Philippine Institute for Development Studies
Surian sa mga Pag-aaral Pangkaunlaran ng Pilipinas

Number of Children and their Education in Philippine Households

Aniceto C. Orbeta Jr.

DISCUSSION PAPER SERIES NO. 2005-21

September 2005

For comments, suggestions or further inquiries please contact:
The Research Information Staff, Philippine Institute for Development Studies
3rd Floor, NEDA sa Makati Building, 106 Amorsolo Street, Legaspi Village, Makati City, Philippines
Tel Nos: 8924059 and 8935705; Fax No: 8939589; E-mail: publications@pidsnet.pids.gov.ph
Or visit our website at http://www.pids.gov.ph

Number of Children and their Education in Philippine Households

Aniceto C. Orbeta, Jr.
June 2005

Abstract

This paper shows how large family size can be an important contributor to poverty in the Philippines. It examines one of the mechanisms behind this link by focusing on the relation between number of children and school attendance of children 6 to 24 years old. It surveys the international literature to establish how the problem has been approached and what the results are for other countries. It then formulates and tests a model using a nationally representative household survey data for the Philippines to explain what determines the decision to keep children in school. The model specifically considered the endogeneity of the number of children school attendance equations.

Keywords: Family Size, School Attendance, Philippines

Number of Children and their Education in Philippine Households: Evidence from an Exogenous Change in Family Size[1]

Aniceto C. Orbeta, Jr.[2]
June 2005

1. Introduction

Education is well recognized as one of the more potent ways that hastens social mobility. Its importance in overall development of a country is also well recognized. This is clear from the sustained and widespread attention it has received in the development literature. One does need to dig deep to realize that what underlies education progress or retrogress is the decision of households to invest in the education of their children. It is, therefore, always important to contribute to the understanding of this process. This is the ultimate object of this paper.

Relative to countries with about the same level of development, the Philippines is known for high school attendance at all levels. Even with its relatively low per capita income, it has achieved attendance rates that approximate those found in high-income countries that led analysts to consider the performance of the Philippines in this area an outlier (see for instance Berhman, 1990, Behrman and Schneider, 1994). This advantage, however, is fast eroding in recent years. For instance, UNESCO data show that Thailand has surpassed the Philippines in attendance rate at the secondary and tertiary levels since late 1990s[3]. But what is even more alarming, as this paper will later show, is that this erosion is faster among larger and also known to be poorer families. The segment of society that needs most higher education investment to hasten poverty alleviation is in fact investing lower than those who need it less.

The paper formulates and estimates a model of the determinants of the proportion of school-age children attending school considering the endogeneity of the number of children and using an instrument for it. As far as the author knows, this is the first that has taken into account the endogeneity of the number of children in the school attendance equation using Philippine data. The quantity-quality literature spawned by the seminal treatment in Becker and Lewis (1973) clearly argues for the endogeneity of the number of children in education equations. Under this framework, OLS estimates of the education equation will be biased and inconsistent. Instrumental variables estimation is needed to generate consistent estimates.

---

[1] This paper also appeared as ADBI Discussion Paper No. 31.

[2] Senior Research Fellow, Philippine Institute for Development Studies (aorbeta@pids.gov.ph). This paper was written while the author was a Visiting Researcher at the Asian Development Bank Institute, Tokyo. Opinions expressed here are solely of the author does not necessarily reflects the view or policies of the Asian Development Bank Institute nor of the Philippine Institute for Development Studies. This paper has benefited from the comments of John Weiss, Haider Khan, and Peter McCawley. Research assistance of Janet Cuenca, Keiko Sasaki, Mihoko Saito, Reiko Nishiura and Nami Sampei are gratefully acknowledged. All errors, however, are solely the responsibility of the author.

[3] See Orbeta (2000) for a discussion on this.

The paper is divided as follows. The next section presents a brief review of the previous literatures. Following that is the presentation of the methodology, instrument and data used. The results are provided next. The final chapter summarizes and identifies some implications for policy.

2. Previous studies

The literature on the impact of family size/number of children on the education of a child has a long history. It has produce results ranging from a negative, no impact and a positive relationship. The methodology of quantification of the relationship has evolved from simple cross-tabulations to elaborate controls not only for other individual, household and community characteristics but more importantly for the likely endogeneity of the family size that has been spawned by the quantity-quality literature originally dealt with in Becker and Lewis (1973). The dependent variable used is also ranged from attendance, attainment, and even investments. This section provides a short review that will highlight some of the main results grouping the studies according the methodologies used.

Controlling for the endogeneity of the family size or number of children in the education equation of children has been hampered by the lack of appropriate instruments. Almost all of the candidates, such as the education of parents or household income, have direct effects on the education of children rendering them inappropriate as instruments. The controls for the endogeneity of the number of children or family size in the education of children equations was pioneered by Rosenzweig and Wolpin (1980) with twins as the instrument using data from India. Since couples don't have control over their birth outcomes, the birth of a twin is considered a good instrument to control for the endogeneity of the family size. The much more recent applications are for the US (Vere, 2005), for Romania (Glick, Marini and Sahn, 2005) and for Norway (Black, Devereux and Salvanes, 2004). Black, et al. (2004). Black et al. (2004) also used sex-mix as an instrument that was introduced in Angrist and Evans (1998) to control for the number of children in labor supply equation and earnings of their parents. A more different tack was adopted in Lee (2004). He used son's preference known to be prevalent in Korea as an instrument using Korean data. Turning to the results, Rosenzweig and Wolpin (1980) found that an exogenous increase in fertility significantly decreased the level of schooling of all children measured as the age-standardized sum of the educational attainment of all children in the household. The outcomes for Romania (Glick et al., 2005) using the probability of primary school enrollment as the dependent variable also confirm the earlier Rosenzweig and Wolpin (1980) results. Black et al. (2004), however, found a more negligible result for Norway after controlling for birth order and attribute most of the effect on educational attainment of children to birth order rather than family size. The found that there is substantial differential impact between the first child and subsequent children, i.e., the first child has significantly higher educational attainment than the subsequent children. Black et. al (2004) results using sex-mix as an instrument found a positive relationship between family size and education but they dismissed it with the argument that sex-mix may be an inappropriate instrument because it may have direct impact on the child outcomes. Turning to the son preference instrument, Lee (2004) finds that that each additional child has significant negative impact on the monthly household expenditure for education in Korea.

The next set of estimates we discuss are multivariate estimates that does not control for the endogeneity of the number of children. The studies in the preceding paragraph usually find that not controlling for the endogeneity of the number of children in education equation would understate the impact (see for instance, Glick et. al. (2005), and Lee (2004)). The result in Lu and Treiman (2005) using data from China and OLS regressions shows a negative impact of family size on the both the educational attainment of children as well as on the familial resources measured by the owning a study desk at age 14. Patrinos and Psacharopoulos (1997) show that the greater number of children increases the probability of being delayed in schooling in Peru. In addition, they found that this effect increases as the number of siblings increase. In the case of Vietnam, a negative relationship between school attendance and family size is found even after controlling for individual and household characteristics (Ahn, et al., 1998). But this is not true for educational attainment where there is no significant relationship except in large households (family size greater than 5) where the negative relationship is found.

Literature using multivariate analysis and Philippine data shows the preponderance of a negative impact of higher number of children on the education of children although some show no significant relationship. Herrin (1993) using data from Misamis Oriental province show that while school participation and attainment of the 7-12 years old are not affected, school participation of children 13-17 years old are negatively affected by the number of siblings. Similar negative impact of the number of siblings on the school participation of children 7-17 years old were found by DeGraff, Bilsborrow and Herrin (1996) using the 1983 Bicol Multipurpose Survey data. Paqueo (1985) also found that the number of siblings negatively affects the highest grade completed of children using the 1982 Household School and Matching Survey. Bauer and Racelis (1992) found that preschool children negative affects the school attendance of older children (17-24) and primary school children (7-12 years old) reduces the enrollment of older children (13-24 years old) using the 1985 Labor Force Survey (LFS). Excess fertility or unwanted births were also found to negatively affect educational attainment (Montgomery et al. 1997). Finally, Orbeta (2000) found in a joint decision model for school attendance and labor force participation that household size did not significantly affects school attendance decision but positively affects labor force participation of children 10-24 years old using the matched data from the 1994 Family Income and Expenditure Survey, LFS and Functional Literacy Education and Mass Media Survey.

Turning to cross-tabulation evidence, Knodel, Havanon and Sittitrai (1990) found that the probability of attending lower secondary and upper secondary is negatively associated with the family size among Thai children using a small sample from two rural areas. This effect, though somewhat reduced, prevails even after controlling for the individual and household characteristics. These results are duplicated in a subsequent study using a nationally representative sample survey (Knodel, J. and M. Wongsith, 1991). In Kenya, however, Gomes (1984) found a positive relationship between completed family size and the educational attainment of children. This impact remains after controlling for household and individual characteristics.

The preceding paragraphs have shown that the results are not consistent across societies and sometimes even in studies using similar methodologies. The studies that control for the endogeneity of family size in the education equation seem to find negative relationships in lesser developed countries (India and Romania) but seem to have conflicting results in more developed countries (Norway and Korea). Multivariate analyses that did not control for the endogeneity appears to have consistently found negative relationships. Cross tabulation analysis also have conflicting results. In terms of outcomes, school attendance/enrollment were always found to be negatively correlated with family size (Glick, et al., 2005, Ahn et al. 1998), on educational attainment there appears to be conflicting results (Rosenzweig and Wolpin 1980, Black 2004, Ahn et al. 1998, Gomes, 1984), on investments the impact is consistently negative (Lee, 2004; Lu and Treiman, 2005). The single study using delay in schooling, shows the negative impact of family size (Patrinos and Psacharopoulos,1997).

3. Methodology, Instrument and Data

3.1 Methodology

To estimate the impact of the number on the education of children we follow Rosenzweig and Wolpin (1980) by estimating the following empirical model

$$E = \alpha_o + \alpha_1 n + X\alpha_2 + \varepsilon$$
$$n = \beta_o + \beta_1 z + X\beta_2 + \mu$$

E is the education variable, n is the number of children z is the instrument to control for the endogeneity of n and X is the vector of individual, household and community characteristics. The error terms ε and μ are, by implication, correlated. The implied subscripts are omitted for clarity. As shown in Rosenzweig and Wolpin (1980) this model is derived from the quantity-quality tradeoff framework originally introduce in Becker and Lewis (1973).

Estimating (1) with OLS will result in a biased and inconsistent estimate if indeed *n* is endogenous. We, therefore, test for the endogeneity of n in (1). If n is endogenous, we use as instruments, the sex of the first two children. The validity of this instrument is explained in the next section. Since we use cross-section data where heteroscedasticity is commonly present, we also test for heteroscedasticity and apply GMM estimation[4] if it exists.

The dependent variable we use in this paper is the proportion of school-age children that are attending school. Most other studies, except for Rosenzweig and Wolpin (1980) and Lee (2004), used individual outcomes[5]. A household outcome variable, rather an individualistic outcome, would be closer to the spirit of the Becker and Lewis (1973) framework. Individualistic schooling variable, by implication, adds the assumption of independence of the decision for each child in the same household which Becker and Lewis (1973) framework did not consider. Rosenzweig and Wolpin (1980) used an age-standardized aggregate of the years of education of the children in the household. Lee (2004), on the other hand, used the household expenditures on education.

---

[4] We use ivreg2 Stata routine (Baum et al. 2003) to test for the endogeneity and

[5] Two of the previous work of the author on the issue used individual outcome variables (Alba and Orbeta 1999, and Orbeta 2000).

The estimation strategy is as follows. We first establish the endogeneity of the number of children using the sex of the first two children as instruments following Angrist and Evans (1998). We do this by various tests available in the `ivreg2` Stata routine described in Baum et al. (2003). We also check the relevance of the instruments by checking the first stage regression results, particularly, the partial R2 for the instruments and check if we have a weak instrument problem (Bound, Jaeger and Baker, 1995). We also test for the presence of heteroscedasticity in the data because this is common in cross-section data. When endogeneity is established it is well known that the OLS estimate will be biased and inconsistent and the 2SLS or GMM estimates would provide a consistent estimate and in the case of the GMM, an efficient estimate as well. When heteroscedasticity is present, GMM would provide a more efficient estimate. When weak instrument is indicated, we present LIML estimates that are found to be more robust than the GMM in this case (Stock, Wright and Yogo, 2002). Finally, in the case of using a separate both male and both female instruments we check the overidentifying restrictions test results. This, of course, cannot be done when using the same sex as instrument as the system is exactly identified.

It is worth noting that given that we are dealing with proportions data, Greene (2003) shows that this can be treated as separate responses for each individual child given common household explanatory variables, i.e., these are essentially replications of individual school attendance decisions within the household. Under this framework, the model can be estimated using the grouped probit using the `bprobit` routine in Stata. Since this is essentially a probit routine, the endogeneity of the number of children equation is corrected by estimating a two-stage probit using the sex of the number first two children as instruments using the proposals discussed in Rivers and Vuong (1988). But then again, we are back to assuming independence of the decision for each individual child in a household even if we consider that they are grouped.

Finally, to provide estimates of the varying impact of the number of children by socioeconomic class, models that include the interaction of the number of children and the per capita income quintile dummy variables are estimated. The differential impact across socioeconomic classes will be estimated by the sum of the coefficient of the base category and the coefficient of the corresponding interaction term. The estimator that we deem to give the most reliable estimate in the average equation is used here.

3.2 Balanced Sex-Mix as an Instrument

There are not too many instruments that one can find for the number children in household models. Most of the likely candidates such the household income, education of the parents or age of marriage are also related to the dependent variable of interest such as labor force participation of parents, savings or education of children, rendering these inappropriate as instruments. Recent research using US data such as Angrist and Evans (1998) has used the hypothesis that families prefer to have balanced sex-mix of children as an instrument for the number of children. The Philippines is one of the countries in Asia where a balance sex-mix are found to have prevailed in contrast to countries in South and Eastern Asia where indications for son preference is often found (Wongboonsin and Ruffolo, 1995). Early literature that confirms preference for balanced sex-mix in the Philippines is found in Stinner and Mader (1975). The other instruments that are available are limited by their applicability only in very specific circumstances. The occurrence of twins have been also been used as instruments again using US data first in Rosenzweig and Wolpin (1980) and in subsequent studies such as Angrist and Evans (1998). A much more recent application was done for Romania (Glick, Marini and Sahn, 2005; Black et al, 2004). Son-preference in Korea was also used as an instrument for the fertility for instance in Lee (2004). Finally, another instrument would be an exogenous policy change that could affect child bearing. Quian (2004), for instance, used the relaxation of the one-child policy in China that allows rural households to have another child if the first child is a girl. Viitanen (2003), on the other hand, used the large-scale giving out of vouchers for privately provided childcare in Finland.

In the case of the balanced sex-mix hypothesis, the fact that families do not have control over the sex of their children makes same sex for the first two children virtually a random assignment. As argued in Angrist and Evans (1998) using same sex as an instrument will allow a causal interpretation. It should be noted, however, that the downside of this instrument is that it will render families that has less than two children unusable for analysis. While this maybe a serious problem in low fertility areas, this may not be in the case of the Philippines where the average number of children exceeds four.

To check on the validity of this instrument, Table 1 provides a cross tabulation of the average proportion of families that have additional children and the average number of number of children by sex of their first two children for 24,000 families that have two or more children using the APIS 2002 dataset. The table shows that 67.4% families that had one male and one female for their first two children had another child while 71.8% had another child when the have same sex for their first two children or a difference of more than 4%. In terms of average number of children, this is 3.49 as against 3.61 or an average difference of a little over 0.12 children. These average differences are statistically significant under conventional level of significance. Comparing this with Table 3 and 5 in Angrist and Evans (1998) one can observe several differences. The difference in the proportion of families having a third child for the two groups of families is smaller and the standard error is larger. In the case of the difference in the average number of children, the difference is larger but so is the standard error. This is not unexpected given the larger family size in the Philippines and the expected larger dispersion of the distribution. Consequently, the implied t statistics in Table 7 are not as large as those in Angrist and Evans (1998) indicating that discrimination generated from the same-sex instrument may not be as strong as those obtained using US data.

3.3 Data Sources

The data on individual and household characteristics and location characteristics were taken from the 2002 Annual Poverty Indicator Survey (APIS). The APIS is a rider survey to the July round of the quarterly Labor Force Survey (LFS) conducted by the National Statistics Office (NSO). The 2002 round is the third of the APIS series conducted by the NSO. The other two were conducted in 1998 and 1999. It provides basic demographic information on all members of the household as well as household amenities. Income and expenditure for the past 6 month period preceding the survey are also gathered.

All monetary values such as income are deflated using provincial consumer price indices compiled by the Price Division of the NSO. This is done to control for inter-provincial price variability.

Barangay and municipal-level data from the 2000 Census of Population and Housing are also used to provide measures of availability of school facilities. It is therefore assumed that there is not much difference in the structure of distribution of the facilities in 2000 and in 2002 or that whatever changes happened it did not upset the relative distribution of the availability of facilities. These barangay and municipal data set were aggregated at the domain level of the APIS and attached to the APIS data set using domain identification variables.

3.4 Descriptive Statistics

Table 2 provides the attendance rates by per capita income quintile and number of children of the total school-aged children (6-24) and also grouped into age groups corresponding to the elementary (6-12), secondary (13-16) and tertiary (17-24) levels. The disparity in school attendance proportion is not very clear in the total school age category but becomes more apparent as one goes up the education ladder. For instance, for the 6-24 age group, attendance proportion for the poorest is 74.2% while for the richest this is 76.8%. For the elementary level the corresponding attendance proportions are 89.6% for the poorest and 99.3% for the richest or about 10-percentage point difference. But for the tertiary level, the attendance proportion is 28.3% for the poorest but 54.7% for the richest or about 26-percentage point difference.

By number of children, the enrollment proportion appears to increase up to about 4 children then starts to go down as one goes to household with more children although this is not true for the elementary school age group. The initial rise for secondary and tertiary group has to give allowance to the fact that smaller households may contain both young families that does not have yet children in this age category and old families whose children may no longer be with their parents. With this consideration in mind, one observes that the decline in school participation is mild as one moves from small households to large households. This can be explained the well-known attitude of Filipino parents to always keep their children in school as long as possible. This is main explanation of the relative high attendance rates one finds in the Philippines given its per capita income. De Dios (1995) succinctly describe this Filipino trait in the following statement: "*Makapagpatapos* (to let as son/daughter graduate) is still the standard by which successful parenting is measured; the stereotype of good parents, bordering caricature, is still those who scrimp and save to send their children to school and to college."

Table 3 provides the descriptive statistics of the variables used in the estimation. The average number of children is about 3.5. The average number of years of education is slightly higher for mothers at 9.2 than for fathers at 9.0. This is not a surprising in the Philippine case. The proportion of barangays with elementary school is about 76% while those with secondary school is substantially lower at 24%.

4. Estimation Results

Tables 4 provides the OLS, 2SLS, and GMM estimates of the determinants of the proportion of children 6-24 years old who are attending school using both male and both female or same sex for the first two births as instruments, respectively. The positive effects of the number of children on the proportion of children 6-24 years old coming out the OLS regression is suspect because of the expected endogeneity of the number of children in this equation as per the quantity-quality of children trade-off literature. The data set confirms this endogeneity with F-values for the Wu-Hausman Test and Chi-Square values for Durbin-Wu-Hausman Test indicating high significance implying a rejection of the null hypothesis that the number of children variable is exogenous in this equation. Thus, more consistent estimates are either the 2SLS or GMM estimates. Given that the presence of heteroscedasticity as indicated by the Pagan-Hall Test, the GMM estimators would give efficient estimates although magnitude wise the estimates are very similar. Given the z values of the estimates, the estimates using same sex as instruments are not as significant as the one generated by the one from using both male and both female as instruments. Thus, the more reliable estimate of the impact of the number of children on the proportion attending is the GMM estimate of about 15 percentage points average decline per additional child. The GMM estimate, however, also need to be appreciated in the light of the significant overidentification statistic indicating some correlation between the instrument and the error term. Given the difference in the dependent variable used in this study and the other studies, the results cannot be compared directly.

The other results confirm most of the results from previous studies. The older the parents are, the lower is the proportion of children attending school. The higher the education of parents is the higher is the probability that children attend school. It is note worthy that the impact of mother's education has about the same impacts as the father's education. Other studies have shown that the mother's education has higher impact on the education of children. Residing in urban areas has no distinct impact of school attendance. The availability of school, indicated by the proportion of barangays with schools, has positive impact on school attendance although this is only true elementary schools but not for secondary schools. The income variable is insignificant. The regional dummy variables are expected to pick-up whatever area-specific influences on school attendance not contained in the availability of schools. The national capital region (NCR) is the reference area. The positive (negative) significant value would mean higher (lower) proportion of children attending in that particular region compared to the NCR on the average after controlling for all the other variables.

The first stage results are given in Table 5. It shows the significance of the either both male, both female, and same sex as determinants of the number of children. Their usefulness as instruments is further validated by the significance of the partial R-square for the instruments with F values of 14.8 for the both male and both female and 21.9 for the same sex instrument. It is worth noting that both male and both female have slightly higher partial R-square of 0.0025 compared to same sex that has a partial R-square of 0.0018.

Estimation results of models that included the interaction of the number of children and per capita income quintiles are given in last three columns of Table 4. The interaction terms are all significant. The results highlight the regressive impact of the number of children on school attendance. For the poorest quintile, the impact of each additional child is -18% reduction on the proportion of children 6-24 that are attending school which is higher that the average impact mentioned earlier. The estimates for the other income quintiles are -11.8% (-17.8+6.0), -12.0% (-17.8+5.8), -12.1%(-17.8+5.7), -12.4% (-17.8+5.4) for the second to the fifth income quintile, respectively.

Finally, estimates for different age groups approximating the different grade levels, namely, elementary (6-12), secondary (13-16) and tertiary (17-24) are also done. The estimates for the 6-12 age groups show that the impact of the number of children are not significant, either on the average or across socioeconomic classes (Table 6). For the secondary and tertiary education age groups, however, the number of children has significant negative affects on school attendance. The results for the other variables are similar to the results for the total 6-24 age group so no further explanation will be provided. Again this GMM estimates has to be appreciated given the indication of correlation between the instrument and the error term as indicated by the significance of the overidentification statistic.

Table 7 summarizes the impacts and computes these as percentage changes relative to current recorded of proportion of children that are attending school. The table clearly shows the regressiveness of the impact of the number of children on school attendance. It is noteworthy that the regressiveness of the impact rises as one goes up the age groupings corresponding to the different levels of the education ladder. The poorest income quintile always has higher negative impact compared to the other socioeconomic groups. For instance, the 6-24 age group, each additional child will decrease the proportion of children attending school by -24% while for the richest quintile this is only -16%. For the tertiary age group, the impact of the poorest quintile is -77% while for the richest quintile this is only -22%.

5. Summary and Policy Implications

The paper presents what to the author's knowledge is the first attempt at considering the endogeneity of the number of children in the estimation of the education of children equation using Philippine data. The endogeneity of the number of children is argued in the quantity-quality literature spawned by the seminal treatment in Becker and Lewis (1973). The estimation framework in this study follows the pioneering test of this quantity-quality framework in Rosenzweig and Wolpin (1980) but instead of twins this study used the balanced sex-mix hypothesis and used the sex of the first two births as instruments for the number of children. This instrument was first used in the Angrist and Evans (1998) in a study on the effect of children on their parents labor supply and earnings. The use of this instrument was prompted by the observation of demographers that Philippines, unlike many countries in East and South Asia, has preference for balance in the sex of their children (Wongboonsin and Ruffolo, 1995; Stinner and Mader,1975). This was confirmed by a simple tabulation of the difference of the number of children by the sex of the first two children.

The estimation result shows that there is negative impact of the number of children on the proportion of school-age children attending school. The average effect for the children 6 to 24 years old is a 19% decline per additional child or almost 1 in every five children. Estimates considering per capita income quintile show that for the poorest quintile the impact is a 24% decline or almost 1 in 4 while for the richest quintile this is an 16% decline or around 4 in 25 per additional child. In addition, while this impact is not significant for the elementary school-age children, these are much bigger in magnitude and much more regressive at higher school-age groupings reaching as much as 77% for the poorest quintile for the tertiary school-age group or 8 in 10 children for this age group.

These results have important implications for policy. Poverty alleviation efforts that address only the current needs of the poor may consign the next generation from poor and large households into poverty. Each additional child, by driving more school-age children out of schools, pushes the succeeding generation also into poverty. Effectively, each additional child constitutes an inter-generational tax households impose upon themselves and this tax is highly regressive. There may be a need for targeted education subsidies for large households particularly those who have completed family size and perhaps those who will effectively promise to bear no more additional children. Orbeta (2004) has shown that there is higher unmet need for family planning and that the desired family size is also higher among the poor. Given these, poverty alleviation packages should include assistance to enable poor families to achieve their desired family sizes. In addition, advocacy for smaller family size need to be intensified among the poor.

References

Angrist, J. and W. Evans (1998) “Children and their Parents’ Labor Supply: Evidence from Exogenous Variation in Family Size,” American Economic Review 88(3), 450-477.

Anh, T., J. Knodel, D. Lam and J. Freidman (1998) “Family Size and Children’s Education in Vietnam,” Demography 35(1), 57-70.

Alba, M. and A. Orbeta (1999) “A Probit Model of School Attendance for Children 7 to 14 Years Old,” Micro Impact of Macroeconomic Adjustment Policies Project (MIMAP) Research Paper No. 20.

Bauer, J. and R. Racelis (1991) “Household Composition and the Activity Status of Filipino Youth,” Paper presented at the Annual Meetings of the Population Association of America, March 21-23.

Baum, C., M. Schaffer and S. Stillman (2003) “Instrumental Variables and GMM: Estimation and Testing,” Boston College Working Paper No. 545.

Becker, G. and Lewis (1973) “On the Interaction between the Quantity and Quality of Children,” Journal of Political Economy, 81(2), S279-S288.

Black, S. , P. Deveruex and K. Salvanes (2004) “The More the Merrier? The Effect of Family Composition on Children’s Education,” NBER Working Paper No. 10720.

Bound, J., D. Jaeger and R. Baker (1995) “Problems with Instrumental Variables Estimation When the Correlation Between the Instruments and the Endogenous Explanatory Variable is Weak,” Journal of the American Statistical Association, 90(430), 433-450.

Behrman, J. 1990. Human Resource Led Development? ILO-ARTEP.

Behrman, J. and R. Schneider (1994). “An International Perspective on Schooling Investments in the Last Quarter Century in Some Fast-Growing East and Southeast Asian Countries,” Asian Development Review, Vol. 12, No. 2.

De dios and Associates (1993). Poverty, Growth and the Fiscal Crisis. Philippine Institute for Development Studies and International Development Research Center.

DeGraff, D., R. Bilsborrow, A. Herrin (1996) “Children's education in the Philippines: does high fertility matter?” Population Research and Policy Review, Vol. 15(3), 219-47.

Glick, P. , A. Marini and D. Sahn (2005) “Estimating the consequences of changes in fertility on child health and education in Romania: An analysis using twins data,” Cornell Food and Nutrition Policy Program Working Papers 183.

Gomes, M (1984) “Family Size and Educational Attainment in Kenya,” Population and Development Review, 10(4), 647-660.

Greene, W. (2003) Econometric Analysis. Fifth Edition. Pearson Education, Inc., Upper Saddle River, New Jersey USA.

Herrin, A. (1993) "Studies on Consequences of Population Change in Asia: Philippines" Asian Population Studies Series No. 121.

Knodel, J. and M. Wongsith (1991) “Family Size and Children’s Education in Thailand: Evidence from a National Sample,” Demography, 28(1), 119-131.

Knodel, J. N. Havanon and W. Sittitrai (1990) “Family size and the education of children in the context of rapid fertility decline,” Population and Development Review 16(1), 31-62.

Lee, J. (2004) “Sibling Size and Investment in Children’s Education: An Asian Instrument,” IZA Discussion Paper No. 1323.

Lu, Y. and D. Treiman (2005) “The Effects of Family Size on Educational Attainment in China: Cohort Variations,” Paper presented at the Annual Meeting of the Population Association of America, Philadelphia, 31 March – 2 April.

Montgomery, Mark R., Cynthia B. Lloyd, Paul C. Hewett and Patrick Heuveline (1997) “The consequences of imperfect fertility control for children’s survival, health and schooling,” Demographic and Health Surveys Analytical Reports no. 7. Calverton, MD.: Macro International.

Orbeta, A. (2000) “Macroeconomic Policy Change and the Joint Schooling and Labor Force Participation Decision of Children 10-24 Years Old,” Micro Impacts of Macroeconomic Adjustment Policies (MIMAP) Project Research Paper No. 46.

Orbeta, A. (2003) “Population and Poverty: A Review of the Links, Evidence and Implications for the Philippines,” Journal of Philippine Development, 30(2), 195-227.

Paqueo, V. (1985). "An Econometric Analysis of Educational Attainment Among Elementary School Age Children: Preliminary Analysis" in Transactions of the National Academy of Science and Technology, Republic of the Philippines, Vol. VII, Metro Manila: The Academy, pp. 359-380.

Patrinos, H. G. Psacharopoulos (1997) “Family Size, Schooling and child labor in Peru- An empirical analysis,” Journal of Population Economics, 10, 387-405

Quian, N. (2004) “Quantity-Quality and the One Child Policy: The Positive Effect of Family Size on School Enrollment in China,” (http://econ-www.mit.edu/graduate/candidates/download_res.php?id=130)

Rosenzweig, M. and K. Wolpin (1980) “Testing the Quantity-Quality Fertility Model: The Use of Twins as a Natural Experiment,” Econometrica, 48(1), 227-240

Rosenzweig, M. and K. Wolpin (2000) “Natural “Natural Experiments” in Economics,” Journal of Economic Literature, 38(Dec.), 827-874.

Stinner, W. and P. Mader (1975) “Sons, Daughters or Both? An Analysis of Family Sex Composition Preferences in the Philippines,” Demography, 12(1), 67-79.

Stock, J., J. Wright and M. Yogo (2002) “A survey of weak instruments and weak identification in generalized method of moments,” Journal of Business and Economic Statistics, 20(4), 518-529.

Vere, J. (2005) “Life Cycle Effects of Fertility on Parents’ Labor Supply,” University of Hong Kong.

Viitanen, T. (2003) “Children and Their Mothers’ Labor Supply: Evidence for a Large-Scale Policy Change in Finland,” Paper presented at the Annual Conference of the European Society for Population Economics, New York, US June 2003

Wongboonsin, K. and V. P. Ruffolo (1995) “Sex Preference for Children in Thailand and Some Other South-East Asian Countries” Asia-Pacific Population Journal, 10(3), 43-62

Table 1. Proportion of families that had a third child and average number of children by sex of first two children

Sex of first two children	Proportion that has a third child Mean	SD	SE	Number of children Mean	SD	SE	Proportion to sample
(1) One Male, One Female	0.6740	0.4688	0.0042	3.4850	1.5436	0.0315	0.964
(2) Both male	0.7179	0.4500	0.0052	3.6452	1.5994	0.0420	0.432
(3) Both female	0.7180	0.4500	0.0063	3.5575	1.4975	0.0495	0.261
(4) Same Sex	0.7179	0.4500	0.0040	3.6095	1.5592	0.0320	1.037
Difference (4)-(1)	0.0439		0.0058	0.1245		0.0449	

Source of basic data: National Statistics Office, Annual Poverty Indicators Survey, 2002

Table 2. Proportion of children attending school by age group, per capita income quintile and number of children, 2002

	Age groups 6-24	6-12	13-16	17-24
Per capita Inc. Quintile				
Poorest	0.742	0.896	0.777	0.283
Lower Middle	0.734	0.936	0.834	0.333
Middle	0.720	0.962	0.889	0.349
Upper Middle	0.726	0.976	0.946	0.437
Richest	0.768	0.993	0.980	0.547
No. of children				
2	0.697	0.953	0.892	0.366
3	0.748	0.950	0.896	0.399
4	0.758	0.942	0.890	0.409
5	0.752	0.938	0.842	0.389
6	0.754	0.924	0.828	0.383
7	0.734	0.916	0.789	0.342
8	0.708	0.907	0.779	0.353
9+	0.706	0.919	0.806	0.339
Philippines	0.737	0.942	0.866	0.386

Source of basic data: NSO APIS 2002

Table 3. Descriptive statistics

Variables	Obs	Mean	Std. Dev.	Min	Max
Prop. of children att school, 6-24 yrs.	22,190	0.74	0.34	0	1
Prop. of children att school, 6-12 yrs.	15,335	0.94	0.20	0	1
Prop. of children att school, 13-16 yrs.	11,317	0.87	0.32	0	1
Prop. of children att school, 17-24 yrs.	11,667	0.39	0.43	0	1
No. of children	24,931	3.55	1.55	2	12
Age, father	13,716	45.15	10.57	20	99
Age, mother	15,210	42.97	10.73	16	99
Years of education, mother	15,210	9.15	3.76	0	17
Years of education, father	13,716	9.01	3.75	0	17
Urban dummy	24,931	0.59	0.49	0	1
Deflated total household income, '0000 (1994=100)	24,931	4.63	6.59	0	270
Prop. of barangay with elementary school	24,931	0.76	0.16	0.20	1
Prop. of barangay with secondary school	24,931	0.24	0.14	0.07	0.89
Region 1 dummy	24,932	0.04	0.21	0	1
Region 2 dummy	24,932	0.04	0.19	0	1
Region 3 dummy	24,932	0.10	0.30	0	1
Region 4 dummy	24,932	0.16	0.37	0	1
Region 5 dummy	24,932	0.05	0.22	0	1
Region 6 dummy	24,932	0.07	0.26	0	1
Region 7 dummy	24,932	0.06	0.23	0	1
Region 8 dummy	24,932	0.05	0.21	0	1
Region 9 dummy	24,932	0.04	0.20	0	1
Region 10 dummy	24,932	0.05	0.22	0	1
Region 11 dummy	24,932	0.05	0.22	0	1
Region 12 dummy	24,932	0.05	0.21	0	1
NCR dummy	24,932	0.10	0.30	0	1
CAR dummy	24,932	0.04	0.20	0	1
ARMM dummy	24,932	0.06	0.23	0	1
Caraga dummy	24,932	0.04	0.19	0	1

Table 4. Determinants of the proportion of children 6-24 years old that are attending school, 2002

Explanatory	OLS (Robust SE)			TSLS			GMM			GMM		
Variables	Coef.	Std. Err.	t	Coef.	Std. Err.	z	Coef.	Std. Err.	z	Coef.	Std. Err.	z
No. of children*	0.0045	0.0015	3.02	-0.1483	0.0418	-3.55	-0.1460	0.0425	-3.44	-0.1783	0.0485	-3.68
No. of children x Quintile 2										0.0601	0.0154	3.91
No. of children x Quintile 3										0.0582	0.0157	3.70
No. of children x Quintile 4										0.0569	0.0161	3.54
No. of children x Quintile 5										0.0540	0.0151	3.58
Age, father	-0.0052	0.0006	-8.85	-0.0038	0.0008	-4.60	-0.0037	0.0008	-4.46	-0.0043	0.0008	-5.33
Age, mother	-0.0109	0.0006	-17.04	-0.0137	0.0011	-12.68	-0.0137	0.0011	-12.36	-0.0150	0.0014	-10.93
Year of schooling, mother	0.0148	0.0010	14.47	0.0072	0.0025	2.91	0.0072	0.0025	2.88	0.0043	0.0032	1.35
Year of schooling, father	0.0098	0.0010	9.90	0.0059	0.0017	3.46	0.0060	0.0017	3.49	0.0016	0.0026	0.60
Urban	0.0013	0.0058	0.22	-0.0044	0.0079	-0.55	-0.0044	0.0080	-0.55	-0.0348	0.0128	-2.71
Household income, (0000)	-0.0005	0.0004	-1.38	0.0004	0.0006	0.70	0.0003	0.0006	0.62	-0.0010	0.0007	-1.35
Prop. of bgy with elem. School	0.0859	0.0216	3.98	0.1225	0.0302	4.05	0.1196	0.0308	3.88	0.1648	0.0371	4.44
Prop. of bgy with sec. School	-0.0236	0.0239	-0.99	-0.0073	0.0339	-0.22	-0.0075	0.0329	-0.23	-0.1076	0.0403	-2.67
Region 1	-0.0046	0.0158	-0.29	0.0367	0.0243	1.51	0.0357	0.0246	1.45	0.0297	0.0243	1.22
Region 2	0.0350	0.0169	2.07	0.0141	0.0249	0.57	0.0160	0.0237	0.68	-0.0129	0.0266	-0.49
Region 3	-0.0452	0.0136	-3.32	-0.0348	0.0185	-1.88	-0.0344	0.0180	-1.91	-0.0737	0.0190	-3.87
Region 4	0.0157	0.0115	1.36	0.0331	0.0164	2.01	0.0321	0.0159	2.02	0.0189	0.0149	1.27
Region 5	0.0339	0.0151	2.25	0.1151	0.0307	3.75	0.1132	0.0312	3.63	0.1385	0.0363	3.82
Region 6	0.0743	0.0131	5.65	0.1252	0.0233	5.37	0.1246	0.0230	5.43	0.1324	0.0247	5.36
Region 7	0.0204	0.0144	1.42	0.0637	0.0225	2.83	0.0630	0.0224	2.81	0.0778	0.0248	3.13
Region 8	0.0612	0.0155	3.93	0.1391	0.0305	4.56	0.1381	0.0303	4.56	0.1621	0.0350	4.62
Region 9	0.0137	0.0173	0.80	0.0313	0.0229	1.37	0.0319	0.0234	1.37	0.0399	0.0248	1.61
Region 10	0.0365	0.0149	2.44	0.0552	0.0216	2.55	0.0558	0.0206	2.71	0.0785	0.0237	3.32
Region 11	0.0000	0.0151	0.00	0.0081	0.0211	0.39	0.0098	0.0204	0.48	0.0139	0.0212	0.66
Region 12	0.0553	0.0154	3.60	0.1097	0.0254	4.32	0.1088	0.0256	4.26	0.1428	0.0320	4.46
CAR	0.0735	0.0147	5.00	0.1496	0.0296	5.06	0.1502	0.0291	5.17	0.1505	0.0287	5.24
ARMM	0.0051	0.0172	0.29	0.0669	0.0268	2.50	0.0661	0.0285	2.32	0.0344	0.0244	1.41
Caraga	0.0709	0.0167	4.24	0.0888	0.0243	3.66	0.0896	0.0232	3.86	0.1182	0.0273	4.33
Constant	1.1199	0.0274	40.89	1.8107	0.1920	9.43	1.8019	0.1942	9.28	1.8710	0.2022	9.25
No. of Obs.	11,995											
R-Square	0.2757											
Overidentification test:												
Sargan (IV) J-Hansen (GMM) (P-value)				11.98 (0.0005)			12.52(0.0004)			8.74(0.003)		
Test for Heteroscedasticity												
Pagan-Hall Test Stat (P-value)				75.248 (0.000)								
Endogeneity of No. of Children												
Wu-Hausman F test: (P-value)				24.317 (0.000)								
Durbin-Wu-Hausman chi-sq test: (P-value)				24.320 (0.000)								

* For 2SLS and GMM estimates, instrumented with both male and both female for the first two births.

Table 5. First stage regression
(Dependent variable: No of children)

Explanatory Variable	Both Male & Both Female			Same Sex		
	Coef.	Std. Err.	t	Coef.	Std. Err.	t
Age, father	0.0089	0.0032	2.83	0.0091	0.0032	2.88
Age, mother	-0.0185	0.0033	-5.52	-0.0183	0.0033	-5.47
Year of schooling, mother	-0.0494	0.0059	-8.39	-0.0497	0.0059	-8.44
Year of schooling, father	-0.0253	0.0058	-4.38	-0.0256	0.0058	-4.42
Urban	-0.0367	0.0342	-1.07	-0.0364	0.0342	-1.06
Disp. Income, per cap (0000)	0.0064	0.0025	2.63	0.0063	0.0025	2.56
Prop. of bgy with elem. School	0.2541	0.1252	2.03	0.2519	0.1253	2.01
Prop. of bgy with sec. School	0.1065	0.1477	0.72	0.1047	0.1477	0.71
Region 1	0.2707	0.0945	2.86	0.2705	0.0945	2.86
Region 2	-0.1441	0.1065	-1.35	-0.1397	0.1065	-1.31
Region 3	0.0718	0.0801	0.90	0.0723	0.0801	0.90
Region 4	0.1158	0.0691	1.68	0.1165	0.0691	1.69
Region 5	0.5271	0.0932	5.65	0.5314	0.0932	5.70
Region 6	0.3305	0.0820	4.03	0.3311	0.0820	4.04
Region 7	0.2859	0.0838	3.41	0.2823	0.0839	3.37
Region 8	0.5137	0.0959	5.36	0.5138	0.0959	5.36
Region 9	0.1145	0.0981	1.17	0.1133	0.0982	1.15
Region 10	0.1211	0.0923	1.31	0.1226	0.0924	1.33
Region 11	0.0530	0.0920	0.58	0.0513	0.0920	0.56
Region 12	0.3595	0.0904	3.98	0.3620	0.0904	4.00
CAR	0.4974	0.0920	5.41	0.4942	0.0920	5.37
ARMM	0.4108	0.0911	4.51	0.4080	0.0911	4.48
Caraga	0.1159	0.1044	1.11	0.1160	0.1044	1.11
Both male	0.1871	0.0344	5.44			
Both female	0.0696	0.0386	1.80			
Same sex				0.1384	0.0296	4.68
Constant	4.4528	0.1449	30.73	4.4476	0.1449	30.69
Obs.	11,995					
R2	0.8599					
Partial R2 of excl. inst	0.0025			0.0018		
Test of excluded instruments F(P-value)	14.82 (0.000)			21.89 (0.000)		

Table 6. Determinants of the proportion of children are attending school by age groups, 2002
(GMM Estimates)

Explanatory Variables	Age 6-12						Age 13-16							
	Model 1			Model 2			Model 1			Model 2			Model 1	
	Coef.	Std. Err.	z	Coef.	Std. Err.	z	Coef.	Std. Err.	z	Coef.	Std. Err.	z	Coef.	Std. Err.
No. of children*	-0.0317	0.0228	-1.39	-0.0380	0.0240	-1.59	-0.2212	0.0729	-3.04	-0.2269	0.0694	-3.27	-0.2270	0.0795
No. of children x Quintile 2				0.0126	0.0061	2.07				0.0619	0.0188	3.29		
No. of children x Quintile 3				0.0143	0.0063	2.26				0.0672	0.0192	3.50		
No. of children x Quintile 4				0.0109	0.0061	1.80				0.0696	0.0190	3.67		
No. of children x Quintile 5				0.0056	0.0043	1.29				0.0588	0.0169	3.48		
Age, father	0.0002	0.0007	0.28	0.0001	0.0007	0.09	0.0007	0.0015	0.47	-0.0005	0.0013	-0.41	-0.0043	0.0017
Age, mother	0.0042	0.0007	6.03	0.0039	0.0006	6.51	-0.0076	0.0031	-2.42	-0.0087	0.0032	-2.74	-0.0210	0.0060
Year of schooling, mother	0.0050	0.0017	2.94	0.0045	0.0019	2.35	0.0014	0.0050	0.28	-0.0010	0.0051	-0.19	0.0094	0.0049
Year of schooling, father	0.0037	0.0011	3.52	0.0028	0.0014	2.06	0.0041	0.0032	1.27	-0.0011	0.0041	-0.26	0.0130	0.0034
Urban	0.0075	0.0047	1.59	0.0001	0.0059	0.01	0.0299	0.0135	2.21	-0.0093	0.0171	-0.54	0.0109	0.0167
Disp. Income, per cap (0000)	-0.0002	0.0002	-1.03	-0.0002	0.0002	-0.99	0.0020	0.0011	1.83	-0.0005	0.0008	-0.66	0.0054	0.0014
Prop. of bgy with elem. School	0.0827	0.0188	4.39	0.0944	0.0215	4.39	0.0177	0.0514	0.34	0.0571	0.0524	1.09	0.0876	0.0590
Prop. of bgy with sec. School	0.0236	0.0180	1.31	-0.0046	0.0201	-0.23	0.1313	0.0613	2.14	-0.0224	0.0589	-0.38	-0.0263	0.0797
Region 1	0.0021	0.0143	0.15	0.0002	0.0135	0.01	0.1066	0.0509	2.10	0.0845	0.0430	1.97	0.0994	0.0615
Region 2	0.0183	0.0098	1.88	0.0116	0.0106	1.10	-0.0019	0.0415	-0.05	-0.0385	0.0437	-0.88	0.0307	0.0488
Region 3	-0.0136	0.0099	-1.37	-0.0257	0.0091	-2.82	0.0065	0.0313	0.21	-0.0415	0.0282	-1.47	-0.0407	0.0389
Region 4	0.0018	0.0085	0.21	-0.0017	0.0076	-0.22	0.0407	0.0283	1.44	0.0206	0.0234	0.88	0.0413	0.0375
Region 5	0.0018	0.0192	0.1	0.0067	0.0203	0.33	0.1174	0.0547	2.15	0.1303	0.0526	2.48	0.1551	0.0633
Region 6	0.0113	0.0130	0.87	0.0123	0.0131	0.94	0.1089	0.0404	2.70	0.1147	0.0383	3.00	0.2240	0.0569
Region 7	-0.0191	0.0131	-1.46	-0.0161	0.0136	-1.18	0.0744	0.0418	1.78	0.0963	0.0416	2.32	0.1286	0.0520
Region 8	0.0052	0.0180	0.29	0.0093	0.0187	0.50	0.1122	0.0551	2.04	0.1277	0.0540	2.37	0.2122	0.0691
Region 9	-0.0519	0.0143	-3.64	-0.0512	0.0144	-3.57	0.0479	0.0428	1.12	0.0517	0.0407	1.27	0.2058	0.0611
Region 10	-0.0105	0.0111	-0.95	-0.0058	0.0122	-0.48	0.0391	0.0339	1.15	0.0757	0.0345	2.20	0.0668	0.0444
Region 11	-0.0277	0.0117	-2.38	-0.0272	0.0117	-2.33	0.0301	0.0364	0.83	0.0457	0.0346	1.32	0.0350	0.0461
Region 12	-0.0260	0.0156	-1.67	-0.0174	0.0180	-0.97	0.1059	0.0498	2.13	0.1421	0.0539	2.64	0.2761	0.0557
CAR	0.0254	0.0161	1.58	0.0245	0.0149	1.64	0.1767	0.0561	3.15	0.1598	0.0477	3.35	0.2886	0.0642
ARMM	-0.1451	0.0174	-8.35	-0.1542	0.0156	-9.91	0.1724	0.0459	3.75	0.1264	0.0353	3.58	0.4180	0.0746
Caraga	0.0018	0.0117	0.15	0.0067	0.0129	0.52	0.1078	0.0411	2.62	0.1467	0.0444	3.30	0.1522	0.0576
Constant	0.7835	0.0679	11.53	0.7941	0.0691	11.50	2.0323	0.4518	4.50	1.9998	0.4091	4.89	2.1660	0.6451
No. of Obs.	8,949						6,435						6,060	
Overidentification test:														
J-Hansen (GMM) (P-value)	1.83(0.176)			1.32(0.250)			10.48(0.0012)			9.81(0.0017)			10.69(0.001)	

* For 2SLS and GMM estimates, instrumented with both male and both female for the first two births.

Table 7. Impact on proportion of enrollment of children by per capita income quintile, %

	Age Groups			
	6-24	6-12	13-16	17-24
Average	-19.3	ns	-25.6	-57.4
Poorest	-23.6	ns	-29.1	-76.7
Lower middle	-15.5	ns	-16.0	-41.9
Middle	-16.0	ns	-16.5	-37.5
Upper middle	-16.0	ns	-16.5	-28.3
Richest	-16.1	ns	-17.1	-22.2
Curr. Attendance	73.7	94.2	86.7	38.6

ns - not statistically significant