The Challenge of Hunger and Malnutrition

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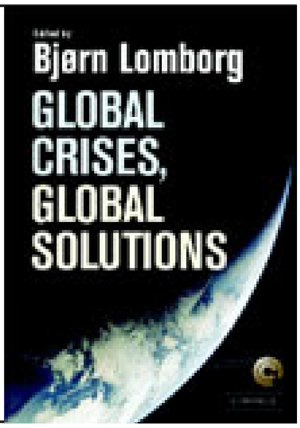

"Has the Relationship between Undernutrition and Income Changed?"

Comment by Peter Svedberg on:
"HUNGER AND MALNUTRITION" by Jere R Behrman, Harold Alderman and John Hoddinott

1. INTRODUCTION

Professor Behrman and his co-authors summarise and discuss results from a large number of micro-level programs aimed at reducing low birth weight (LBW) and child malnutrition through knowledge-dissemination and supplementation of micro-nutrients and improved breast-feeding technologies. Almost all the evaluations of the programs show high benefit-cost ratios. Benefits are measured in money at alternate discount rates. The costs are mainly those associated with providing new drugs and therapies, while the expenses for the infrastructure required to disseminate new knowledge and medicines are not directly included. Behrman et al. (2004) nevertheless exude optimism when it comes to challenge inadequate child nutritional status through an array of opportunities for micro level interventions.

Two other developments since the late 1980s and early 1990s may add optimism for opportunities and possibilities for reducing the prevalence of (child) mal- and undernutrition in poor developing countries—even in the absence of rapid economic growth. First, improved vaccines and extended immunisation, and also cheap and efficient curing methods, have become more readily available during the 1990s. Second, there has been a notable change of policy instruments used by government for alleviating under- and malnutrition; away from broad-based food-price support, to more narrowly targeted nutrition-cum-health programs.

In this comment, I will provide a simple test of the extent to which these various "technological developments" at the micro level during the 1990s, have helped reduce malnutrition world-wide, as measured at the macro level by the overall prevalence of child stunting and underweight. More details on the new technological developments are presented in section 2. Section 3 summarises the empirical results from the economic literature aimed at identifying the underlying reasons for undernutrition, and the main problems encountered in such investigations. Section 4 presents the method and data used for estimating the effect of new technologies on the incidence of undernutrition. Section 5 presents the main results and section 6 contains a discussion of some of these. A few concluding remarks and some ideas for further investigations are ventured in section 7 and 8.

2. NEW OPPORTUNITIES FOR HUNGER ALLEVIATION?

2.1. New insights about the importance of breastfeeding and micro-nutrients

Behrman et al. (2004) discuss seven methods, or opportunities, for reducing the prevalence of LBW in the developing countries. They also convincingly argue that infant and child nutrition can be vastly improved by the promotion of exclusive breastfeeding and provide ample evidence to support their case. They also presents a lot of evidence to the fact that infant and child nutrition can be improved through the supplementation of micro-nutrients (iron, iodine, vitamin A and Zink). As everybody has read their paper and heard the presentation, I will not go into details at this point, but come back to some of the question marks I have a little later on.

2.2. Immunisation and Improved Medical Practises

There is a host of other instruments— old and new— for reducing child ill health, such as immunisation against TB, DPT, polio and measles, and more lately, Hepatitis B. Also oral rehydration therapy and other child disease control practices have come fourth recently (e.g. treated malaria bed-nets and improved drugs). Since child health and undernutrition are intimately inter-related, any improvement in child health following from the application of such vaccines, cures and technologies should help alleviate under- and malnutrition, to the extent that they have been adopted on an increasing scale during the 1990s.

In several countries, National Surveillance Systems (NSS), which monitor child nutrition status and collect anthropometric data, have been expanded or initiated during the 1990s. For these countries, there are annual data on stunting and underweight and the coverage is usually several hundred thousand children. So far there is no systematic analysis (that I know of) of what the various NSSs actually deliver in terms of nutritional support and health care for children in the respective country, and whether they are fully national. A glance at the raw anthropometric data, however, suggests that the countries with NSSs (as reported in WHO, 2004), have relatively low levels of stunting and underweight. A hypothesis is that adoption of nutrition-improving technologies spread more quickly in countries which have NSSs. In the tests to be conducted, we will check whether this hypothesis holds statistically.

2.3. From Broad-based Food-Price Support to Narrow Targeting

During the 1970s and 1980s, governments in many developing countries provided food at subsidised prices to large sections of the population. The most well-documented cases are Bangladesh, Egypt, India and Sri Lanka. The methods varied across these countries. In Bangladesh ration cards was the main instrument, while in India, “fair-price” shops. In Egypt and Sri Lanka, the food subsidies were extended to the great majority of the population. Common to all these interventions in the food market were that they were ill-targeted (some by intention), leakages were exuberant, corruption rampant, and the fiscal burden excessive.[1]

In the late 1980s or early 1990s, these broad-based programs were abolished or scaled down considerably. In most instances, they were replaced by various more narrowly targeted nutrition-cum-health programs (Allen and Gilliespie, 2001). A similar transition took place in many other countries, for example in Tunisia, Jamaica and Costa Rica (Adams, 2000). The more narrowly targeted programs that have flourished during the 1990s are of various types. Some rely on means-testing (income or assets) and various incentive-based screening methods (school attendance), others on self-selection

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[1] For evaluations of these broad-based programs, see among many recent studies, Chowdhury and Haggeblade, 2000; Adams (2000, 2001); Ahmed and Bouis (2002): Löfgren and El-Said (2001): McClatterly (2000); Ramaswami and Balakrishnan (2002).

(food for work or education), and still others on administrative fiat (selection at health clinics or by place of residence).

3. THE BASIC REASONS FOR UNDERNUTRITION: THE EMPIRICS

An extensive empirical literature show that poverty (low income) is the crucial determinant of hunger and undernutrition. This has been demonstrated in numerous cross-country (as well as cross-household) studies.[2] Figure 1 shows the correlation between the prevalence of child stunting (height for age below norm) and the log of per-capita Gross National Income (GNI/C). The plot is based on data from national anthropometric surveys of 0-5 year olds from 67 countries from years in the 1998-2002 period. The correlation is statistically significant at the 0.000 level and the adjusted R-square is 0.536 (see Table 1 below). That is, more than half the variation child stunting across the countries is "explained" by the income variable alone. (I will come back to the problem with reverse causality.)

[Figure 1 about here]

The correlation picks up the two main effects of income on child nutritional status. The first is that with higher per-capita income, households can (on average) exert stronger effective demand for essential private consumption goods, including more and nutritionally better food. The second is that higher GNI/C means higher government revenues and expenditures. To the extent that these expenditures finance public investment and consumption in health- and nutrition-related services, there should be a positive effect on child nutritional status (Svedberg, 2000, ch. 15; Smith and Haddad, 2002; Haddad *et al*., 2003).

However, almost half the cross-country variation in the prevalence of child stunting is *not* explained by differences in per-capita income. Figure 1 reveals large differences between individual countries at similar income levels. In Jamaica, for example, only 4.4 per cent of the children are stunted, while 25-30 per cent are stunted in Albania, Peru and the Philippines, countries in the same per-capita income bracket. To

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[2] For a recent contribution to the large literature based on cross-household data, see Haddad *et al*. (2003).

identify the reasons for this variation, not related to income, has been a main preoccupation of empirical economists in the field.

Various proxy variables for parental education status, public provision of services and demographic variables have been added on the right-hand side of the estimations. Some of these are found to be significant in many of the studies, but not in others, and when they are significant, their impact is usually small in the sense that including them in the regressions only increases the explanatory power marginally (e.g. as measured by adjusted R-square). Furthermore, the significance of these variables is seldom solid enough to survive a battery of robustness tests. [3]

The main underlying problem with the weak and non-robust results for all these "other" variables is probably that they are intimately correlated to per capita income—and also internally, i.e. there is multicollinearity. This holds for parental (or mother) educational attainment, as well as the many proxy variables for the provision of public services (e.g. basic health care, clean water and sanitation). It also applies for most of the demographic variables that have been included in the regressions (such as the total fertility rate and different dependency ratios). The high degree of multicollinearity makes it difficult to disentangle the separate effects of the explanatory variables. Moreover, it means that estimates become very sensitive to the inclusions or exclusion of individual observations, and to the specification of the regression model.[4]

In Appendix Table 1 [incomplete], the bivariate cross-country correlations between a set of "other" explanatory variables and Ln GNI per capita in 2000 are reported. The table confirms that all these variables are correlated to income and are statistically significant. In most instances, the income variable "explains" more than half the variance in the variable (as measured by adjusted R-square).

4. NEW RELATIONSHIP BETWEEN UNDERNUTRITION AND INCOME?

4.1. Hypothesis

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[3] Cross-country studies include Osmani (1997), Klasen (1999), Svedberg (2000), Smith and Haddad (2002) and Haddad *et al*. (2003).

[4] An illustrative example is the different results for the education proxy (female secondary school enrolment) in Smith and Haddad 2002 and Haddad *et al*., 2003, respectively. In the former study, this variable is found to be statistically significant, but not in the latter.

The basic hypothesis to be tested is whether the relationship between undernutrition (child stunting and underweight) and real income has changed during the past decade. Behind this hypothesis lies a presumption that the technological improvements (discussed in section 2) have been spread widely among and within the poor countries, that targeting instruments have been refined, and that the intervention methods have become more efficient during the 1990s. Since knowledge travels slowly and application takes time, it is important that we have the most recent anthropometric data available (up to 2002/03).

However, there may be other reasons than "technology improvements" for a changed relationship between child nutrition status and real income, which have to be controlled. One obvious possibility is that, at given incomes, governments in developing countries have allocated increasing (or smaller) shares of the public expenditures to purposes that affect child undernutrition (such as primary health care and education).

4.2. Estimation Method

The simple method to be applied was first used in a paper by Samuel Preston (1975). He estimated the correlation between longevity and level of income across countries during different decades and found that the regression curve had drifted downward over time. That is, for given levels of real per capita income, mortality tended to decline decade by decade. These results have later been confirmed for more recent decades. The conventional interpretation is that general advances in medical practices, new drugs and vaccines, and more widespread immunisation, unrelated to the per-capita income in particular countries, have reduced mortality, especially in young children (under-5-year olds).[5]

[5] A basic question is whether the prevalence of stunting and underweight among children in the developing countries has actually declined over the recent decade. De Onis *et al*. (2000), associated with the WHO, have derived aggregated numbers from the Global Database. They find that the weighted average incidence of stunting in developing countries declined between 1985 and 1995 from 39.8 per cent to 32.5 per cent (ibid, Table 2; the numbers for 2000 in this table are projections). As rare as this is done in statistical reports from international organisations, these authors commendably report statistical confidence intervals. I then turns out that the point estimates for these two years are not statistically significant different as the two 95 per cent confidence intervals overlap to a considerable extent. This is noteworthy, considering that developing countries had (unweighted average) a per-capita growth of GDP of about 2 per cent annually 1985-1995 (WDR, 1997) We have to go back to 1980 in order to find that the 1995 prevalence is significantly different.

In this paper the focus is on *changes* in the relationship between prevalence of stunting and underweight, on the one hand, and real per capita income, on the other. The two specific (sub)-periods for which we will compare this relationship are 1998-2002 and 1988-92. Subsequently, other variables than per-capita income will be included in the regressions so as to check whether changes in these variables have affected the association between stunting/underweight and income. We will also allow for the possibility that there is reverse causality between child anthropometric status and national per-capita income (simultaneity).

4.3. Regression Model and Data Sources

The simple regression to be run is the following:

$$\text{CHILD-UND}_{it} = \alpha_t + \beta_{kt}\,\text{LnGNI/C}_{it} + [\boldsymbol{X_{kit}}]\left[\delta_{kt}\right] + \varepsilon_{it},$$

Where i = 1....n (number of countries), t= 1, 2 are the two time period and k = 1....K are the number of control variables; $[\boldsymbol{X_{kit}}]$ is a vector of controls and ε_{it} is the random error term. Child undernutrition (CHIL-UND) will alternately be measured by the share of children who are stunted and underweight. In the first round of regressions we only have LnGNI/C on the right-hand side so as to avoid (for the time being) the multicolinearity problem.

The WHO (2004) Global Database on Child Growth and Malnutrition provides the data needed to undertake the tests of the proposition raised above. This database contains nationally representative data on the prevalence of stunting and underweight for varying years in the late 1980s up to 2003 from more than 100 developing countries. After some filtering (see Svedberg, 2004), we ended up with a data set comprising 115 anthropometric surveys, 48 for years close to 1990 and 67 surveys for years close to 2000. For 37 countries we have anthropometric observations for both periods, which enable inter-temporal comparisons for a given set of countries. Income in both sub-periods is measured by GNI/C, valued in 2000 constant international dollars (PPP), derived from World Bank data sources (see Svedberg, 2004, for details).

5. RESULTS

5.1. Overall Changes between 1990 and 2000

Let us start by looking at how stunting/underweight has changed over the 1990s (Table 1, column 1). In the full samples, the (unweighted) average prevalence of stunting fell from 31.5 to 28.0 per cent, or by 11.1 per cent in relative terms. The prevalence of underweight declined from 21.8 to 20.4, or by 6.4 per cent. In the 37 overlapping countries, the average incidence of stunting fell from 33.2 to 27.9, and underweight from 23.5 to 20.3. In relative terms, these drops correspond to 16.0 and 13.6 per cent, respectively.

[Table 1 about here]

The annual (unweighted) average growth of real GNI/C over the 1990s in the 37 overlapping countries was 1.5 per cent, signifying a cumulative income growth of about 16 per cent. Simply taking the relative changes in stunting and underweight as a ratio to cumulative GNI/C growth, gives "elasticities" of -1.0 and -0.85, respectively.[6] These crude elasticities hence suggest that in the 37 overlapping country sample, a one per cent increase in real income reduces the prevalence of stunting and underweight by about equally much. As we will see later, the correlation between *changes* in stunting/ underweight and growth of GNI/C across the 37 countries, suggests lower elasticities.

5.2. Bivariable Cross-country and Pooled Regressions

The prevalence of stunting and per-capita income in 1998-2002 (67 countries) and 1988-92 (48 countries) are plotted in Figures 1 and 2, respectively. Simple ocular inspection suggests that the association between stunting and real income is close in both sub-periods, which is confirmed by the statistical tests (Table 1). It is also rather evident that the regression line has shifted downwards during the intervening 10 years, which is vindicated by two statistical tests. The first test is to check whether the 95 per cent confidence intervals (±2 sd) around the intercepts overlap, which they do not (Table 1). The other test is too pool the observations for the two periods into a panel and check

[6] This underweight-income elasticity is higher than the one derived by Haddad *et al*. (2003), on pooled cross-country data (-0.51) and for non-overlapping countries and varying years (back to the 1970s).

whether a dummy for the observations in the earlier period turns out significant, which it does at the 0.072 probability level (Appendix Table 2).

The regressions further suggest that the largest percentage-point declines in stunting took place in countries where the initial prevalence was the highest. In Figure 1 and 2, this is shown by the fact that the slope of the regression line is less steep in the later period. In statistical terms (Table 1), it is confirmed by the fact that the 95-per cent confidence intervals for the β-coefficients in the two periods do not overlap (in the regressions for the full samples of countries).

A parallel test for underweight (weight for age) yields different results. The regression lines for the two periods are almost identical (Figure 3 and 4) and this is corroborated by the statistical tests. Neither of the two tests reveal a statistically significant difference between the two periods. Moreover, the β-coefficients are not statistically different from each other, signifying that the non-change is uniform for countries at different income levels in these samples of countries. A few, perhaps speculative, reasons for this difference between stunting and underweight will be discussed later on.

The fact that partly different countries are included in the samples from 1988-92 and 1998-2002 do not seem to have influenced the results. The main results for the 37 countries for which we have data from both periods countries are—by and large—the same. The decline in stunting is significant with the dummy in the pooled-data test (AT 1), but barely so in the other (Table 1). The results for underweight are insignificant, as before, by both tests.

5.3. Multivariable Cross-country and Pooled Regressions

The tests conducted so far have relied exclusively on simple bivariate regressions between stunting/underweight and real income. Most previous empirical attempts to identify the reasons behind undernutrition have, besides income, included various proxy variables for parental education, community services and demographic characteristic. As noted earlier, due to problems with multicollinearity, these proxies, even when statistically significant, are seldom robust.

In a longer paper on which this comment draws (Svedberg, 2004b), I have undertaken additional regressions based on a large set of explanatory variables. Almost all of these turn out insignificant, or are not robust to alternative inclusions of controls. These multivariable regressions further indicate that the previous results regarding the bivariate relationship between stunting/underweight and per capita GNI/C holds—by and large—when additional variables are included.

Although there are problems with multicollinearity, the results from a few multivariable regressions are reported in Table 2. The female literacy rate (FLR) turns out insignificant in all the regressions.[7] Whether this is due to the fact that FLR is highly correlated to income, or is reflecting real phenomena, is difficult to say.[8] There are some interesting results concerning the role of prevalence of LBW. In the regressions for the 1998-02 period, this variable is either insignificant, or barely so (for underweight). In the earlier period (1988-92), LBW is highly significant and with the inclusion of this variable in the regressions, the South Asian dummy variable loses its significance. This result has previously been demonstrated for stunting by Osmani (1997) on the basis of observations from about the same period. The interesting result here is that this relationship seems to have vanished in the 1998-2002 period. It could also be noted that in allregressions, the ratio of health expenditures to GDP (HE/GDP) falls out as insignificant (not reported here).[9]

[Table 2 about here]

[7] The role of mother education for child nutrition has been emphasised in several recent studies, see among others: Senauer and Kassouf (1996): Glewwe (1999); Handa (1999); Schultz (2002).

[8] In ongoing research I measure FLR as the difference between the de facto rate and that predicted by the per-capita income of countries in order to circumvent the multicolinearity problem. This procedure is in line with Amertya Sen's contention that countries that devote more resources than others, at given income levels, to education and health, accomplish better outcomes.

[9] There is no real possibility to find data that shed light on this question directly. In recent years, the WHO (2003, table 5) publishes estimates of the share of GDP that goes to health care (both government and private), but these aggregate numbers say nothing about how much is spend on child health. Moreover, the correlation between health expenditures and health outcomes is very weak, signifying huge disparities in allocation and in quality across countries. In the aggregate, however, there are no indications that larger shares of government expenditures have gone to health and education. The UNICEF (2004) data, replicated in AT 3, suggest no major changes in any of the major geographical regions, (except for education in Latin America). When it comes to spending on health care, these aggregate statistics suggest a drop by one percentage point over the time period covered.

There is also the question whether there has been a change in the relationship between stunting and underweight and real per-capita income when additional variables are included in the regression. In Table 3a, results are reported based on the pooled data from both the 1998-02 and the 1988-92 periods, with FLR and LBW as controls. The results are the same as in the bivariate regression reported earlier. The dummy variable for the observations from the earlier period turns out significant in the regression for stunting, while not in the regressions for underweight (not reported here).

[Table 3a about here]

5.4. Correlation of Changes in Stunting/underweight and Income

The fact that we have anthropometric surveys for 37 countries for both periods makes it possible to correlate changes in stunting/underweight to changes in GNI/C over the 1990s. In these regressions we have also included two additional variables: initial income (GNI/C_{1990}) and income distribution (as measured by the share of total income/expenditures that accrues to the 40 per cent poorest in countries). The initial income is included to test for the possibility that there is a tendency for the poorest to catch up with the not-so-poor (or fall further behind). The income-distribution variable is included to check whether more growth is required in countries with uneven income distribution (cf. the poverty reduction cum growth literature).

The results are reported in Table 4. The association between *changes* in stunting/ underweight and income growth is statistically significant throughout at the 0.05 level. We have measured the change in anthropometric status in both relative and absolute terms (percentage point change), but the results are quite similar. The initial income turns out insignificant in 3 out of the 4 regressions, while being highly significant in the fourth. This reversal is most probably a statistical artefact. The income-distribution variable is significant in most cases, tentatively suggesting that economic growth in countries where income distribution is relatively even, reduces stunting and underweight proportionally more than in countries with more uneven distribution. The inclusion of additional explanatory variables had little impact on the results (not reported) and were insignificant. The intuitive reason for this is probably that there are seldom large changes in adult female literacy rates, the provision of communal services, or in demographic composition, in individual countries over a 10-year period.

[Table 4 about here]

5.4. Comparison with a Related Study

Whether the relationship between the incidence of child underweight (but not stunting) has changed over time has been examined in at least one previous study (Haddad *et al*., 2003). The authors use pooled data from various years in the 1970-97 period, i.e. child underweight in a particular country/year is matched to real income for the same year. The main objective in that study is to assess "How far Income Growth Takes Us" when it comes to reduce child undernutrition, considering also female education, democracy and other potential influences on child nutritional status. Dummy variables for observations from different decades suggest no significant change between the 1980s and the 1990s (up to 1996). They found, however, underweight to be significantly lower in both these decades as compared to the 1970s, when per-capita income is controlled.[10]

6. CHECKING FOR SIMULTANEITY

There is the possibility that there is reverse causality between stunting/underweight and per-capita income. In most earlier related empirical cross-country studies, the simultaneity problem has been ignored (Osmani, 1997; Klasen, 1999; Svedberg, 2000; Haddad *et al*., 2003). The predominant view hence seems to be that reverse causality is not a major problem when it comes to the association between the nutritional status of very young children and national income per capita. Only one of related papers attempts to test for simultaneity problem through the use of instrument variables (Smith and

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[10] The change from the 1970s may well be explained by data shortcomings. In the WHO Database, there are only 13 surveys from the 1970s that stand up the quality criteria set up by the WHO. This number is much too small to be representative for developing countries at large and the 13 countries are not comparable to the much larger number of countries with surveys from the 1980s and (early) 1990s. A similar result is reported indirectly in a manuscript by Klasen (1999). Klasen included both stunting and underweight in his investigation, the main aim of which was to shed light on the puzzle that child mortality is notably higher in Sub-Saharan Africa than in South Asia, while anthropometric failure is the most prevalent in the latter region. The question whether there had been a change in the income-undernutrition relationship over time is not explicitly discussed by Klasen, although his tables reporting on results include decade dummies, which turned out insignificant.

Haddad, 2002). They found little evidence of reverse causality, but some doubts remain about the validity of the chosen instruments.[11]

6.1. Why Simultaneity?

Even though it is difficult to find valid instruments for the *level* of income, the simultaneity problem cannot be dismissed off hand. If the prevalence of undernutrition in children is a marker of undernutrition in the population as a whole, and poor nutritional status has negative effects on labour productivity[12], this may stifle economic growth and, in the longer term, keep per-capita income at a low level.[13] The "marker hypothesis" is not altogether implausible considering the close correlation (0.88) between the prevalence of underweight children and adult women across 23 countries for which data are available (Nubé, 2001: Figure 5)

Another plausible hypothesis is that "third" factors explain both low income levels and child undernutrition. This is basically the question why some countries have had little (or no) growth over their entire history, reflected in very low per-capita incomes today as well as miserable social conditions in all respects, including the nutritional status of the population.[14] Rather self-evident, but nevertheless central to recall, the high incomes in the contemporary richest countries is the outcome of an accumulation of physical and human capital over a very long period—more than 200 years (Maddison, 1995). Why this long-term accumulation of productive assets has taken place in some countries, while not in others, is perhaps the most important question in development

[11] In a paper by Pritchett and Summers (1996), aimed at estimating the extent to which "Wealthier is Healthier" on the basis of cross-country data, the ratio of (1) investment and (2) Foreign Direct Investment (FDI) to GDP, are used as instruments for income growth. Smith and Haddad (2002) use the same instruments, making reference to Pritchett and Summers, for the *level* of per-capita GDP. That the variation in the level of incomes across countries should be a function of the contemporary investment ratios, has no support in the empirical growth literature (Temple, 1999).

[12] A large number of investigations of the link from poor nutrition (status or calorie intake) to low labour productivity have been made, although in most cases the simultaneity problem is not satisfactorily resolved (see Svedberg, 2000, chapter 4 for references and a discussion of studies using calorie intake as the nutrition variable and Thomas and Strauss, 1998, for references to studies based on anthropometric indicators for adults (e.g. height).

[13] In some of the cross-country regressions aimed at identifying the determinants of growth, longevity (a marker of health-cum-nutrition status), comes out as a significant and robust explanatory variable in growth regressions. Bloom *et al*. (2004) provide summaries of results from more than a dozen such studies as well as own estimates.

economics. In recent years, broad consensus seems to have emerged on the notion that long-term growth depends on "institutional arrangements: on the legal systems that enforce contracts and protect property rights and on political structures, constitutional provisions, and the extent of special -interest lobbies and cartels" (Olson, 1996).

6.2. The Instrument

As an instrument for per-capita income, we will use an index of the quality of countrys' institutions. This choice of this instrument is inspired by many findings in the recent growth literature and not the least by the results obtained by Acemoglu *et al*. (2001).[15] They found current bad institutions to be a function of historically (ca 1900) bad institutions and that per capita income today to be closely associated with present institutions (after several robustness tests). Our assumption is hence that the persistence of bad institutions over a long time explains both low levels of GNI/C and high prevalence of stunting/underweight in children. While there may be reverse causation between poor nutritional status and income growth, concurrent child undernutrition can hardly explain the historic, and hence the present, bad institution.

6.3. Correlation between GNI/C and Instrument

The correlation between GNI/C_{2000} and the ICCR instrument are reported in Table 5 for different sets of countries. All regressions show a very strong correlation, significant at the 0.000 level throughout. For all 128 countries for which data are obtainable, the adjusted R-square is 0.79. This is a remarkable number: 79 per cent of the variation in countries GNI/C today, ranging from less than US$1000 (PPP) to well above US$35,000, is explained by this index of the contemporary quality of institutions. Moreover, this result is not dictated by the choice of this particular index. Practically identical results emerge when an alternative index (ECCWR) is used.

[Table 5 about here]

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[14] In constant international dollar, the poorest countries today, with a GNI/C below 1000 US$ (PPP) in 2000 price level, are as poor as they were in 1900 (see Maddison, 1995, and Jones, 1997, for further discussion).

6.4. Effects on Main Results

Replacing GNI/C in our regressions with the Institutional Investment Credit Ratings (IICR) index, does not alter our main results. The cross-country bivariate correlations between stunting/underweight and this income instrument are intact, although the adjusted R^2s drop notably (see Table 6a; no results for underweight are reported here). The statistical significance for the income instrument remains at the 0.000 level throughout. It is also notable that the dummy variable for NSS turns out significant in these regressions with the expected sign.

[Table 6a about here]

7. WHY NOT MORE IMPACT?

It is not straightforward to say whether a weakly significant and not very large reduction in stunting, un-related to per-capita income growth, is a development that merits optimism or not. Is it surprising that the improvement has not been larger, and why is there no similar effect when it comes to reduction in underweight? A few more or less speculative notions on these questions will end this paper. We start with the latter question.

(a) Why Different Results for Stunting and Wasting?

From at least one perspective, the different results for stunting and underweight is puzzling. This is because most children who are underweight are also stunted, i.e. the stunted and underweight overlap to a considerable extent. According to findings by Nandy *et al*. (2003) in a survey from India (the 1998-99 survey included also in our investigation), 28 per cent of the children were both stunted and underweight, while 10 per cent were stunted only, and 6 per cent underweight only. That is, nearly two-thirds of these children were both stunted and underweight. The picture is similar in most other developing countries with high overall prevalence of anthropometric failure.

[15] Other relevant references are Knack and Keefer (1995), Collier and Gunning (1999), Hall and Jones (1999), and Rodrik (1999).

A positive interpretation is that the micro-level interventions with supplementation of vitamins and minerals, iodine-fortification, improved vaccines and more widespread immunisation, have had an impact large enough to make a dent in the statistics at the macro level. Our results suggest, however, that such interventions are more important for enhancing child growth in stature, while less so for stifling underweight and wasting. The latter two conditions are probably determined more by provision of sanitation facilities, the disease environment, and the quantity of food (calories) rather than the quality (micro-nutrients). It seems that most nutritionists are nowadays convinced that micro-nutrients are more important for child growth than mere calories. Lacking expertise in these matters, however, I refrain from further speculation on this issue.

(b) Infrastructure and Human Resource Constraints?

Although more efficient targeting instruments and new nutrition-enhancing technologies, available at little or no costs, may have come forth during the 1990s, constraints on implementation remain in many poor economies. In countries where the administrative capacity and physical infrastructure is highly underdeveloped, even free-of-charge knowledge may take considerable time and effort to actually implement on a substantial scale. The scarcity of adequately trained personnel (i.e. doctors and health workers), needed to disseminate free-to-obtain knowledge and improved drugs, is also a constraint.

There are no comprehensive and detailed data on the extent to which new "technologies" actually have been applied throughout the developing countries. Scattered evidence suggest, however, that many programs reach only a fraction of the population in respective country (Allan and Gillespie, 2001). Most of the micro-level interventions analysed by Behrman et al. (2004) are experimental trials, aimed at gathering information rather than full-fledged policy programs. The targeting efficiency varies (usually evaluated as the share of the explicit or implicit income transfer going to the poorest quintile group).

It may hence be that the new "technologies" have yet to be applied on a scale that leaves larger marks in the aggregate statistics. This could be the reason for the apparent micro-macro paradox. That is, while many evaluations of projects and programs at the micro level shows positive results, there is little trace of success at the macro level. This paradox has frequently been observed for foreign aid (projects).

(c) Corruption and Political Indifference

In many of the countries included in our data set, corruption is endemic. According to the assessment made by Transparency International (2002), only three of the 67 countries in our sample for 1998-2002, Botswana, Chile and Trinidad and Tobago, score more than 5 in its index— where a "clean score" is 10. Incidentally, the latter two countries had the lowest incidence of stunting and underweight out of the 67 countries in the 1998-2002 sub-period. Botswana, a middle-income country, with relatively high incidence of stunting and underweight, may be special because it has the highest prevalence rate of HIV/AIDS in the world, estimated at 39 per cent of the adult population (UNICEF, 2004, Table 4).

Not all countries in our sample are covered by TI, but more than two dozen of these countries are included, and all score less than 3. According to TI, such low scores reflect "deep-rooted and widespread corruption at most levels in society". It is also noteworthy that it was exuberant levels of corruption that eroded the previous food price subsidy schemes in Bangladesh, India, Egypt and some other countries. It is not too farfetched to presume that many of the more narrowly targeted programs for hunger alleviation have also suffered from inefficiency and corruption. This is probably part of the explanation why we do not see more notable changes in the relationship between real income and prevalence of undernutrition at the aggregate level.

There is also the uncomfortable question whether governments in many of the countries covered here actually have improved child health and nutrition on their short list of priorities. As clearly demonstrated by Behrman *et al*. (2004, Table 6), the high benefit-cost ratios for some interventions are derived on discount rates that could be relevant in high-income countries (say 5 per cent). In countries with non-elected, unaccountable and unstable governments, one may suspect that investments in social-welfare programs for the poor are discounted at much higher rates. Since many of the benefits are very long-term (decades), high discount rates make many investments unattractive in such political environments.

8. SUMMARY AND CONCLUSION

Since long we know that economic growth reduces child undernutrition (and most other depravations, including LBW prevalence). Considering that per-capita economic growth de facto is very low in many countries and even negative in many cases, there is a desperate need for methods and policies that reduce the plight of children, which are not primarily dependent on high per-capita incomes. In this paper, we have examined what, besides economic growth, could contribute to a notable reduction of child undernutrition.

The results are not totally encouraging. The relationship between stunting and per-capita real income has drifted downwards somewhat during the 1990s, indicating that non-income factors have helped reduce stunting. The impact is not very large, however, and there is no similar evidence when it comes to underweight. The search for improved micro-level interventions and targeting methods must continue, but in the absence of higher economic growth rates in the poor countries, there is scant hope for realising the Millennium objective of halving the prevalence of child undernutrition over the next ten years.

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2004-03-28

Acemoglu, D., S. Johnson and J.A. Robinson (2001), “The Colonial Origins of Comparative Development: An Empirical Investigation”, *American Economic Review* 91(5): 1369-1401.

Adams, R.H. Jr (2000), ”Self-Targeted Subsidies: The Political and Distributional Impact of Egyptian Food Subsidy System”, *Economic Development and Cultural Change* 49(1): 15-36.

Adams, R.H. Jr (1998), “The Political Economy of the Food Subsidy System in Bangladesh”, *Journal of Development Studies* 35(1): xxx-xxx.

Ahmed, A.U. and H.E. Bouis (2002), ”Weighting What’s Practical: Proxy Means Tests for Targeting Food Subsidies in Egypt”, *Food Policy* 27(5-6): 519-40.

Allen, L. and S. Gillespie (2001), “What Works? A Review of Efficacy and Effectivness of Nutrition Interventions”, ACC/SCN Nutrition Policy Paper 19

Bahrgava, A., D.T. Jamison, L.J. Lau, and C.J.L Murray (2001), “Modelling the Effects of Health on Economic Growth”, *Journal of Health Economics* 20(3): 423-40. 2001

Behrman, J.E., H. Alderman and J. Hoddinott (2004), Hunger and Malnutrition, Challenge Paper for Copenhagen Consensus, May 24-28, 2004.

Bloom, D.E., D. Canning, J. Sevilla (2004), ”The Effect of Health on Economic Growth: A Production Function Approach”, *World Development* 32(1): 1-13.

Collier, P. and J.W. Gunning (1999), “Why has Africa Grown Slowly?, *Journal of Economic Perspectives* 13(3): 3-22.

De Onis, M., E. Frongillo, M. Blössner (2000), “Is Malnutrition Declining? *Bulletin of World Health Organisation* 78: 1222-33.

Gabremedhin, B. and S.M. Swinton (2001), ”Reconciling Food-for-Work Projects with Food Aid Targeting in Tigraay, Ethiopia”, *Food Policy* 26(1): 85-95.

Glewwe, P. (1999), ”Why Mother’s Schooling Raise Child Health in Developing Countries. Evidence from Morocco”, *Journal of Human Resources* 34(1): 124-59.

Gutner, T. (2002), ”The Political Economy of Food Subsidy Reform: The Case of Egypt”, *Food Policy* 27(5-6): 455-76.

Haddad, L., H. Alderman, S. Appleton, L. Song, Y Yohannes, (2003), “Reducing Child Undernutrition: How far does Income Growth Take Us?”, *World Bank Economic Review*, 17(1): 107-31.

Hall, R.E. and C.I. Jones (1999), ”Why Do some Countries Produce so Much More Output per Worker than Others?”, *Quarterly Journal of Economics* 114(1): 83-116.

Handa, S. (1999), ”Maternal Education and Child Height”, *Economic Development and Cultural Change* 47(2): 421-40.

Hassan, K.M. and D.R. Tufte (2001), “Cash Transfer Programs with Income Multipliers: PROCAMPO in Mexico”, *World Development* 29(6): 1043-56.

Jayne, T.S., J. Strauss, T. Yamano, D. Molla (2001), “Giving to the Poor: Targeting Food Aid in Ethiopia”, *World Development* 29(5): 887-910.

Klasen, S. (1999/2003), ”Malnourished and Surviving in South Asia, Better Nourished and Dying Young in Africa: What can Explain This Puzzle”, draft University of Munich.

Knack S. and P. Keefer (1995), ”Insitutions and Economic Performance: Cross-Country Tests Using Alternative Measures”, *Economics and Politics* 7(3): 207-27.

Löfgren, H. and M. El-Said (2001), ”Food Subsidies in Egypt: Reform Options, Distribution and Welfare”, *Food Policy* 26(1): 65-83.

Maddison, A. (1995), *Monitoring the World Economy 1820-1992*, OECD: Paris.

McClafferty, B. (2000), ”Ensuring Food Security in Egypt: Food Subsidy, Income Generation and Market Reform”, *Food Policy* 25(2): 219-24.

Nandy 2003

Nubé, M. (2001) “Confronting Dietary Energy Supply with Anthropometry in the Assessment of Undernutrition Prevalence at the Level of Countries”, *World Development* 29(7): 1275-89.

Olson, M. (1996) “Big Bills Left on the Sidewalk: Why some Nations are Richer and Others Poor”, *Journal of Economic Perspectives* 10(2): 3-24.

Osmani, S.R. (1997), ”Poverty and Nutrition in South Asia”, *Nutrition Policy Paper 16*, ACC/SCN, World Health Organisation.

Preston, S. (1975)

Pritchett, L. and L.H. Summers (1996), “Wealthier is Healthier”, *Journal of Human Resources* 31(4): 841-68.

Ramaswami, B. and P. Balakrishnan (2002), ”Food Prices and the Efficiency of Public Distribution System in India”, *Food Policy* 27(5-6): 419-36.

Rodrik, D. (1999), ”Where Did All the Growth Go?”, *Journal of Economic Growth* 4(4): 385-412.

Sala-i-Martin, X. (1997), “I just Ran one Million Regressions”, *American Economic Review* 87(2): xxxxxxxx

Schultz, T.P. (2002), “Why Governments Should Invest More to Educate Girls”, *World Development* 30(2): 207-25.

Senauer, B. and A.L. Kassouf (1996), ”Direct and Indirect Effects of Parental Education on Malnutrition among Children in Brazil: A Full Income Approach”, *Economic Development and Cultural Change* 4???: 817-37.

Skoufias, E., B. Davis, S. de la Vega (2001), “Targeting the Poor in Mexico: An Evaluation of the Selection of Households into PROGRESA”, *World Development* 29(10): 1769-84.

Smith, L.C. and L. Haddad (2002), ”How Potent is Economic Growth in Reducing Undernutrition? What are the Pathways of Impact? New Cross-Country Evidence”, *Economic Development and Cultural Change* 51(1): 55-76.

Svedberg, P. (2000), *Poverty and Undernutrition: Theory, Measurement, and Policy*, Oxford: Oxford University Press.

Svedberg, P. (2002), ”Undernutrition Overestimated”, *Economic Development and Cultural Change* 51(1): 5-36.

Svedberg, P. (2004a), “Has the Relationship Between Child Undernutrition and Income Changed?: A Cross-country Investigation” (mimeo IIES)

Svedberg, P. (2004b), “World Income Distribution: Which Way?”, *Journal of Development Studies* 40(5), forthcoming.

Temple, J. (1999) “The New Growth Evidence”, Journal of Economic Literature 17 (March): 112-56.

Transparency International (2003),

UNICEF (2004), *The State of the Worlds Children, 2004*, UNICEF: Geneva.

World Bank (2002), *World Development Report*, Washington DC.

World Bank (2003), *World Development Indicators*, 2003.

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Table 1: Bivariate Regressions of Prevalence of (1) Stunting (HA) and (2) Underweight (WA) on GNI/C_{2000} in constant international dollars

Dependent variable	Mean of dep var	Growth of GNI/C 1990-00	Intercept (± 2 sd)	Coefficient (± 2 sd)	t-value (prob)	Adjusted R^2	No obs.
	(1)	(2)[a)]	(3)	(4)	(5)	(6)	(7)
HA_{88-92}	31.5	-	157 (143-171)	-16.2 (14.4-18.0)	-8.95 (0.000)	0.642	45
HA_{98-02}	28.0	-	127 (116-138)	-12.8 (11.3-14.3)	-8.72 (0.000)	0.536	66
HA_{88-92}	33.2	1.5	151 (135-167)	-15.6 (13.4-17.8)	-7.21 (0.000)	0.593	36
HA_{98-02}	27.9	1.5	133 (119-147)	-13.6 (11.8-15.4)	-7.47 (0.000)	0.610	36
WA_{88-92}	21.8		127 (110-144)	-13.7 (11.6-15.8)	-6.39 (0.000)	0.459	48
WA_{98-02}	20.4		122 (110-134)	-13.1 (11.5-14.7)	-8.41 (0.000)	0.518	66
WA_{88-92}	23.5	1.5	125 (105-145)	-13.5 (10.8-16.2)	-5.07 (0.000)	0.407	37
WA_{98-02}	20.3	1.5	119 (103-135)	-12.8 (10.7-14.9)	-6.07 (0.000)	0.499	37

Notes: a) Annual growth rate, unweighted average.
Memo: All numbers have been checked against the printout.

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Table 2. Selected Results from Multiple Regressions for Stunting and Underweight 2000 and 1990

N = 67/48	Height for Age (<-2sd)		Weight for Age (<-2sd)	
Indep var	2000	1990	2000	1990
	(1)	(2)	(3)	(4)
LnGNI/C 2000 and 1990	-11.67 [-6.62]*	-12.80 [-5.57]*	-10.10 [-6.08]*	-7.72 [-3.37]**
FLR 2000 and 1990	-0.027 [-0.46]	0.001 [0.02]	-0.069 [-1.21]	-0.050 [-0.83]
LBW 2000 and 1990	0.092 [0.43]	0.831 [2.43]***	0.357 [1.82]****	1.13 [3.33]**
D-SA	16.11 [2.84]****	-2.14 [-0.20]	20.11 [3.91]*	1.46 [0.13]
R^2-adj	0.61	0.73	0.70	0.72
N	63	44	63	47

Source: Regressions-CH-04-03-31 in computer printout.

Notes: t-values in squared brackets

*   significant at the 0.000 level

** significant at the 0.01 level

*** significant at the 0.05 level

**** significant at the 0.10 level

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Table 3a. Pooled regression for height for age, 1998-02 and 1988-92, with dummy variable for observations in the earlier period

N=115	Dependent Variable: Height for age (<-sd)					
Indep var	(1)	(2)	(3)	(4)	(5)	(6)
LnGNI/C	-14.21 [-12.25]*	-12.24 [-8.27]*	-12.27 [-10.31]*	-12.47 [-8.47]*	-12.32 [-10.44]*	-11.99 [-8.56]*
FLR	-	-0.091 [-2.15]***	-	-0.080 [-1.89]***	-	-0.014 [-0.31]
LBW	-	-	0.541 [4.14]*	-	0.528 [4.08]*	0.558 [3.94]*
D-1988-92	-	-	-	3.08 [1.70]****	2.90 [1.71]****	3.29 [1.91]****
Adj R^2	0.58	0.59	0.63	0.60	0.63	0.64
N	111	108	110	108	110	107

Source: Regressions-CH-04-03-31 in computer printout.

Notes: t-values in squared brackets

* significant at the 0.000 level

** significant at the 0.01 level

*** significant at the 0.05 level

**** significant at the 0.10 level

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Table 4: Correlation between change in stunting/underweight and change in GNI/C 1990-2000, with controls for initial level of income (GNI/C_{1990}) and income distribution.

	Dependent Variables (change over period 1990 to 2000)							
	Height for age				Weight for age			
	Relative change		Absolute change		Relative change		Absolute change	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GNI/C_{00}/ GNI/C_{90}	-0.38 [-2.89]*	-0.39 [-2.85]*	-10.68 [-3.00]*	-10.36 [-3.07]*	-0.26 [-2.03]**	-0.25 [-2.59]*	-5.54 [-2.17]**	-4.77 [-2.00]**
$GNI/_{90}$	-	-0.000 [-0.44]	-	0.000 [0.75]	-	-0.008 [-5.08]*	-	-0.000 [-0.74]
Income distrib.[a)]	-	-0.003 [-0.34]	-	-0.57 [-2.23]**	-	-0.018 [-2.46]**	-	-0.53 [-3.01]**
Adj R^2	0.17	0.14	0.19	0.30	0.08	0.49	0.09	0.25
N	36	34	36	34	37	35	37	35

a) Income distribution is measured as the share of total income or expenditures accruing to the 40 per cent poorest in the countries.

* significant at the 0.01 level

** significant at the 0.05 level

[Memo: checked all numbers against computer printout]

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Table 5: Regression of GNI/C_{2001} on Indexes of Quality of Institutions. Base sample and the World

	Dependent variables			
	GNI/C_{2000}	$LnGNI/C_{2001}$		
Sample	Base sample	Base sample	World	World
	(1)	(2)	(3)	(4)
Independent variable	IICR[a)]	IICR[a)]	IICR[a)]	ECCWR[a)]
	131.55 [9.67]*	0.043 [8.19]*	0.038 [21.73]*	0.044 [22.10]*
R-square adjusted	0.61	0.52	0.79	0.78
N	61	61	128	138

Source: Regressions-CH-04-03-30 in computer printout.

a) IICR = Institutional Investor Credit Rating and ECCWR = Euromoney Country Credit-Worthiness Rating as reported in World Bank, WDI, 2003b: Table 5.2.

Notes: t-values in squared brackets

* significant at the 0.0000 level

[Memo: checked against computer printout]

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Table 6a. Correlation between Prevalence of Stunting and GNI/C. OLS and Instrument Variables (IV) and Dummy Variables, 2000.

	Dependent variable: Height for Age (<-2sd)					
	OLS	IV	OLS	IV	OLS	IV
Indep variable	(1)	(2)	(3)	(4)	(5)	(6)
$LnGNI/C_{2001}$	-12.79 [-8.72]*	-0.53 [-4.54]*	-12.46 [-9.21]*	-0.56 [-5.31]*	-12.04 [-7.96]*	-0.47 [-4.05]*
D-SA	-	-	17.72 [3.55]**	23.83 [3.74]*	-	-
D-NSS	-	-	-	-	-7.41 [-1.69]****	-12.47 [-2.26]***
R^2-adj	0.54	0.25	0.61	0.39	0.55	0.30
N	66	60	66	60	66	60

Source: Regressions-CH-04-03-30 in computer printout. Data from WDI, 2003, Tables 1.1 and 5.2 (GNI/C and instruments) and WHO, 2004 (NNS).

Notes: t-values in squared brackets.

* significant at the 0.000 level

** significant at the 0.01 level

*** significant at the 0.05 level

**** significant at the 0.10 level

[numbers checked against computer printout]

Memo: FLR and HE non-significant in all regressions for H/A

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Appendix Table 1: Correlation between Selected Variables and $LnGNI/C_{2000}$ in Base Sample of Countries (67). OLS Regressions.

	Independent variable: $LnGNI/C_{2000}$				
Dependent Variables, 2000 (%)	Coeffic	t-value	Prob	R^2-adj	N
Total fertility Rate (TFR)	-1.70	-9.25	0.000	0.56	67
Low Birth Weight (LBW)	-3.01	-3.00	0.004	0.11	67
Dependency Ratio (DEPR)	-4.94	-9.29	0.000	0.56	67
Share of 0-14 year olds (0-14y)	-6.94	-7.72	0.000	0.47	67
Female Literacy Rate (FLR)					
Health Expenditures/GDP (HE/GDP)					
Improved Water (WATER)					
Adequate Sanitation (SANIT)					
Immunisation Coverage (IMMUN)					
Breast-feeding					
Protein in diet (FAO)					

Source: Regressions-CH-04-03-30 in computer printout. Data on GNI/C_{2000} are from WDI, 2002, Table 1.1; data on HE are from WHO, 2003, Annex Table 5; Other data are from UNICEF, 2004, Tables 1,2, 3 and 5.

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Appendix Table 2: Simple Regressions of Prevalence of (1) Stunting (HA) and (2) Underweight (WA) on GNI/C in constant 2000 international dollars,pooled data for 1988-92 and 1998-02 . Estimates for all countries and for the ones with data for both periods (2x37=74)

Dependent variable	GNI/C coefficient (t-value)	Dummy for 1988-92 (t-value) (prob)	Mean of dependent variable	Adjusted R-square	No of obser-vations
	(1)	(2)	(3)	(4)	(5)
HA-All$_{90+00}$	-14.2 (-12.25)*	-	29.4	0.575	111
HA-All$_{90+00}$	-14.2 (-12.36)*	3.26 (1.82)**	29.4	0.584	111
WA-All$_{90+00}$	-13.3 (-10.52)*	-	21.0	0.493	114
WA-All$_{90+00}$	-13.3 (-10.51)*	1.58 (0.81)	21.0	0.491	114
HA-74$_{90+00}$	-14.6 (-10.06)*	-	30.5	0.586	72
HA-74$_{90+00}$	-14.4 (-10.13)*	4.08 (1.87)**	30.5	0.600	72
WA-74$_{90+00}$	-13.2 (-7.85)*	-	21.9	0.453	74
WA-74$_{90+00}$	-13.1 (-7.77)*	2.17 (0.853)	21.9	0.451	74

* significant at the 0.000 level
** significant at the 0.10 level

Memo: All numbers checked against printout.

Appendix Table 3. Change in Per Cent Central Government Expenditure on Health and Education in Total Expenditures

	Per cent Central Government Expenditure on[a]					
	Health			Education		
Region	1986-1992[b]	1992-2000[b]	Change	1986-1992[b]	1993-2001[b]	Change
	(1)	(2)	(3)	(4)	(5)	(6)
Sub-Saharan Africa	4	..	..	12	..	..
Middle East & North Africa	5	5	0	17	17	0
South Asia	2	2	0	3	3	0
East Asia (China)	2	2	0	10	10	0
Latin America & Caribbean	5	6	1	10	13	3
Central Asia[c]	..	4	..	..	5	..
All Developing Countries[d]	4	3	-1	10	11	1
Memo: Developed Countries	14	12	-2	4	4	0

Sources: Original data from the International Monetary Fund (IMF), replicated in UNICEF (1996, Table 10; and 2003, Table 7)

Notes: a) Local government and private expenditures on health and education are not included and as a share of total expenditures, these shares vary markedly across countries (see WHO, 2003, for recent data); b) Data refer to the most recent year available during the period specified in the column heading; c) Mainly Central Asian, ex-Soviet reepublics, but included are also the Baltic states and some Eastern European ex-central-planned countries; d) All numbers in the above table are weighted averages and it should be noted that the numbers are rounded (no decimal points), which means that estimated relative changes are imprecise.

FIGURE 3. HA8892 VS LNGNI90

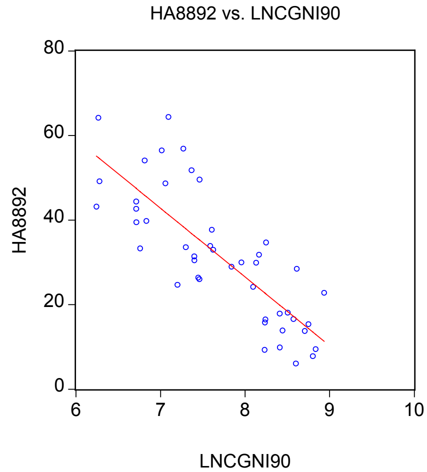

FIGURE 1: HA9802 VS LNGNI00

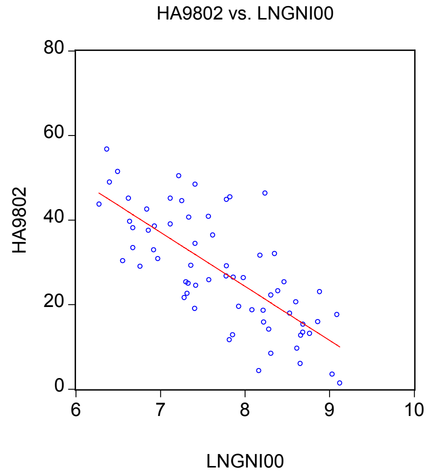

FIGURE 4. WA8892 VS LNGNI90

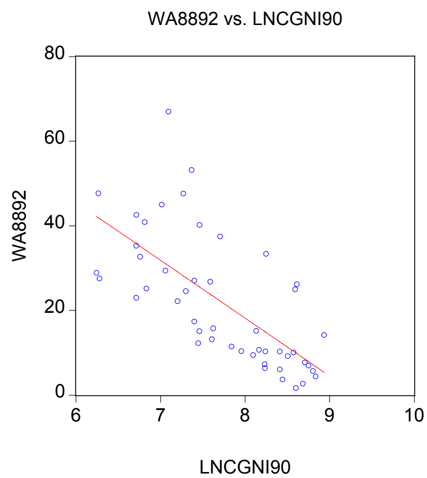

FIGURE 2: WA9802 VS LNGI00