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Personal Well-Being during Growth[*]

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Abstract: This paper considers the relative importance of improvements in economic status in explaining improvements in non-monetary measures of well-being during Vietnam's economic boom in the 1990s. This study finds that improvements in economic status can explain virtually all of the 20 percent increase in schooling attainment and most of the observed improvements in child nutrition and declines in child labor for the poorest half of the population. In contrast, improvements in economic status can explain little of the observed changes in adult health. This study illustrates that the relationship between well-being and economic status is neither simple nor monotone. Thus, the debate over the ability of improvements in economic status to affect well-being needs to be nuanced to a country's particular situation and reliance on economic status alone to measure poverty may neglect important aspects of well-being.

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1. Introduction

The positive correlation between economic growth and various measures of poverty or non-monetary measures of well-being such as health or education is well-established, but its interpretation is controversial. On one side of the debate, improvements in well-being follow directly from measured improvements in economic status (Barro and Sala-i-Martin 1995, Pritchett and Summers 1996, Easterly 1999, Barro and Lee 2001). Empirical support for this argument comes from a variety of studies that find a positive marginal effect of some measure of economics status such as per capita expenditure on some well-being measure such as educational attainment. On the other side of the debate, researchers argue that much of the correlation between growth and well-being is an artifact of exogenous price changes that, in part, reflect technology and the underlying policy environment (see Anand and Ravallion 1993 for discussion). Technologies and policies that reduce poverty and improve well-being either affect growth or occur with it. Thus, the policy question that arises in the center of this debate over growth and well-being is whether various indicators of well-being should be targeted as a separate determinant of policy in addition to a focus on fostering growth. This policy question is integrated with the debate over whether measuring poverty by economic status alone captures sufficient information for the formulation of policy.

This study develops a measure of the relative importance of changes in economic status in explaining changes in non-monetary measures of well-being during an episode of growth. That is, this study develops a decomposition tool to compute the counterfactual: how would well-being change if only economic status improved and exogenous prices did not change. The decomposition relies on repeated observations on the economic status of individuals and measures of their well-being. The idea behind the decomposition is that at any point in time, individuals face a common technology and policy environment that is reflected in a common set

of exogenous prices.[1] Thus, the counterfactual of what well-being would be with only the observed improvements in economic status and no exogenous price changes is constructed by using observations on improvements in economic status through time and the relationship between economic status and well-being at a single point in time.

The decomposition framework is applied to analyze changes in education, child labor, child nutrition, and adult health during Vietnam's economic boom in the 1990s.[2] This study finds that economic status improvements appear important in all of the observed changes in well-being in Vietnam in the 1990s except for adult health. Educational attainment as measured by the completion of schooling beyond primary in children 12-16 increases by 20 percent between 1993 and 1998 in Vietnam, and 98 percent of this increase in schooling can be explained by improvements in economic status as measured by per capita expenditure. Child labor as measured by participation in wage work or a family business declines by 30 percent, and 93 percent of the decline in child labor in households below the poverty line can be explained by improvements in economic status. Child nutrition status as measured by the height for age z-scores of children under 10 improves by 20 percent. Improvements in economic status can explain 69 percent of this improvement child nutrition in households below the poverty line in 1993 and 58 percent of the improvements throughout the distribution. Adult health is measured by the number of days in the last 4 weeks that an adult 20-40 cannot perform his/her usual activities because of illness or injury. The number of days missed declines by almost 30 percent between 1993 and 1998. Only 5 percent of this improvement can be explained by changes in per capita expenditure for households below the poverty line, although in the poorest decile,

[1] To the extent that individuals in the cross-section do not face a common set of exogenous prices, improvements in economic status will fail to explain changes in well-being during an episode of growth with the methodology developed herein.

[2] More detailed exploration of this study's child labor and nutrition results are in Edmonds (2005) and Edmonds (2004) respectively. The present study differs from those in motivation, implementation of the decomposition, and dataset used (with this study using the full panel, while those studies use subsets of the panel), but the general patterns observed for child labor and nutrition are similar.

economic status improvements can explain 71 percent of the observed improvement in adult health

In general, economic status improvements are more important in explaining changes in well-being in the bottom of the distribution than in the top of the distribution. This result reflects the non-linear nature of the relationships between well-being and economic status. Moreover, while per capita expenditure improvements can explain a majority of the improvements in well-being other than adult health, the data in general reject the hypothesis that economic status improvements can explain all of the observed change in well-being (education and child labor in households below the poverty line are exceptions). These results suggest that a nuanced view of the relationship between growth and well-being is appropriate. While an emphasis on growth (and thereby economic status) alone may yield large improvements in some indicators of well-being especially for the very poor, increasing wealth is not a panacea. Moreover, these findings are consistent with the recent push to measure poverty beyond measuring economic status (see Case and Deaton 2003 for a recent discussion), because they illustrate how economic status is not a sufficient statistic for other non-monetary measures of well-being.

This article is organized as follows. The next section outlines the theory that motivates the decomposition, then discusses its implementation in practice. Section 3 introduces the data and discusses the over 50 percent improvement in per capita expenditure observed in Vietnam between 1993 and 1998. Section 4 examines how important economic status improvements appear to be in explaining changes in the educational attainment, child labor, nutritional status of children, and adult health. Section 5 concludes.

2. The Decomposition

This section outlines the assumptions under which the decomposition separates the effects of policy and other factors driving exogenous price shifts on well-being from the effects of improvements in economic status. It begins with a basic theoretical model that suggests an approach for the decomposition. Then, this section considers how to implement the

decomposition in practice and ends with technical details about the estimation techniques used in this study.

2.1 In theory

Individuals observed at time *t* have some endowment of value Ω_t. This endowment reflects the market's value of the human and physical capital with which an individual begins time t. Individual decisions at time *t* are based on the value of their endowment and the vector of external prices p_t that the individual faces. External prices are common to all individuals at time *t* and in part reflect the technology and policy environment. Household decision-making will also be affected by a set of endogenous prices that depend on the value of endowments and exogenous prices. However, these endogenous prices do not need to be consider explicitly under the assumption that they are fully determined by $\{\Omega_t, p_t\}$. A given vector $\{\Omega_t, p_t\}$ maps to a unique observed economic status measure m_t. Thus, at a given p_t, uniqueness implies that m_t identifies the value of an individual's endowment Ω_t. As such, this study's focus on the ability of economic status improvements to explain changes in well-being is really a focus on the ability of changes in the value of endowments to explain changes in well-being.

All individual decisions at time *t* stem from $\{\Omega_t, p_t\}$. The measure of well-being *y* is a component of a vector of non-stochastic outcomes from the individual's decision-making process based on $\{\Omega_t, p_t\}$. Because of the uniqueness of the mapping between $\{\Omega_t, p_t\}$ and m_t, there is a unique mapping between $\{\Omega_t, p_t\}$ and the set $\{y_t, m_t\}$ that is observed in the data even if *y* does not take on a unique value for each $\{\Omega_t, p_t\}$. The individual's decision-making process is stable through time so that whenever $\{\Omega_t, p_t\}$ occurs, the same economic status and measure of well-being $\{y_t, m_t\}$ will be observed. This assumption rules out an effect of relative poverty on $\{y_t, m_t\}$.

The goal of the decomposition is to construct the counterfactual of how well-being *y* would have changed with the observed improvements in economic status if exogenous prices did not change. When exogenous prices are constant, the observed change in economic status reflects a change in the value of an individual's endowment. Thus the construction of the counterfactual requires the observation on m_{t+1} and the mapping between $\{\Omega_t, p_t\}$ and $\{y_t, m_t\}$ at time *t*. If m_{t+1} were observed at prices p_t, then this implies a change in endowments from Ω_t to $\hat{\Omega}_{t+1}$. The counterfactual $\hat{y}_{t+1}$ then follows directly from this new endowment and the external prices at time *t*: $\{\hat{\Omega}_{t+1}, p_t\} \rightarrow \{\hat{y}_{t+1}, m_{t+1}\}$.

2.2 In Practice

The value of individual endowments and the complete vector of external prices are unobserved. Instead, repeated observations on economic status *m* and well-being *y* are available. For simplicity, consider the case of two time periods indexed *t* and *t+1*. Of particular interest, in this study is how the ability of improvements in economic status to explain changes in well-being varies across the distribution. Thus, the decomposition is developed for a particular point m_t on the baseline (first observed) living standards distribution. In a cross-section, prices are fixed, so the cross-sectional relationship between *m* and *y* maps out the relationship between endowments and well-being. Thus, conditioning on a given point m_t in the living standards distribution is equivalent to conditioning on an endowment value in the baseline distribution.

There is measurement error in economic status. Thus, any observed individual change in economic status contains a potentially substantive measurement error component. m_t is the observed economic status and the true measure of status is $m_t^* = m_t - e_t$ where *e* is the measurement error component. This measurement error is assumed to be mean zero in the neighborhood of the true economic status. Thus, rather than working with individual observations, this study employs smoothing techniques and works with points on a grid of the

baseline distribution. Moreover, the measurement error at time *t+1* is assumed to be mean zero at each point in the baseline time *t* living standards distribution, and there is a unique one-to-one correspondence between m_t^* and m_{t+1}^*. That is:

$E\left[m_{t+1}\middle|m_t\right] = E\left[m_{t+1}^*\middle|m_t\right] + E\left[e_{t+1}\middle|m_t\right] = E\left[m_{t+1}^*\middle|m_t\right]$. Denote $E\left[m_{t+1}\middle|m_t\right] = g\left(m_t\right)$. Thus, smoothing techniques need to be employed in both the intertemporal and cross-sectional components of the decomposition because of the measurement error problem.

For some point on the baseline distribution m_t, the change in *y* from time *t* to *t+1* can be written $E\left[y_{t+1} - y_t\middle|m_t\right] = E_{t+1}\left[y_{t+1}\middle|m_t\right] - E_t\left[y_t\middle|m_t\right]$. The time subscript on the expectations operator denotes what set of prices affect the observed economic status and well-being measure. Denote $E_t\left[y_t\middle|m_t\right] = f\left(p_t, m_t\right)$. Prices change by some amount ε and observed economic status change by δ for the point m_t. Because of the assumption that relationships are stable overtime:

$$E_{t+1}\left[y_{t+1}\middle|m_t\right] = E_{t+1}\left[E_{t+1}\left[y_{t+1}\middle|m_{t+1}\right]\middle|m_t\right] = f\left(p_t + \varepsilon, m_t + \delta\right).$$

Thus, changes in *y* are associated with the observed change in economic status, the changes in external prices, or the interaction of the two.

The decomposition problem is to separate factors attributable to changes in endowments that are represented by changes in economic status from other external factors (reflected in p) that change simultaneously with growth. The change in *y* associated with changes in *m* alone is the value of *y* that occurs when *p* is fixed. That is:

(1) $$E_t\left[y_{t+1}\middle|m_t\right] = f\left(p_t, m_t + \delta\right).$$

Thus, the decomposition is based on the observation that $E\left[y_{t+1} - y_t\middle|m_t\right]$ has two component parts: the change attributable to economic status improvements

$$f\left(p_t, m_t + \delta\right) - f\left(p_t, m_t\right) \equiv E_t\left[\Delta\middle|m_t\right]$$

and the residual $f\left(p_t+\varepsilon, m_t+\delta\right)-f\left(p_t, m_t+\delta\right)$ that reflects changes in exogenous prices owing to policy changes or other aspects of the individual's economic environment and the interaction of these exogenous prices changes with economic status.

Given δ, (1) depends only on information from time *t* and should therefore be observable in the time *t* data provided that there is support for $m_t+\delta$ in the time *t* income distribution. Thus, the decomposition is based on computing an estimate of δ for each point on the living standards distribution in the base year of time *t*. This is equivalent to calculating $E\left[m_{t+1}\middle|m_t\right]=g\left(m_t\right)$ and using the expectation at time *t* of *y* for this expected economic status to calculate the *y* expected at time *t+1* given the observed improvement in economic status. That is:

(2) $$E_t\left[y_{t+1}\middle|m_t\right]=f\left(p_t, m_t+\delta\right)=f\left(p_t, g\left(m_t\right)\right).$$

Of course, prices are not fully observable. However, this does not create a problem for computing (2), because all individuals observed at time *t* face a common set of exogenous prices. This suggests executing the decomposition as follows for some point m_t on the baseline living standards distribution:

1. Compute $E_t\left[y_t\middle|m_t\right]=f\left(p_t, m_t\right)=f_t\left(m_t\right)$ by a regression of *y* on *m* at time *t.*
2. Compute $E\left[m_{t+1}\middle|m_t\right]=g\left(m_t\right)$ by regressing m_{t+1} on m_t
3. Compute $E_t\left[y_{t+1}\middle|m_t\right]$ as the estimate from step 1 for the economic status estimated in step2. That is: $E_t\left[y_{t+1}\middle|m_t\right]=f\left(p_t, g\left(m_t\right)\right)=f_t\left(g\left(m_t\right)\right)$.

$f_t\left(g\left(m_t\right)\right)-f_t\left(m_t\right)\equiv E_t\left[\Delta\middle|m_t\right]$ is the change in *y* at point m_t that would be expected based on the observed economic status improvements alone (given prices). The residual change in *y* observed at some point on the baseline distribution m_t is attributable to price changes as well as the interaction of these price changes with economic status improvements.

The change in well-being predicted by economic status improvements at point m_t alone is not easy to interpret. A more meaningful summary statistic is the fraction of the observed change in well-being at point m_t that can be explained by economic status improvements. This is computed by dividing $E_t\left[\Delta\middle|m_t\right]$ by the actual change in well-being. Denote this fraction Λ:

$$E\left[\Lambda\middle|m_t\right] \equiv \frac{E_t\left[\Delta\middle|m_t\right]}{\left(E_{t+1}\left[y_{t+1}\middle|m_t\right] - E_t\left[y_t\middle|m_t\right]\right)}$$

where $E_{t+1}\left[y_{t+1}\middle|m_t\right]$ is the result of the regression of y_{t+1} on m_t. Moreover, researchers are not generally interested in the explanatory power of economic status changes at any one point. Rather, they are interested in the explanatory power of economic status improvements over a range of the baseline distribution. This is computed by taking the density weighted average of $E\left[\Lambda\middle|m_t\right]$ over the range of interest (e.g. individuals below the poverty line).

Thus, constructing the counterfactual of how much of the observed changes in well-being can be explained by economic status improvements alone requires computing estimates of $E_t\left[y_t\middle|m_t\right], E_{t+1}\left[y_{t+1}\middle|m_t\right], E\left[m_{t+1}\middle|m_t\right]$, and the density at each point m_t from the available data. In the following, each expectation is computed by the nonparametric regression of the relevant dependent variable on m_t and density estimation uses standard kernel density techniques.[3]

Nonparametric techniques are preferred to linear regression for three reasons. First, non-linearities are likely to be important in the relationship between economic status and well-being. Second, an important part of the decomposition is how the ability of economic status improvements to explain improvements in well-being varies across the living standards distribution. Linear regression imposes a uniform effect given the observed change in economic status. Third, linear regression entails an additional restriction functional form restriction on the

[3] The empirical work below uses a Fourier series approximation for nonparametric regression. y_t y_{t+1}, and m_{t+1} are each (separately) regressed on m_t, m_t^2, and a series of the form of $\sin\left(jm_t\right)$ and $\cos\left(jm_t\right)$ for j=1 to 6 after m_t is transformed to range between 0 and 2π.

mapping between prices, endowments, and economic status. As is discussed in detail in section 5, the key identifying assumption in the decomposition is the uniqueness of the mapping between $\{\Omega_t, p_t\}$ and m_t. By allowing this mapping to differ from point to point in the distribution of m_t, nonparametric methods avoid the need to specify a functional relationship. Moreover, a linear form might be misinterpreted as defining a marginal effect of changes in economic status on well-being. Economic status is an outcome in this model, and it serves as a summary statistic for the underlying decisions-making process that maps endowments and prices to well-being. Thus, differences in economic status reflect both differences in endowments and prices, and there is no sense in which a marginal effect of a change in economic status has any interpretation in this setting.

3. Data

This study analyzes changes in educational attainment, child labor, child nutrition, and adult health during an episode of growth using the Vietnam Living Standards Surveys (VLSS). The first round of the VLSS took place between September 1992 and October 1993, and the second round of the VLSS took place between December 1997 and December 1998 (World Bank 2000). Both rounds are designed to be nationally representative, cross-sectional household surveys. However, the decomposition in this study focuses on the 4304 panel households that are observed in both rounds of the survey.[4] The VLSS is a multi-purpose household survey following the format of the World Bank's Living Standards Measurement Surveys, and the questionnaires are nearly identical in each round of the survey.

Table 1 presents summary statistics for each nationally representative cross-section (columns 1 and 2) and the household level panel used in this study (columns 3 and 4). Means in columns 1 and 2 are weighted to be nationally representative. In the second round of the VLSS, there was a large increase in sample size. Hence, the number of observations in column 2 is

[4] Glewwe and Nguyen (2002) discuss attrition in the panel and conclude that the panel appears to be approximately nationally representative. The panel recaptured 89.6 percent of its targeted households.

larger than other columns. One notable exception is that the number of children under 10 is lower in the second round of the VLSS than in the first round despite the expansion of the sample. This drop in children under 10 from 1.25 per household in 1993 to .91 per household in 1998 also appears in the panel households. This reflects the almost halving of birth rates that occurs between 1993 and 1998 as discussed in Edmonds (2003).

Economic status is measured by household per capita expenditures. The calculation of the expenditure aggregate for the VLSS is described in World Bank (2000).[5] The expenditure measure is defined as annual expenditure, and most expenditure is on food. Expenditure includes both purchased goods and the imputed value of home production that is consumed in the household. Durable goods are not included in total expenditure, but an imputed rental value of durables is included. Expenditure is deflated so that expenditure in both 1993 and 1998 is expressed in hundreds of January 1998 Dongs.

Between 1993 and 1998, mean per capita expenditure increased by 52 percent. Figure 1 pictures the distribution of the logarithm of per capita expenditure for all VLSS households in 1993 and 1998 weighted to be nationally representative. The two distributions are kernel estimates of the density of logarithm of per capita expenditure. The vertical line in figure 1 is the official 1993 poverty line (approximately USD $106 per person per year). The poverty line's calculation is described in the *Vietnam Development Report 2000*. It is the estimated cost of acquiring enough food to consume 2100 calories per person per day plus an allowance for nonfood expenditures.

The dramatic improvement in economic status between 1993 and 1998 is evident in figure 1. Despite being deflated to be in the same units, the mass of the entire distribution of per capita expenditure is shifted right. In 1993, 58 percent of the population is below the poverty line. In fact, 25 percent of households have per capita expenditures below the estimated costs of purchasing 2100 calories per day. 5 years later, only 8 percent of the population has 1998

[5] The January 1998 exchange rate was 13,300 Dongs per dollar.

expenditures below this level, and 33 percent of the population lives below the 1993 poverty line.[6] Not only is the shift in the distribution dramatic, but the shape of the two densities are largely unchanged between 1993 and 1998. In fact, Glewwe and others (2002) find that improvements in per capita expenditure are roughly uniform throughout the distribution and as a result that overall inequality is largely unchanged.

This study examines the ability of these improvements in economic status to explain changes in various measures of individual well-being. One difficulty in tracking any outcome through time is to make sure that the survey instrument is consistent through time on that measure. The expenditure aggregate used to measure economic status improvements is based on virtually identical questions. Similarly, the measures of well-being are chosen, because their questions are identical in the two rounds of the VLSS.

This study focuses on the ability of economic status improvements to explain changes in educational attainment, child labor participation, child nutrition, and adult health. The relevant measure of each is summarized in table 1. Improvements in educational attainment are measured by the 20 percent increase in children 12-16 that have completed schooling past primary school. For child labor, this study analyzes the 30 percent decline in children 6-14 that participate in work for wages, non-wage self-employment, or work in the family business such as agriculture or some home enterprise. To measure nutritional status, this study examines the ability of economic status improvements to explain the 20 percent improvement in height for age. Finally, for the health status of adults, this study explores the 30 percent decline in the number of days in the last 4 weeks that an adult age 20-40 is unable to perform his/her usual activities because of illness or injury. Each of these measures of well-being is discussed in detail below.

4. Results

4.1 Educational Attainment of Children

[6] There is also a 1998 poverty line calculation that puts the poverty line slightly above the inflated 1993 line. The discussion in the text focuses on the 1993 line alone for consistency.

World Bank President James Wolfensohn writes: "All agree that the single most important key to development and poverty alleviation is education" (World Bank 2002). The economic growth literature generally documents a strong correlation between growth and education (Topel 1998). Microeconomic evidence from developing countries general finds that higher levels of education are associated with increased earnings (Psacharopoulos 1994) and lower fertility (Schultz 1997).

Educational decisions are made by weighing the returns to education against its costs. Returns to education may include the parent's valuation of the perceived market return to education in the child's adulthood and it may include the parent's utility from educating their child. The costs of education include direct monetary costs (and thereby foregone consumption) as well as the opportunity costs of the child's time in school. These opportunity costs could be negative if schooling serves a daycare role, but in the developing country context most authors seem to view them as positive because of the foregone earnings of children.

The debate about growth and education centers on whether improvements in economic status are responsible for rising educational attainment or confounding factors play a larger role. Improved economic status increases schooling because schooling is a normal good and because increased income overcomes liquidity constraints that limit schooling. The endogeneity of education and measures of economic status mean that evidence of a marginal effect of economic status on educational attainment is scarce. One notable exception is a study by Glewwe and Jacoby (2004) who use the same dataset as this paper.

Confounding factors work through changing the relative return to schooling. Mechanisms might be changes in the return to education, the direct cost of schooling, or the opportunity cost of schooling. Growth may raise the relative return to education by expanding the market rewards to education or shifting the market structure in ways that the educated may be better positioned to exploit. It may also lead to increased investments in educational institutions which improve school quality and thereby increase the returns to schooling. If growth raises the

return to education, children will be drawn into schooling. Foster and Rosenzweig (1996) find improvements in the return to education to be the dominant factor explaining increases in education during the rapid growth of green revolution India. Growth may lower the direct costs of schooling to the household either because the marginal utility of income declines with improved economic status or because growth is associated with improved educational investments such as school construction as Duflo (2001) found in Indonesia or schooling programs that lower school fees. Finally, growth may be associated with a change in the opportunity cost of schooling if it is accompanied by an economic shift away from sectors in which children easily substitute for unskilled adult labor. For example, Goldin (1999) finds that increased youth unemployment in the U.S. during the depression lead to large increases in high school graduation rates.

Educational attainment is measured in this study by an indicator for whether a child 12-16 has completed schooling beyond primary school in Vietnam. Children on a normal enrollment path without repetition would complete primary school at age 11, and thus could have completed a year of schooling beyond primary by age 12. The upper age limit of 16 is chosen so that none of the children in the 1998 sample could have completed schooling beyond primary in the initial 1993 dataset. Gross primary school enrollment rates were above 100 percent in Vietnam even throughout the 1980s while secondary school enrollment rates were in the neighborhood of 40 percent (Glewwe and Jacoby 1998). These differences mean that while primary school completion rates were high at the start of transition, completing schooling beyond primary was more unusual. While 70 percent of children 12-16 had completed primary school in 1993, only 50 percent completed any schooling beyond primary. Between 1993 and 1998, the probability that a child completed more than primary school increased by 20 percent.

Figure 2 illustrates that economic status improvements are able to explain virtually all of this increase in educational attainment rates. The bottom line in figure 4 depicts the relationship between rates of completion of schooling beyond primary and per capita expenditures in 1993

based on nonparametric regression using a Fourier series (footnote 3). There appear to be three distinct regions in the 1993 data. Below the poverty line (pictured as a vertical line, discussed in section 2), schooling attainment increases rapidly in per capita expenditure. In the neighborhood of the poverty line, the relationship flattens, finally increasing rapidly again about a standard deviation above the poverty line.

The top line in figure 2 depicts the 1998 relationship which appears considerably flatter than the 1993 line. The 1998 line is intertwined with the counterfactual - the predicted educational attainment in 1998 given the improvements in economic status (the lighter line). This counterfactual is computed by using the relationship between per capita expenditure and the completion of schooling in 1993 (the bottom line) to predict completion rates in 1998 based on nonparametric estimates of per capita expenditure in 1998 for each point of the 1993 distribution. 90 percent confidence bounds on the predicted line are also depicted.[7] Improvements in economic status appear to explain most of the observed changes in the incidence of completing more than primary school in all but the wealthiest households.[8] In the wealthiest households in 1993, attainment is similar in 1998 and 1993, and the decomposition fails to predict the small observed increase in schooling.

In fact, the ability of economic status improvement to explain increases in schooling attainment declines in each successive quartile of the 1993 distribution. This is reported in table 2. It summarizes the explanatory power of economic status improvements for the poorest decile of the population, quartiles of the 1993 per capita expenditure distribution, households below the poverty line, and of course the full sample. The summary statistics reported in table 2 are weighted averages of the fraction of the change in well-being that can be explained by improvements in economic status (the difference between the counterfactual and the 1993

[7] These confidence bounds are bootstrapped percentiles based on 2,000 replications. The bootstrap replicated the clustered sample design.

[8] Because some of the observed per capita expenditures in 1998 are unobserved in 1993, the decomposition fails to generate an out of sample prediction. As a result, the predictions do not span the full range of the per capita expenditure distribution and it is impossible to tell whether the poor performance of the decomposition in wealthier households is an artifacts of this support problem or an attribute of the data.

estimate divided by the difference between the 1998 and 1993 estimates) for the indicated region of the 1993 distribution. The weights are kernel density weights based on the 1993 data (figure 1).

Improvements in per capita expenditure predicted larger changes in educational attainment in the poorest decile , the poorest quartile, and households below the poverty line in 1993. This finding is interesting, because it implies that exogenous price movements are associated with a decline in education over that which is suggested by improvements in economic status alone. However, the data do not reject the hypothesis that economic status improvements explain all of the variation in education for these poor parts of the distribution. Table 2 reports whether 0 is within a 90 percent confidence interval and whether 1 is within a 90 percent confidence interval for the estimates of the explanatory power of economic status improvements in each region. 0 is the hypothesis that living standard improvements have no explanatory power, and 1 is hypothesis that economic status can explain all of the observed improvements. The data never reject that 1 is within a 90 percent confidence band, and they reject 0 for every part of the distribution except the top quartile. Overall, improvements in economic status predict 98 percent of the observed changes in rates of completing schooling beyond primary by age 16. Thus, the data strongly support a link between schooling attainment and economic status.

4.2 Child Labor[9]

Fewer issues in developing countries draw more public policy attention than child labor. It has become a major human rights issue intertwined with trade policy. Economists are primarily concerned with child labor because of its consequences for human capital development. Child labor is in direct contest with schooling for the child's time and attention. Moreover, it may have health and developmental consequences that further attenuate the child's

[9] Edmonds (2005) considers the relationship between economic status and child labor documented herein in greater detail. That study uses a slightly different methodology and cut of the data (his sample is restricted to children in households with children 6-15 in both rounds of the VLSS). However, his findings are qualitatively similar.

human capital accumulation. Child labor may itself be a public bad deserving of attention, but through these affects on human capital accumulation, it may play an important role in perpetuating poverty through generations (see Basu and Tzannatos 2003 for a recent survey).

Child labor is not the reciprocal of education, but the role of growth to affect child labor is intertwined with way growth affects schooling. Children work when the return to their time in work is greater than the return outside of work. The return to work may be higher because wages are relatively high or because the marginal utility of income in the present is very high. That is, despite low wages, the valuation of the income children bring into the household is high. Returns to time outside of work may be relatively low because school quality is poor, schooling is unavailable, or because safe environments for child leisure are unavailable. In this setting, growth can affect a decline in child labor through the same set of mechanisms that growth affects an increase in education.

Unlike the debate about education and growth where the argument is about why there is a connection, the debate over child labor and growth is largely over whether there is any connection at all. A cross-country comparison suggests a strong correlation between child labor and economic status (Edmonds and Pavcnik 2005). However, evidence using micro-data is scarce (see Edmonds 2005 for discussion). Moreover, several papers have examined episodes of growth that coincide with periods of increases in schooling or declines in child labor and identified factors such as changes in technology (Levy 1985, Brown and Peter 1992), the returns to schooling (Foster and Rosenzweig 1996), or policy (Acemoglu and Angrist 1999) that are correlated with both living standards improvements and child labor or schooling.

Child labor is measured in the VLSS by an indicator for whether a child participates in the last 7 days in work for wages or the family business including agriculture. Participation questions are identical between rounds of the VLSS while the hours work questions change such that it is not possible to track changes in hours worked through time (Edmonds and Pavcnik 2004). The ages 6-14 are chosen, because the questionnaire only collects data on economic

activities starting at age 6 and 15 is the age at which most types of work become acceptable under many international conventions such as ILO Convention 182 on the worst forms of child labor. 30 percent of children 6-14 are working in Vietnam in 1993 and between 1993 and 1998, child labor declines by 30 percent (table 1).

Figure 3 illustrates that child labor varies in 1993 between nearly 70 percent of children at the bottom of the distribution to under 20 percent at the top of the distribution. The top line in figure 3 is the relationship between child labor and per capita expenditure in 1993. The bottom line plots the relationship between child labor in 1998 and 1993 per capita expenditure. Throughout the distribution, child labor is substantially lower in 1998. The middle line is the predicted child labor in 1998 given improvements in economic status. While the predictions miss the declines in the top of the distribution, improvements in economic status can explain a large portion of the declines in child labor in households below the poverty line.

Economic status improvements can explain 93 percent of the decline in child labor below the poverty line, and the data do not reject the hypothesis that improvements in economic status explain all of the observed change in child labor below the poverty line (table 2). However, the explanatory power of economic status is worse in the top half of the distribution. In both the 3rd and top quartile, economic status improvements explain less than half of the decline in child labor, and the data do not reject the hypothesis that none of the observed decline in child labor can be explained by economic status improvements. Taken together, improvements in economic status explain 67 percent of the observed declines in child labor in Vietnam in the 1990s.

4.3 The Nutritional Status of Children[10]

Inadequate nutrition in children affects their cognitive development (Balazs, Jordan, Lewis, and Patel 1986), their morbidity, their mortality, and their long-term physical development (Barker 1990). This in turn has implications for their productivity as adults

[10] Edmonds (2004) considers the relationship between per capita expenditures and child height documented herein in greater detail. That study uses a slightly different dataset (his sample is restricted to children in households with children under 10 in both rounds of the VLSS). However, his findings are qualitatively similar.

(Strauss and Thomas 1998) and the intergenerational transmission of poverty (Dasgupta and Ray 1986).

There are a variety of mechanisms through which economic growth may influence the nutritional status of children. Increased economic resources can be invested in improved diets, better sanitation and health practices, and increase use or more effective use of these health services. Empirical evidence on the link between nutrition and growth largely focuses on estimating the effect of changes in per capita expenditure on nutritional intake. Estimates of the demand elasticity vary between 1 (Pitt 1983, Strauss 1984) and 0 (Wolfe and Behrman 1983, Behrman, Deolalikar, and Wolfe 1988, and Bouis and Haddad 1992). Results based on nonparametric techniques suggest that the demand elasticity of nutrition is close to one in very poor households and much smaller in wealthier households (Strauss and Thomas 1992, Subramanian and Deaton 1996).

The link between height and economic prosperity is generally believed to be so strong that many historians have used height as a measure of living standards (e.g. Fogel 1994). However, evidence directly on the effects of income on child nutritional status (generally measured by child height) is scarcer than evidence on the calorie elasticity of income. Most of the published literature finds a positive but small marginal effect of increases in living standards on child height (Horton 1986, Sahn 1990, Thomas, Strauss, and Henriques 1990, Thomas, Levy, and Strauss 1996, Duflo 2003, Glewwe, Koch, and Nguyen 2003) although the finding of a positive correlation is not universal (Wolfe and Behrman 1987, Thomas Strauss and Henriques 1991).

Nutritional status in this study is measured by the child's height for age z-score. Height for age is a measure of cumulative nutritional status and is therefore of greater interest than more transitory nutritional measures of nutritional status in considering the relationship between growth and nutrition. The VLSS collects data on height and age for each household member. For children below the age of 10, age is collected in months. For children 24 months and older,

height is measured as standing height. Height for age z-scores are then computed for all children below the age of 10 using the standard NCHS/WHO international reference curves for age, sex, and height.[11]

Between 1993 and 1998, height for age z-scores improve by 20 percent (table 1) in Vietnam. Vietnam starts from an extremely poor position in terms of children in 1993. The average Vietnamese child has a height for age that is over 2 standard deviations below that of a healthy, well nourished child in the reference population. A full 20 percent of children are more than 3 standard deviations below the reference population. By 1998, height for age z-scores improve to 1.6 standard deviations below the reference population on average, and 11 percent of children under 10 report height for age z-scores at or below -3.

The results of the decomposition are presented in figure 4. The bottom line in figure 4 contains the nonparametric regression of height for age z-scores in 1993 on the log of real 1993 per capita expenditure. The relationship between height for age and per capita expenditure appears flat in the poorest of the population. However, in the neighborhood of the estimated expenditure necessary to purchase 2100 calories per person per day (around USD $65 per person per year or 7.0 on the x-axis), height for age scores improve dramatically with increases in per capita expenditure.

The top line in figure 4 is the nonparametric regression of height for age z-scores in 1998 on the log of real 1993 per capita expenditure. The positive slope is retained throughout the distribution, but the largest changes in height for age z-scores are in the poorest part of the population (this is evident in the difference between the 1998 and 1993 lines). The middle line in figure 4 is the predicted height for age z-score in 1998 based on the relationship between height for age and per capita expenditures in 1993 and the observed improvements in per capita expenditure. 90 percent Confidence bounds are depicted for the predicted 1998 height for age z-score.

[11] Following convention, HAZ below -6 and above +6 are assumed to be in error and are dropped from the analysis. Errors may be attributable to measurement error in higher or age misreporting.

Improvements in per capita expenditure can explain 58 percent of the improvement in height for age scores in the general population and nearly 70 percent of the improvement enjoyed by the population that lives below the poverty line in 1993 (table 2). Throughout the distribution, the data reject the hypothesis that there economic status improvements can explain none of the improvements in height for age, but with the exception of the second quartile, the data are also not consistent with the hypothesis that economic status improvements can explain all of the improvements in height for age. In general, economic status improvements explain more of the improvements in height for age s-scores in poorer households than in rich households. Over 70 percent of the improvement in height for age z-scores can be explained by improvements in economic status below the median, but the explanatory power of economic status is below 40 percent for the poorest part of the population.

4.4 Adult Health

The health status of adults is important both because health is an important component of well-being and because unhealthy adults are less able to contribute to household economic resources and may even tax resources. Poor adult health has been found to be associated with reduced household consumption, lower schooling rates of children, diminished nutritional status of children, and higher levels of child labor. Moreover, the long-term consequences of poor adult health may be the intergenerational persistence of poverty. Strauss and Thomas (1998) survey the recent literature on consequences of poor health in the development literature.

Improvements in economic status may impact health through improved food intake, water, sanitation, access to or willingness to pay for health services, diminished risky behavior, reduced stress associated with a retreat from living on the survival margin, or changes in discount rates. While the cross-country evidence suggesting a correlation between mortality and income is strong (Pritchett and Summers 1996), micro-evidence of a causal effect of improvements in income on adult morbidity is weak (see Deaton 2003 for a discussion). Many

authors have highlighted confounding factors such as literacy and urbanization that might be associated with economic status but have a large, distinct effect on health status.

Adult health status is measured by the number of days in the last four weeks that the respondent was unable to perform her usual activities as a result of illness or injury. Self-reported morbidity questions change between the 1993 and 1998 surveys, but this activities question is identical between rounds. This activities measure of health status obviously suffers from the problem that it may confound changes in health status with changes in usual activities. That is, if usual activities become less physically intensive as households grow richer, the number of days that an individual is unable to work because of illness or injury may decline even if health status does not change (see Thomas and Frankenberg (2000) for a discussion of the problems in measuring health status). The implicit assumption in this measure of adult health status is that these sorts of dramatic changes in the types of activities performed are small relative to changes in health status. In fact, Edmonds and Pavcnik (2003) consider changes in labor supply in the VLSS dataset between 1993 and 1998 and find increase in work outside of the household, but they do not observe any dramatic movement away from agriculture or labor intensive work.

Between 1993 and 1998, the number of days in the last four weeks in which illness prevents an adult from performing her usual tasks declines by 28 percent in Vietnam (table 1). However, the data do not reject the hypothesis that economic status improvements can explain none of the observed improvement in adult health. Figure 5 contains the results of the decomposition.

Throughout the living standards distribution, reported days in which an individual cannot perform her usual activities are higher in 1993. The top line in figure 5 contains the results of the regression of the adult health measure on per capita expenditures in the 1993 data. The bottom line in figure 5 contains the results of the nonparametric regression of adult health in 1998 on per capita expenditure in 1993. The difference between the two lines appears similar in all but the

richest households. The middle line in figure 5 is the predicted days in which an individual is unable to perform his usual activities in 1998 based on the observed improvements in economic status between 1993 and 1998. Confidence bounds on the prediction are also pictured.

In contrast to child nutrition, economic status improvements are poor predictors of improvements in adult health. This occurs despite the negative gradient between poor health and economic status observed in the 1993 cross-section. As summarized in table 2, improvements in economic status can explain only 17 percent of the observed improvements in adult health in the full sample and only 5 percent of the change observed in individuals below the poverty line. The only exception is that in the poorest decile of the population, economic status improvements appear to be able to explain 71 percent of the improvement in health in this destitute group. However, the data do not reject the hypothesis that improvements in status can explain none of the improvements in adult health in this or any other population group.

These findings for adult health contrast sharply with the results for other aspects of well-being. Why might adult health be different? First, health impacts income (e.g. Strauss and others 1993). That is, health is a part of the endowment, so the negative gradient between inactivity and economic status may reflect the economic impact of poor health. Changes in status from economic growth rather than health then cannot explain improvements in adult health with a gradient that reflects the impact of health on economic status. Second, health status in adulthood may be largely predetermined by experiences in childhood (as Case, Fertig, and Paxson 2003 find). The gradient in 1993 reflects the persistence of relative economic status through time. Improvements in economic status through time, then, have little impact on adult health whereas the scope for impact on child health is large. Third, relative health status may be important. A large public health literature argues that relative economic status matters for health (see Deaton 2003 for a critical discussion of this literature). The present decomposition considers the explanatory power of absolute changes in economic status and thereby fails to capture any aspects of the effects of relative status.

5. Conclusion

This study considers the relationship between four measures of non-monetary well-being and improvements in economic status during an episode of growth. The substantive aim of this study is to obtain measures of how much of the observed changes in well-being can be explained by improvements in economic status rather than the other, confounding, exogenous price changes that accompany an episode of growth. Improvements in economic status have the strongest predictive power for educational attainment. They can explain 98 percent of the almost 30 percent increase in schooling attainment observed between 1993 and 1998 in Vietnam. Economic status improvements also appear very important in explaining declines in child labor and improvements in child nutrition in the poorest households in 1993. However, economic status improvements do a relatively poor job of explaining improvements in nutrition or declines in child labor in wealthy households, and they can explain little of the observed improvements in adult health.

The decomposition developed herein cannot be viewed as causal evidence. The results are best interpreted as suggestive of an underlying link between improvements in wealth accompanying growth and these measures of well-being. As such, the places where improvements in economic status cannot explain observed changes in well-being are perhaps the most interesting from a policy perspective, because the data are not consistent with the hypothesis that a policy focus on economic status alone will be sufficient to affect improvements in this aspect of well-being in Vietnam. Moreover, this lack of a finding of a strong link between improvements in economic status and improvements in well-being for a substantive portion of the population would seem to support the idea that macro level measures of well-being should move beyond a simple tracking of per capita expenditure and consider several facets of well-being separately.

One issue that has been neglected in interpreting the results of this study is the question of absolute versus relative well-being. Several authors question whether relative economic status

is more important than absolute economic status in well-being (Wilkinson (1996) for health and Swinnerton and Rogers (1999) for child labor). Indeed, one interpretation of each baseline measure of the relationship between a well-being measure and economic status is that it captures the relative poverty. However, inequality is largely unchanged during this period of economic growth in Vietnam, and therefore the changes in economic status that are used to explain improvements in well-being are absolute changes rather than relative changes. If relative poverty were all that matters, then, improvements in economic status should not be able to predict improvements in well-being. Thus, the findings of this study do not contradict theories on the importance of relative economic status in health, but the data are not consistent with the idea that relative status is all that matters in general for personal well-being.

The main attribute of the decomposition methodology developed in this study is also its main weakness: it is entirely data driven. Thus, the decomposition has no out of sample predictive power, and the predictions perform poorly in regions where there is little support in the data. The support problem is particularly relevant in the Vietnam data used in this application. Wealthy households in 1993 obtain per capita expenditures in 1998 that are rarely observed in 1998. As a result, the decomposition predicts poorly in the richest households. Thus, it is impossible to tell whether the failure to predict the observed improvements in child nutrition or declines in child labor in wealthier households indicates the importance of price changes or is an artifact of the methodology. The data, however, do not suggest that measurement is the only issue. In general the explanatory power of economic status improvements is decreasing in initial status and is weak in the third quartile where support is not an issue.

This finding that improvements in economic status are important in explaining changes in well-being in the poor may be indicative of a scope for policy that has been found in other contexts. For example, Moehling (1999) finds that anti-child labor policy in the U.S. follows large declines in child labor. That is, at certain levels of poverty, poor economic status is the

driving force behind poor measures of well-being. However, as countries become richer, other factors become relatively more important, and the ultimate push to eliminate something like child labor may need to come from policy. The evidence of this study is then consistent with a nuanced view of the link between growth and well-being. One statement consistent with the patterns observed in the data would be that there is a range in which poverty is the driving force behind poor states of well-being and to the extent that growth benefits the poor, well-being will improve. However, in some instances and at some levels of development, policy may need to be engaged. The tools developed in this study are useful for identifying indicators and situations when a focus on economic status alone may not be sufficient.

Works Cited

Acemoglu, D. and J. Angrist (1999): "How Large are the Social Returns to Education? Evidence from Compulsory Schooling Laws." *NBER Working Paper #7444, December.*

Anand, S. and M. Ravallion (1993): "Human Development in Poor Countries: On the Role of Private Incomes and Public Services," *Journal of Economic Perspectives*, 7(1), 133-150.

Balazs, R., T. Jordan, P. Lewis, and A. Patel (1986): "Undernutrition and brain development." in *Human Growth, Volume 3.* F. Falkner, J. Tanner, eds. Plenum Press, 415-474.

Barker, D. (1990): "The Fetal and Infant Origins of Adult Disease," *British Medical Journal*, 301.

Barro, R. and J. Lee (2001): " School Quality in a Cross Section of Countries," *Economica*.

Barro, R. and X. Sala-i-Martin (1995): *Economic Growth.* McGraw-Hill: New York.

Basu, K. and Z. Tzannatos (2003): "The Global Child Labor Problem: What do we know and what can we do?" *World Bank Economic Review*, forthcoming.

Behrman, J., A. Deolalikar, and B. Wolfe (1988): "Nutrients: Impacts and Determinants," *World Bank Economic Review* 2(3), 299-320.

Bouis, H. and L. Haddad (1992): "Are estimates of calorie-income elasticities too high? A recalibration of the plausible range," *Journal of Development Economics* 39(2), 333-364.

Brown, M., and P. Peter (1992): "The Decline of Child Labor in the U.S. Fruit and Vegetable Canning Industry: Law or Economics?" *Business History Review*, 66, Winter, 723-770.

Case, A. and A. Deaton (2003): "Consumption, Health, Gender, and Poverty," *RPDS Working Paper #212*, Princeton University.

Case, A., A. Fertig, and C. Paxson (2003): "From Cradle to the Grave? The Lasting Impact of Childhood Health and Circumstance," *NBER Working paper # 9788*, June.

Dasgupta, P. and D. Ray (1986): "Inequality as a determinant of malnutrition and unemployment: Theory," *Economic Journal*96, 1011-1034.

Deaton, A. (2003): "Health, Inequality, and Economic Development," *Journal of Economic Literature*, 41, 113-158.

Dollar, D (2003): "Reform, Growth, and Poverty in Vietnam," in P. Glewwe, N. Agrawal and D. Dollar (eds), *Economic Growth, Poverty and Household Welfare: Policy Lessons from Viet Nam*. Washington DC: World Bank, forthcoming.

Dollar, D. and A. Kraay (2003): "Growth is Good for the Poor," *Journal of Economic Growth.*

Duflo, E (2001): "Schooling and Labor Market Consequences of School Construction in Indonesia: Evidence from an Unusual Policy Experiment," *American Economic Review* 91(4), 795-813.

Duflo, E. (2003): "Grandmothers and Granddaughters: The Effects of Old Age Pension on Child Health in South Africa," *World Bank Economic Review.*

Easterly, W. (1999): "Life During Growth," *Journal of Economic Growth*, 4, 239-276.

Edmonds, E. (2003): "The Timing of Births in Transition," Work in Progress.

Edmonds, E. (2004): "How well do improvements in economic status track non-monetary measures of well-being? Evidence from child height," *Dartmouth Manuscript.*

Edmonds, E. (2005): "Does Child Labor Decline with Improving Economic Status?" *The Journal of Human Resources,* forthcoming, Winter.

Edmonds, E. and N. Pavcnik (2003): "Trade Liberalization and the Allocation of Labor between Households and Markets in a Poor Country," *Dartmouth Manuscript*.

Edmonds, E. and N. Pavcnik (2004): "Product Market Integration and Household Labor Supply in a Poor Economy: Evidence from Viet Nam," *World Bank Policy Research Working Paper #3234*, 2004

Edmonds, E. and N. Pavcnik (2005): "Child Labor in the Global Economy," *Journal of Economic Perspectives*, forthcoming.

Fogel, R. (1994): "Economic Growth, Population Theory, and Physiology," *American Economic Review* 84(3), 369-395.

Foster, A. and Rosenzweig, M. (1996): "Technical Change and Human Capital Returns and Investments: Evidence from the Green Revolution," *American Economic Review*, 86, 4, September, 931-953.

Glewwe, P. and H. Jacoby (1998): "School Enrollment and Completion in Vietnam." in *Household Welfare and Vietnam's Transition*. D. Dollar, P. Glewwe, and J. Litvack, eds. Washington DC: World Bank, pp201-234.

Glewwe, P. and H. Jacoby (2004): "Economic Growth and the Demand for Education: Is there a Wealth Effect?" *Journal of Development Economics.*

Glewwe, P. and P. Nguyen (2003): "Economic Mobility in Viet Nam in the 1990s," in P. Glewwe, N. Agrawal and D. Dollar (eds.), *Economic Growth, Poverty and Household Welfare: Policy Lessons from Vietnam*. Washington DC: World Bank.

Glewwe, P. M. Gragnolati, and H. Zaman (2002): "Who Gained from Vietnam's Boom in the 1990s?" *Economic Development and Cultural Change*, 50(4), 773-92.

Glewwe, P. S. Koch, and B. L. Nguyen (2003): "Child Nutrition, Economic Growth, and the Provision of Health Care Services in Vietnam in the 1990s," in P. Glewwe, N. Agrawal and D. Dollar (eds.), *Economic Growth, Poverty and Household Welfare: Policy Lessons from Vietnam*. Washington DC: World Bank.

Goldin, C. (1999): "Egalitarianism and the Returns to Education during the Great Transformation of American Education," *Journal of Political Economy*, 107(6), S65-S94.

Horton, S. (1986): "Child Nutrition and Family Size in the Philippines," *Journal of Development Economics* 30(1), 161-176.

Imbens, G. and J. Angrist (1994): "Identification and Estimation of Local Average Treatment Effects," *Econometrica* 62(2), 467-475.

Levy, V. (1983): "Cropping Pattern, Mechanization, Child Labor, and Fertility in a Farming Economy: Rural Egypt," *Economic Development and Cultural Change*, July, 33(4), 777-91.

Moehling, C. (1999): "State Child Labor Laws and the Decline of Child Labor," *Explorations in Economic History*, 36, 72-106.

Pitt, M. (1983): "Food preferences and nutrition in Bangladesh," *Review of Economics and Statistics*, 65(1), 105-114.

Pritchett, L. and L. Summers (1996): "Wealthier is Healthier," *Journal of Human Resources* 31(4), 841-868.

Psacharopoulos, G. (1994): "Returns to Investments in Education: A Global Update," *World Development*, September, 22(9), 1325-43.

Sahn, D. (1990): "Malnutrition in Cote d'Ivoire," *World Bank Social Dimensions of Adjustment Working Paper 4*.

Schultz, T. P. (1997): "Demand for Children in Low Income Countries," in M. Rosenzweig and O. Stark, eds., *Handbook of Population and Family Economics 1A*, Amsterdam: North-Holland, 349-432.

Steckel, R. (1995): "Stature and the Standard of Living," *Journal of Economic Literature* 33(4), 1903-40

Strauss, J. (1984): "Joint Estimation of Food Consumption and Production in rural Sierra Leone: Estimates of a household-firm model," *Journal of Development Economics* 14, 77-103.

Strauss, J. and D. Thomas (1992): "Prices, infrastructure, household characteristics and child height", *Journal of Development Economics*, 39(2), :301-332.

Strauss, J. and D. Thomas (1995): "Human resources: Empirical models of household decisions", in Behrman, J. R. and T. N. Srinivasan, (eds.), *Handbook of Development Economics*, (Volume IIIA), North Holland, 1885-2023.

Strauss, J. and D. Thomas (1998): "Health, Nutrition, and Economic Development," *Journal of Economic Literature* 36(2), 766-817.

Subramanian, S. and A. Deaton (1996): "The Demand for Food and Calories." *Journal of Political Economy*, 104(1), 133-162.

Swinnerton, K. and C. Rogers (1999): "The Economics of Child Labor: Comment," *American Economic Review* 89.

Thomas, D. and E. Frankenberg (2000): "The Measurement and Interpretation of Health in Social Surveys," *UCLA Manuscript.*

Thomas, D., V. Levy, and J. Strauss (1996): "Public policy and anthropometric outcomes in the Cote d'Ivoire", *Journal of Public Economics*, 61(2), 155-92.

Thomas, D., J. Strauss, and M. Henriques (1990): "Child survival, height for age and household characteristics in Brazil", *Journal of Development Economics*, 33, 197-234.

Thomas, D., J. Strauss, and M. Henriques (1991): "How does mother's education affect child height?", *Journal of Human Resources*, 26(2), 183-211.

Topel, R. (1999): "Labor Markets and Economic Growth," in O. Ashenfelter and D. Card, eds., *Handbook of Labor Economics Volume 3*, Amsterdam: North Holland, 2943-2984.

Wilkinson, R. (1996): *Unhealthy Societies: The Affliction of Inequality*. London: Routledge.

Wolfe, B. and J. Behrman (1983): "Is Income Overrated in Determining Adequate Nutrition?" *Economic Development and Cultural Change* 31(3), 525-549.

Wolfe, B. and J. Behrman (1987): "Women's Schooling and Children's Health: Are the Effects Robust with Adult Sibling Control for the Women's Childhood Background," *Journal of Health Economics* 6(3), 239-254.

World Bank (2000): *Vietnam Development Report 2000*

World Bank (2002): *Education and Development*, Washington, DC: World Bank Education Advisory Service.

Table 1: Summary Statistics

	Nationally Representative Cross-Sections		Panel	
	1993	1998	1993	1998
Sample Size (households)	4,799	5,999	4,304	4,304
Ln Real Per Capita Expenditure	7.40	7.82	7.39	7.79
	(0.61)	(0.63)	(0.60)	(0.58)
Education				
# Children 12-16	5,729	7,173	5,163	5,197
Child 12-16 has completed schooling beyond primary school	0.52	0.62	0.51	0.61
	(0.50)	(0.49)	(0.50)	(0.49)
Child Labor				
# Children 6-14	7,493	8,790	6,766	6,444
Child 6-14 participates in work for wages or family business in last 7 days	0.27	0.19	0.28	0.21
	(0.44)	(0.37)	(0.45)	(0.39)
Nutrition				
# Children under 10	5,997	5,483	5,392	3,898
Height for Age	-2.02	-1.62	-2.04	-1.67
	(1.30)	(1.26)	(1.29)	(1.23)
Health				
# Adults 20-40	7,342	8,598	6,607	6,008
Days in last 4 weeks that adult 20-40 is unable to perform usual activities because of illness or injury	1.19	0.86	1.21	0.90
	(3.53)	(2.89)	(3.56)	(3.02)

Means in columns 1 and 2 are weighted to be nationally representative.

Standard deviations in parenthesis

Counts are sample counts, not populations estimates.

Table 2: Decomposition Results - Fraction of change in well-being measure that can be explained by economic status improvements for various population groups

Well-being Measure:	Variable	Full Sample	Poorest Decile	Quartiles of 1993 PCX distribution				Below Poverty Line
				1	2	3	4	
Education	Child 12-16 has completed schooling beyond primary school	0.98 *	1.25 *	1.38 *	0.89 *	0.88 *	0.80	1.09 *
Child Labor	Child 6-14 participates in work for wages or family business in last 7 days	0.67 *	1.32 *	0.99 *	0.96 *	0.47 *^	0.26 *^	0.93 *
Nutrition	Height for Age Z-Score of children under 10	0.58 *^	0.61 *^	0.71 *^	0.72 *	0.47 *^	0.39 *^	0.69 *^
Health	Days in last 4 weeks that adult 20-40 is unable to perform usual activities because of illness or injury	0.17 ^	0.71	0.32 ^	-0.22 ^	0.45	0.15 ^	0.05 ^

* 0 is not within a 90 percent confidence interval.

^1 is not within a 90 percent confidence interval.

Confidence intervals are bootstrap percentiles based on 2,000 replications. The bootstrap replicates sample design by drawing psus.

Figure 1: The 1993 and 1998 Distributions of the Logarithm of Real Per Capita Expenditure

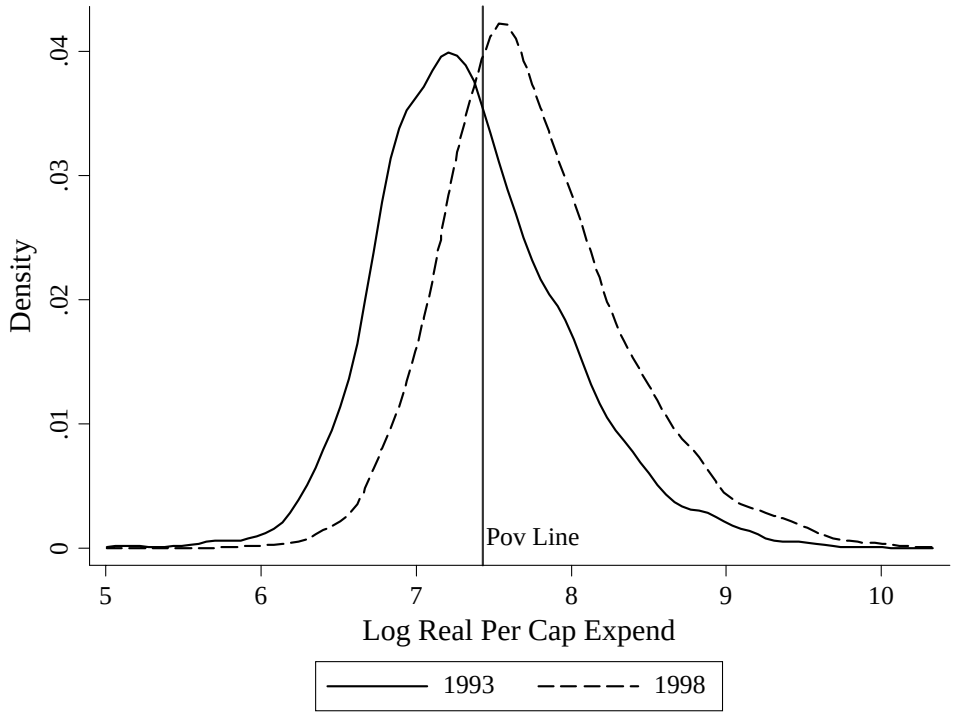

Figure 2: Education and Economic Status Improvements

Dependent Variable - Completed at least 1 year of schooling beyond primary school, children 12-16

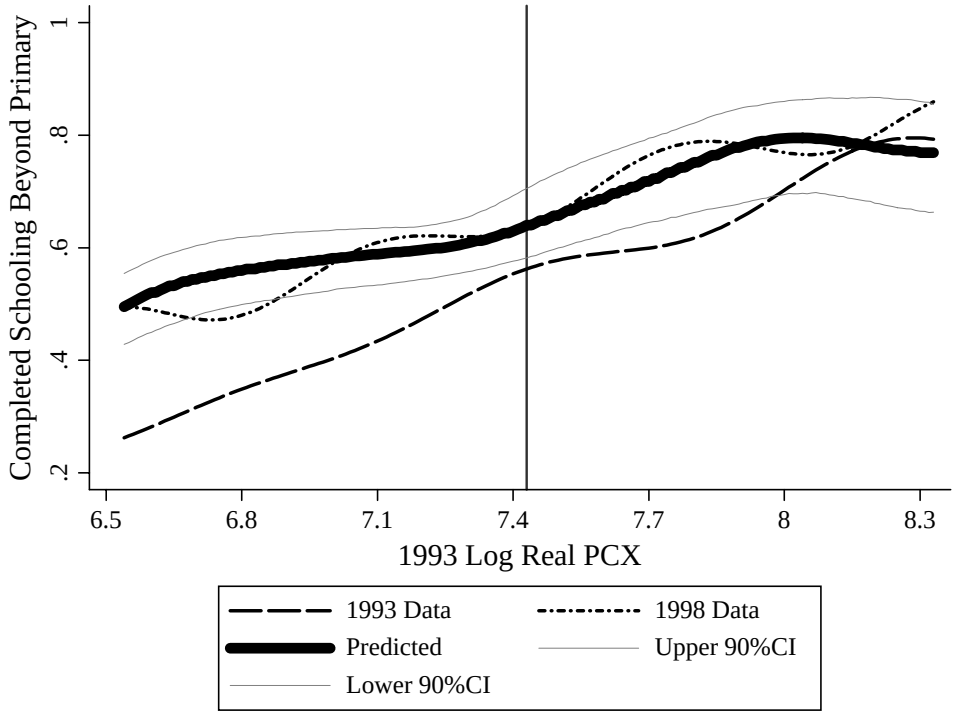

Figure 3: Child Labor and Economic Status Improvements

Dependent Variable - Participation in work for wages or family business in last 7 days, children under 15

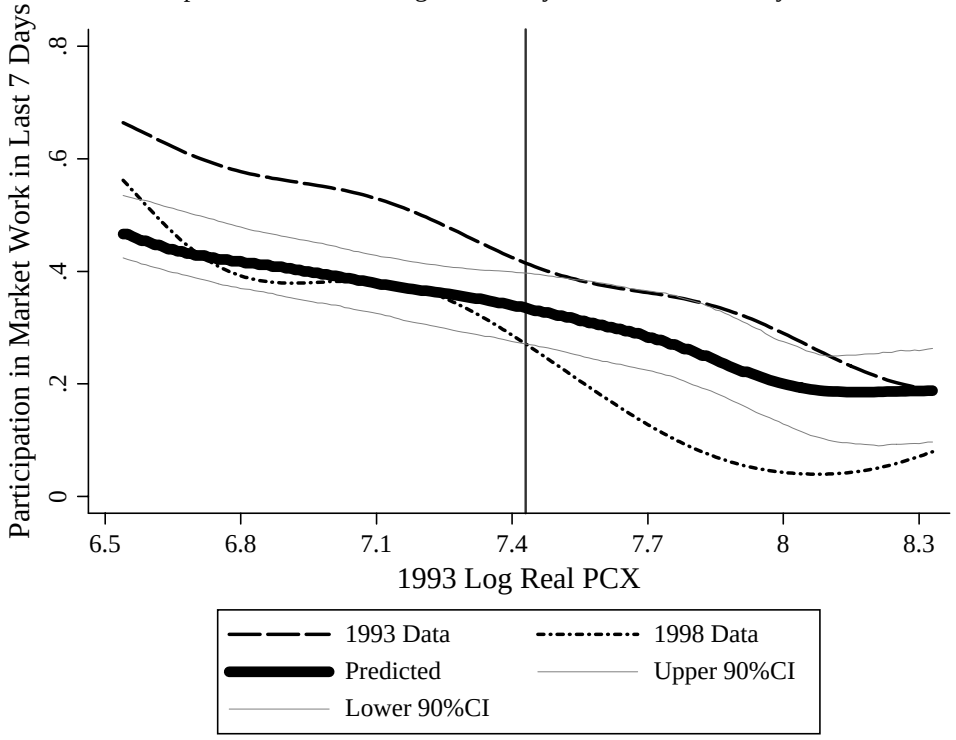

Figure 4: Child Nutrition and Economic Status Improvements

Dependent Variable - Height for Age Z-score for children under 10

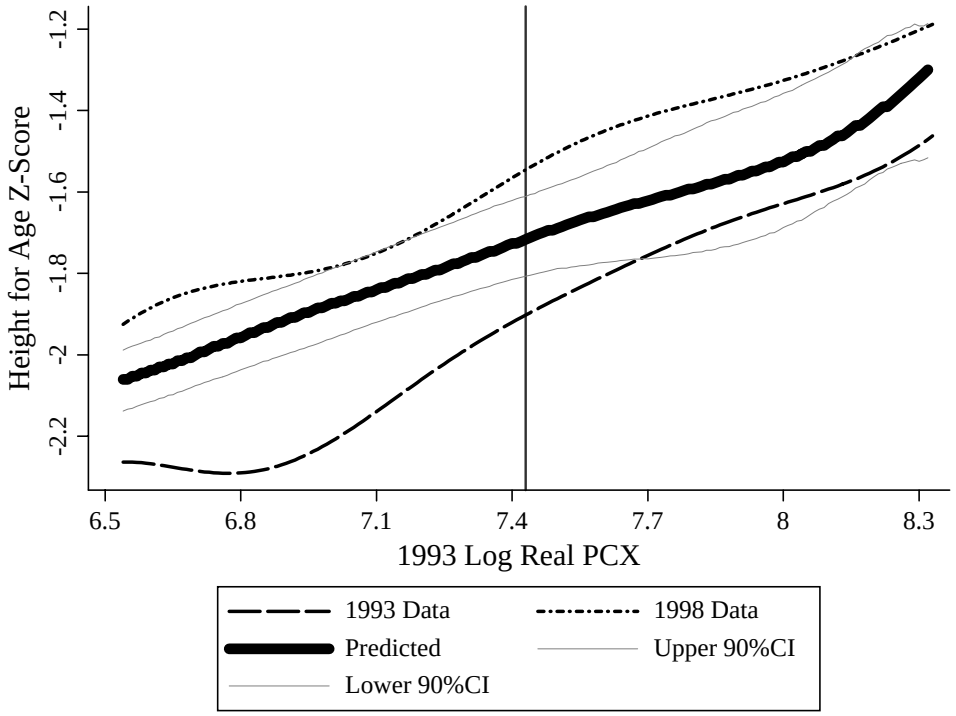

Figure 5: Adult Health and Economic Status Improvements

Dependent Variable - Days in which individual is unable to perform his usual activities as a result of illness or injury in the last 4 weeks, adults 20-40