Bulletin of Indonesian Economic Studies Vol 35 No 3, December 1999, pp. 115–44

FEMALE EDUCATION AND CHILD MORTALITY IN INDONESIA

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This paper uses a sample of 6,620 women from the 1994 Indonesian Demographic and Health Survey to examine the relationship between female education and child mortality in Indonesia. Female education is measured in terms of both years of education and literacy. Both primary education and secondary schooling significantly decrease the probability of child death, while literacy plays an insignificant role. When the sample is divided into urban and rural locations, primary and secondary education are significant in both areas in reducing the likelihood of a mother experiencing child mortality. The benefits of public and private infrastructure appear to differ in rural and urban areas. The results confirm that investment in female human capital lowers the probability of child mortality.

INTRODUCTION

The Indonesian child mortality rate has fallen significantly over the past 20 years. Infant mortality fell from 125 to 51 deaths per thousand births between 1960 and 1995 (World Bank 1980, 1997). Information on child mortality is harder to come by, but there is evidence of a similar decline.[1] Apart from the obvious micro-level benefits to mothers and families, lower child mortality is also desirable at the macro level. High child mortality is often cited as a significant determinant of high fertility rates and high population growth. In an environment where there is very little public financial support for the elderly, it is important for individuals to ensure that they have offspring who will survive to look after them in old age. If child mortality rates are high then there is an incentive to have more children to guarantee that some survive. Risk-averse parents tend to overcompensate for the risk of child death, and high population growth results. Thus, lower child mortality rates reduce the incentive to have large families, and over time result in lower fertility rates and a consequent lowering of the population growth rate.[2]

A lower rate of population growth has long been a goal of the Indonesian government. Under its highly successful family planning program, the fertility rate dropped from five to three children per woman in the 20 years between 1971 and 1991 (Jensen 1996). Given the research interest in these fertility changes (for example, Jensen 1996; Gertler and Molyneaux 1994; and Hull 1993), and the continuing government view of fertility and population control as an important policy objective, it is surprising that so little research has been conducted on child mortality.[3] We are specifically interested in examining the relationship between child mortality and the mother's level of education.

The only previous studies of Indonesian child mortality of which we are aware are Cho, Suharto, McNicoll and Mamas (1980), McDonald (1980) and Martin, Trussel, Salvails and Shah (1983). Cho *et al.* examined differences in infant mortality rates across urban and rural areas in the 1960s, but did not analyse the determinants of these differentials. McDonald's paper is a short note that examines the proportion of children dying before the age of five in 1976. He presents cross-tabulations of deaths by the education of the mother and of the father. Child mortality was highest among households in which the father had no education, and next highest among those in which the mother had no education. He found the effect of primary school education to be quite small, however. The largest decrease in child mortality occurred with secondary education. Without the ability to control for household expenditure or income, however, it is not clear whether he was identifying a pure education effect or the result of higher incomes.

Martin *et al.* (1983) conducted a more sophisticated statistical analysis using a hazard model to estimate the probability of child death. Their study used data from the 1976 Indonesian Fertility Survey, which covered only Java and Bali. They examined the effect of the mother's education, but the data did not allow them to control for household income or expenditure. Husband's education level was included as a proxy for household income. They were also unable to control for household and community infrastructure. The study found that one to six years of maternal education did not affect the probability of child death, but more than six years of education lowered it.

This paper contributes to the literature in a number of ways. First, it provides only the second multivariate study of child mortality in Indonesia. Second, it uses data from the 1994 Demographic and Health Survey (DHS), and so significantly updates this field of inquiry and is able to study the entire nation, rather than just Java and Bali. Third, we are able to control for household expenditure, and so can separate out the income-enhancing effect of education from its other roles. Fourth, we use data on literacy as well as years of formal schooling to assess more accurately the type of education or knowledge that impacts on child mortality. Finally, the DHS provides information on household infrastructure such as toilet facilities and piped water, and we merge this with provincial level data on the provision of health services. As a result, we are able to examine the previously unstudied effect of such facilities on child mortality in Indonesia.

EDUCATION AND CHILD MORTALITY

The role of female education in lowering child mortality has been widely recognised in the literature. In an early survey of studies in this area, Cochrane (1979) showed that most empirical research had found maternal education to reduce the probability of child mortality.

Mother's education is hypothesised to lower child mortality in a number of ways. Education reduces the cost of information; thus more educated women have been found empirically to have a greater understanding of the value of public health infrastructure and to be better able to locate health services (Singh 1994: 209–20; Caldwell 1979: 405–9; Aly and Grabowski 1990: 735). Access to health care facilities and toilet connections has been found to benefit children of educated mothers more than those of less educated mothers. Education may also serve to reduce fatalistic attitudes towards illness, promoting the use of modern techniques of child care and disease prevention, and thus reducing reliance upon traditional methods of child care (Caldwell 1979). In both of these ways, female education is a complement to health services. It has also been found to compensate for a lack of health facilities: Barrera (1990) and Benefo and Schultz (1994) found that a higher level of education amongst mothers counteracted the effects of an unclean community environment and a lack of safe water connections.

There is evidence that maternal education may also affect the traditional balance of family relationships, and that this works to the advantage of children. Several studies have found a relationship between child outcomes and women's control of assets and income.[4] Given that education and income are positively related, it is likely that higher levels of maternal education may also decrease the probability of child mortality via greater maternal bargaining power within the household. Even household preferences involving food types consumed, weaning and methods of child care may alter because of education (Caldwell 1979:

409–10). The positive relationship between education and earnings may also have a direct effect in terms of increased household expenditure. Better educated women may be more likely to find partners with greater earning potential, which would augment this income effect (Schultz 1984). Barrera (1990) found, however, that an increase in family economic status is not a significant channel through which education affects child health.

Finally, a woman's educational attainment reflects the willingness of her parents to invest in female children, and may be correlated with the mother having received relatively high nutrition and good training as a child. This background may improve her capacity to produce healthy children (Barrera 1990). It is difficult, however, to test this empirically.[5]

This research focuses on the socio-economic determinants of child death. We recognise, however, that child death is directly physiological. As is clear from the discussion above, socio-economic variables such as the education of the mother affect child death via intermediate factors that influence the physiological wellbeing of the child. Mosley and Chen (1984) develop an analytical framework that links the socio-economic determinants of child death to these intermediate determinants. This set of variables includes maternal factors, nutrient deficiency, personal illness control and environmental contamination. In this study, we do not explicitly model these linkages. We believe this is appropriate, given that our main aim is to quantify the effect of maternal education on the probability of child death. If we were to control completely for all intermediate factors, then the socio-economic variables would be seen to have no impact on child death. We know that this is not the case, and that the socio-economic variables simply lie further back along the chain of causality. Furthermore, as we discuss below, the inclusion of these intermediate factors is often problematic because of their likely endogeneity, and in some cases their inclusion is impossible owing to lack of data. We have included some simple controls for environmental contamination and immunisation, and examine explicitly whether the impact of these variables differs with the educational attainment of the mother.

DATA

The 1994 Indonesian Demographic and Health Survey contains individual, household and community level information pertaining to 28,168 Indonesian 'ever-married' women between the ages of 15 and 49.[6] It provides detailed data on health and demographic variables and on household structure and expenditure patterns over the 12 months prior to the survey.

The sample used in this paper is restricted to women who had given birth in the five years before the DHS survey and for whom there are expenditure data. Owing to cost constraints the expenditure data were collected only for a random 50% of the sample. As our study relies heavily on this information, the working sample is restricted to this proportion of the population. The final sample includes 6,620 women.

We limited the sample to women who had given birth relatively recently because we wished to examine more recent child deaths. This was necessary because the DHS provides information on the value of the explanatory variables only in the year of the survey. For instance, we know what per capita household expenditure was in 1994, but not in previous years. We are thus examining the relationship between past deaths and the current circumstances of the mother. For variables that we expect to be largely non-time-varying, such as maternal education and province of residence, this is not problematic. Even the time-varying variables used, such as per capita expenditure and control for socio-economic status, are likely to be highly correlated across time. Thus, for example, per capita household expenditure today is likely to be highly correlated with past expenditure, and hence with past child deaths. Restricting the sample to mothers who have young children in order to focus the analysis on relatively recent deaths ensures the relevance of the current values of the variables.[7] In the restricted sample, 75% of the mothers who have experienced child death have done so in the last 10 years, and the reported results are robust to restricting child deaths to those that occurred *only* in the last 10 years. We also present results estimated using only non-time-varying variables.[8]

It is not possible to restrict the sample to only very recent births (for example, those in the past three years) because this exacerbates the censoring of observations in the sample; that is, any child aged less than five at the time of the survey has not had the full opportunity to die before his or her fifth birthday. Hence, the choice of sample reflects the need to balance the biases that arise from censoring (so including children born more than five years ago) against the need to examine relatively recent births because of the lack of information on past values of the explanatory variables.[9]

The DHS data are supplemented with regional information from the *Statistical Yearbook of Indonesia* (BPS 1995) on local market prices, the number of public health centres and weather patterns in 1994.

METHODOLOGY

Child mortality is here defined as the death of a child before the age of five. Of the women in the sample, 22% have had a child die before this age.[10] There are a number of ways to model child death. We model the probability of a mother experiencing the death of a child using probit estimation. Another alternative would have been to estimate tobits, with the proportion of the woman's children who died as the dependent variable, and upper censoring at 1.0 and lower censoring at zero. A tobit specification theoretically uses the data more efficiently because it utilises more information than just the 0/1 nature of accounting for a child death. We estimated tobits but found the results did not differ significantly from the probit results. This suggests that little differentiates a woman who has had one child die from women who have experienced multiple child deaths. In the interests of clarity we have chosen to present the probit results.[11]

A further alternative would have been to structure the data with one observation per ever-born child, and then to have estimated the probability of each child having died before the age of five. The main advantage of this would have been to allow us to control for some of the intermediate determinants of child death. However, as discussed above, we wish to capture the full effect of socio-economic determinants on child death and so do not wish to apportion them over the various intermediate factors. In addition, data limitations make it impossible to control for variables such as the duration of breast-feeding (reported only for children born in the last three years) and immunisation (reported only for children who were alive at the time of the survey). The DHS does provide data on preceding birth intervals for all children and the birth age of the mother, but these variables are likely to be endogenous. It is well established that fertility and mortality are jointly determined, so any variable that is a function of fertility is endogenous to child mortality. For instance, the birth age of the mother is a function of her fertility behaviour and so is endogenous, as is any variable that is a function of previous or current mortality experience. Barrera (1991) argues that breast-feeding is endogenous because whether to breast-feed or not is a function of child health. Since the length of the preceding birth interval is likely to be a function of whether the previous child survived or not, it is similarly endogenous.

Given that little is gained from using the child as the unit of observation, and that the focus of the paper is on the effect of maternal education on child mortality, we present results from a sample with one observation per woman. Results obtained from samples with one observation per child are qualitatively identical, and are available from the authors on request.

The probit model assumes that there is a latent variable y_i^* which can be written as a linear function of variables that affect the probability of a child dying. Hence, we can write:

$$y_i^* = \beta X_i + \varepsilon_i \tag{1}$$

where X_i is a vector of explanatory variables, β is the vector of coefficients that will be estimated and ε_i is a random error term. The latent variable is unobservable and instead the dummy variable $y_i = 1$ if a child has died, and zero otherwise, is observed. It is defined as:

$$y_i = 1 \text{ if } y_i^* > 0$$
$$= 0 \text{ otherwise}$$

The probit model assumes that the error term, ε_i, is distributed according to the cumulative normal distribution function. If this is the case, then the probability of at least one child dying can be written as:

$$P = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\beta X_i} e^{-0.5t^2} dt \tag{2}$$

where t is a standardised normal variable. Maximum likelihood estimation produces estimates of the βs.

Explanatory Variables

Household Level Variables. The probability of a child dying will reflect characteristics of both the mother and father and the household's socio-economic status. The geographic region in which the household lives and the extent of social and household infrastructure in the region may also be important determinants of child mortality.

The characteristic of the mother that has received the most attention as a determinant of child mortality is her educational attainment (Aly and Grabowski 1990; Singh 1994), which can affect child mortality through the channels discussed above. We are interested in determining the level of education that is effective in reducing child mortality. Some studies have suggested that it is literacy rather than years of formal education that is of importance. United Nations (1991), for example, states that 'literacy is a better measure of education than enrollment since it usually reflects a minimal level of completing schooling'. Obviously, literacy and years of education are closely related variables. In the DHS data they are, however, independent enough to allow us to include both as explanatory variables. A dummy variable (*literate*), which equals 1 if the mother is able to read and zero otherwise, is included in the regressions. We also define three variables (*primary, secondary, tertiary*), which indicate the number of years of schooling received by the mother at each of the respective stages of the education process. By defining three variables, we allow the effect of an additional year of schooling to differ depending on whether it is at primary, secondary or tertiary level.

If it is literacy *per se* that has a negative effect on the incidence of child mortality, then we would expect *literate* to be statistically significant in the regressions. This might be the case, for example, if by being literate one has access to information on health that is not available to the illiterate. However, it may be that through additional formal education women can further reduce the likelihood of a child dying. For example, information on health procedures may be disseminated through schools, or it could be that through participation in the formal education process one establishes the contacts and confidence to use public health facilities more effectively.

The woman's education is also likely to affect her earning capacity, and hence the income and expenditure of the household. The DHS does not provide income data. We are able to control for household expenditure, however, and include the logarithm of per capita annual household expenditures as an explanatory variable. Hence, the coefficients on the education terms will pick up the pure effect of education on child mortality, not the effect via income or expenditure. Expenditure is likely to be endogenous because it will vary with household size, which is a function of child mortality. Even per capita expenditure is likely to vary with household size, because of economies of scale within the household.[12] The estimation procedure deals with the likely endogeneity of the logarithm of per capita expenditure. An expenditure equation is estimated, and the predicted value, rather than the actual value, of the logarithm of per capita expenditure is used in the child mortality probits. To ensure identification we need to include instruments in the prediction regression that do not belong directly in the child mortality probit. The instruments used are: whether the family owns its own home; whether it has a mortgage or pays rent; and whether it has electricity, a television set, a kerosene stove, a motor cycle or a motor boat.[13]

We further control for the socio-economic status of the household by including variables reflecting the husband's occupation. The sample includes only ever-married women, and we control for the occupation of the husband, regardless of whether he still resides in the household. This is because the husband's occupation is likely to be correlated with the socio-economic status of the woman whether he is resident or not. We control for the presence of the husband using a dummy variable (*husband*) that equals 1 if the husband lives in the household and 0 otherwise.

The woman's age is also likely to be an important determinant of the probability of her having experienced the death of a child. We define five age category variables, which range from the lowest age of 15 to the highest of 49. The woman's age is a proxy for her physical health and her reproductive opportunities. Because the likelihood of genetic disorders in the child increases with the age of the mother, we would expect a positive relationship between the mother's age and the probability of child death. In addition, the woman's age identifies her birth cohort, and so may also capture the effects on child mortality of Indonesia's development stage. For example, a woman who is 45 is more likely to have had children 20 years ago, when there was much less in the way of public health education and health centres.[14]

The overriding factor with respect to age, however, is likely to be that older women will have had more children on average than younger women, and so will have had greater exposure to the possibility of child death. Ideally, we would control for the number of children ever born to each woman. However, the number of children ever born is likely to be endogenous, because women whose children have died will be more likely, other things being equal, to have had more children than those who have not experienced the death of a child. Modelling the number of children ever born is a complex undertaking and beyond the scope of this paper.[15] The estimation procedure used here does, however, make use of data on the number of children ever born to each woman. The inability to control directly for the number of children gives rise to a heteroscedasticity problem. The variance of the residuals is likely to be smaller for women who have had more children, because more information is contained in these observations.[16] The variance of the error term is thus inversely related to the number of children; that is:

$$Var(\varepsilon_i) = \frac{\sigma^2}{children_i} \tag{3}$$

To correct for this, we estimate a weighted probit where the weights are the square root of the number of children ever born.[17] All of the possible relationships between the mother's age and child mortality discussed above give rise to a positive association between the two variables. We will be unable, however, to differentiate empirically between these hypotheses.

The sanitation facilities of the household are also likely to affect the probability of child death. We control for access to piped water and for whether the household has a toilet.

We also control for the woman's religion. Child mortality may differ across religious groups because of differences in traditions (such as the practice of circumcision) and in the cultural importance of children.

Provincial Level Variables. In addition to household level variables, we supplement the DHS data with some provincial level indicators. Rice is the dominant subsistence food in Indonesia, so we include provincial retail rice prices to control for the effect on child health of differences in purchasing power across regions. We also control for different inflation rates across provinces by including a clothing price index, a general price index and a housing price index.[18] The average monthly rainfall in each province in the wet and dry seasons may also be relevant. Rainfall may impact upon child mortality, as it is linked to the prevalence of certain infectious diseases and parasites, and is correlated with agricultural conditions (Benefo and Schultz 1994: 9–10).[19]

We also control for the number of public health centres per province.[20] A potential problem with the inclusion of infrastructure variables is the possible endogeneity of government policy. Interregional variation in policies and programs may not be independent of household resources and preferences. For example, health programs may be set up in regions with particularly serious health problems. Immunisation and disease control may be targeted to poorer areas where the populace is less educated. Hence some public health programs could be associated with *higher* child mortality. Additionally, there is the problem of endogenous migration. People may relocate toward healthier environments and specially targeted public health programs. If these migrants also invest relatively more in the health of their family for unobserved reasons, then this type of migration may lead to bias in regionally based policy evaluation studies. We do not attempt to endogenise these policy variables, but such issues need to be kept in mind when interpreting their coefficients.

We also wished to control for child immunisation. The proportion of each woman's children who were immunised is likely to be endogenous, however, because women who have had a child die may be more inclined to have their remaining children immunised. Also, it is an inappropriate measure in practice, because the DHS reports it only for living children. To overcome this problem, the provincial average immunisation rate was constructed from the DHS data. The provincial average reflects the prevalence of immunisation in the province, and so will control for community attitudes to immunisation and the existence and effectiveness of immunisation programs, while avoiding the problem of endogeneity.

TABLE 1 *Summary Statistics*

Variable		Mean	Standard	Min.	Max.
Dependent variable					
At least one of the mother's offspring died before the age of five		0.221	0.415	0	1
Explanatory variables at the individual and household levels					
Women's completed years of schooling					
Primary		4.398	2.253	0	6
Secondary		1.437	2.306	0	6
Tertiary		0.151	0.906	0	6
Literacy dummy		0.810	0.393	0	1
Logarithm of annual household expenditure per capita		13.02	0.587	10.65	15.81
Predicted logarithm of annual household expenditure per capita		13.00	0.394	12.29	14.45
Woman's age:	15–24	0.252	0.434	0	1
	25–29	0.288	0.453	0	1
	30–34	0.236	0.425	0	1
	35–39	0.149	0.356	0	1
	40–49	0.075	0.263	0	1
Husband's occupation					
Administration		0.010	0.100	0	1
Agriculture		0.452	0.498	0	1
Clerical		0.065	0.247	0	1
Industry		0.222	0.416	0	1
Professional		0.074	0.261	0	1
Sales		0.104	0.306	0	1
Service		0.048	0.215	0	1
Other		0.004	0.059	0	1
Current rural resident		0.734	0.442	0	1
The family owns its own land		0.309	0.462	0	1
Religion:	Catholic	0.083	0.276	0	1
	Christian	0.089	0.285	0	1
	Buddhist	0.009	0.092	0	1
	Hindu	0.034	0.180	0	1
	Other	0.002	0.049	0	1
Toilet facility in residence		0.426	0.495	0	1
Protected water source, including piped water		0.119	0.324	0	1
Provincial level variables					
Average monthly rainfall:	Dry season	2.181	1.929	0	7.02
	Wet season	9.469	2.778	3	16.3
Average immunisation rate		0.444	0.102	0.27	0.67
Price of:	Rice	743.0	85.97	589.2	969.5
	Housing	209.5	219.1	128.0	1167.2
	Clothing	135.6	11.57	119.7	166.9
	General items	153.4	6.405	139.9	169.2
Number of public health centres		287.6	270.5	78	951

N = 6,620

Two estimation strategies were adopted. First, the regressions were estimated with the full set of explanatory variables detailed above. Second, provincial dummy variables were included. These control for all observable and unobservable differences across provinces. Their inclusion meant, however, that we could not include the provincial level variables that may be of policy interest, such as the immunisation rate and the number of public health centres.[21] Table 1 presents the descriptive statistics of the dependent and explanatory variables.

Urban versus Rural Areas. It may be argued that the effect of female education is likely to differ between rural and urban areas. Rural people are more likely to rely on traditional methods for dealing with health problems. Health facilities are not so readily accessible, and perhaps not of the same quality as in urban areas. The information communicated through education may thus be more important in rural than in urban areas, where information is more readily available and clinics are more accessible (Aly and Grabowski 1990: 73). In the first specifications we used a rural/urban dummy to control for whether the household was situated in a rural area. To allow for the possible differential impact of education in rural and urban areas, we then estimated separate rural and urban equations.

Interacting Education with Infrastructure. In the same way that the value of education may differ across rural and urban settings, the value of social infrastructure may vary depending on the educational attainment of the population. To examine this, we ran additional regressions that interacted the years of education with the variables that reflect the existence of toilet facilities, the availability of piped water, the number of public health centres and the average provincial immunisation rate.

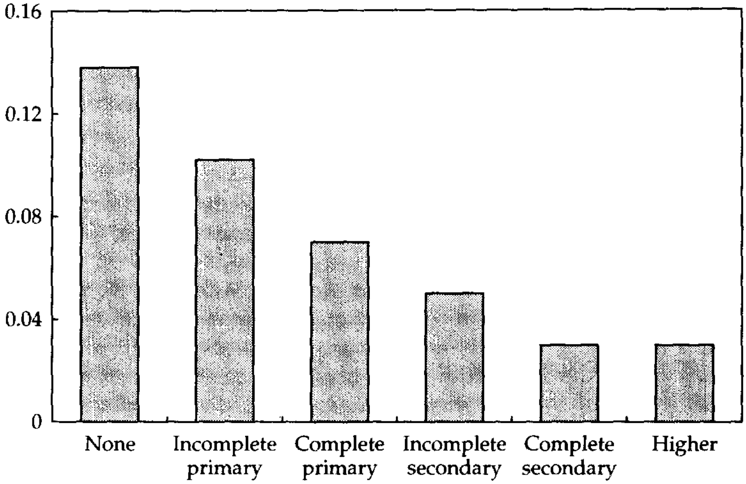
EMPIRICAL RESULTS

Preliminary Results

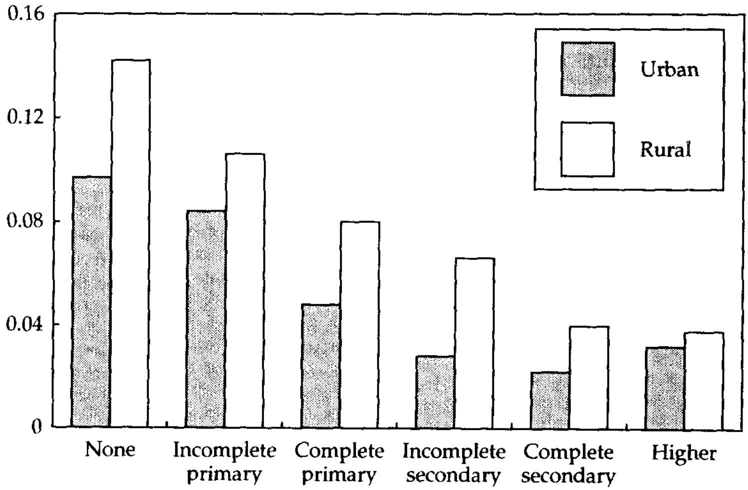
Figures 1a and 1b present the raw relationship between female education and child mortality in the DHS data. The negative relationship is clearly depicted. The results suggest that the benefits of education are concentrated in the first six years of education (the completion of primary school). This is at odds with the conclusions drawn in Martin *et al.* (1983) and McDonald (1980). Women with no education experience child mortality rates 35% higher than those who have entered, but not completed, primary school, and 97% higher than those who have completed primary school. The mean child mortality rate drops even further from 5% for women who have entered secondary education to

FIGURE 1 *Mean Child Mortality by Educational Attainment*

(a) Total Sample



(b) Urban and Rural Samples



3% for women who have completed secondary education or entered higher education.

The figures for urban and rural areas suggest that the relationship between the mother's education and child mortality differs with the region of residence. The rural child mortality rate is higher at each level of education, and the benefits of education do not seem to drop away so sharply after the completion of primary school in rural areas.

Estimation Results

Table 2 presents the probit results. The marginal effects and z-statistics are reported; the probit coefficients are not reported, but are available from the authors on request.

The Endogeneity of Expenditure in the Child Mortality Regression. Column 1 presents the results without instrumenting for the logarithm of per capita expenditure and without the inclusion of provincial dummies. A comparison of the results in column 1 with those in column 2, which instrument for expenditure, confirms the expectation that expenditure is endogenous. When expenditure is not treated as endogenous, the coefficient on expenditure is positive and statistically significant. This suggests that the greater the level of expenditure per capita in a household, the higher child mortality is likely to be. This is clearly counter-intuitive.[22] Once one addresses the possible endogeneity of the variable, the coefficient remains statistically significant but becomes negative. The marginal effect indicates that a household with 10% higher current per capita household expenditure than another household has on average a 0.97 percentage point lower probability of having had a child die.[23] The first stage regression is reported in appendix table A1. The instruments were jointly significant (F-stat = 36.92; p-value = 0.000).

Education Variables. The results in column 2 of table 2 show that additional years of either primary or secondary school education significantly reduce the probability of child death. (Tertiary education is negatively correlated with child mortality, but the relationship is not significant.) In contrast, the literacy dummy is insignificant. If literacy is the only control for education in the regression, it comes in as being strongly negatively related to child mortality, but when we also control for years of education, literacy is no longer statistically significant. This suggests that literacy is an important determinant of child death, but that it is more than just literacy skills that reduces the probability of child death. Involvement in formal education, even beyond the years in which literacy skills are acquired, is an important factor.[24]

TABLE 2 *Weighted Probit Results*[a]
(dependent variable = 1 if the woman had a child who died aged ≤5 years, 0 otherwise)

N = 6,620	(1)		(2) Instrumenting for Log Exp		(3) Incl. Provincial Dummies & Instrumenting	
Variable	dF/dx	z-stat.	dF/dx	z-stat.	dF/dx	z-stat.
Household level variables						
Female education in years						
Primary	–0.019	–4.71	–0.018	–4.28	–0.017	–3.98
Secondary	–0.026	–6.69	–0.021	–5.12	–0.020	–4.85
Higher	–0.018	–1.65	–0.011	–1.02	–0.009	–0.82
Literacy dummy	0.006	0.29	0.009	0.42	0.008	0.38
Logarithm of annual expenditure per capita	0.032	2.61	–0.097	–2.39	–0.126	–3.03
Family owned land	–0.041	–2.48	–0.047	–2.88	–0.046	–2.75
Woman's age: 25–29	0.124	5.98	0.118	5.72	0.116	5.58
30–34	0.229	11.03	0.223	10.72	0.225	10.75
35–39	0.284	12.66	0.273	12.16	0.271	11.95
40–49	0.361	14.02	0.350	13.56	0.350	13.40
Husband present	–0.061	–1.77	–0.050	–1.46	–0.044	–1.30
Husband's occupation						
Professional	–0.034	–0.74	–0.023	–0.50	–0.023	–0.48
Administration	0.050	0.67	0.085	1.09	0.085	1.09
Clerical	0.037	0.74	0.054	1.05	0.064	1.23
Sales	0.016	0.36	0.023	0.52	0.026	0.57
Service	0.080	1.56	0.089	1.73	0.091	1.76
Agriculture	0.034	0.80	0.021	0.50	0.022	0.51
Industry	–0.010	–0.23	–0.007	–0.17	–0.007	–0.17
Other	–0.198	–1.99	–0.205	–2.10	–0.209	–2.23
Rural residence	0.040	2.44	0.005	0.24	0.011	0.51
Toilet facility in residence	–0.066	–5.22	–0.052	–3.88	–0.044	–3.16
Piped water	–0.079	–3.62	–0.067	–2.99	–0.065	–2.91
Religion: Buddhist	–0.167	–2.72	–0.148	–2.25	–0.162	–2.52
Catholic	–0.049	–2.25	–0.052	–2.37	–0.013	–0.44
Christian	–0.065	–3.18	–0.070	–3.43	–0.074	–3.35
Hindu	–0.130	–3.53	–0.134	–3.70	–0.186	–3.62
Other	–0.148	–1.55	–0.151	–1.58	–0.165	–1.80
Provincial level variables						
Dry season rainfall	0.006	1.45	0.008	1.94		
Wet season rainfall	–0.011	–3.91	–0.010	–3.79		
Public health centres/100	–0.006	–2.48	–0.005	–2.12		
Average immunisation rate	–0.251	–5.22	–0.327	–4.36		
Price of housing	–0.000	–0.23	–0.000	–0.94		
Price of clothing	–0.003	–5.42	–0.003	–4.50		
Price of general items	0.004	2.74	0.005	3.71		
Price of rice	0.000	0.45	0.000	1.76		
Pseudo-R^2	0.12		0.12		0.13	

[a]The excluded categories are: aged 15–24; husband not working; Muslim. Note that the marginal effects correspond to a one-unit increase in continuous variables and a discrete change from 0 to 1 for dummy variables.

An extra year of primary school education decreases the probability of a mother experiencing child death by 1.9 percentage points. The marginal effect for secondary schooling is slightly higher (2.6 percentage points), but we cannot reject the hypothesis that an additional year of secondary schooling has the same effect as an additional year of primary schooling (p-value = 0.57).

These results are consistent with the findings of McDonald (1980) and Martin *et al.* (1983), in that we find secondary education to be an important determinant of child mortality. Like these studies, the point estimates suggest that an additional year of secondary school might have a slightly larger effect than a year of primary schooling, but, as stated above, we cannot reject the hypothesis that the coefficients on primary and secondary schooling are equal. The finding that primary schooling plays a significant role is contrary to the results of the earlier studies.

Other Variables. As expected, there is a positive relationship between maternal age and child death, and it is strongly statistically significant. The estimated marginal effect on the probability of child death increases monotonically through the age categories. A woman aged 25–29 has a 12.4 percentage point higher probability of having had a child die than a woman aged 15–24. A woman aged 40–49 has a 36.1 percentage point higher probability of one of her children having died. This is consistent with the idea, discussed above, that older women have a higher risk of child mortality for biological and reproductive cycle reasons. Additionally, the effect of Indonesia's development path is captured in these variables, with younger families having greater access to health services, and the quality of these services being higher.

Owning land decreases the probability of child death by 4.1 percentage points, and this is statistically significant. Land ownership confers greater power over the family's livelihood, and may be correlated with more stable incomes. Husband's occupation, included as another measure of socio-economic status, does not seem to be an important determinant of child mortality. Only in the 'other' category is the relationship statistically significant at the 5% level. Women with husbands in this category have a 20.5 percentage point lower probability of having had a child die. We experimented with also including husband's educational attainment, and found that the paternal education variables were statistically insignificant.[25] The presence of the husband in the household has a negative but statistically insignificant effect on child mortality.

The results for the provincial price variables are mixed. These variables were included to reflect differences in the cost of living across provinces. They were thus expected to be positively correlated with child mortality. The general price index has a positive effect and is statistically significant.

Higher prices, if not immediately compensated for by higher incomes, reduce a household's purchasing power and so may reduce expenditure on inputs to child health. The price of rice, although also on average being positively correlated with child mortality, is insignificant at the 5% level (p-value = 0.08). This is somewhat surprising, given the role of rice as a staple food. The clothing price index is also statistically significant, but has a negative sign. Both of the price index effects are quantitatively small.[26]

Infrastructure and Environment. We included the dry season and wet season rains as a proxy for the prevalence of disease in each province. Child mortality is higher in regions where there are high dry season rains (although this variable has a p-value of 0.052) and lower in regions with high wet season rains (p-value = 0.00). This suggests that a more monsoonal climate may be beneficial for child health.

In terms of household infrastructure, we found that both having a toilet and having piped water in the residence reduced the probability of child death. The coefficients for presence of these facilities were strongly statistically significant and quantitatively quite important. The presence of a toilet decreased the probability of child death by 5.2 percentage points. Piped water was even more important, reducing the probability of one or more of a woman's children dying by 6.7 percentage points.

The number of public health centres in the province also has a statistically significant negative effect on the probability of a mother experiencing child death.[27] The coefficient on the variable is small, however, with the addition of 100 public health centres reducing the probability of child mortality by a factor of 0.5 percentage points. As discussed above, this quantitatively small effect is difficult to interpret, given the possible endogeneity of health centre placement.

The provincial immunisation rate has a large and strongly statistically significant negative effect on the probability of child death. A woman living in a province where there is no immunisation has a 32.7 percentage points higher probability of having a child die than a woman who lives in a province where all of the children are immunised.

The coefficients on the religion dummies indicate that there are substantial religious differences in the incidence of child mortality. Muslims are significantly more likely to experience child death than non-Muslims. Catholics are the next most likely, then Protestants, Buddhists and Hindus. The magnitude of the effect is quite large. For example, the probability of having a child die is 7.0 percentage points lower for a Protestant than for a Muslim.

Inclusion of Provincial Dummies

Column 3 of table 2 presents the results of the probit regressions in which provincial dummy variables were used to absorb any across-province differences. The coefficients on the other variables are largely invariant to whether we control for all provincial differences using the dummy variables or include provincial level explanatory variables. This suggests either that the provincial level variables in column 2 were picking up a lot of the across-province variation, or that provincial level differences are largely uncorrelated with the other explanatory variables. Only the coefficients on dummy variables that reflect some of the minority religions change appreciably. This is not surprising, given that the religions differ across geographic zones. There are still statistically significant differences across religious groups, although there is no longer any statistically significant difference in the prevalence of child death for Muslims and Catholics. The coefficients and standard errors of the provincial dummies are reported in appendix table A2. Geographic differences in child mortality are found. The provinces of Lampung, North Sulawesi, Central Java, Central Kalimantan and Yogyakarta are all associated with a significantly lower likelihood of child mortality than the omitted province of Jakarta. Among mothers in the sample, the probability of having had at least one child die is actually highest in Bali, although this is not statistically significantly different from that for Jakarta at the 5% level (p-value = 0.081). Child mortality is significantly higher in West Kalimantan and West Nusa Tenggara than in Jakarta. The differences across provinces are large. For example, the probability of a mother in West Kalimantan having one or more children die is 27.0 percentage points higher than that for a mother in Yogyakarta.

Non-Time-Varying Variables Only

Our sample was restricted to women who had given birth in the last five years in order to focus attention on relatively recent deaths, because the data set measured the explanatory variables only in the survey year. To assess the sensitivity of our results to the use of the current values of time-varying variables, we estimated the regressions using only non-time-varying variables, including provincial dummies. We also included the variables that reflect the age of the woman, because these to some extent capture the time path of mortality changes. Appendix table A3 shows that the results of this experiment are very similar to those produced with the full set of explanatory variables. Of the educational variables, only primary and secondary education are statistically significant. The estimated marginal effects of extra years of schooling at these levels are, not surprisingly, slightly larger than when we include the full set of explanatory variables. An extra year of primary school is now estimated to reduce the probability of a woman experiencing child death by 2.2 percentage points (compared to the earlier 1.7 percentage points in column 3 of table 2) and a year at secondary school is estimated to lower the probability by 3.3 percentage points (compared to the previous 2.0 points). The education categories now pick up the effects of all of the omitted time-varying variables with which they are correlated. So, for instance, as education generally results in higher incomes and hence higher expenditure, the education variables are now also picking up the negative effect of expenditure on child mortality. To avoid this omitted variable bias, because we expect the time-varying variables to be highly correlated across time, and furthermore because, as mentioned earlier, the results were found to be robust to restricting attention to just a subset of more recent deaths, we proceed using both time-varying and non-time-varying variables.[28]

Rural and Urban Comparisons

Table 3 presents the results for the estimation over the rural and urban areas separately. Although the rural dummy is not significant in the estimation over the full sample (once one endogenises expenditure), it is likely that an additive dummy cannot effectively capture the difference in the probability of child mortality between rural and urban regions. The estimation results in table 2 restrict the coefficients on the variables, other than the constant, to be invariant across these two regions. It may be, for example, that female education plays a different role in rural and urban areas. In fact a different relationship is suggested in figure 1, where child mortality falls more slowly with female education in rural than in urban areas. Estimating the equations over the separate samples allows us to test this.

The pattern of benefits of female education is very similar in urban and rural areas. Literacy *per se* is insignificant in both regressions, as is tertiary education. Primary and secondary education significantly reduce the probability of child death in rural and urban areas, and in both areas we cannot reject the hypothesis that the benefit of an extra year of secondary education is the same as that of an extra year of primary education (as was concluded for the whole sample). However, the point estimates suggest that the benefits of additional maternal education are greater in urban than in rural areas. An extra year of primary (secondary) education reduces the probability of child death by 1.7 (1.9) percentage points in rural areas, and by 2.3 (2.0) percentage points in urban areas. A

TABLE 3 *Rural–Urban Comparisons*[a]

Variable	Rural		Urban	
	dF/dx	z-stat.	dF/dx	z-stat.
Female education (years)				
Primary	–0.017	–3.28	–0.023	–3.40
Secondary	–0.019	–3.37	–0.020	–3.78
Higher	–0.014	–0.68	–0.011	–1.07
Literacy dummy	0.002	0.08	0.022	0.60
Logarithm of annual per capita expenditure	–0.140	–2.60	0.0003	0.01
Family owned land	–0.053	–2.81	0.0182	0.32
Number of public health centres/100	–0.003	–0.97	–0.011	–2.46
Average provincial immunisation rate	–0.276	–2.92	–0.547	–4.37
Toilet facility in residence	–0.062	–3.79	–0.023	–1.07
Piped water	–0.033	–0.89	–0.070	–3.11
Dry season rainfall	0.012	2.38	–0.006	–0.71
Wet season rainfall	–0.013	–4.01	–0.002	–0.39
Pseudo-R^2	0.10		0.18	
N	4,860		1,699	

[a]Log per capita expenditure has been instrumented for. These regressions also controlled for all of the other variables shown in table 2. Only variables of specific interest and of distinct difference between the models have been reported. The results for the unreported coefficients are available from the authors on request.

possible explanation for this difference is that rural education is of lower quality.[29] Excessively high student–teacher ratios and a shortage of fundamental resources such as libraries in rural areas (relative to urban areas) may reduce the impact on child mortality of years of education completed. It may be that the effect of a year of a *standardised* quality of education does not differ in urban and rural areas. An alternative possibility is that students may receive education relevant to appropriate child care practices in both regions, but that it may be more difficult to implement these practices in a rural environment.

Coefficients on some of the other explanatory variables also differ between rural and urban areas. Expenditure is only significant in rural areas. Health care services and other facilities are more accessible in urban areas, whereas greater expenditure may be required in rural areas to compensate for isolation.[30] The family's ownership of land is also significant only in rural samples. Land ownership is likely to be of greater importance in rural areas, owing to its role as a production input and its effect on the level and stability of income streams. In urban areas, although reflecting wealth, the ownership of land is less likely to have such a direct impact on livelihood.

The infrastructure variables reflecting waste disposal and cleanliness of water supply suggest interesting variations across urban and rural areas. Both variables have negative signs for both samples, implying that toilet and protected water connections tend to reduce child mortality. However, the toilet connections variable is significant only in the rural sample, whereas the protected water variable is significant only in urban areas. Piped water may be more important in urban areas, where congested conditions may lower the cleanliness of naturally available water.

The rural areas were driving the coefficients on the weather variables in the estimation over the entire sample. In the wet season higher rainfall reduces the prevalence of child mortality in rural areas, and in the dry season it increases it. Rainfall is not a significant determinant of child mortality in urban areas in either season. This may reflect the effect of weather conditions on agricultural output. Alternatively, rural diseases may be more dependent on rain conditions than diseases that are prevalent in urban areas.

The coefficient for the average immunisation rate bears a negative sign and is significant in both areas, although quantitatively immunisation is a much more important determinant in urban areas. Congested conditions in cities may make immunisation (not just of one's own but also of neighbours' children) an important factor in the spread of disease. Another possibility is that immunisation programs may be more reliable and of a higher quality in the city.

The number of public health centres is significant only in urban areas, and the magnitude of the effect is much larger than when estimated over the whole sample. The presence of an extra 100 health centres per province decreases the probability of a mother losing a child by 1.1 percentage points. The difference between rural and urban areas in the importance of public health centres probably reflects clustering of health facilities in urban centres. Rural residents benefit little from greater numbers of health centres if they remain geographically isolated from such services.

Interaction of Public Health Programs with Female Education

One of the hypothesised benefits of higher levels of education among mothers has been increased knowledge of the worth of public and private facilities. For example, greater knowledge of the benefits of health and sanitation services may cause more educated women to use these facilities or to use them more effectively, and hence may lower child mortality rates. Alternatively, education may serve as a substitute for community health programs. Both relationships suggest that the variables reflecting access to facilities should be interacted with the mothers' years of education.

Table 4 reports the results of regressions that include these interaction terms. Only the coefficients on the interacted variables are reported, although the full set of explanatory variables was included in the regression. None of the interaction terms is statistically significant at the 5% level. The urban/rural results in table 3 suggested that it might be worth including the interacted variables in separate rural and urban regressions. This was done, but the interaction terms remained insignificant in both cases. Hence we find no evidence that the benefits of health infrastructure and immunisation are greater or less for women with higher levels of education.

TABLE 4 *Interaction of Female Education with Infrastructure Variables*[a]

	Odds Ratio	z-statistic
Total years of education interacted with:		
Toilet	0.007	1.91
Piped water	0.010	1.72
Number of public health centres/100	0.000	–0.01
Average provincial immunisation rate	0.014	0.90

[a]The other explanatory variables used in the previous regressions were also controlled for in this regression. In addition, this regression allowed the effect of years of education to differ across rural and urban areas.

CONCLUSION

Child mortality and the health of young children are important issues in all countries, but particularly in developing nations, where child mortality rates are high by international standards. The empirical results obtained in this study suggest that increased investment in the human capital of women is one way of lowering these mortality rates. In Indonesia, the benefits are obtained via primary and secondary level education. An extra year of maternal primary schooling is estimated to reduce the probability of child death by 1.7 percentage points, and an extra year of secondary schooling by 2.0 percentage points.

The separate regressions for urban and rural women display patterns similar to those of the full sample. However, education in years completed appears to have a greater influence over the probability of child mortality in urban areas. This may be due to lower educational quality in remote rural regions. Moreover, the relatively low educational attainment of females in rural areas suggests that much can still be achieved in reducing child mortality through rural education programs aimed at women.

Public health variables were found to be statistically significant, but the impact differed by rural/urban residence. While immunisation rates are significant in both regions, the benefits are greatest in urban areas. In contrast, the number of public health centres per province is significant only in the urban sample. Having a toilet in the household reduces child mortality in rural areas, whereas in urban areas access to piped water is more important.

The results obtained in this study indicate that encouraging women to complete secondary education is likely to be effective in reducing child mortality in Indonesia. The extent to which lowered child mortality results in a consequent lowering of fertility rates and a slowing of population growth is an interesting area for further research.

NOTES

* We thank Joe Hirschberg and Chris Worswick for their helpful comments and assistance with the data, and acknowledge funding from Australian Research Council. Any errors are our own. The authors may be contacted by e-mail at: <l.cameron@ecomfac.unimelb.edu.au>.

1 Child mortality is defined in this study as the death of a child aged up to five years. World Bank (1980) provides figures for deaths of children aged between one and four years. These fell from 31 per thousand in 1960 to 20 per thousand in 1978.

2 Ray (1998) and Dasgupta (1994) discuss these linkages in detail.

3 None of the empirical studies of which we are aware includes child mortality as a determinant of fertility.

4 Hodinott and Haddad (1994) and Thomas (1990) find that mother's income has a positive effect on child anthropometric measures (weight for height, height for age). Thomas (1997) and Quisumbing and de la Briere (1998) find that households in which mothers have higher income spend a larger proportion of the household budget on education. Doss (1997) finds that the completed level of schooling of children is positively related to current assets owned by women. Galasso (1999) finds that child labour is less likely in Indonesian households where the woman would receive more assets if the couple were to divorce.

5 Better educated mothers may be better able to process information and therefore less likely to repeat the fertility behaviour of previous generations. Lower child mortality rates may be factored into fertility decisions more readily by women with higher levels of education. They may also place more confidence in modern medicine and child care practices. In this way, education can serve to reduce *expected* child mortality as well as *actual* child mortality, thus lowering the *ex ante* response of fertility to child mortality.

6 The data collection was managed by Macro International Inc. and funded by USAID.

7 Interestingly, current per capita expenditure has greater explanatory power over deaths more than 10 years ago than over more recent deaths. This may be due to the lower coverage of public health programs in years past and the greater reliance on families' own financial resources.

8 A lack of data corresponding to the period of death is common in studies of this kind (Martin *et al.* 1983).

9 Restricting the sample in this way results in an over-representation of high fertility women, because they are more likely to have had a child in any given period. However, this is also the case in studies that use the child as the unit of observation.

10 We do not attempt to differentiate between the determinants of infant mortality and those of the death of older children. Benefo and Schultz (1996) and Barrera (1990) studied child mortality and infant mortality separately, and found their determinants not to be significantly different.

11 Another possibility was to estimate ordinary least squares with the proportion of child deaths as the dependent variable. This has the disadvantage of not restricting the proportion to lie between zero and one. We could, of course, have estimated logits rather than probits, the only difference being that the underlying distribution of the errors is assumed to be the cumulative logistic distribution function. Probits were chosen because their estimation makes it easier to calculate the marginal effect on the dependent variable of changes in the explanatory variables.

12 Ideally equivalence scales would be used in order to take into account the fact that consumption is likely to differ among household members. For example,

one would expect that children would consume less than their parents. The use of equivalence scales is highly controversial, however, because of the difficulty of determining appropriate scales.

13 No attempt has been made in this paper to correct any heteroscedasticity that may arise from the use of the predicted regressor.

14 Even though the sample includes only women who have had a child in the past five years, the dependent variable equals one if *any* of her children has died before the age of five.

15 See Schultz (1984) for a study that recognises the endogeneity of the number of children, and models child mortality and fertility simultaneously.

16 To see this, recognise that a zero value of the dependent variable for a woman who has had eight children has a higher information content than a zero value for a woman who has only ever had one child.

17 In practical terms, the weighted and non-weighted probit results differ only a little.

18 All price data are for the capital city of each province, as published in BPS (1995).

19 For instance, greater rainfall acts against water-borne diseases such as cholera, although malaria is more prevalent during the wet season.

20 The rainfall data and the number of public health centres are the 1994 figures from *Statistik Indonesia* (BPS 1995).

21 Because they are perfectly collinear with the provincial dummies.

22 The more likely causality is that if a child dies, there are fewer household members and so expenditure per capita is higher.

23 Note that the interpretation of the marginal effect on this variable differs from that for all of the other variables, because expenditure is measured in logarithms. As a result, the marginal effect corresponds to a 100% increase in the explanatory variable, as opposed to a one-unit increase, as is the case for variables measured in levels.

24 In the data it is possible to be literate and not to have attended school, and vice versa. The correlations between literacy and years spent in primary, secondary and tertiary education are as follows: 0.80, 0.30, 0.08.

25 Specifically, we included dummy variables reflecting the husband's highest level of schooling as primary, secondary or higher, with and without the inclusion of husband's professional status. In both formulations, the coefficient on husband's education was *positive* but statistically insignificant.

26 The price data, like the other variables, are for the year 1994, and so may differ from those that prevailed around the time of the offspring's early childhoods. We are implicitly assuming that the woman has not moved provinces since the birth of her children and that price differences and other provincial level variables are relatively stable across time and provinces. This is a common problem in studies of this kind (Martin *et al.* 1983, for example), and must be borne in mind when interpreting the results.

27 It could be argued that we should study the effect of the number of health centres per head of population. We have used the absolute number of centres because we believe that this better captures access to a health centre: individuals who live in a sparsely populated province with a high number of centres per head may not have easy access to a centre, because they are likely to live at a long distance from one.

28 Although the results are robust to restricting attention to births in just the last 10 years, we prefer to report the results where the dependent variable reflects all child deaths that a woman has experienced: it is somewhat arbitrary to treat as having experienced child death a woman whose child died 10 years ago and not one whose child died 11 years ago. Also, using all deaths results in the regressions having much higher explanatory power.

29 See Hill (1996: 211–12) for an outline of problems relating to the quality of education in Indonesia's more remote areas.

30 Hill (1996: 213) notes that public funding of hospitals (normally based in urban centres) absorbs a larger portion of the health budget than does funding of rural health centres and services.

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APPENDIX TABLE A1 *First Stage Regression*
(dependent variable = logarithm of annual per capita household expenditure)

Explanatory Variables		Coefficient	t-statistic
Female education in years completed			
Primary		0.0095	2.5392
Secondary		0.0194	3.4646
Higher		0.0401	5.0933
Woman's age:	25–29	–0.0462	–2.0492
	30–34	–0.0682	–3.1956
	35–39	–0.0857	–3.9203
	40–49	–0.0948	–2.2935
Family owned land		–0.0349	–1.8725
Average provincial immunisation rate		–0.5265	–5.1658
Number of public health centres/100		0.0132	0.3486
Husband's occupation			
Administration		0.1425	1.7740
Agriculture		–0.0537	–1.1560
Clerical		0.0160	0.2759
Industry		0.0087	0.1878
Professional		–0.0055	–0.0870
Sales		–0.0102	–0.1846
Service		0.0467	0.9469
Other		–0.1258	–1.2678
Husband present		–0.0031	–0.0803
Price of rice		0.0007	9.2388
Price of clothing		0.0026	2.8724
Price of general items		0.0112	4.6833
Price of housing		–0.0002	–5.1725
Rural		–0.1595	–6.9427
Toilet connection		0.0577	3.1753
Protected water source		–0.0038	–0.1048
Dry season rainfall		0.0142	2.0037
Wet season rainfall		0.0009	0.3552
Religion:	Buddhist	0.1767	2.7573
	Catholic	0.0266	0.7797
	Christian	–0.0307	–0.9611
	Hindu	–0.0927	–1.8349
	Other	–0.0753	–0.6677
Woman headed household[a]		–0.1004	–1.8236
Owns motor boat or motor cycle[a]		0.1465	7.0618
Owns television set[a]		0.1050	5.0358
Owns bicycle[a]		0.0004	0.0237
Has electricity[a]		0.1226	5.4071
Owns refrigerator[a]		0.3284	10.5020
Owns kerosene stove[a]		0.0868	4.2009
Pays mortgage/rent[a]		0.0900	2.5463
Owns the building[a]		–0.1046	–3.4716
Constant		10.6345	35.2900
R^2		0.2831	

[a]Indicates the instruments.

APPENDIX TABLE A2 *Coefficients and Standard Errors on Provincial Dummy Variables (corresponding to table 2, column 3; Jakarta is the omitted province)*

Province	dF/dx	z-statistic
Bali	0.137	1.74
West Kalimantan	0.110	2.38
West Nusa Tenggara	0.105	2.32
West Java	0.080	1.95
Southeast Sulawesi	0.074	1.43
Bengkulu	0.054	1.15
Sth Kalimantan	0.053	1.07
Nth Sumatra	0.047	1.04
Maluku	0.034	0.70
Irian Jaya	0.033	0.62
Riau	0.030	0.71
East Nusa Tenggara	0.010	0.19
East Kalimantan	0.009	0.19
Central Sulawesi	0.004	0.09
West Sumatra	0.003	0.07
South Sulawesi	–0.033	–0.75
Aceh	–0.035	–0.84
Jambi	–0.040	–0.86
East Timor	–0.042	–0.84
South Sumatra	–0.064	–1.48
East Java	–0.070	–1.64
Lampung	–0.106	–2.51
North Sulawesi	–0.115	–2.48
Central Java	–0.118	–3.18
Central Kalimantan	–0.144	–3.40
Yogyakarta	–0.164	–3.83

APPENDIX TABLE A3 *Non-Time Varying Explanatory Variables*[a]

Variable	dF/dx	z-statistic
Female education (years)		
Primary	–0.022	–5.35
Secondary	–0.033	–9.24
Higher	–0.020	–1.87
Literacy dummy	0.004	0.20
Woman's age		
25–29	0.110	5.38
30–34	0.214	10.35
35–39	0.259	11.68
40–49	0.341	13.31
Pseudo-R^2	0.12	
N	6,620	

[a]Dummy variables reflecting the province of residence and religion of the household were also included.