WPS1700

POLICY RESEARCH WORKING PAPER 1700

Child Nutrition, Child Health, and School Enrollment

A Longitudinal Analysis

Harold Alderman
Jere R. Behrman
Victor Lavy
Rekha Menon

Private behavioral choices and policies that affect the health and nutrition of children have far greater effects on school enrollment and thus on eventual productivity than most literature suggests.

The World Bank
Policy Research Department
Poverty and Human Resources Division
January 1997

Summary findings

Better health and nutrition are widely thought to improve children's performance in school, and therefore their productivity after school. But most of the literature ignores the fact that child health and schooling reflect behavioral choices, so the estimated impact of health and nutrition on a child's schooling reflects biases in the studies — possibly substantial biases.

Using an explicit dynamic model for preferred estimates, Alderman, Behrman, Lavy, and Menon use longitudinal data to investigate how children's health and nutrition affect school enrollment in rural Pakistan. These estimates use price shocks when children were of preschool age to control for behavior determining the measure of children's health and nutrition stock.

The authors find that children's health and nutrition is three times more important for enrollment than is suggested by "naive estimates" that assume that children's health and nutrition is predetermined rather than determined by household choices. Not only does improved nutrition increase school enrollments, it does so more for girls, thus closing a portion of the gender gap.

These results strongly reinforce the importance of using estimation methods that are consistent with the economic theory of households to explore the impact of some choice variables on others, using socioeconomic behavioral data. Private behaviors and public policies that affect the health and nutrition of children have much greater effects on school enrollment and on eventual productivity than suggested by the methods used in most earlier literature.

This paper — a product of the Poverty and Human Resources Division, Policy Research Department — is part of a larger effort in the department to evaluate the economic impact of human resource investments. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Andrea Ramirez, room N8-049, telephone 202-458-5734, fax 202-522-1153, Internet address aramirez@worldbank.org. January 1997. (31 pages)

The Policy Research Working Paper Series disseminates the findings of work in progress to encourage the exchange of ideas about development issues. An objective of the series is to get the findings out quickly, even if the presentations are less than fully polished. The papers carry the names of the authors and should be cited accordingly. The findings, interpretations, and conclusions expressed in this paper are entirely those of the authors. They do not necessarily represent the view of the World Bank, its Executive Directors, or the countries they represent.

Produced by the Policy Research Dissemination Center

CHILD NUTRITION, CHILD HEALTH, AND SCHOOL ENROLLMENT: A LONGITUDINAL ANALYSIS

by

Harold Alderman, Jere R. Behrman, Victor Lavy, and Rekha Menon*

*Alderman and Menon World Bank; Behrman, University of Pennsylvania; Lavy, Hebrew University.

Section 1. Introduction

Improved child health and nutrition are welfare-enhancing in themselves. Better child health and nutrition, in addition, are widely thought to improve various dimensions of child school performance, and therefore subsequent post-school productivity in a wide range of activities. There are many studies in the literature that report significant associations between child health/nutrition and child schooling performance (see Pollitt 1990 and Behrman 1996 for references).

But the associations between child health/nutrition and child school performance based on socioeconomic behavioral data in the literature may not accurately portray the causal impact of child health and nutrition on school performance. Child health/nutrition and schooling performance both may reflect household decisions regarding investments in children's human capital. Almost all of the literature on the impact of child health/nutrition on child schooling performance ignores this implication of household models of human resource investment behavior.[1] As a result, the estimated impact of child health/nutrition on child schooling in these studies may be biased and therefore misleading as a guide for understanding behavior or for policy formation, perhaps substantially (Behrman, 1996). Moreover, depending on the nature of the intrahousehold allocation processes, the bias may be either upwards or downwards (Behrman and Lavy 1995). That is, the standard estimates that do not control for the behavioral choices underlying child health/nutrition can not be confidently assumed to give a known (i.e., known to be upper or known to be lower) bound on the true impact of child health/nutrition on child school success.

While there is an extensive literature on the impact of nutrition on schooling, we are

---

[1] See, for example, Jamison (1986); Moock and Leslie (1986).

aware of only three studies that attempt to control for behaviors determining child health/nutrition in investigations of the impact of child health/nutrition on child schooling performance using socioeconomic data. Two of these explore the relations between health/nutrition and schooling success and how robust the estimates are to some of the problems that household behavioral choices in the presence of unobserved characteristics and measurement errors cause for such analysis (Behrman and Lavy, 1995; Glewwe and Jacoby, 1995). These studies use the 1988-9 Ghanaian Living Standard Measurement Study (LSMS) data conducted by the World Bank. A third recent study uses a sibling model to indicate the relationship of nutrition and schooling the Philippines (Glewwe, et al., 1996)

Behrman and Lavy (1995) estimate cognitive achievement production relations in which child health/nutrition is one of the production inputs. Alternative estimates suggest that the estimated impact of child health/nutrition on cognitive achievement varies considerably depending on what assumptions are made about the underlying behavior. If it is assumed that (i) child health/nutrition reflects behavioral decisions of households in the presence of unobserved individual, family and community predetermined variables (e.g., genetic endowments and general learning environments that are not observed by analysts) but (ii) there are no unobserved inputs to child cognitive development that reflect choices of households (such as parental time allocations), current prices are appropriate instruments. In this case the estimated child health/nutrition impact is two to three times as large as in standard OLS approaches (what we refer to below as "naive" models). If assumption (ii) is dropped, however, and estimates are presented that control for unobserved family and community factors that affect the allocation of unobserved variables such as parental time, the estimates indicate that the standard "naive" procedure biases the true causal impact of child health/nutrition on child schooling success substantially upwards. Therefore what appears to be a positive impact of child health/nutrition on cognitive achievement with the commonly used empirical approaches (or appears even stronger with the usual instrumental variable statistical means of dealing with behavioral choices in production function estimates) is actually due to unobserved household and community factors that are affecting both child health/nutrition and child cognitive development.

Glewwe and Jacoby (1995) investigate how child health/nutrition affects the age at which children first enroll in school after demonstrating that the age of initial enrollment can have a substantial impact on life-time wealth generated from post-school labor earnings. A range of estimates are explored to see how sensitive the results are to the underlying behavioral assumptions. The results indicate that delays in enrollment are responsive to early child health/nutrition as indicated by height-for-age. This effect is reduced substantially (by almost two fifths), however, if there is control for unobserved family and community variables. As in Behrman and Lavy, this suggests that indicators of child health/nutrition in part proxy for such unobserved factors in the standard estimates.

Taken together these two studies suggest that estimates of the impact of child health/nutrition on child schooling success may be quite sensitive to the underlying behavioral assumptions and the nature of unobserved variables. However the dependence of these studies on basically cross-sectional data with limited recall information limits the extent to which satisfactory methods can be used to obtain unbiased estimates of the impact of child health/nutrition on child school performance. In particular, these studies do not have measures of preschool child health/nutrition and the instruments that are used to control for behavior are current prices from cross-sectional data. These instruments are questionable for identification if current prices affect not only the observed variables (including child health/nutrition) but also other unobserved behaviors such as parental time use that affect various indicators of child school enrollment and performance.

The Cebu study, using longitudinal data, also indicates that measurement error in nutrition can lead to a significant underestimate of the impact of nutrition on schooling. This study uses a unique panel from Metro Cebu, but investigates the timing of enrollment in a community in which virtually every child is enrolled in primary school.

In the present study we employ longitudinal data to investigate the impact of child health/nutrition on school enrollments in rural Pakistan. With these longitudinal data we are able to use price shocks when children are of pre-school age to control for the behavior determining the child health/nutrition stock measure. Such price shocks are uncorrelated with price shocks at the subsequent ages at which decisions are made whether or not to enroll children in school. Therefore this procedure permits estimation of the impact of child health/nutrition on child school enrollment without contamination from unobserved behaviors such as time allocation decisions for other household members that are concurrent with the enrollment decision. We explore how much the estimates differ with this preferred procedure in comparison with a range of alternatives, including a "naive" model in which (like most of the literature) child health/nutrition is treated as exogenous as well as other alternatives with current price shocks and current and lagged price levels used for the first-stage estimates to attempt to control for the behavior determining child health/nutrition.

Our results indicate that the estimation strategy and related assumptions make a considerable difference in the estimated impact of child health/nutrition status on enrollment. Our preferred point estimates, guided by explicit modeling of human resource dynamic decision rules, indicate that child health/nutrition is three times as important for enrollment than suggested by "naive estimates" that assume child health/nutrition is predetermined rather than determined by household choices in the presence of unobserved factors such as preferences and health endowments. Our results also illustrate that how the behavioral determinants of child health/nutrition are treated statistically makes a considerable difference in the estimated effects. If current or lagged price levels are used to identify the impact of child health/nutrition on schooling enrollment under the ad hoc assumption that long-run expected prices do not directly affect the schooling enrollment decision, the regressions do not yield significantly positive estimated effects of child health/nutrition on enrollment.

The results of this study, therefore, reinforce strongly the importance of using estimation methods that are consistent with the economic theory of households to explore the impact of some choice variables on others using socioeconomic behavioral data. In this case the preferred estimates indicate a much more powerful effect of child health/nutrition on school enrollment than do some of the a priori less satisfactory alternatives in the previous literature on the impact of child health/nutrition on child school performance. Therefore private behaviors and policies that affect child health/nutrition have much greater effects on school enrollments and on eventual productivities than suggested by the methods used in the previous literature. The basic point, moreover, holds for many other empirical explorations using cross-sectional socioeconomic behavioral data in which there is interest in the impact of one choice variable on another.

Section 2. Modeling Schooling Enrollment Decisions

Models of human resource investments predict that household demands for schooling investments reflect child health/nutrition if parents expect either that schooling makes a greater addition to the lifetime productivity of a healthy child than to an unhealthy one or that better health of a child lowers the costs of obtaining a given level of schooling. Thus, if a healthy child learns more in class than otherwise - a common pathway proposed in the literature on the impacts of health/nutrition on education - an improvement in the child's health/nutrition increases the effectiveness of a given time period of schooling and raises expected gross returns. Holding costs constant, the higher returns increase the demand for schooling. Similarly, if the expected increment to earnings from schooling is more than additive with the increment to earnings that comes from better post-schooling health/nutrition and if post-schooling health/nutrition is based importantly on early child health/nutrition, household schooling investment depends on early child health/nutrition.

To systematize considerations about the relation between child health/nutrition and child schooling enrollment, consider a simple stylized three-period model that focuses on decisions regarding evolving child health/nutrition and school enrollment.[2] Within the first two periods there are investment decisions that affect the stocks (including child health/nutrition stocks) carried over into the next period, as well as a range of decisions (including some related to health and nutrition) that affect within-period outcomes.

(1) <u>Preschool age</u>. In this period the household invests in child health/nutrition $\mathbf{I}^{H}_{1}$ and

---

[2]Other household decisions are assumed to be separable from these in order to sharpen the focus on the child human resource investment decisions.

in other assets $\mathbf{I}^A{}_1$ in light of given initial assets $\mathbf{A}_0$, child endowments **E**, preferences **T** (e.g., discount rates, tastes regarding intrahousehold distribution), current market price shocks $\mathbf{P}_1 - \mathbf{P}^*$, long-run expected market prices $\mathbf{P}^*$ (including the expected prices of schooling and the expected returns to health/nutrition directly in terms of productivity and indirectly through affecting schooling), and shocks within the period $\mathbf{U}_1$ such as from the weather. The household also makes decisions that affect within-period child health/nutrition inter alia on the basis of the same determinants. At the end of this period the child has an observed stock of health/nutrition status $\mathbf{H}_1$ and the household has end-of-first-period assets $\mathbf{A}_1$. These both reflect initial conditions and within-period investment decisions related to preferences, endowments, long-run expected prices, first-period price shocks, and first-period shocks.

(2) School-enrollment decision age. In this period the household decides inter alia whether or not to enroll the child in school S[3] and the amount of investments in child health $\mathbf{I}^H{}_2$ and in assets $\mathbf{I}^A{}_2$ -- given current market price shocks $\mathbf{P}_2 - \mathbf{P}^*$, long-run expected market prices $\mathbf{P}^*$, child endowments E, preference parameters **T**, the child's observed stock of health/nutrition status $\mathbf{H}_1$ and other assets $\mathbf{A}_1$ at the start of the period, and within-period shocks $\mathbf{U}_2$. Decisions also are made that affect, inter alia, within-period child health/nutrition (in addition to the investment decisions that carry over to the next period). At the end of this period the child has an observed stock of health/nutrition status $\mathbf{H}_2$ and school enrollment outcome S and the

---

[3]For simplicity in this stylized example, all children are enrolled in school for this entire period or not at all. Because of positive discount rates and finite expected lives, if a child is ever going to enroll in school, the optimal decision is to enroll during this period, not later. If the child does not enroll in school the child may contribute to household production (e.g., care for younger siblings), farm production (e.g., herd animals), or work in the labor market. The prices include the opportunity cost of the child's time in such activities.

household has end-of-second-period assets $\mathbf{A_2}$, all of which reflect initial conditions at the start of the period and within-period investment decisions that depend on long-run expected prices, second-period price shocks, and second-period shocks.

(3) Post-school enrollment decision period. In this period the returns from the human resource investments are realized, including the returns of child health/nutrition at the end of the second period and the school enrollment decision in the second period, as well as from assets.[4]

Implications for Estimation. A stationary state is assumed in which long-run prices are constant across periods so price shocks in a period are the deviation between current prices and long-run prices ($\mathbf{P_1} - \mathbf{P^*}$, $\mathbf{P_2} - \mathbf{P^*}$). Price levels within regions are correlated across periods because of their common long-run components over time in each region, but price shocks are orthogonal across periods. Both current price shocks and long-run prices enter into dynamic decision rules for each period. Because current price shocks are defined to be the deviation of current prices from long-run prices, the dynamic investment decision rules can equivalently be written in terms of current price levels (rather than current price shocks) and long-run prices -- which is the form that we use in what follows.

The linear approximation for the dynamic decision whether or not to enroll the child in school in the second period as a function of variables that are predetermined from the point of view of the household in the second period is:

(1) $S = a_{11}\mathbf{P_2} + a_{12}\mathbf{P^*} + a_{13}\mathbf{H_1} + a_{14}\mathbf{A_1} + \mathbf{U_2} + \mathbf{E} + \mathbf{T}$.

The last three terms are unobserved so they enter into the composite disturbance term (and their

[4]Evidence concerning returns to human resource investments in rural Pakistan is presented in Alderman, Behrman, Ross and Sabot (1996) and Behrman, Foster and Rosenzweig (1996).

coefficients each can be normalized to one). Note that the child health status at the end of the first period enters into this decision rule, though not the health status at the end of the second period nor any health/nutrition related within-period flows. This is because the health status at the end of the second period and within-second period flows are the outcomes of endogenous contemporaneous household decisions (and thus are not predetermined from the point of view of the household when it is making second-period decisions).

A similar linear approximation for the dynamic decision that determines the child's health at the end of the second period as a function of predetermined variables from the point of view of the household in the second period is:

$$(2)\quad \mathbf{H}_2 = a_{21}\mathbf{P}_2 + a_{22}\mathbf{P}^* + a_{23}\mathbf{H}_1 + a_{24}\mathbf{A}_1 + a_{25}\mathbf{U}_2 + a_{26}\mathbf{E} + a_{27}\mathbf{T}.$$

Straight-forward manipulation of these two expressions in the case in which all the variables are scalars to eliminate, for example, $\mathbf{A}_1$ can yield an expression in which S depends on the child's health/nutrition at the end of the second period:

$$(3)\quad S = a_{31}\mathbf{P}_2 + a_{32}\mathbf{P}^* + a_{33}\mathbf{H}_1 + a_{34}\mathbf{H}_2 + a_{35}\mathbf{U}_2 + a_{36}\mathbf{E} + a_{37}\mathbf{T}.$$

From this expression prima facie it might appear possible to estimate the impact of second-period child health/nutrition on second-period school enrollment. But, as noted in Behrman and Lavy (1995), the coefficient of second-period child health a_{34} is only the ratio of the impact of the variable that was eliminated to get relation (3) on school enrollment relative to the impact on second-period child health/nutrition (i.e., a_{14}/a_{24}). This does not reveal much of interest regarding the impact of current child health/nutrition on the school enrollment decision. This raises questions about how to interpret estimates of the impact of current health/nutrition on current schooling (or of any currently determined variable on another currently determined variable) if the expressions are derived from dynamic decision rules.[5] The coefficient of the contemporaneously determined health/nutrition variable in a relation such as (3) is not the impact of that health/nutrition on the dependent variable S. Yet relation (3) is the form of most estimates in the literature.

Consistent estimates of a_{13} in relation (1), in contrast, would be informative regarding the impact of the child health/nutrition status at the end of the first period $\mathbf{H}_1$ on school enrollment S in the second period. However $\mathbf{H}_1$ was determined in the first period, inter alia, by **E** and **T**, so a "naive" estimate of relation (1) in which this determination is ignored leads to biased estimates of a_{13} if $\mathbf{H}_1$ and the composite disturbance term (including **E** and **T**) are correlated. Nevertheless most estimates in the current literature make this "naive" assumption as a maintained hypothesis (usually implicitly). Instrumental variable techniques using current price levels $\mathbf{P}_2$ or price shocks $\mathbf{P}_2 - \mathbf{P}^*$ could not be used to identify the impact of $\mathbf{H}_1$ in relation (1) except under the unsatisfactory ad hoc assumption that current prices or current price shocks do not enter directly into (2). Instrumental variable techniques with first-period price shocks $\mathbf{P}_1 - \mathbf{P}^*$ could be used to identify the impact of $\mathbf{H}_1$ in relation (1) if there are price shocks in the first period that are not correlated with those in the second period. The price shocks are critical because the permanent price components enter into the determination of $\mathbf{H}_1$ as well as S, so they do not provide identification. Yet, with cross-sectional data set, one is often forced to assume that recorded price levels reflect long-run prices, for if they did not, they provide little or no information about the price regime at the time the nutrition/health choices being instrumented

---

[5]If the relation being specified is a production function, then it is clear how to interpret the estimates if there are no unobserved choice variables in the production function (Behrman and Lavy 1995).

were made.

The use of instruments such as past price shocks also eliminates classical measurement error bias (towards zero in the one variable case) that is likely to be a problem for usual measures of health/nutrition. For example one widely used measure is based on height-for-age. It often is hard to measure height accurately in field surveys, and age is also likely to be inaccurate due to rounding to the nearest year or six month intervals. The second measure that we use is experience with diarrhea. While our measure of diarrhea is based on multiple observations over a year, due to random elements in the timing of disease, such periodic observations may be inaccurate for many individuals, even if the population mean is precise.

Section 3. Data

We use data collected in Pakistan between 1986 and 1992 by the International Food Policy Research Institute (IFPRI), under the auspices of the Pakistan Ministry of Food and Agriculture. The panel consists of more than 800 rural households drawn from 45 villages in three relatively poor districts -- Attock in the Punjab, Dir in the North West Frontier Province (NWFP), and Badin in the Sind -- and one relatively prosperous district -- Faisalabad in the Punjab. A range of economic data was collected from both female and male heads in each household in each of the 15 rounds of data collection using female and male interviewers, respectively. Anthropometric measurements and disease incidence were recorded for all children under six years of age in each round. School enrollments were collected in six of the rounds.

Because of the panel nature of these data and the information collected about preschool health/nutrition status as well as subsequent school enrollments and longitudinal information on prices, we are able to estimate relation (1) using past price shocks as instruments for the health indicators to obtain our preferred estimates and explore how robust the estimates are to alternative estimation strategies. Almost all of the other studies that have been used to investigate the impact of child health/nutrition on child school performance have been cross-sectional in nature, and thus have not permitted the undertaking of what we argue in Section 2 is the preferred estimation strategy.

We use data on two indicators of the health/nutrition -- height-for-age and diarrhea experience -- of three birth-year cohorts at five years of age, which is the end of period 1, the preschool age period in Section 2. As noted above, these indicators have been widely used in studies of associations between child health/nutrition and school performance using socioeconomic behavioral data; height-for-age in fact is the most common indicators used in such studies (see Behrman 1996). We also have data on current prices for major commodities at that time as is necessary for identification. We define period 2, the school-enrollment decision period, to refer to when children are ages six and seven. We use as our dependent variable for our estimates of relation (1) whether a child is enrolled in school by the end of age seven. We note that almost all children who eventually attend school in the sample are enrolled by the end of age seven.[6] The data also include prices for the school-enrollment period, which should be included in relation (1) because they enter into the contemporaneous second-period budget

[6]For example, of those children who were 7 years old in 1987 and not enrolled in school, only 13% were observed to enroll subsequently; among those who were nine in 1991 and attending school in that year, 92% were enrolled two years earlier when they were seven years old.

constraint.[7] We control for long-run expected prices by including geographical dummy variables because relative prices differ over space. We can identify the effects of both price shocks and long run prices because we have three yearly cohorts and, thus, prices or price shocks are not collinear with the dummy variables.[8].

Our estimation strategy does not imply that the price shocks at age five necessarily are the most crucial prices for determining health investments.[9] Indeed, price shocks at any given time are likely to convey less information than long-run prices; however, they contain <u>different</u> information, and thus, provide a means of identification. Although price shocks when children are younger than five may be more important in determining their long-run health/nutrition status than price shocks when they are five years old, as long as price shocks when children are five have significant impact on health/nutrition investments in children, these price shocks can identify the impact of preschool child health/nutrition status on subsequent school enrollment decisions.

---

[7]Therefore such prices, as noted above, cannot be used to identify the impact of child health/nutrition on school enrollment unless they arbitrarily are excluded from relation (1).

[8]We begin with village dummy variables. In our preferred model restrictions that coefficients are the same for all villages in a district are not rejected at the 10% level of significance, so we use district dummy variables. The geographical dummy variables, of course, control not only for longer-run relative price structures but also for other fixed characteristics that differ over space. An alternative to using the geographical dummy variables to control for long-run prices is to use average prices for geographical areas; because the average prices for geographical areas are equivalent to geographical fixed effects, this alternative yields the same estimates as those that we present in this paper.

[9]Clinical evidence suggests that shocks, including price shocks, are more important in determining long-run health/nutrition status when children are younger, particularly in the post-weaning period, than are shocks when children are five. Unfortunately, though our data set permits us to control for some preschool price shocks in contrast to most data sets used for related studies, it does not permit us to control for all preschool price shocks.

We include parental schooling and household consumption expenditure averaged over three years to represent the resource constraint (A_1 in relation 1) in our estimates. The use of a three-year average removes some of the transitory fluctuations in expenditure and reduces the impact of random errors in measurement. We also used a set of observed physical and financial measures as an alternative representation of the resource constraint and obtained basically the same results in estimates that are not presented. Because the ability to respond to price movements is plausibly linked to parental education,[10] we also include in the estimates the interaction of prices and the education of the household head.[11]

The means and standard deviations for the basic data that we use are presented in Table 1. Because we pool boys and girls, heights are standardized with gender-specific international references by using Z scores that measure how many standard deviations an observation is above or below the standards. Failure to standardize heights would make it difficult to distinguish gender-specific demand from inherent differences in average heights. The number of days with diarrhea in the past two weeks is the average over all survey rounds in the same year as the relevant height measurement as reported by the child's mother or care giver. School enrollments are based on those recorded in the middle of the academic year two years after the height and diarrhea data were recorded.

School enrollments and health/nutrition indicators in the sample villages differ somewhat,

---

[10]Rosenzweig (1995), for example, strongly emphasizes that the critical role of schooling is to facilitate dealing with new information, and gives examples of several supportive empirical studies.

[11]The household head generally is male. Because female schooling is so low in this sample (none in the majority of cases), we do not include interactions with schooling of wives of household heads.

but not all that much, from those for the country as a whole. For example, about 49% of children in Pakistan (including urban as well as rural areas) were found to be stunted in terms of having height-for-age that was more than two standard deviations below reference levels in 1990 (Government of Pakistan, 1991). In comparison, the communities in the IFPRI survey had stunting rates for children under six of 62%. Schooling rates for children in Pakistan in general and in the sample villages in particular are low in comparison with other countries of similar per capita incomes (Behrman and Schneider 1993). Primary school enrollment rates in low income countries in 1991 as classified by the World Bank (excluding China and India) averaged 79%, while rates in Pakistan were only 46% (World Bank, 1994). Moreover, only 31% of girls were enrolled. In the sample villages, overall primary enrollment rates were 56%, but only 38% of girls aged 10-18 had ever enrolled in primary school (Alderman et al. 1995).

Section 4. Estimates

We use probits for our estimates of whether children enrolled in school (relation 1) because the school enrollment choice of interest is a binary variable. The reported standard errors have been corrected for the inclusion of predicted variables in the regression with the method reported in Murphy and Topel (1985). The first-stage estimates for the determination of the Z score for child height and the average days ill with diarrhea every two weeks for the preschool period are given in Appendix Table A1. The Ψ^2 tests also given there reject the constraint that the six identifying instruments (price shocks and their interactions with the education of the household head) all have coefficients constrained to zero. Moreover, the restrictions that the subset of the coefficients for three price variables are jointly zero or a similar restriction for the coefficients for the three interaction variables taken together are rejected.[12] Table 2 summarizes the coefficient estimates for the impact of the two preschool health indicators in the school enrollment relation; the probit equation used to estimate these indicators are in Appendix Table A2. Because of the strong gender differences in school enrollments in the sample the coefficient estimates are allowed to differ by gender and an additive gender dummy variable is also included.

Preferred estimates: The preferred estimates are summarized in column 1 of Table 2. There is a significantly positive effect of preschool Z score for height for girls on subsequent school enrollment. The effect of height is significantly and substantially greater for girls than for boys -- more than three times as large for girls than for boys. Once there is control for the gender difference in the effect of preschool height on subsequent enrollment, there is not an additional additive effect; the dummy variable for male is not significantly different than zero. However, if the coefficient on height is constrained to be the same across genders, this dummy variable is significant and positive for males relative to girls, with a value of 0.87 and a standard error of 0.21 (these estimates are not presented here). The indicator for diarrhea, while negative for both girls and boys, is not significantly so. The coefficient estimate for this variable remains insignificant if the gender interaction is removed.

We also note that current price shocks have a significant impact on school enrollment decisions, as posited in relation (1) (the Ψ^2 test statistics for restricting the coefficients on all these prices to zero is 7.73 which rejects such a restriction at the 5% level). This means that

[12]We also explored including a larger set of prices and price-education interactions. But, because of multicollinearity among the prices, adding further prices only led to more imprecision in the price coefficients but did not change the basic results.

the use of current price shocks to attempt to identify the preschool child health/nutrition effects by excluding them from relation (1) (as in column 4 in Table 2 below) imposes an arbitrary restriction on relation (1) that is not supported by the estimates as well as not consistent with the model in Section 2.

Because of the nonlinearity in the probit estimates, it is not clear merely from looking at the first column of Table 2 (or of Table A2) whether these effects are large or small. To facilitate understanding of the magnitude of the estimated preschool child health/nutrition effects on subsequent school enrollment, Table 3 presents some simulations based on the preferred probit estimates. Because the derivatives of a probit differ according to the value of every other variable in the regression, some assumptions need to be made regarding the other variables. Table 3 is based on the mean of the predicted probability of enrollment over each individual in the sample rather than the derivatives at the mean values for the sample.

The second row of Table 3 gives the simulations for an improvement of 0.25 in the height Z scores for the entire preschool population - a possible, if slightly optimistic, value for a successful preschool child health/nutrition improvement program. Such an increase is simulated to increase the probability of school enrollment for girls by 10% over the base case and by 2% for boys, so that the gender gap in enrollment is estimated to be closed by almost 25%.

The third row gives the simulations for cutting in half the number of days of diarrhea for the entire preschool population.[13] The impact of this scenario is to increase enrollments by 6%

---

[13]In order to avoid a meaningless negative number of days for some observations, we divide the number of days in half rather than subtracting the same value for everyone.

for girls and by 3% for boys, so that the gender gap in enrollment falls by 9%.

However, it is unlikely that a reduction in the number of days of illness would occur in isolation from a change in the Z score for height. As indicated in Alderman and Garcia (1994), a reduction in either the probability or the duration of diarrheal disease has a significant impact on height of preschool children in Pakistan. Thus, we present an illustration of the impact of both improvements jointly in the last row of Table 3. This simulation indicates a 16% increase in enrollment rates for girls, a 5% increase in enrollment rates for boys, and a 33% drop in the gender gap in enrollment rates.

Thus, our preferred estimates indicate that possible magnitudes of improved preschool child health/nutrition on school enrollments in rural Pakistan may be important, with larger effects for girls. Therefore, the large gender gaps in school enrollments in the sample would be lessened considerably with improved preschool child health and nutrition. To provide an order of magnitude estimate of the gains that the increased enrollment in Table 3 might have in rural Pakistan, we note that a child in rural Pakistan could expect an annual reduction of productivity of 4.6% per year of schooling foregone.[14] Not all of this would be in cash earnings because many individuals in rural areas (particularly women) are not employed in the formal wage sector. Nevertheless, it is a standard assumption that the productivity gains for individuals who do not enter the wage labor force are similar to the gains for those for whom wages are observed (Schultz, 1993). Moreover, most studies indicate that rates of returns to

---

[14] This estimate is based on the marginal increment in wages in OLS regressions of ln wages on years of schooling in Alderman et al. (1996). That study acknowledges that the preferred approach is to estimate schooling and wages in a simultaneous system. However, the study concentrated on estimates of the wage impact of cognitive achievement, not years of schooling per se, and does not present simultaneous estimates for wages and years of schooling.

education are similar across genders.

Conditional on entering school, the average male (female) in these villages attend 7.6 (6.3) years of school (Alderman, et al. 1995). To make an order of magnitude estimate of the schooling impact of a sucessful nutrition intervention we assume no productivity gain for those individuals who would have attended school in the absence of the nutritional improvement or for those who still are not enrolled -- assumptions that presumably lead to an underestimate of the total impact. Those who are induced to attend school by a change in health status are assumed to attend as many years as the average student and, thus, increase lifetime earnings by 35% for males and 29% for girls, the difference being the gender disparity in average number of years of schooling conditional on enrollment.

Under these assumptions, an improvement of average nutrition of 0.25 Z score adds 0.94% to the average productivity of the cohort. This is a weighted average of the individual increases of 29-35% for those assumed to experience such increases and of zero for those who have no increase under the assumptions. This estimate is fairly robust; if we assume that 25% of those who are considered new entrants actually would have entered at a later date and only assign these individuals an additional 2 years of lifetime schooling instead of 7.6 (6.3) years, the increase of productivity is 0.78%. A more drastic assumption would be that these 25% of the affected individuals only change the date of enrollment but do not change the total years of school they would have attended. Glewwe and Jacoby (1995) note that in order to maintain total years with delayed entry, an individual would have to enter the work force later, and calculate that for each year of delay in entry to primary school a child in their study loses 3% of lifetime wealth. Assuming a 6% increase in the value of lifetime earnings for the portion of children in our sample who are assumed to only change the date of enrollment and continuing to assume 29-35% increases for the rest who are affected by improved nutrition implies a 0.75% increase of lifetime earnings for the cohort. These figures all roughly increase by two thirds if one considers the joint impact of lowered morbidity and improved nutrition.

Alternative estimates: The substantial existing literature on the impact of child health/nutrition on school performance does not use what we argue is the preferred method. As discussed in Section 2, this may make a difference in the estimates. However, how substantial is this difference is an empirical question. If the theoretically preferred approach does not yield results that are in sharp contrast with simpler approaches, the estimates in the literature may be good guides for predictions and for policy formation. It is possible, however, that the estimates in the literature may be quite misleading. We explore this question for the present sample by undertaking several alternative estimates, summarized in the remaining columns of Table 2.

The "naive" model presented in column 2 assumes that child health/nutrition is given independently of the disturbance term in relation (1) and is measured without random error, so there is no need to instrument child health/nutrition. Under these assumptions the coefficient estimate of height is significantly positive and the estimated interaction for males indicates that this effect is much larger for girls. While this is qualitatively similar to the results in our preferred model, the apparent impact is much smaller than in our preferred estimates -- only a third as large for either girls or boys.[15] The estimate for boys is less than 0.05 and not

---

[15]If the true model is relation (1), "naive" estimates may be less than the true estimates for the impact of child health/nutrition if there is measurement error or if there is a negative correlation between health/nutrition and child endowments **E** or tastes **T**. The latter might occur if there is heterogeneity across children in unobserved endowments for education versus health or across households in unobserved preferences for smart versus healthy children or in

significantly different from zero. If our preferred estimates are the true estimates, these naive estimates may be quite misleading -- and, as we note above, most of the estimates in the literature make the assumptions of this naive model. Similarly, while both our preferred estimates in column 1 and the "naive" estimates in column 2 have coefficient estimates for diarrhea experience that are not significantly nonzero, the point estimates are much larger in absolute value in the preferred estimates.

The estimates in column 3 are identical to our preferred estimates except that they exclude current price shocks from the school enrollment probits in relation (1). Not surprisingly (given that the current price shocks are defined conceptually to be orthogonal to the other included variables), these estimates do not differ significantly from our preferred estimates, although current prices do influence schooling choice.

The estimates in columns 4 and 5, respectively, use lagged and current price levels for identification with exclusion of both current price shocks and long-run prices from the probit for the schooling enrollment decision in relation (1). The exclusion of the long-run prices means that these estimates effectively attempt to use price levels rather than price shocks to identify the impact of child health/nutrition in the school enrollment decision. A priori, the exclusion of prices from directly affecting the schooling enrollment decision seems implausible, though at times such ad hoc identification assumptions have been made in the education as well as the wage literature.[16] Moreover, if relation (1) is the true relation, the exclusion of the long-run

---

unobserved prices for education versus health inputs (see Behrman and Lavy 1995).

[16] See, for example, Deolalikar, 1988; Behrman and Deolalikar 1989; Haddad and Bouis, 1991.

prices from the schooling enrollment decision and the use of price levels (whether lagged or current) as instruments means that the instruments are correlated with the disturbance term in the schooling enrollment decision because both the instruments and the disturbance term include long-run prices.[17] The estimates that are obtained under these assumptions are implausible: both sets of results are imprecise and generally of opposite signs to the preferred estimates. These estimates imply negative effects of height on enrollments; the effect for boys is significantly different from zero. Similarly there is a positive imprecisely estimated effect of diarrhea on enrollment. Such estimates contrast sharply with our preferred estimates and with conventional wisdom, and demonstrate that the ad hoc use of price exclusions from the decision rule for identification can lead to very misleading estimates.

We not not employ an estimation approach that uses current price shocks rather than lagged price shocks in the first stage. The use of current price shocks for instruments has no obvious advantage. It is no more widely applicable than our preferred specification because it has the same information requirements -- requiring longitudinal data to be able to characterize the price shocks separate from the longer-run prices. Moreover, the use of current price shocks as identifying instruments requires the a priori implausible assumption that current price shocks do not affect the schooling enrollment decision directly. Finally, the use of these shocks requires the assumption that price shocks in period two carry information that explain investments in period one.[18]

---

[17]For the estimates in column 6 there is a further correlation because both the instruments and the disturbance term include current price shocks.

[18] Not surprisingly, if this is attempted, all prices are jointly and individually not significant, even with low power levels of significance.

Section 5. Conclusion

Conventional wisdom holds that, for poor children -- particularly those with poor health and nutrition -- there may be a considerable impact on various dimensions of schooling of better child health/nutrition. A large number of studies based on socioeconomic survey data find associations between child health/nutrition and child school performance that purport to support such an interpretation. But most of these studies do not concern themselves with the implications for estimation of endogenous choices concerning child health/nutrition and of measurement errors in the available indicators of child health/nutrition. Those studies that do concern themselves with these estimation problems tend to use methods to deal with them (i.e., current prices as instruments) that are problematic and that can lead to substantial misunderstanding of the true effects.

We first discuss these estimation issues and then provide alternative estimates of the impact of preschool age child health/nutrition on subsequent school enrollment decisions in rural Pakistan using a longitudinal data set that permits us to address these issues better than in the previous literature. We find that the estimates are quite sensitive to the estimation procedure, and some of the alternatives used in the previous literature lead to much different -- much smaller or even inverse -- estimated roles of preschool child health/nutrition in affecting school enrollment in comparison with our preferred estimates. If this result carries over to other contexts, a substantial proportion of the previous literature may be substantially misunderstanding an important effect of preschool child health/nutrition on school performance. Similar problems, of course, may exist in other attempts to assess the impact of one endogenous variable on another using cross-sectional data (e.g., the impact of health, nutrition and schooling on productivity and earnings).

With regard to the substantive question addressed in this paper, we find fairly substantial effects of preschool child health/nutrition on school enrollments that are larger for girls than for boys. This means that improvements in child preschool health/nutrition, whether resulting from changes in private behavior due to the process of development or better information or resulting more directly from policy changes, are likely to have important longer-run productivity effects through inducing greater schooling in general and to help reduce the substantial gender gaps in schooling and in subsequent productivity gains in particular.

References

Alderman, Harold, Jere R. Behrman, Shahrukh Khan, David R. Ross, and Richard Sabot, 1995, "Public Schooling Expenditures in Rural Pakistan: Efficiently Targeting Girls and a Lagging Region," in Dominique van de Walle and Kimberly Nead, eds., *Public Spending and the Poor: Theory and Evidence*, Baltimore and London: The Johns Hopkins Press for the World Bank, 187-221.

Alderman, Harold, Jere R. Behrman, David Ross, and Richard Sabot, 1996, "The Returns to Endogenous Human Capital in Pakistan's Rural Wage Labor Market," *Oxford Bulletin of Economics and Statistics* 58:1 (February), 29-55

Alderman, Harold and Marito Garcia, 1994, "Food Security and Health Security: Explaining the Levels of Nutritional Status in Pakistan," *Economic Development and Cultural Change* 42:3 (April), 485-508.

Behrman, Jere R., 1996, "Impact of Health and Nutrition on Education," *World Bank Research Observer* 11:1 (February), 23-37.

Behrman, Jere R. and Victor Lavy, 1995, "Production Functions, Input Allocations and Unobservables: The Case of Child Health and Schooling Success," Philadelphia: University of Pennsylvania, mimeo.

Behrman, Jere R. and Ryan Schneider, 1993, "An International Perspective on Pakistani Human Capital Investments in the Last Quarter Century," *Pakistan Development Review* 32:1 (Spring 1993), 1-68.

Behrman, Jere R. and Anil B. Deolalikar, 1989, "Wages and Labor Supply in Rural India: The Role of Health, Nutrition and Seasonality," in David E. Sahn, ed., *Causes and Implications of Seasonal Variability in Household Food Security*, Baltimore, MD: The Johns Hopkins University Press, 107-118.

Behrman, Jere R., Andrew Foster, Mark R. Rosenzweig. 1996. "The Dynamics of Agricultural Production and the Calorie-Income Relationship: Evidence from Pakistan." *Journal of Econometrics.*

Deolalikar, Anil B., "Nutrition and labor productivity in agriculture: Estimates for rural South India," Review of Economics and Statistics, Vol. 70, No. 3 (August 1988), 406-413.

Glewwe, Paul and Hanan Jacoby, 1995, "An Economic Analysis of Delayed Primary School Enrollment and Childhood Malnutrition in a Low Income Country," *Review of Economics and Statistics* 77:1 (February), 156-169.

Glewwe, Paul, Hanan Jacoby, and Elizabeth King. 1996. "Estimating an Economic Model of

Nutrition and Learning using Longitudinal Data". World Bank. Mimeo.

Government of Pakistan, 1991, *Demographic and Health survey of Pakistan*, Islamabad: National Institute of Population Studies.

Jamison, Dean T., "Child malnutrition and school performance in China," Journal of Development Economics, Vol. 20, No. 2, (1986), pp. 299-310.

Moock, Peter R. and Joanne Leslie, "Childhood malnutrition and schooling in the terai region of Nepal," Journal of Development Economics, Vol. 20, No. 1, (1986), pp. 33-52.

Murphy, Kevin and Robert Topel, 1985, "Estimation and Inference in Two-Step Econometric Models," *Journal of Business and Economic Statistics* 3:4, 370-9.

Pollitt, Ernesto, 1990, *Malnutrition and Infection in the Classroom*, Paris: Unesco.

Rosenzweig, Mark R., 1995, "Why Are There Returns in Schooling?" *American Economic Review* 85:2 (May), 153-158.

Schultz, T. Paul, 1993, "Returns to Women's Education," in Elizabeth M. King and M. Anne Hill, eds, 1993, *Women's Education in Developing Countries: Barriers, Benefits, and Policies*, Baltimore and London: The Johns Hopkins University Press, Published for the World Bank, 51-99.

World Bank, 1994, *World Development Report*, Oxford: Oxford University Press for the World Bank.

Table 1:
Principal Variables: Means and Standard Deviations

Variable	Mean	Standard Deviation
School enrollment	0.557	0.497
(enrollment for girls)	0.480	
(enrollment for boys)	0.632	
Height Z score	-1.868	1.516
Days of diarrhea/two week period	0.222	0.475
Gender (male =1)	0.506	0.500
Father's schooling	0.380	0.486
Mother's schooling	0.597	0.237
Log of average expenditure	10.018	0.758
Price of books (rupees)	34.782	16.602
Own distance to school (min)	16.076	11.247
Cross distance to school (min)	16.044	10.855
Faisalabad District	0.134	0.241
Attock District	0.128	0.335
Dir District	0.382	0.486
Mother's height (cm)	139.2	42.80
Mother missing	0.085	0.279
Mother's age (years)	30.48	7.43
Orchards owned (acres)	6.139	1.143
Irrigated land (acres)	5.081	14.195
Rainfed Land (acres)	2.259	7.663
Livestock Valve (1000 rupees)	13.127	12.375
Vehicle value (1000 rupees)	8.153	36.883
Machine value (rupees)	8638	32.908
Price wheat (rupees/kg)	2.407	0.372
Price rice (rupees/kg)	3.5800	1.259
Price milk (rupees/liter)	4.274	1.277

Table 2: Estimated Preschool Child Health/Nutrition Effects on Subsequent Child School Enrollment in Rural Pakistan, Alternative Estimates[a]

	'Preferred'	Alternatives			
	(1)	(2)	(3)	(4)	(5)
Instruments	Lagged Price Shocks	None "Naive" Model	Lagged Price Shocks	Lagged Price Levels	Current Price Levels
Schooling Probit Includes:					
Current Prices	Yes	Yes	No	No	No
Long-run Prices[b]	Yes	Yes	Yes	No	No
Estimates for Schooling Probit					
Male	-.10	.17	-.24	-1.00	-.85
	(.48)	(.27)	(.45)	(.57)	(.55)
Height Score	.61	.23	.60	-.28	-.17
	(.16)	(.06)	(.15)	(.28)	(.23)
Interaction for Male	-.44	-.18	-.50	-.65	-.57
	(.19)	(.08)	(.18)	(.29)	(.27)
Diarrhea	-.78	-.27	-1.07	.79	1.46
	(.58)	(.19)	(.57)	(1.29)	(1.17)
Interaction for Male	.20	.43	.23	.52	.84
	(.66)	(.28)	(.66)	(1.01)	(1.00)

[a]See the probits in Table A2 for the schooling enrollment decision and estimates in Table A1 for estimates of preschool child health/nutrition (i.e., Z scores for height, diarrhea experience). Standard errors are under point estimates.

[b]As noted in the text, geographical dummy variables are used to control for long-run prices.

Table 3: Scenarios of Health Changes

	Boys		Girls		Difference	
	Level	Index	Level	Index	Level	Index
Base[1]	0.641	100	0.493	100	0.148	100
Improve Nutrition by 0.25 Z scores	0.654	102	0.542	110	0.112	76
Reduce Diarrhea by half	0.658	103	0.523	106	0.135	91
Improve both Nutrition and Disease	0.671	105	0.572	116	0.099	67

Mean predictions from probits do not necessarily coincide with population mean values

Appendix Table A.1
First Stage Regressions (Standard errors in parentheses)

Dependent Variable	Height Z-Score	Days of Diarrhea
Constant	-7.32 (2.25)	1.15 (0.75)
Sex	-0.33 (0.12)	-0.01 (0.04)
Mother's Age	0.08 (0.06)	-0.06 (0.02)
Mother's Age Squared	-0.00 (0.00)	0.00 (0.00)
Mother's School	0.28 (0.35)	0.00 (0.11)
Father's School	0.29 (0.18)	-0.08 (0.06)
Logarithm of 3 Years Average Expenditures	0.10 (0.20)	-0.04 (0.06)
Price Wheat	0.08 (0.26)	0.04 (0.08)
Price Rice	0.11 (0.13)	0.01 (0.04)
Price Milk	0.50 (0.30)	0.03 (0.10)
Price Wheat * Education	-0.56 (0.30)	-0.07 (0.10)
Price Rice * Education	-0.28 (0.11)	0.03 (0.03)
Price Milk * Education	0.11 (0.11)	0.00 (0.03)
Number of Males with Primary Education	1.74 (0.95)	0.08 (0.32)
Number of Females with Primary Education	0.13 (0.22)	0.06 (0.07)
Number of Males with Secondary Education	0.15 (0.10)	0.01 (0.03)
Number of Females with Secondary Education	0.02 (0.37)	-0.05 (0.12)
Number of Males with Post-Secondary Education	0.10 (0.18)	0.00 (0.06)
Cohort 1	-0.84 (0.23)	0.05 (0.07)
Cohort 2	-0.01 (0.19)	0.11 (0.06)
[village dummy variables not reported]		
Test of Significance of 3 Price Coefficients	F (3,470) = 2.04	F (3,470) = 0.28
Test of Significance of 3 Interaction Variables	F (3,470) = 2.40	F (3,470) = 0.89
Test of 6 Coefficients	F (6,470) = 1.92	F (3,470) = 0.62

Appendix Table A.2: School Enrollment Probits (Standard Errors in Parentheses)

	Preferred	Alternatives			
	(1)	(2)	(3)	(4)	(5)
Constant	-4.16 (2.25)	-4.91 (1.88)	-2.03 (2.01)	-8.35 (2.09)	-9.10 (2.08)
Sex	-0.10 (0.48)	0.17 (0.27)	-0.24 (0.44)	-1.00 (0.57)	-0.85 (0.55)
Height[a]	0.61 (0.16)	0.23 (0.06)	0.60 (0.15)	-0.28 (0.28)	0.17 (0.23)
Height * Gender[a]	-0.44 (0.19)	-0.18 (0.08)	-0.50 (0.18)	-0.65 (0.29)	-0.57 (0.27)
Diarrhea[a]	-0.78 (0.58)	-0.27 (0.19)	-1.07 (0.56)	0.79 (1.29)	1.45 (1.12)
Diarrhea * Gender[a]	0.20 (0.66)	0.43 (0.28)	0.23 (0.66)	0.52 (1.01)	0.84 (1.00)
Mother's Age	-0.03 (0.06)	0.00 (0.06)	-0.05 (0.06)	0.10 (0.09)	0.14 (0.08)
Mother's Age Squared	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	-0.001 (0.001)	0.001 (0.001)
Mother's Schooling	0.68 (0.36)	0.82 (0.36)	0.46 (0.33)	1.00 (0.36)	0.92 (0.35)
Father's Schooling	0.15 (0.15)	0.25 (0.14)	0.15 (0.15)	0.54 (0.16)	0.57 (0.15)
Logarithm of 3 Year Average Expenditure	0.45 (0.20)	0.41 (0.17)	0.39 (0.19)	0.68 (0.18)	0.70 (0.18)
Birth year 1980/1	0.72 (0.29)	0.51 (0.27)	0.55 (0.19)	-0.19 (0.20)	-0.15 (0.19)
Birth year 1981/2	0.09 (0.18)	0.02 (0.17)	0.07 (0.15)	-0.09 (0.22)	-0.22 (0.21)
Price Wheat	0.18 (0.15)	0.14 (0.15)			
Price Rice	-0.19 (0.09)	-0.17 (0.09)			
Price Milk	0.32 (0.13)	0.31 (0.13)			
Dummy for Faisalabad District	1.47 (0.38)	1.26 (0.36)	1.39 (0.35)		
Dummy for Attock District	1.17 (0.32)	0.99 (0.31)	1.24 (0.25)		
Dummy for Dir District	0.27 (0.55)	0.08 (0.52)	1.27 (0.23)		
Distance to School for Own Gender	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)	-0.00 (0.01)	-0.00 (0.01)
Distance to School for Other Gender	-0.00 (0.01)	-0.00 (0.01)	-0.00 (0.01)	-0.00 (0.01)	-0.00 (0.01)
Price of Books	0.003 (0.01)	0.00 (0.01)	-0.00 (0.01)	0.01 (0.01)	0.00 (0.01)

[a] These variables are predicted in all models except the naive model (2).

Policy Research Working Paper Series

	Title	Author	Date	Contact for paper
WPS1678	Financial Development and Economic Growth: Views and Agenda	Ross Levine	October 1996	P. Sintim-Aboagye 38526
WPS1679	Trade and the Accumulation and Diffusion of Knowledge	Pier Carlo Padoan	November 1996	M. Pateña 39515
WPS1680	Brazil's Efficient Payment System: A Legacy of High Inflation	Robert Listfield Fernando Montes-Negret	November 1996	T. Ishibe 38968
WPS1681	India in the Global Economy	Milan Brahmbhatt T. G. Srinivasan Kim Murrell	November 1996	S. Crow 30763
WPS1682	Is the "Japan Problem" Real? How Problems in Japan's Financial Sector Could Affect Developing Regions	Shigeru Otsubo Masahiko Tsutsumi	November 1996	J. Queen 33740
WPS1683	High Real Interest Rates, Guarantor Risk, and Bank Recapitalizations	Philip L. Brock	November 1996	N. Castillo 33490
WPS1684	The Whys and Why Nots of Export Taxation	Shantayanan Devarajan Delfin Go Maurice Schiff Sethaput Suthiwart-Narueput	November 1996	C. Bernardo 37699
WPS1685	Macroeconomic Crises and Poverty Monitoring: A Case Study for India	Gaurav Datt Martin Ravallion	November 1996	P. Sader 33902
WPS1686	Institutions, Financial Markets, and Firms' Choice of Debt Maturity	Asli Demirgüç-Kunt Vojislav Maksimovic	November 1996	P. Sintim-Aboagye 37644
WPS1687	Regionalism versus Multilateralism	L. Alan Winters	November 1996	A. Kitson-Walters 33712
WPS1688	Risk, Taxpayers, and the Role of Government in Project Finance	Michael Klein	December 1996	S. Vivas 82809
WPS1689	Is Economic Analysis of Projects Still Useful?	Pedro Belli	December 1996	K. Schrader 82736
WPS1690	Stock Markets, Banks, and Economic Growth	Ross Levine Sara Zervos	December 1996	P. Sintim-Aboagye 38526
WPS1691	Integrating the Unofficial Economy into the Dynamics of Post-Socialist Economies: A Framework of Analysis and Evidence	Daniel Kaufmann Aleksander Kaliberda	December 1996	S. Torres 39012

Policy Research Working Paper Series

	Title	Author	Date	Contact for paper
WPS1692	Regulating Market Risk in Banks: A Comparison of Alternative Regulatory Regimes	Constantinos Stephanou	December 1996	P. Infante 37642
WPS1693	Famines and Economics	Martin Ravallion	December 1996	A. Ramirez 85734
WPS1694	What Can New Survey Data Tell Us about Recent Changes in Distribution and Poverty?	Martin Ravallion Shaohua Chen	December 1996	A. Ramirez 85734
WPS1695	Are There Dynamic Gains from a Poor-Area Development Program?	Jyotsna Jalan Martin Ravallion	December 1996	A. Ramirez 85734
WPS1696	South-North Migration and Trade: A Survey	Maurice Schiff	December 1996	M. Patena 39515
WPS1697	Strategies to Develop Mortgage Markets in Transition Economies	Dwight M. Jaffee Bertrand Renaud	December 1996	R. Garner 37670
WPS1698	Regulatory Structure and Risk and Infrastrcuture Firms: An International Comparison	Ian Alexander Colin Mayer	December 1996	R. Schneiderman 30191
WPS1699	The Maturity Structure of Debt: Determinants and Effects on Firms' Performance—Evidence from the United Kingdom and Italy	Fabio Schiantarelli Alessandro Sembenelli	January 1997	B. Moore 38526
WPS1700	Child Nutrition, Child Health, and School Enrollment: A Longitudinal Analysis	Harold Alderman Jere R. Behrman Victor Lavy Rekha Menon	January 1997	A. Ramirez 85734
WPS1701	Monitoring Environmental Standards: Do Local Conditions Matter?	Catherine Dion Paul Lanoie Benoît Laplante	January 1997	B. Laplante 85878