the variables in Models 1 to 6.

The results in Table 4 show that the distance to family planning center has a strongly statistically significant impact on family size, and this impact is positive, as expected.[31] Importantly, except in the case of Model 1 (which is simplistic), the magnitude of the estimated coefficient on the distance to the family planning center is almost identical in all the models at around 0.007, which indicates that a child living 10 kilometers further away from a family planning center would have 0.07 more siblings on average. This consistency suggests both the strong relevance and robustness of this instrument. Since most of the additional variables in Models 4 to 6 are statistically insignificant, to keep our models parsimonious, we will use the variables in Model 3 in subsequent regressions. In a later

[31] The t-statistics for Model 3 are equivalent to an F-statistic of 8.6, which is slightly below the value of 8.96 for a strong IV suggested by Stock and Yogo (2005). Note, however, that Stock and Yogo's critical values rely on the assumption of independently and identically distributed (iid) errors, whereas our F-statistic is obtained from a cluster-robust regression that is robust to heteroskedastic errors. Without this cluster-robust option, the F-statistic for Model 3 is much higher at 22.6.

section on robustness analysis, we explore different specifications to further assess the validity of this instrument.

6. Estimation Results

6.1. Uninstrumented results on quantity and quality

Table 5 provides estimation results for equation (1) as first-cut test of the quantity-quality hypothesis with the marginal effects for the Tobit regressions provided in Table 1.2 in the Appendix. We control for several child, family, and community characteristics, as well as regional and urban dummies.

In each of these regressions, the coefficient on number of siblings is negative and highly statistically significant. These results are consistent with the quantity-quality tradeoff story: families that are raising fewer children invest more in the education of each child, even controlling for income and parental education. Controlling for other characteristics, each additional sibling is associated with a 0.1 standard deviation reduction (=66,390/745,710) reduction either in the expenditure on a child's education or in expenditures on his or her tutoring (=24,498/ 465,350; Appendix Table 1.2), a decrease of 0.04 (or 4 percentage points) in his or her probability of being enrolled in tutoring, and a drop of 0.09 in the child's enrollment and tutoring index or tutoring attendance frequency. Each additional sibling is also associated with the child losing a quarter of a year of schooling, and with the child spending 46 fewer hours and 0.23 fewer years on tutoring.

6.2. IV estimates

The uninstrumented regression results in Table 5 provide evidence only for a correlational, not causal, relationship between family size and households' investment in their children's education. While these uninstrumented results are useful for a first look, they

are biased given the endogeneity of family size. If some parents decide to choose fewer children and greater investment in each child, a smaller family size would be strongly correlated with unobserved parental devotion to their children, thus biasing estimates upward; however, the opposite holds if parents decide to choose both more children and greater investment in them at the same time. More generally, the mismeasured relationship between family size and household investment in uninstrumented regressions would mask the true relative price of quantity over quality depicted in Figure 1 and would provide biased estimates. The direction of bias appears to be an empirical issue, which is indicated by our review of previous studies discussed earlier.

The instrumented regressions shown in Table 6 indicate that a quantity-quality tradeoff exists in Vietnam: all of the instrumented estimated coefficients on family size have the same sign (i.e., negative) as the uninstrumented coefficients but have much larger absolute magnitude. (For the marginal effects for the Tobit regressions, see Table 1.2 in the Appendix.) In some cases, the instrumented coefficients on number of siblings are from four (enrollment and tutoring attendance index) to seven times (tutoring expenditure or attendance) as large as their uninstrumented counterparts, and the instrumented coefficients are statistically significant in the case of six of the nine dependent variables.

Controlling for other characteristics, each additional sibling is now shown to result in much larger reductions in the investments in a child's schooling: reductions in education expenditure and tutoring expenditure respectively by 0.4 standard deviations (or equivalently, a reduction of D 308,246) and 0.5 standard deviations (or a reduction of D 211,087, Appendix Table 1.2); a decrease of 32 percentage points in his or her probability of being enrolled in tutoring; and a drop of 0.34 in the child's enrollment and tutoring index or tutoring attendance frequency. One more sibling also leads to the child spending 74 fewer

hours and 1.4 fewer years on tutoring, although the estimated coefficient on tutoring hours is no longer statistically significant.

Estimation results also indicate that, ceteris paribus, older children are less likely to enroll in school but more likely to attend tutoring, while boys are less likely either to enroll in school or attend tutoring.[32] Children that are farther from the last grade in their current school level are, as expected, less likely to have tutoring, but the coefficient on this variable is mostly statistically insignificant except in the case of tutoring hours. Older mothers and richer households invest more in their children's tutoring, but the quadratic term on mothers' age is negative, indicating that the marginal effect of age declines and eventually turns negative.

6.3. Robustness checks

Is it possible that results using the distance to the nearest family planning center in fact are driven by unobserved characteristics about the commune that this distance proxies for? For example, communes that are located in a more remote (less developed) area may also be farther away from any family planning center. In such cases, the negative impact of household size on the outcome variables, as instrumented by availability of family planning, could be caused by the negative correlation between the general development level of the commune and these outcomes (e.g., poorer communes may spend less on their children's tutoring classes).

[32] If the distance to family center can also be used as the instrument for the number of male or female siblings, we could consider the number of brothers and sisters age 0-18 separately instead of family size. However, this instrument is statistically significant only in the first-stage regressions for the number of brothers, with qualitatively similar second-stage estimation results (not shown). While this result may indicate a degree of son preference in Vietnam, and it is consistent with previous studies (see, e.g., Phai et al., 1996; Belanger, 2002), it may also suggest sex-selective abortion at the same time. Deeper analysis for intra-household gender differences would require better (and more than one) instruments than currently available. Thus we leave this to further research.

To test this possibility, we include as control variables in the equation of interest some commune-level variables such as commune infrastructure (row 1, Table 7) and the distance to health facilities (row 2). To address the concern that rural farming households may have had the incentive to have more children because of land allocation rules in the past, we also include the share of the commune population working in agriculture (row 3) separately, and then also together with the commune infrastructure and distance to health facilities variables (row 4). Since our estimation sample is restricted to rural households, to examine the hypothesis—albeit in an indirect way—that urban households spend more on tutoring, we also include the distance from the commune to the nearest major city in Vietnam (row 5).[33] However, estimation results are qualitatively similar for all specifications, except for the model specification with all the commune infrastructure and distances variables (row 4). That specification has weaker statistical significance, perhaps unsurprisingly: the model is over-fitted, with all the distance variables statistically insignificant in both the first-stage regressions (as shown in Table 1.1) and second-stage regressions (not shown).

Our previous study (Dang, 2007) shows that communes with higher levels of education spend more on tutoring and argues that this impact can come from both the demand side (e.g., children have peer pressure to study harder or beneficial interaction with well-educated adults) and the supply side (e.g., communities with higher educational levels may be able to supply more tutors). To check whether the levels of commune education can affect our results, we include in our equation of interest the share of the commune adult population with upper secondary education or higher (row 6). As a further check, using the primary school census (DFA) database, we calculate the commune-averaged shares of teachers with

[33] These cities are Hanoi and Haiphong in northern Vietnam, Danang in central Vietnam, and Cantho and Ho Chi Minh in southern Vietnam. We also experiment with using the distance to the provincial city instead of the distance to these major cities and have similar, albeit slightly statistically weaker, results.

upper secondary education, upper secondary education plus two more years of additional training, two-year teacher training college education, four-year teacher training college education, and student-teacher ratios. These variables are expected to capture teacher and school quality in the commune (row 7). Again, the estimation results are similar to those in our base specification.

While we have reduced some contemporaneous correlation between the distance to family planning center and household investment in their children by using values for the former in 2002 and the latter in 2006 in our regressions, this gap of four years may not be enough, given that household only make their investment when children are 6 years old or more. Thus, if the family planning center was built in 2002, it may have had little impact on parents' decision to give birth to the children that are at least 6 years old in 2006; the impact in this case comes through the household decision on the number of younger siblings for these children. To examine the impacts of family planning center on total family size, in row 8 we restrict our estimation sample to the cases where the family planning center had been in operation for five years or more by 2002, which reduces the estimation sample by more than half.[34] Our results are for the most part qualitatively similar, except that the effects on education and tutoring expenditure now lose their statistical significance (though they keep their negative signs), while the effects on hours and years spent on tutoring become even more statistically significant.

For communes without a family planning center, commune officials report to the best of their knowledge the distance to the nearest center. This could result in measurement errors, especially for communes that are far away from any such center. To address this bias, we

[34] The distances to school variables are not significant in this specifications, thus we left them out for larger sample sizes and more accurate estimates.

drop the highest 5 percent of the distance to family planning center. Again, there are some changes within a broadly similar pattern of estimation results (row 9): the effects on education expenditure become statistically insignificant and the effects on tutoring and enrollment and tutoring attendance variables are now significant only at 10 percent; but on the other hand, the effects on completed years of schooling and tutoring hours become statistically significant, with a 5 percent significance level for tutoring hours.

6.4. Further/ heterogeneity analysis

Different definitions of family size

Estimation results thus far support the negative relationship between family size and household investment in their children's education, in particular tutoring classes. But could our estimation results be sensitive to how we define family size? We provide further analysis based on different definitions of family size in Table 8. First, we restrict the number of siblings to not more than three (in row 1), to test whether the main result is driven by unusually large family sizes. Second, we extend the definition of family size from the children born of the same mother to all the children living in an extended family (row 2), who can include cousins or distant relatives. While the former definition is more common, the latter definition would perhaps be more consistent with an altruistic model in which resources are shared within the extended family (see, for example, Alger and Weibull, 2010, and Winkelmann, 2011). An altruistic model may be an equally valid model in the context of Vietnam, where Confucian culture remains strong (Huu Ngoc, 1996; Tran, 2001). Third, we restrict the number of siblings to age 6-18 only (row 3), hypothesizing that the quantity-quality tradeoff will be stronger in the case of children with school-age siblings, because households have to invest more in school-age children than in younger ones.

Our estimation results remain similar. In fact, estimates are both larger in magnitude and have slightly stronger statistical significance when we use the more general definition of family size (row 2) and restrict the analysis to school-age siblings (row 3).

Birth order

Beyond the impacts of family size, the birth order of a child can also influence his or her parents' resource allocation (see, for example, Steelman et al., 2002, for a review). Previous studies suggest that birth-order effects may come through several different channels, including household resources constraints (or allocation), biological factors, and cultural factors. Moreover, these effects are not necessarily uni-directional but can be in opposite directions. For example, first-born children may enjoy more parental time and investment due to their unique timing position compared to their younger siblings—a hypothesis that is supported by recent evidence for the US (Conley and Glauber, 2006; Price, 2008; de Haan, 2010)—but if parents' earnings increase over the life cycle, the younger siblings may benefit more (Parish and Willis, 1993).[35] Similarly, while older children may come when their mothers are younger and healthier (Behrman, 1988), younger children may also be at an advantage because of their mothers' accumulated experience in child-rearing.

Since birth order is closely related with family size (e.g., a child in a higher birth order is more likely to be in a larger family), we follow Ejrnaes and Portner (2004) and construct a birth-order index that is purged of any family-size effect. This index is simply $\frac{p-1}{n-1}$, where p is the child's birth order, and n the total number of children in the family. The Pearson correlation coefficient with family size decreases from 0.52 for birth order to 0.16 with this index, which indicates that family size effect is considerably netted out. We add this birth-

[35] A recent study for Turkey by Dayioglu, Kirdar, and Tansel (2009) also find that middle-born children fare worse in term of school enrollment than their earlier- and later-born siblings.

order index to our equation of interest (row 4) and find that coefficients become larger (in absolute value) but somewhat statistically weaker, with the birth-order index being marginally statistically significant at the 10 percent level in the three outcomes related to tutoring attendance. However, note that we do not have census data, and thus the birth order we have is for those children that are currently living in the household, and the Ejrnaes and Portner birth order index effectively rules out households with only children. To address this latter concern, we then construct another birth order index suggested by Booth and Kee (2009), which is defined as p/((n+1)/2), but find very similar results for this new index.[36]

School quality

We turn next to the role of school quality in influencing parents to send their children to tutoring lessons. As discussed above, only a small proportion of households in Vietnam cite poor school quality as the reason for enrolling their children in tutoring classes, but other studies suggest that inadequate schooling quality may be one of the main drivers of tutoring investment in other countries (Kim and Lee, 2010; Bray and Lykins, 2012). If this is true, we may find that children enrolled in high-quality schools do not attend tutoring classes as much as their less fortunate peers, and the negative impacts of family size may possibly not hold for this group of children. To examine this hypothesis, we restrict our estimation sample to children going to schools perceived by their parents as being of high quality, and we find estimation results for tutoring outcomes to be very similar, except that the impact of household size on education expenditure now loses its statistical significance (row 5).

Interestingly, the coefficient on completed years of schooling becomes strongly statistically significant (after being insignificant in all other specifications) for this subset of

[36] Certain cultures, especially in Asia, may prefer sons over daughters, thus older sons may imaginably be more favored than their younger female siblings. We also try interacting this birth-order index with the male variable but this interaction variable is not significant either.

the parent population. While too much should not be read into this single specification, it may indicate that these parents are those who are most interested in their children's education and thus are likely to be most aware of their decisions related to the tradeoff between the quantity and quality of their children.

Local Average Treatment Effects (LATE)

Since IV estimates may refer to the unobserved subset of the population that reacts to distance to the family planning center—which is known as the LATE (see, for example, Imbens and Angrist, 1994; Angrist and Pischke, 2009)—one concern arises that our previous estimation results may apply only to these households, which may comprise a small share of the total. However, various estimation results presented in this paper indicate that a substantial share of the population appears to be influenced by this IV. For example, distance to the family planning center remains statistically significant and has similar estimated coefficients even when the first-stage regressions control for various commune characteristics, including infrastructure and occupation (Table 1.1 in the Appendix). The IV impacts of family size on different outcomes remain similar (and are even stronger for certain outcomes) in the case of households with larger extended families (row 2, Table 8), households that perceive their children's school as being of good quality (row 5, Table 8), and those that are better-off (that is, that belong to the richest three consumption quintiles—results not shown). A conservative estimate shows that together, these groups of households make up half or more of our estimation sample.

Outcomes for younger cohorts in 2008

Even if the quantity-quality tradeoff exists, it will not necessarily remain the same for different cohorts over time. Recent studies find that this tradeoff holds for younger but not

older cohorts in Norway (Black, Devereux, and Salvanes, 2010), turns from positive to no effect and then negative during the 1977-2009 period in Brazil (Marteleto and de Souza, 2012), and changes from positive for older cohorts to negative for younger cohorts in urban areas in Indonesia (Maralani, 2008).

To investigate whether the same quantity-quality tradeoff applies to younger cohorts in the same age range (6-18) in Vietnam, we rerun the same regressions on available indicators in the 2008 round of the VHLSS.[37] While the 2008 data collect fewer variables on tutoring and include information only on tutoring expenditures, our estimation results on the available indicators provide broadly qualitatively similar results (row 6), except that the effect on education expenditure is no longer statistically significant, while the effect on enrollment is statistically significant at the 10 percent level, and the effect on tutoring expenditure becomes stronger both in magnitude and statistical significance.

6.5. Other tutoring-related measures

The regressions in Tables 6 through 8 consider absolute measures of household investment in tutoring only. An alternative is to focus on relative expenditures on tutoring, through scaling tutoring investment by more traditional measures of education investment, such as household education expenditure or children's completed years of schooling. If household investment in tutoring is more sensitive to changes in family size than are other traditional measures, this would both strengthen the case of using tutoring as a new measure of household investment and would strengthen the robustness of our results. Table 9 tests this by estimating the impacts of family size on two share variables: tutoring expenditure over total education expenditure, and years of tutoring over completed years of schooling.

[37] As in a previous regression in Table 7, because the distances to school variables are not significant in this specification, we left them out to allow larger sample sizes and greater precision of estimates.

The estimated coefficients are negative and statistically significant at the 10 percent and 5 percent levels, respectively, and indicate that one more sibling results in a decrease of 8 percentage points and 20 percentage points, respectively, in the two share variables.

7. Conclusion

Using the distance to family planning center as the instrument to identify the impacts of family size on household investment, we find that families invest less in the education of school-age children who have larger numbers of siblings. The instrumented number of siblings has a strongly negative effect on education investment, and the estimated coefficient is much larger (in absolute value) than in the original uninstrumented regressions. This effect is robust across different indicators of educational investment—including the child's general education expenditure, frequency of tutoring attendance, and expenditure and hours spent on tutoring—as well as with different specifications and definitions of family size.

Our results provide evidence for the quality-quantity tradeoff in the context of Vietnam, and suggest that the availability of family planning services has increased investment in education, by lowering the relative cost of child quality and encouraging families to invest in quality. If we can hypothesize that the traditional measures of school enrollment and even completed years of schooling as indicative of household investment in quantity of education, our results suggest that household investment in tutoring can be used as new and possibly more illuminating measures of parents' willingness to invest in the quality of education of their children. Indeed, the hypothesized quantity-quality tradeoff appears much more strongly in the tutoring-based measures than in the simple enrollment decision, which may be a coarser indicator of the household's desire to invest in human capital. These results suggest the need for more research into these quality-oriented measures of schooling

investment, with a view to providing better empirical evidence on the quantity-quality tradeoff in other settings.

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Table 1: Reasons for attending private tutoring classes for students age 9-20 (percent), Vietnam 2007

	Tutoring organized by school	Tutoring not organized by school
Prepare for examinations	47.2	41.7
Do not catch up with the class	12.9	14.4
Acquire skills for future employment	12.2	12.7
Like this subject	6.4	11.3
Parents too busy to take care	2.7	1.6
Poor quality lessons in school	2.7	6.0
Subjects not taught in mainstream classes	0.5	1.5
Others	15.4	10.9
Total	100	100
N	376	301
Source: Vietnam Household and Tutoring Survey 2007- 2008.		

Table 2: Household expenditure on private tutoring classes by consumption quintiles, Vietnam 2006

	Poorest	Quintile 2	Quintile 3	Quintile 4	Richest	All Vietnam
Average household expenditure on tutoring in 2006 (D '000)	54.2	126.4	222.8	325.0	814.3	321.3
Distribution of household with exp. on private tutoring as percent of total expenditure in 2006						
0%	78.8	61.8	55.1	56.3	52.6	60.4
1% - 5%	20.0	36.4	41.6	38.7	38.9	35.6
5% - 10%	1.0*	1.5*	3.0	4.4	7.0	3.5
10% or higher	0.1*	0.3*	0.2*	0.6*	1.6*	0.6
Total	100	100	100	100	100	100
No. of households	1,278	1,269	1,263	1,290	1,198	6,298
Note: * fewer than 20 observations.						
Source: VHLSS 2006.						

Table 3: Summary statistics for children age 6-18, Vietnam 2006

Variable	Obs	Mean	Std. Dev.	Min	Max
Enrolment in past 12 months	5012	0.87	0.33	0	1
Total education expenditure in past 12 months (D'000)	4248	583.83	745.71	0	20165
Completed years of schooling	5012	5.80	3.25	0	12
Private tutoring attendance in past 12 months	4125	0.42	0.49	0	1
Enrolment and private tutoring attendance in past 12 months (0= not enrolled in school, 1= enrolled in school but have no tutoring, 2= enrolled in school and have tutoring)	5012	1.22	0.65	0	2
Expenditure on private tutoring in past 12 months (D'000)	4125	104.15	465.35	0	18000
Expenditure on private tutoring in past 12 months for those attending private tutoring (D'000)	1614	246.59	691.19	6	18000
Number of hours spent on private tutoring in past 12 months	4247	89.06	158.71	0	1728
Number of hours spent on private tutoring in past 12 months for those attending private tutoring	1624	215.43	183.61	2	1728
Tutoring attendance frequency (0= no tutoring, 1= tutoring either during school year or holidays/ break, 2= tutoring during both school year and holidays/ break)	4248	0.65	0.77	0	2
Years attending private tutoring to date	4248	1.90	2.58	0	13
Number of siblings age 0-18	4248	1.58	1.04	0	7
Distance to family planning center	4248	8.56	9.78	0	80.5
Age	4248	11.90	3.20	6	18
Male	4248	0.50	0.50	0	1
Years before last grade in current school level	4248	1.67	1.23	0	4
Secondary school	4248	0.58	0.49	0	1
Mother age	4248	37.38	6.00	21	68
Female-headed household	4248	0.12	0.32	0	1
Head's years of schooling	4248	7.36	3.39	0	16
Ethnic majority group	4248	0.83	0.37	0	1
Total household expenditures	4248	19222	10209	2145	175393
Distance to primary school	4248	0.82	1.25	0	10
Distance to secondary school	4248	2.78	2.81	0	25
North East and West region	4248	0.16	0.37	0	1
North Central region	4248	0.19	0.39	0	1
South Central region	4248	0.09	0.29	0	1
Central Highlands region	4248	0.06	0.24	0	1
South East region	4248	0.09	0.29	0	1
Mekong River Delta region	4248	0.16	0.37	0	1
Note: All numbers are weighted using population weights.					

Table 4: Impacts of distance to family planning center on number of siblings age 6-18, Vietnam 2006 (first-stage regressions)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Distance to family planning center	0.009***	0.007***	0.007***	0.007***	0.007***	0.006***	0.006***
	(3.60)	(2.95)	(2.87)	(2.85)	(2.86)	(2.58)	(2.61)
Additional control variables							
Regional dummy variables	Y	Y	Y	Y	Y	Y	Y
Individual & household characteristics		Y	Y	Y	Y	Y	Y
Distances to school			Y				Y
Community infrastructure				Y			Y
Distance to health facilities					Y		Y
Share of commune population working in agriculture						Y	Y
R2	0.12	0.25	0.23	0.23	0.23	0.23	0.24
N	6309	5413	4248	4178	4294	4294	4168

Note 1. *p< .1, **p<0.05, ***p<0.01; robust t statistics in parentheses account for clustering at the household level.

Table 5: Impacts of family size on educational investment for children age 6-18, Vietnam 2006 (uninstrumented regressions)

	Enrolment	Total education expenditure	Completed years of schooling	Tutoring attendance	Enrolment & Tutoring attendance	Tutoring attendance frequency	Tutoring expenditure	Tutoring hours	Years attending tutoring
Number of siblings age 0-18	-0.038***	-66.390***	-0.240***	-0.043***	-0.085***	-0.083***	-79.516***	-46.051***	-0.233***
	(-6.50)	(-8.06)	(-7.60)	(-5.21)	(-7.91)	(-7.18)	(-3.66)	(-5.58)	(-6.19)
Age	-0.032***	119.922***	0.786***	0.012***	-0.023***	0.021***	31.626***	10.422***	0.257***
	(-17.39)	(14.60)	(82.50)	(3.06)	(-7.41)	(3.57)	(5.10)	(3.60)	(11.83)
Male	-0.031***	-38.017**	-0.165***	-0.034***	-0.072***	-0.059***	-72.360**	-28.680***	-0.132**
	(-3.57)	(-2.22)	(-3.86)	(-2.63)	(-4.48)	(-3.01)	(-2.28)	(-2.69)	(-2.19)
Years before last grade in current		38.866***		-0.012**		-0.034***	-18.502	-16.689***	-0.047*
school level		(5.84)		(-2.06)		(-3.63)	(-1.37)	(-3.46)	(-1.75)
Secondary school		-333.080***		0.047**		0.105***	9.545	10.907	-0.054
		(-7.48)		(2.12)		(3.28)	(0.25)	(0.70)	(-0.50)
Mother age	0.036***	-2.187	0.216***	0.014	0.062***	0.003	28.197	3.608	0.008
	(4.81)	(-0.16)	(4.86)	(1.30)	(4.71)	(0.21)	(1.48)	(0.37)	(0.16)
Mother age squared	-0.000***	0.012	-0.003***	-0.000	-0.001***	-0.000	-0.368	-0.040	-0.000
	(-4.85)	(0.06)	(-4.72)	(-1.33)	(-4.80)	(-0.41)	(-1.55)	(-0.34)	(-0.36)
Female-headed household	-0.027*	66.364**	-0.022	0.051**	0.007	0.069*	77.676**	21.155	0.257**
	(-1.77)	(2.44)	(-0.27)	(2.04)	(0.23)	(1.84)	(2.30)	(1.17)	(2.04)
Head's years of schooling	0.011***	19.404***	0.086***	0.011***	0.024***	0.024***	20.155***	9.391***	0.059***
	(6.77)	(5.82)	(9.66)	(3.89)	(7.41)	(5.67)	(2.62)	(4.12)	(4.53)
Ethnic majority group	0.023	151.817***	0.332***	0.187***	0.175***	0.239***	359.761***	177.675***	0.639***
	(1.43)	(5.93)	(3.87)	(7.39)	(6.16)	(7.36)	(3.31)	(6.72)	(5.46)
Total household expenditures	0.000***	0.014***	0.000***	0.000***	0.000***	0.000***	0.012**	0.003***	0.000***
	(6.40)	(4.25)	(5.57)	(4.75)	(6.96)	(5.50)	(2.31)	(3.97)	(4.49)
Distance to primary school	0.003	-0.958	0.048**	0.003	0.004	-0.005	11.253	6.047	-0.005
	(0.62)	(-0.14)	(2.25)	(0.55)	(0.54)	(-0.64)	(1.10)	(1.14)	(-0.18)
Distance to secondary school	-0.002	-3.888	-0.030**	-0.003	-0.005	-0.006	-10.135	-4.647*	-0.034***
	(-0.80)	(-1.04)	(-2.58)	(-0.99)	(-1.64)	(-1.57)	(-1.61)	(-1.86)	(-2.96)
Constant	0.541***	-1016.257***	-8.426***	0.034	0.319	0.418	-1448.037***	-282.743	-0.448
	(3.92)	(-3.82)	(-10.46)	(0.16)	(1.30)	(1.35)	(-2.64)	(-1.49)	(-0.44)
Model	OLS	OLS	OLS	OLS	OLS	OLS	Tobit	Tobit	OLS
(Pseudo) R2	0.18	0.31	0.79	0.29	0.23	0.30	0.04	0.05	0.37
Log likelihood	-1102	-31774	-9129	-2191	-4235	-4099	-13455	-12542	-8966
N	5012	4125	5012	4125	5012	4248	4125	4247	4248
Number of left-censored obs.							2511	2623	

Note 1. *p< .1, **p<0.05, ***p<0.01; robust t statistics in parentheses account for clustering at the household level.

2. All regressions control for regional dummy variables.

3. Total household expenditure is net of education expenditure and tutoring expenditure respectively for the regressions for these outcomes.

Table 6: Impacts of family size on educational investment for children age 6-18, Vietnam 2006 (instrumented regressions)

	Enrolment	Total education expenditure	Completed years of schooling	Tutoring attendance	Enrolment & Tutoring attendance	Tutoring attendance frequency	Tutoring expenditure	Tutoring hours	Years attending tutoring
Number of siblings age 0-18	-0.072	-308.246**	-0.589	-0.318**	-0.337**	-0.488**	-573.957*	-188.425	-1.424**
	(-1.04)	(-2.02)	(-1.50)	(-2.17)	(-2.27)	(-2.45)	(-1.94)	(-1.51)	(-2.34)
Age	-0.033***	118.354***	0.783***	0.010**	-0.026***	0.017**	28.066***	9.061***	0.245***
	(-16.42)	(13.76)	(75.24)	(1.98)	(-7.10)	(2.32)	(3.38)	(2.61)	(9.88)
Male	-0.038**	-83.508***	-0.236***	-0.085***	-0.124***	-0.138***	-166.057**	-56.664**	-0.365***
	(-2.27)	(-2.64)	(-2.62)	(-2.75)	(-3.57)	(-3.10)	(-2.38)	(-2.10)	(-2.61)
Years before last grade in current school level		44.779***		-0.006		-0.023*	-6.165	-12.973**	-0.016
		(5.06)		(-0.71)		(-1.83)	(-0.39)	(-2.12)	(-0.44)
Secondary school		-358.526***		0.018		0.063	-41.929	-3.793	-0.176
		(-7.30)		(0.61)		(1.48)	(-0.81)	(-0.18)	(-1.28)
Mother age	0.048**	83.564	0.334**	0.111**	0.148***	0.148**	203.311*	54.731	0.433*
	(1.97)	(1.50)	(2.39)	(2.10)	(2.89)	(2.05)	(1.89)	(1.20)	(1.95)
Mother age squared	-0.001**	-1.063	-0.004**	-0.001**	-0.002***	-0.002**	-2.563*	-0.680	-0.006**
	(-2.01)	(-1.52)	(-2.39)	(-2.11)	(-2.91)	(-2.09)	(-1.90)	(-1.19)	(-1.99)
Female-headed household	-0.038	-17.588	-0.137	-0.044	-0.076	-0.069	-91.760	-27.225	-0.150
	(-1.43)	(-0.29)	(-0.91)	(-0.73)	(-1.23)	(-0.83)	(-0.84)	(-0.57)	(-0.58)
Head's years of schooling	0.009*	5.200	0.062**	-0.006	0.007	-0.000	-9.533	0.974	-0.012
	(1.75)	(0.53)	(2.25)	(-0.66)	(0.67)	(-0.04)	(-0.55)	(0.13)	(-0.32)
Ethnic majority group	0.010	68.578	0.200	0.091	0.080	0.096	189.625	127.766**	0.218
	(0.33)	(1.15)	(1.20)	(1.45)	(1.17)	(1.12)	(1.40)	(2.42)	(0.80)
Total household expenditures	0.000***	0.016***	0.000***	0.000***	0.000***	0.000***	0.017**	0.004***	0.000***
	(4.05)	(4.65)	(4.05)	(3.76)	(5.04)	(4.33)	(2.52)	(2.74)	(3.94)
Distance to primary school	0.003	6.485	0.055**	0.012	0.009	0.006	26.266	9.945	0.028
	(0.73)	(0.62)	(2.15)	(1.22)	(0.88)	(0.45)	(1.51)	(1.44)	(0.66)
Distance to secondary school	-0.002	-4.156	-0.031**	-0.003	-0.005	-0.006	-10.533	-4.657*	-0.035**
	(-0.81)	(-0.95)	(-2.52)	(-0.80)	(-1.35)	(-1.14)	(-1.39)	(-1.69)	(-2.17)
Constant	0.396	-2134.169***	-9.903***	-1.221*	-0.745	-1.465	-3736.470**	-950.852	-5.988**
	(1.26)	(-2.85)	(-5.38)	(-1.72)	(-1.12)	(-1.50)	(-2.38)	(-1.55)	(-1.97)
Model	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	IV-Tobit	IV-Tobit	2SLS
F/ Chi2 test	32.49	46.85	862.88	44.50	46.67	47.28	40.31	501.57	50.25
Log likelihood							-19019	-18262	
N	5012	4125	5012	4125	5012	4248	4125	4247	4248
Number of left-censored obs.							2511	2623	

Note 1. *p< .1, **p<0.05, ***p<0.01; robust t statistics in parentheses account for clustering at the household level.

2. All regressions control for regional dummy variables.

3. Total household expenditure is net of education expenditure and tutoring expenditure respectively for the regressions for these outcomes.

Table 7: Robustness checks (instrumented regressions)

No		Enrolment	Total education expenditure	Completed years of schooling	Tutoring attendance	Enrolment & Tutoring attendance	Tutoring attendance frequency	Tutoring expenditure	Tutoring hours	Years attending tutoring
1	Commune infrastructure added	-0.027	-269.941*	-0.356	-0.259*	-0.235*	-0.417**	-448.894*	-115.710	-1.241**
		(-0.40)	(-1.85)	(-1.01)	(-1.93)	(-1.80)	(-2.25)	(-1.71)	(-1.00)	(-2.14)
	N	4914	4048	4914	4051	4914	4171	4051	4170	4171
2	Distance to health facilities added	-0.072	-304.337**	-0.587	-0.310**	-0.331**	-0.490**	-561.864*	-187.625	-1.451**
		(-1.05)	(-2.00)	(-1.51)	(-2.16)	(-2.26)	(-2.48)	(-1.94)	(-1.52)	(-2.38)
	N	5015	4125	5015	4128	5015	4251	4128	4250	4251
3	Share of commune population working in agriculture added	-0.076	-275.085*	-0.608	-0.317**	-0.339**	-0.502**	-555.206*	-194.495	-1.474**
		(-1.05)	(-1.76)	(-1.48)	(-2.00)	(-2.18)	(-2.29)	(-1.78)	(-1.44)	(-2.20)
	N	5015	4125	5015	4128	5015	4251	4128	4250	4251
4	Community infrastructure & distance to health facilities & share of commune population working in agriculture added	-0.026	-237.802	-0.370	-0.256*	-0.232*	-0.417**	-426.885	-110.868	-1.266**
		(-0.38)	(-1.61)	(-1.01)	(-1.78)	(-1.71)	(-2.08)	(-1.56)	(-0.90)	(-2.01)
	N	4914	4048	4914	4051	4914	4171	4051	4170	4171
5	Distance to major cities added	-0.015	-300.939**	-0.193	-0.302**	-0.269*	-0.533**	-335.899*	-191.139	-1.640**
		(-0.20)	(-1.98)	(-0.52)	(-1.97)	(-1.83)	(-2.40)	(-1.86)	(-1.54)	(-2.35)
	N	4416	3642	4416	3643	4416	3761	3643	3760	3761
6	Share of commune adult population with upper secondary education or higher added	-0.071	-320.893*	-0.563	-0.329**	-0.340**	-0.510**	-600.891*	-198.691	-1.472**
		(-0.94)	(-1.88)	(-1.33)	(-2.02)	(-2.10)	(-2.30)	(-1.84)	(-1.45)	(-2.20)
	N	5015	4125	5015	4128	5015	4251	4128	4250	4251
7	Commune-averaged teacher quality and student teacher ratio added	-0.075	-293.820*	-0.545	-0.292*	-0.332**	-0.486**	-517.767*	-155.886	-1.471**
		(-0.99)	(-1.73)	(-1.31)	(-1.89)	(-2.07)	(-2.22)	(-1.74)	(-1.18)	(-2.15)
	N	4993	4106	4993	4109	4993	4232	4109	4231	4232
8	Family planning center in operation for 5 years or more	-0.079	-154.852	-0.251	-0.220**	-0.282**	-0.435**	-445.706	-282.800**	-1.889***
		(-1.33)	(-0.83)	(-0.82)	(-2.09)	(-2.40)	(-2.51)	(-1.55)	(-2.28)	(-2.80)
	N	2343	1439	2343	1925	2343	1990	1925	1989	1990
9	Distance to family planning center less than or equal to 30 km	-0.059	-258.032	-0.834*	-0.351*	-0.330*	-0.722**	-541.113*	-367.771**	-2.132**
		(-0.74)	(-1.23)	(-1.67)	(-1.78)	(-1.89)	(-2.08)	(-1.80)	(-2.07)	(-2.08)
	N	4798	3954	4798	3957	4798	4079	3957	4078	4079
	Model	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	IV-Tobit	IV-Tobit	2SLS
Note	1. *p< .1, **p<0.05, ***p<0.01; robust t statistics in parentheses account for clustering at the household level.									
	2. Each cell provides estimates from a seperation regression that controls for the explanatory variables in Table 6 and regional dummy variables.									
	3. Total household expenditure is net of education expenditure and tutoring expenditure respectively for the regressions for these outcomes.									

Table 8: Further/heterogeneity analysis (instrumented regressions)

No		Enrolment	Total education expenditure	Completed years of schooling	Tutoring attendance	Enrolment & Tutoring attendance	Tutoring attendance frequency	Tutoring expenditure	Tutoring hours	Years attending tutoring
	Various definitions for family size									
1	Number of siblings age 0-18 less than or equal to 3	-0.110	-520.659	-1.001	-0.630*	-0.609**	-0.876**	-1158.703*	-321.754	-2.450*
		(-0.89)	(-1.63)	(-1.33)	(-1.88)	(-2.03)	(-2.05)	(-1.75)	(-1.43)	(-1.92)
	N	4750	3934	4750	3937	4750	4054	3937	4053	4054
2	Number of siblings age 0-18, relaxed definition	-0.136	-436.722**	-0.745	-0.474**	-0.541**	-0.767**	-902.347**	-347.998**	-2.283**
		(-1.37)	(-1.96)	(-1.41)	(-2.13)	(-2.15)	(-2.33)	(-2.03)	(-1.96)	(-2.28)
	N	7000	5540	7000	5550	7000	5704	5550	5703	5704
3	Number of siblings age 6-18	-0.115	-457.807*	-0.914	-0.461**	-0.523**	-0.729**	-846.219*	-283.496	-2.132**
		(-1.04)	(-1.89)	(-1.41)	(-2.08)	(-2.06)	(-2.27)	(-1.91)	(-1.54)	(-2.22)
	N	5015	4125	5015	4128	5015	4251	4128	4250	4251
	Birth order									
4	Birth order index added	-0.014	-386.459	-0.074	-0.475**	-0.458*	-0.738**	-1031.285*	-266.253	-1.644*
		(-0.11)	(-1.58)	(-0.12)	(-2.02)	(-1.75)	(-2.07)	(-1.84)	(-1.29)	(-1.72)
	N	3702	3139	3702	3140	3702	3241	3140	3240	3241
	School quality									
5	School considered to have good or excellent quality by parents	N/A	-177.341	-0.790**	-0.306*	-0.288**	-0.565**	-602.280*	-150.720	-1.293**
			(-1.17)	(-2.38)	(-1.94)	(-1.97)	(-2.34)	(-1.85)	(-1.23)	(-1.97)
	N		2149	2215	2150	2215	2215	2150	2214	2215
	Outcomes in 2008									
6	All outcome variables in 2008	-0.215*	-413.753	-0.073	-0.519*	-0.576**	N/A	-1222.416**	N/A	N/A
		(-1.90)	(-1.13)	(-0.15)	(-1.91)	(-2.28)		(-2.10)		
	N	6030	4678	6030	4678	6030		4678		
	Model	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	IV-Tobit	IV-Tobit	2SLS
Note	1. *p< .1, **p<0.05, ***p<0.01; robust t statistics in parentheses account for clustering at the household level.									
	2. Each cell provides estimates from a seperation regression that controls for the explanatory variables in Table 6 and regional dummy variables.									
	3. Total household expenditure is net of education expenditure and tutoring expenditure respectively for the regressions for these outcomes.									

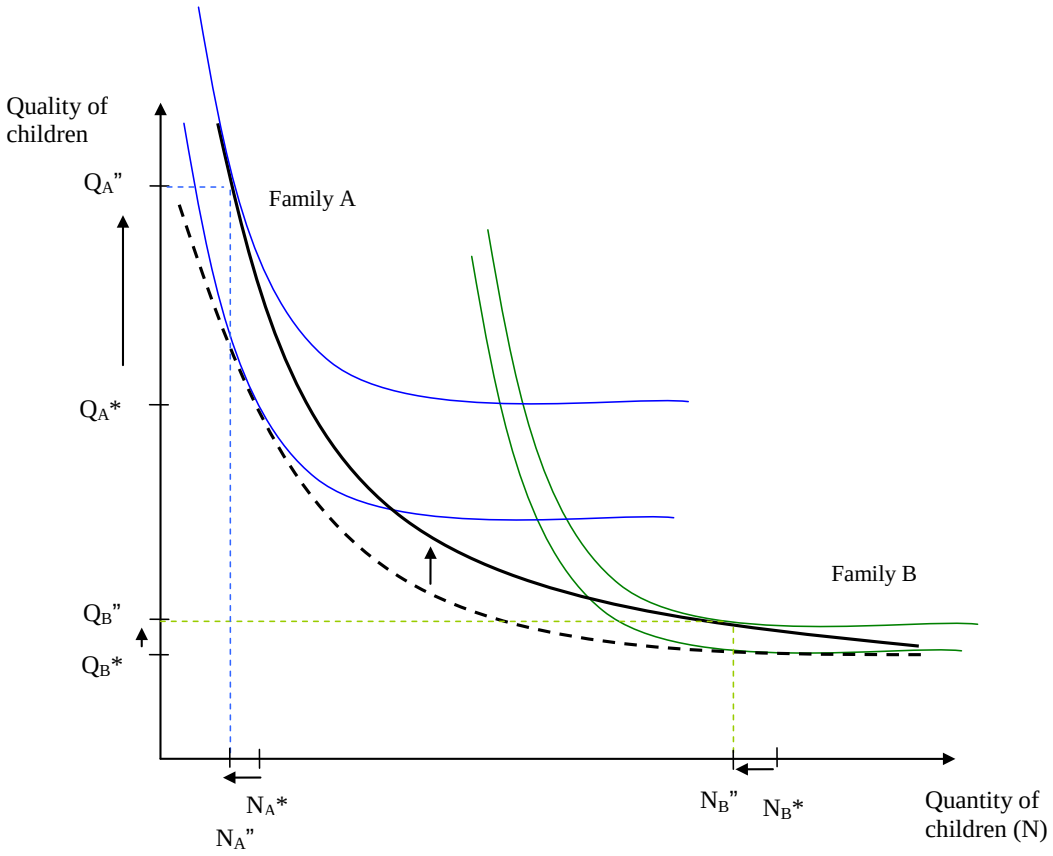
Table 9: Impacts of family size on other educational investment for children age 6-18, Vietnam 2006 (instrumented regressions)

	Share of tutoring expenditure in education expenditure	Share of years attending tutoring over completed years of schooling
Number of siblings age 0-18	-0.077*	-0.203**
	(-1.84)	(-2.12)
Age	0.002	-0.002
	(1.06)	(-0.48)
Male	-0.027***	-0.061***
	(-2.87)	(-2.83)
Years before last grade in current school level	-0.003	0.003
	(-1.12)	(0.48)
Secondary school	-0.012	-0.044**
	(-1.39)	(-2.30)
Mother age	0.027*	0.064*
	(1.79)	(1.82)
Mother age squared	-0.000*	-0.001*
	(-1.82)	(-1.88)
Female-headed household	0.007	-0.027
	(0.38)	(-0.69)
Head's years of schooling	-0.001	-0.001
	(-0.47)	(-0.24)
Ethnic majority group	0.026	0.073*
	(1.52)	(1.71)
Total household expenditures	0.000***	0.000***
	(4.23)	(3.74)
Distance to primary school	0.005*	0.005
	(1.81)	(0.85)
Distance to secondary school	-0.002**	-0.005**
	(-2.45)	(-2.21)
Constant	-0.264	-0.445
	(-1.28)	(-0.92)
Model	2SLS	2SLS
R2	0.08	0.08
N	31.68	37.61
Mean of dependent variable	0.11	0.30

Note 1. *p< .1, **p<0.05, ***p<0.01; robust t statistics in parentheses account for clustering at the household level.

2. All regressions control for regional dummy variables.

Figure 1: Effects of a Reduction in the Price of Quality on Quantity and Quality of Children



Appendix

Table 1.1: Impacts of distance to family planning center on number of siblings age 6-18 Vietnam 2006 (first-stage regressions)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Distance to family planning center	0.009***	0.007***	0.007***	0.007***	0.007***	0.006***	0.006***
	(3.60)	(2.95)	(2.87)	(2.85)	(2.86)	(2.58)	(2.61)
Age		-0.005	-0.010	-0.012	-0.010	-0.011	-0.012
		(-0.70)	(-1.06)	(-1.21)	(-1.04)	(-1.13)	(-1.26)
Male		-0.186***	-0.198***	-0.203***	-0.200***	-0.201***	-0.203***
		(-7.20)	(-6.49)	(-6.63)	(-6.59)	(-6.68)	(-6.66)
Years before last grade in current school level		0.021	0.024	0.020	0.024	0.024	0.021
		(1.62)	(1.55)	(1.27)	(1.54)	(1.57)	(1.36)
Secondary school		-0.064*	-0.101**	-0.092**	-0.098**	-0.097**	-0.093**
		(-1.70)	(-2.23)	(-2.01)	(-2.18)	(-2.15)	(-2.03)
Mother age		0.355***	0.360***	0.365***	0.361***	0.362***	0.367***
		(11.49)	(9.92)	(10.13)	(10.10)	(10.18)	(10.13)
Mother age squared		-0.004***	-0.005***	-0.005***	-0.005***	-0.005***	-0.005***
		(-11.71)	(-9.99)	(-10.26)	(-10.18)	(-10.27)	(-10.25)
Female-headed household		-0.279***	-0.337***	-0.338***	-0.327***	-0.312***	-0.321***
		(-5.85)	(-5.16)	(-5.21)	(-5.14)	(-4.99)	(-4.99)
Head's years of schooling		-0.058***	-0.058***	-0.058***	-0.058***	-0.059***	-0.059***
		(-9.85)	(-8.16)	(-8.05)	(-8.17)	(-8.31)	(-8.21)
Ethnic majority group		-0.336***	-0.334***	-0.343***	-0.331***	-0.318***	-0.337***
		(-4.99)	(-4.48)	(-4.47)	(-4.49)	(-4.29)	(-4.34)
Total household expenditures		0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
		(3.70)	(3.58)	(3.65)	(3.52)	(3.75)	(3.90)
Distance to primary school			0.027				0.028
			(1.17)				(1.16)
Distance to secondary school			-0.002				-0.003
			(-0.25)				(-0.29)
Distance to nearest paved road				0.002			0.001
				(0.33)			(0.25)
Distance to public transportation				-0.003			-0.003
				(-1.54)			(-1.56)
Distance to post office				-0.001			-0.002
				(-0.21)			(-0.46)
Distance to health facilities					-0.009		-0.014
					(-0.35)		(-0.52)
Share of commune population working in agriculture						0.327**	0.343**
						(2.29)	(2.40)
Urban	-0.422***	-0.311***					
	(-8.83)	(-6.26)					
Constant	1.339***	-4.612***	-4.759***	-4.777***	-4.756***	-5.071***	-5.138***
	(33.59)	(-7.67)	(-6.73)	(-6.83)	(-6.84)	(-7.26)	(-7.23)
R2	0.12	0.24	0.23	0.23	0.23	0.23	0.23
N	6309	5413	4248	4178	4294	4294	4168

Note 1. *p< .1, **p<0.05, ***p<0.01; robust t statistics in parentheses account for clustering at the household level.
2. All regressions control for regional dummy variables.

Table 1.2: Impacts of family size on educational investment for children age 6-18 Vietnam 2006 (instrumented regressions), marginal effects

	Uninstrumented regressions		Instrumented regressions	
	Tutoring expenditure	Tutoring hours	Tutoring expenditure	Tutoring hours
Number of siblings age 0-18	-24.498***	-16.953***	-211.087*	-73.946
Age	9.744***	3.837***	10.322***	3.556***
Male	-22.293***	-10.558***	-61.072**	-22.238*
Years before last grade in current school level	-5.700	-6.144***	-2.267	-5.091**
Secondary school	2.941	4.015	-15.421	-1.488
Mother age	8.687	1.328	74.773*	21.479
Mother age squared	-0.113	-0.015	-0.943*	-0.267
Female-headed household	23.931**	7.788	-33.747	-10.684
Head's years of schooling	6.209***	3.457***	-3.506	0.382
Ethnic majority group	110.837***	65.408***	69.739*	50.141***
Total household expenditures	0.004***	0.001***	0.006***	0.002**
	3.467	2.226	9.660	3.903
Distance to secondary school	-3.122*	-1.711*	-3.874	-1.828*
N	4125	4247	4125	4247
Number of left-censored obs.	2511	2623	2511	2623

Note 1. *p< .1, **p<0.05, ***p<0.01; marginal effects are calculated based on the estimates in Tables 5 and 6.