Does Child Labor Decline with Improving Economic Status?

Eric V. Edmonds

ABSTRACT

Between 1993 and 1997, child labor in Vietnam declined by nearly 30 percent while the country's GDP grew by nearly 9 percent per year on average. Using a simple, nonparametric decomposition, I investigate the relationship between improvements in per capita expenditure and child labor with a panel data set that spans this episode of growth in Vietnam. Improvements in per capita expenditure can explain 80 percent of the decline in child labor that occurs in households whose expenditures improve enough to move out of poverty. This finding suggests a previously undocumented role for economic growth in the amelioration of child labor.

I. Introduction

Few issues in the lives of the world's poor receive more attention from rich country observers than child labor. There are two distinct literatures on the relationship between improvements in economic status (generally measured by income or total expenditure) and changes in child labor (typically defined as the employment of children in wage work or in the family farm or enterprise). One line of research considers whether child labor may be a cause of poverty and may help perpetuate the intergenerational transmission of depravation through its impact on

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human capital accumulation.[1] The present study contributes to a second strand of research that considers the role low family income plays in the decision to have a child work. The cross-country picture suggests a strong link between child labor and GDP per capita (Krueger 1997) as does the economic history of many developed economies (Moehling 1999, for example). These images have contributed to a common view among many economists, implicit in many contemporary theoretical pieces on child labor supply, that child labor would be reduced significantly by rising incomes.[2]

However, this view that child labor will decline with rising economic status has recently encountered significant academic opposition. Several studies have used cross-sectional household survey data to argue against a strong link between economic status and child labor by comparing the activities of children in different households that vary in their income (see Brown, Deardorff, and Stern 2003, or Basu and Tzannatos 2003 for recent surveys).[3] The absence of a strong negative correlation between economic status and child labor within a cross-section in a country is often interpreted in two ways. First, if child labor is not bad in parental preferences because of cultural norms or parental attitudes, then improvements in income may have no effect on the economic activities of children (Ennew 1992; Ray 2000; or Deb and Rosati 2002). In fact, researchers as far back as Marx have argued that variation in child labor is primarily labor demand driven (Basu 1999). Second, to the extent that improvements in economic status come from increases in market earnings (or earnings opportunities), child labor may be positively correlated with improvements in economic status (Parsons and Goldin 1989; Psacharopoulos 1997, or Bhalotra and Heady 2003).[4] Moreover, several papers have examined episodes of growth that

1. Working children may bring income into the household and thereby ameliorate poverty. Children also may learn skills while working that bring a return later in life (Beegle, Dehejia, and Gatti 2003b). On the other hand, the presence of children in the labor market may depress wages for adults and thereby create poverty (Basu and Van 1998). Moreover, child labor may conflict with school attendance (for example, Boozer and Suri 2001), it may reduce the time children invest in study and thereby school performance and attainment (as in Heady 2003), it may impair child development through diminished play and leisure, and child labor may be associated with worse health and nutritional status because of the environment in which children work (see Fassa 2003). Through these mechanisms, child labor may create an intergenerational poverty trap. For formal presentations see Basu (1999), Emerson and Souza (2002), and Hazan and Berdugo (2002).

2. This result follows from studies where child labor is a bad in parental preferences such as Basu and Van (1998), Baland and Robinson (2000), Ranjan (2001), and Bommier and Dubios (2003). Rogers and Swinnerton (2003) point out that rising incomes can increase child labor if credit market imperfections induce parents to overinvest in education as a way of securing income for parents in the future (via transfers from children).

3. One exception is the recent literature that has appeared subsequent to this paper that considers how child labor supply is affected by economic shocks (Beegle, Dehejia, and Gatti 2003a; Guarcello, Mealli, and Rosati 2003; Yang 2003) which generally finds child labor supply to be responsive to unanticipated changes in the household's environment. While the response of child labor supply to shocks depends on the operation of credit and insurance markets, there also may be an income component in these studies.

4. A third interpretation is the Ben-Porath (1967) model where educational investments (and then child labor supply) are determined by weighing the present discounted value of schooling against its opportunity cost. If the equilibrium investment decision does not vary with economic status, then child labor might not vary either. I have not seen this point raised as an interpretation of a weak cross-sectional association between child labor and living standards.

coincide with periods of increases in schooling or declines in child labor and identified factors such as changes in technology (Levy 1985; Brown, Christiansen, and Peter 1992), the returns to schooling (Foster and Rosenzweig 1996), or policy (Acemoglu and Angrist 1999) that are correlated with both improving economic status and child labor or schooling.

If correct, the hypothesis that increases in income will not result in substantial declines in child labor has important implications for the way economists think about the amelioration of child labor and the consequences of globalization and economic growth. First, to the extent that policy desires to reduce child labor, if child labor supply does not decline with income, then reduction in child labor may require a social policy targeted specifically at child labor. This viewpoint is consistent with the "human development" approach of formulating policy based on targeting various nonfinancial measures of well-being as discussed in Anand and Ravallion (1993). Second, as is often claimed in the popular debate over globalization, the promotion of growth does not imply the elimination in child labor. In fact, to the extent that economic growth is associated with employment growth, policies that foster economic growth could spur increases in child labor. This issue becomes particularly relevant in the debate over trade liberalization where the principal aim of the policy is the expansion of economic activity.

The relationship between improvements in economic status and child labor is examined in this study using household level panel data from the 1993 and 1998 Vietnam Living Standards Surveys (General Statistical Office 1994 and 1999). This data set is novel both in the large number of households that it interviews in each round of the panel and in its collection of detailed child labor data in a consistent manner over time. The attraction of the panel is that by observing the same households over time, it is easy to evaluate assertions that child labor supply is invariant to the household's economic environment because of time-invariant cultural norms or parental attitudes that are impossible to test in the cross-section as these norms and attitudes are unobserved heterogeneity. In fact, the data reveal dramatic, nearly 30 percent, declines in child labor in the same set of households over a five-year period.

Moreover, the panel nature of the data makes it straightforward to separate changes in child labor supply over time that are attributable to exogenous changes in the technology, policy, or market environment from factors driving improving economic status. These environmental changes occur through time, and thus are not present in the cross-sectional relationship between child labor and economic status. As a result, this study uses the relationship between child labor and economic status in the first round of the panel (1993) to predict the observed declines in child labor through time (between 1993 and 1998) using information on improvements in economic status through time. Of course, while technology, policy, or price changes that are concurrent with growth are not present in the cross-section, there are a vast set of differences between households that vary in their economic status other than just economic status. To the extent that cross-sectional variation in child labor reflects these differences that are not determined by economic status, the cross-sectional relationship between child labor and economic status will not be able to predict changes in child labor using observed improvements in economic status. In fact, the data suggest that 60 percent of the observed changes in child labor through time can be explained in this manner by improvements in economic status.

Finally, the size of the panel data set is large enough that it is possible to employ nonparametric techniques in analyzing the relationship between declines in child labor and improvements in economic status. Nonparametric techniques are particularly useful for studying the relationship between child labor and economic status, because there are strong theoretical reasons to expect the relationship between the two to be highly nonlinear. In the Basu and Van (1998) model, children work only when their income is necessary to meet subsistence needs. Thus, the relationship between child labor and economic status should be flat until households begin to meet subsistence needs, and then child labor should decline rapidly. In fact, the data reveal dramatic nonlinearity in the relationship between child labor and economic status around the official poverty line. The importance of nonlinearity may explain why many other studies fail to find a relationship between child labor and economic status if linear regression techniques average over regions where child labor is and is not elastic. In the Vietnamese data, child labor declines dramatically at the poverty line in the 1993 cross-section, and improvements in economic status can explain 80 percent of the decline in child labor in households that exit poverty.

This paper is organized as follows. The next section of the paper discusses the data and describes the changes in economic status and child labor that occur in Vietnam. Section III begins with descriptive evidence on the relationship between increasing economic status and declining child labor. Part B of Section III develops the nonparametric decomposition that will be used in this study in the context of the Basu and Van (1998) model. Part C of Section III describes and implements the nonparametric decomposition. Section IV discusses the interpretation of the decomposition and considers how substantive nonlinearity is in this study's analysis by comparing the nonparametric framework to a more standard, linear decomposition.[5] Section V places the results of this paper in the broader literature, discusses several important caveats, and assesses the extent to which the results of this paper might generalize.

II. Data Description

I explore the link between economic status improvements and child labor using data from the 3,347 panel households with children between the ages of 6 and 15 in 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).[6] The VLSS is a multipurpose household survey, collecting

5. The working paper version of this study extends the decomposition by looking at several gender, age, and household size subgroups (Edmonds 2003). It also develops a semiparametric version of the methodology in Section III in order to controls for differences in child labor that vary with gender, age, and household size. The semiparametric framework is also extended to consider whether different assumptions about the calculation of adult equivalence scales affect the predictive power of living standards.

6. Glewwe and Nguyen (2004) 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. However, the reader should be cautioned that the experiences of panel households might not generalize to the nation as a whole.

detailed information on the activities of household members as well as household expenditures. To measure household economic status, I consider the logarithm of per capita expenditure.[7] The calculation of the expenditure aggregate for the VLSS is described in World Bank (2000). I use a definition of expenditure that is comparable between the two rounds of the VLSS.[8] The expenditure measure is defined as annual expenditure and includes both household purchases and imputed values of home produced and traded goods.[9] Food constitutes 61 percent of the total household budget in 1993 and 58 percent in 1998.

Households are much better off in 1998 than in 1993. Figure 1 pictures the distribution of the logarithm of per capita expenditure for all VLSS households in 1993 and 1998. The two distributions are kernel estimates of the density of logarithm of per capita expenditure. There are two vertical lines in Figure 1. The left-most line is the estimated cost of acquiring enough food to consume 2,100 calories per day (with no allowance for nonfood expenditures), approximately USD $65 per person per year. The second line adds to the 2,100 calorie per day line an estimate of the cost of nonfood necessities. It is the official 1993 poverty line (approximately USD $106 per person per year). The calculation of both lines is described in the *Vietnam Development Report 2000*.

The dramatic improvement in economic status in Vietnam during the 1990s 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 1998. Large declines in the population living in households that can afford 2,100 calories per day and declines in the overall poverty rate accompany this dramatic improvement in the per capita expenditure distribution. Twenty-five percent of the population in 1993 is in households with per capita expenditures below what is necessary to purchase 2,100 calories per day. Only 8 percent of the population has 1998 expenditures below this level; 58 percent of the population is in households below the poverty line in 1993, while 33 percent of all households in 1998 report expenditures below the 1993 poverty line. The shape of the two densities in Figure 1 is similar. This indicates that overall

7. I divide total expenditure by household size to get total expenditure per capita. Implicit in dividing by household size is a set of strong assumptions about the costs of children and economies of scale within the household (Deaton and Paxson 1998). I consider this issue of economies of scale in greater detail in the working paper version of this study (Edmonds 2003). There are two justifications for looking at expenditure rather than income. First, most households do not participate exclusively in formal labor markets. Hence, calculating income is difficult. Second, while income is variable, households may try to smooth consumption (represented in the VLSS by expenditure) through time. Evidence such as Paxson (1993) suggests that expenditure varies less than income, and the life-cycle hypothesis suggests expenditure better reflects the household's current beliefs about its long-term economic status.

8. 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.

9. Measurement error in total expenditure is a chronic problem in expenditure surveys such as the VLSS. The VLSS attempts to minimize measurement error by attaining expenditure information separately on 64 food items and 86 nonfood items. However, measurement error in total expenditure may hurt the ability of apparent per capita expenditure improvements to predict declines in child labor, because some of the "improvements" might stem from measurement error rather than changes in the household's economic environment.

inequality is largely unchanged. The aim of this paper is to relate this shift in the per capita expenditure distribution to changes in child labor.

To discuss the link between economic status and child labor, I focus on the economic activities of children between the ages of six and 15 that are household members. I restrict my sample to VLSS panel households, but I do not limit my analysis to children who reappear in the survey in both rounds. I begin with children aged six, because the VLSS does not collect data on the economic activities of children under six. I choose 15 as an upper bound because that is a common upper bound in many international conventions on child labor. In this study, a child engages in child labor if the child worked during the last week in agriculture, in a family business, or outside of the household for pay. The VLSS collects information on each of these types of activities separately. Table 1 presents child participation rates by age and year in each of these categories separately and aggregated together (labeled "work").

Most working children participate in agriculture. This is true at every age and in both years. In general, the probability that a child works increases in age. Not surprisingly, the probability that a child works falls more for older children than younger children over time. This reflects the fact that participation rates are higher for older children in

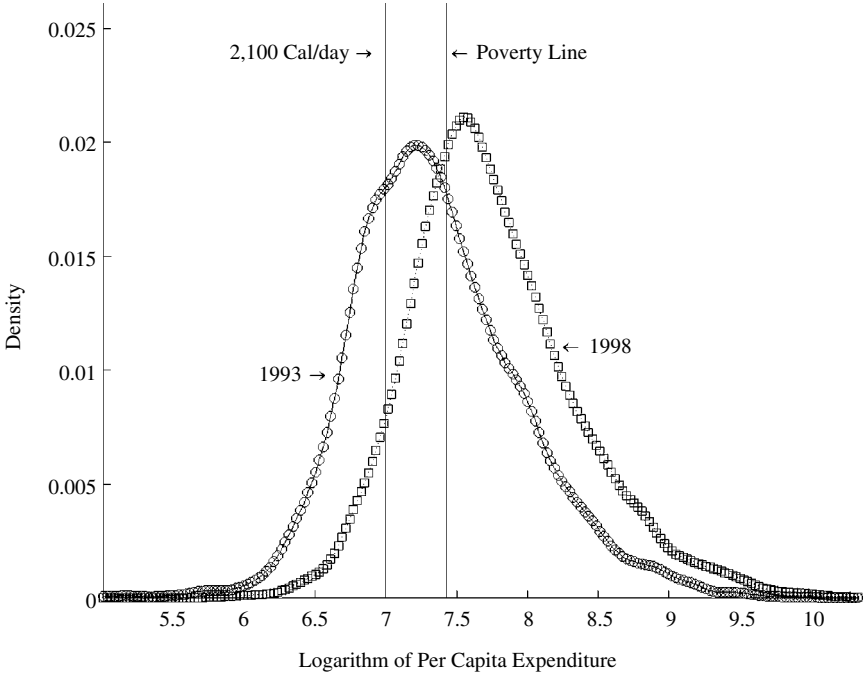

Figure 1
The Distribution of Per Capita Expenditures in 1993 and 1998
Kernel density estimates

Table 1
Child Labor by Age and Through Time for Children

Percent of children participating in various types of work

	1993				1998			
Age	Work	Outside House	Agriculture	Family Business	Work	Outside House	Agriculture	Family Business
6	1.5	0.0	1.3	0.2	1.1	0.0	1.1	0.0
7	7.3	0.2	6.8	0.3	2.2	0.0	2.2	0.0
8	13.1	0.1	12.2	0.9	7.9	0.0	7.9	0.2
9	18.9	0.2	17.5	1.1	7.9	0.2	7.0	1.1
10	27.1	0.3	25	2.3	13.1	0.0	12.6	0.5
11	29.8	1.1	26.7	3.4	22.7	0.1	21.3	1.8
12	40.7	3.2	31.7	7.5	28.7	0.7	26.5	2.1
13	48.0	3.0	40.5	6.8	35.6	1.9	31.3	4.1
14	61.0	5.5	49.1	10.8	40.1	3.9	32.9	5.9
15	69.4	9.7	52.4	12.6	49.3	5.3	40.3	8.0

All means are weighted to be nationally representative for the indicated year. "Work" refers to participation in the last seven days in any of the indicated work categories. "Outside House" indicates work outside of the child's household for pay (cash or in-kind). "Agriculture" indicates work inside the child's own household in agricultural activities. "Family Business" refers to work inside the child's own household in a family business or enterprise other than agriculture.

1993, and the declines in child labor over time are largest for these older children in agriculture. At every age and in every type of work, participation rates either do not change or decline between 1993 and 1998 in Vietnam.

III. Explaining Child Labor Declines with Improving Expenditures

A. Tabulations of Child Labor by Expenditure Quintile

Table 2 previews the relationship between per capita expenditure and child labor that I explore in this paper. I split the sample into quintiles of per capita expenditure in 1993. The left side of Table 2 contains the probability a child works in 1993 in each of the work categories from Table 1. The right side of Table 2 contains the 1998 data.

The negative relationship between child labor and household expenditure is evident in Column 1 of Table 2. The probability that a child works declines with each quintile in 1993 from a high of 39 percent of children 6–15 in the poorest quintile to 16 percent of children in the top quintile in 1993. This decline in child labor with improvements in per capita expenditure appears in both work outside of the household and work in agriculture. There is a noticeable exception in work for a family business as wealthier households are more likely to own a family business than are

Table 2
Child Labor by Quintile of Per Capita Expenditure in 1993

Percent of children participating in various types of work, Panel Households Only

	1993				1998			
Quintile	Work	Outside House	Agriculture	Family Business	Work	Outside House	Agriculture	Family Business
1	38.8	3.1	34.1	3.7	32	1.4	29	3.3
2	36.8	2.1	33.2	2.9	25.2	1.3	22.8	2.2
3	32.9	1.8	27.6	4.5	21.9	1.6	17.7	3
4	26.1	1.8	20.4	5.5	12.9	0.9	11.4	2
5	15.6	1.1	10.2	5.4	4.8	0.6	2.8	2

Quintiles are household quintiles of 1993 per capita expenditure. See Table 2 for column definitions.

poor households. Thus, the data on participation in a family business confound the fact that the opportunity to work in a family business is increasing in per capita expenditure with any link between per capita expenditure and the household's desired child labor supply.

The quintiles for both years of data in Table 2 are quintiles of expenditure per capita in 1993. Hence, the same households are in the same quintile in both years. In every type of work and every quintile, the probability that a child works is lower in 1998 than in 1993. In general, the relationship between per capita expenditure in 1993 and the size of the decline in child labor that occurs between 1993 and 1998 is unclear. In percentage terms, participation in any type of work declines more in richer households than in poorer households, but this reflects the lower participation rates in rich households in 1993 rather than the magnitude of the decline in child labor. In magnitude (rather than percentage terms), the largest decline in participation in any type of work is in agricultural work for households in the second to poorest quintile.

In the decomposition that follows, economic status improvements appear to be the primary reason for declines in child labor in this group. While most households experience improvements in per capita expenditure (Glewwe and Nguyen 2002), the decomposition below suggests that the improvements in economic status for this second quintile group are large enough to significantly reduce the need for children to work. Economic status does not increase enough in the poorest quintile to affect a dramatic decline in child labor, and in richer households, perhaps factors other than poverty drive child labor supply.

B. Theoretical motivation

The decomposition employed in this study follows from a simple adaptation of Basu and Van's (1998) model of child labor supply.[10] Let s_i denote the expenditure

10. In this discussion, I abstract from the question of how inequality affects child labor supply. See Ranjan (2001) and Rogers and Swinnerton (2001) for in-depth discussions.

necessary for household i to be able to make its desired investments (nutritional, educational, etc.) in its members, household i's subsistence expenditure. In the population, households differ in what they perceive as the necessary level of household expenditure at which children no longer need to work, s. The shape of the s distribution is an empirical question, but in the present discussion s has a continuous, log concave distribution such as the lognormal with some positive density throughout the population. In the language of this study, changes through time in technology, policy, the returns to education, relative prices, etc. are reflected in changes in the distribution of s. Thus, the objective of the empirical work is to see how much of the decline in child labor can be explained by holding the distribution of s fixed.

In order to simplify the present discussion, assume the household consists of one parent and one child. The parent decides whether the child works, $y \in \{0,1\}$. Parental preferences are defined over household per capita expenditure x and child labor supply. Basu and Van's luxury axiom implies that, for all $\delta > 0$:

$$(x_i, 0) \succ (x_i + \delta, 1) \text{ if } x_i \geq s_i$$
$$\text{and } (x_i, 0) \prec (x_i + \delta, 1) \text{ if } x_i < s_i$$

Without child labor, parents can attain some maximum household income m_i. m_i can be interpreted as a function of the household's endowments when children do not work, whereas s reflects factors that affect the household's perceived subsistence needs such as local prices, policies, or other environmental factors. Note that changes in both observed expenditures and child labor are jointly determined by the household's ability to translate its endowment to income. Child labor adds an additional increment w to household income. For simplicity, w does not vary across households. The household's budget set is: $2x_i \leq y_i w + m_i$ and the solution to the household's maximization problem gives child labor supply as:

$$y_i = \begin{cases} 0 \text{ if } m_i \geq 2s_i \\ 1 \text{ if } m_i < 2s_i \end{cases}.$$

Because s varies across households and has positive density throughout the population, for any level of per capita expenditure, I observe households where children work and children do not work. In households without child labor, $m_i \geq 2s_i$, and per capita expenditure is $m_i/2$. In households with child labor, $m_i < 2s_i$, and per capita expenditure is $(w + m_i)/2$.

In this model, the incidence of child labor depends on the joint distribution of s and m. However, conditional on a given level of expenditure per capita, the incidence of child labor depends on the conditional distribution of s given m. This calculation is straightforward:

$$\begin{aligned} E[y|x] &= 0^* \Pr(m \geq 2s|m) + 1^* \Pr(m < 2s|m + w) \\ &= \Pr(m < 2s|m + w) = \Pr(m < 2s|m) \\ &= \Pr\left(s > \frac{m}{2}|m\right) = \int_{m/2}^{\infty} g(s|m)\, ds \end{aligned} \tag{1}$$

Thus, the expectation of child labor given per capita expenditure depends on distribution of subsistence needs given the value of the household's endowment.

In the present context, households are observed twice. Let Subscripts 1 and 2 denote observations from the first and second round of the panel respectively. The change in child labor participation rates between 1993 and 1998 observed at point x_1 in the baseline (1993) per capita expenditure distribution is then: $E[y_1|x_1] - E[y_2|x_1]$. Following Equation 1, define:

$$(2) \quad E[y_1|x_1] = \int_{m_1/2}^{\infty} g(s|m_1)\,ds \text{ and}$$

$$(3) \quad E[y_2|x_1] = \int_{m_1/2}^{\infty} h(s|m_1)\,ds.$$

The change in child labor participation rates is then attributable to the difference between $g(s|m_1)$ and $h(s|m_1)$. Two factors are responsible for any differences between the two densities. First, the value of the household's income absent child labor (or, alternatively, the income attainable from the value of the household's endowment) may change. That is, m_1 differs from m_2. Second, the distribution of subsistence needs changes. For example, a policy change could lower the cost of schooling. Hence, the household income at which children no longer needed to work would decline. This would affect child labor participation rates even if the value of household endowments remained fixed. The aim of the decomposition in the paper is to estimate how important changes in the value of household endowments are in the observed declines in child labor. To do this, the conditional distribution of s given m needs to be fixed.

Denote $\hat{x}_2$ as the expected per capita expenditure in 1998 expected at point x_1 in the baseline (1993) per capita expenditure distribution: $\hat{x}_2 = E[x_2|x_1]$. The change in the child participation rate at x_1 that would be expected based on improvements in per capita expenditure alone is $E[y_1|x_1] - E[y_1|\hat{x}_2]$ where $E[y_1|\hat{x}_2] = \int_{\hat{m}_2/2}^{\infty} g(s|\hat{m}_2)\,ds$.

Thus the calculation of how important improvements in per capita expenditure are in changes in child labor participation rates is straightforward. First, the association between child labor and per capita expenditures in the cross-section is computed using nonparametric regression. The predicted child labor participation rate based on improvements in per capita expenditure then follows from this relationship and estimated improvements in per capita expenditure.

C. A Nonparametric Decomposition

In this section, I describe how I examine the relationship between child labor and household economic status. Child labor and economic status are jointly determined so the conditional expectations computed in this study do not have causal interpretations. A straightforward application of the Blinder-Oaxaca methodology to the present case would entail regressing child labor in 1993 on per capita expenditure in 1993, then using the estimated regression coefficient to predict child labor in 1998. I consider this approach at the end of this section. However, as discussed in the introduction and the previous subsection, nonlinearity in the relationship between per capita expenditure and child labor may be very important. Thus, this study uses nonparametric techniques to compute child labor participation rates (or

the probability that "work" equals one times 100) throughout the household per capita expenditure distribution: $E[Y|X] = \pi(X)$. Per capita expenditure (X) is the logarithm of total per capita expenditure, and Y is the corresponding child labor participation rate. $\pi(X)$ is estimated with a local-linear regression technique so the estimate of $\pi(x)$ is the predicted value from the local regression at x (Fan and Gijbels 1995).[11]

I begin by estimating the relationship between child labor and the logarithm of per capita expenditure in 1993. Figure 2 contains this regression for panel households with children aged 6-15 in 1993; 90 percent confidence bands (the dotted lines) are also pictured in Figure 2.[12] With nonparametric regression, the ability to compute participation rates conditional on per capita expenditure is limited to regions of the per capita expenditure distribution where there is support. In the bottom 5 percent of the per capita expenditure distribution, the standard deviation of the logarithm of per capita expenditure is almost six times that of the next 5 percent of the population. Because of this diffusion, the local regression techniques in this paper do not perform well. A similar problem plagues the top of the distribution 1993. Hence, the analysis of this paper focuses on households with a logarithm of per capita expenditure above 6.51 and below 8.28. 94 percent of all working children in 1993 are within this range.

The probability a child works declines in per capita expenditure. There are two important parts of Figure 2. First, in the poorest households with per capita expenditure below that necessary to purchases 2,100 calories per day, child labor appears fairly inelastic with respect to per capita expenditure. A flat or even increasing relationship is consistent with the indicated confidence bounds. If there is any upward slope in this range, it may reflect the contribution of child labor to household per capita expenditure. However, around the 2,100 calorie per day line, child labor begins to decline with expenditure. This corresponds to a per capita expenditure of about USD $65 per person per year. The second important part of Figure 2 is around the poverty line. There, the rate of decline in participation rates appears to increase before leveling off slightly at around the equivalent of USD $192 per person per year (7.7 in Figure 2). Thus, the picture in Figure 2 is

11. The bandwidth selection procedure in Figures 2–4 works as follows. I pick a bandwidth for the point on the per capita expenditure grid with the greatest density. I then compute a bandwidth for each point on the per capita expenditure grid by multiplying this bandwidth by the square of the inverse of the estimated density (relative to the greatest observed density). The advantage of this weighting is that the bandwidth used in estimating the expected incidence of child labor is greater for parts of the per capita expenditure distribution with less mass. The base bandwidth (at the point of greatest density) is selected by a cross-validation procedure that works as follows. I consider a grid of possible bandwidths. For each bandwidth on the grid, I use the density based procedure just described to compute a bandwidth for each point on the per capita expenditure grid. I then compute the mean-integrated squared error across all observations. I repeat this procedure across the range of bandwidths, and select the bandwidth that minimizes mean-integrated squared error.

12. I estimate standard errors for the regression function by bootstrapping. The VLSS panel consists of 3347 households with children drawn from 117 communes. Since there is likely significant homogeneity in child labor within communes, the effective sample size is less than 3436. My bootstrapping procedure preserves this feature of the sample design by sampling communes rather than households, then retaining all of the households within the selected commune. I generate 100 such bootstrap samples and re-estimate the local regression for each draw of the bootstrap.

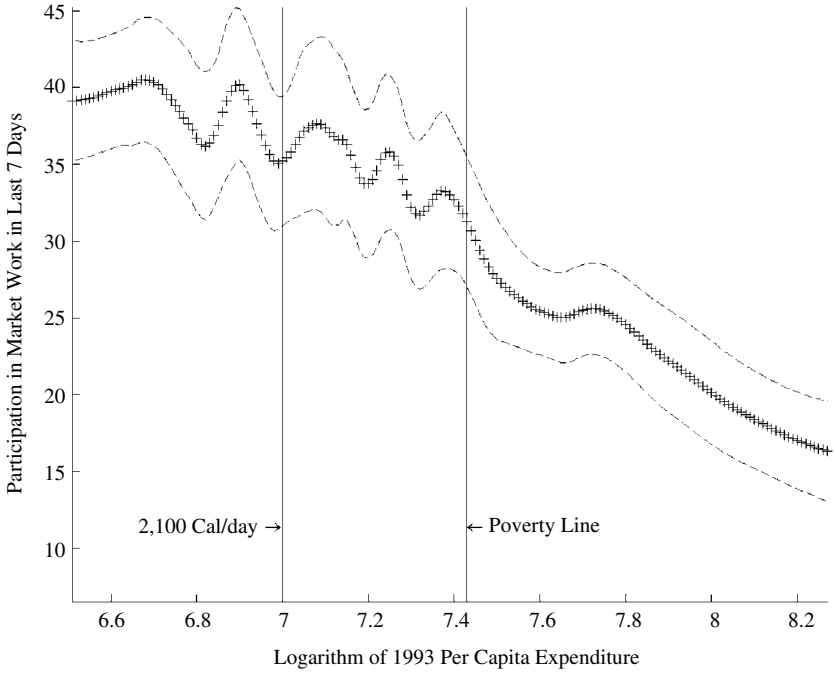

Figure 2
Child Labor by Per Capita Expenditure in 1993
Local regression results

consistent with the framework elucidated in the previous section. Below subsistence, there is little evidence of a link between child labor and per capita expenditure. Above the 2,100 calorie per day line, households begin to have per capita expenditures above the household's perception of subsistence, and the number of households with subsistence levels in the neighborhood of the poverty line is large. Thus, the decline in child labor accelerates in the neighborhood of the poverty line.

The relationship between child labor and the logarithm of per capita expenditure in Figure 2 indicates how child labor participation co-varies with per capita expenditure at a single point in time. This mapping summarizes all of the mechanisms that cause child labor to vary with per capita expenditure in the 1993 cross-section. The aim of this decomposition is to identify how much of the observed decline in child labor is associated with improvements in economic status (that is, the process of moving across the per capita expenditure distribution in Figure 2) as opposed to other time-varying factors associated with growth that are not directly related to differences in economic status across households. Thus, the explanatory power of improvements in per capita expenditure is computed by using Figure 2 to predict child labor in 1998.

To do this, the decomposition proceeds in three steps. First, the relationship between child labor and per capita expenditure is mapped in the 1993 data set (Figure 2):

(4) $E[y_{i,93}|X_{i,93}] = \pi_{93}(X_{i,93})$

This conditional expectation is used to predict the decline in child labor through time. In order, to use this mapping of the link between per capita expenditure variation and child labor, I need to know how much per capita expenditures improve through time at each point of the 1993 per capita expenditure distribution. This is a straightforward calculation:

(5) $E[X_{i,98}|X_{i,93}] = \theta_{98}(X_{i,93})$

This regression appears in Figure 3.

While Figure 1 indicates that the distribution of per capita expenditure shifts forward between 1993 and 1998, Figure 3 shows that within-household changes are generally large and positive. The straight line is the 45 degree line where per capita expenditure in 1993 equals per capita expenditure in 1998. Poorer households experience larger increases in per capita expenditure than do richer households. The obser-

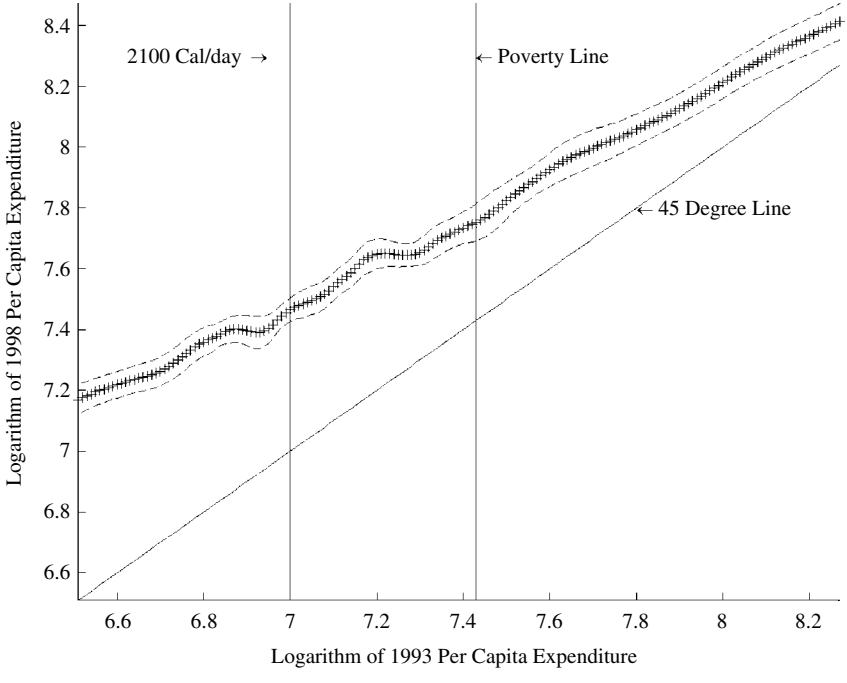

Figure 3
Per Capita Expenditure in 1998 by Per Capita Expenditure in 1993
Local regression results

vation that poorer households experience larger increases in expenditure per capita may in part reflect measurement error. Glewwe and Nguyen (2004) find that estimates of economic mobility in Vietnam are substantially reduced when they correct for measurement error in expenditure per capita. In the present case, this likely hurts the predictive power of the decomposition. If these increases in per capita expenditure are noise, then they would not predict declines in child labor.

The third step in the decomposition is to use the prediction of per capita expenditure improvements in Equation 5 to predict child labor in 1998 from the relationship between per capita expenditure and child labor defined by Equation 4. This can be written:

$$(6) \quad \overline{y}_{i,\,98} = \pi_{93}(\theta_{98}(X_{i,\,93}))$$

I compare this predicted child labor to the observed child labor in 1998. This is calculated by a regression of child labor in 1998 on per capita expenditure in 1993:

$$(7) \quad E[y_{i,\,98}|X_{i,\,93}] = \pi_{98}(X_{i,\,93})$$

This approach differs from a standard decomposition in two ways. First, it is entirely nonparametric, so it is not just calculating the decomposition at the sample mean. Second, it makes use of the panel structure of the data. At any given x for the decomposition, I include the same households. Hence, all of the variation observed in this decomposition comes from within-household changes in child labor. Parental callousness, social norms, or other models that posit child labor to be a household fixed effect would thus predict no changes in child labor, and the shift in the per capita expenditure distribution should not explain any changes in child labor that are observed.

Figure 4 presents the results of this decomposition analysis.[13] The line marked 1993 contains the 1993 cross-sectional relationship observed in Figure 2. It appears flatter in this figure because of the change in the scale of the vertical axis. The line marked 1998 contains the expected child labor in 1998 by per capita expenditure in 1993 (Equation 5). The line marked *predicted* is the output of the calculation in Equation 6 and contains the predicted child labor in 1998 based on the relationship between child labor and per capita expenditure observed in 1993 (Figure 2). The (dotted line) 90 percent confidence bands in this picture are for the *predicted* line. There are two vertical lines in Figure 4. The right-most vertical line is the 1993 poverty line. On average, households between the poverty line and the left-most vertical line exit poverty between 1993 and 1998. Thus, I refer to these households as poverty exiting households in the remainder of the paper.

The cross-sectional relationship between child labor and per capita expenditure in 1993 does a remarkable job of predicting child labor in 1998 based on per capita

13. Because the 1993 mapping (Equation 4) encounters support problems with the logarithm of per capita expenditure in 1993 above 8.28, the 1998 predicted incidence of child labor can only be computed for regions where the predicted per capita expenditure in 1998 is at or below 8.28. Thus, the decomposition is limited to households with a 1993 logarithm of per capita expenditure of 8.07 or less, because the predicted per capita expenditure in 1998 for households with a 1993 log pcx of 8.07 is 8.28. All remaining figures are then pictured with a range of 6.51 to 8.07.

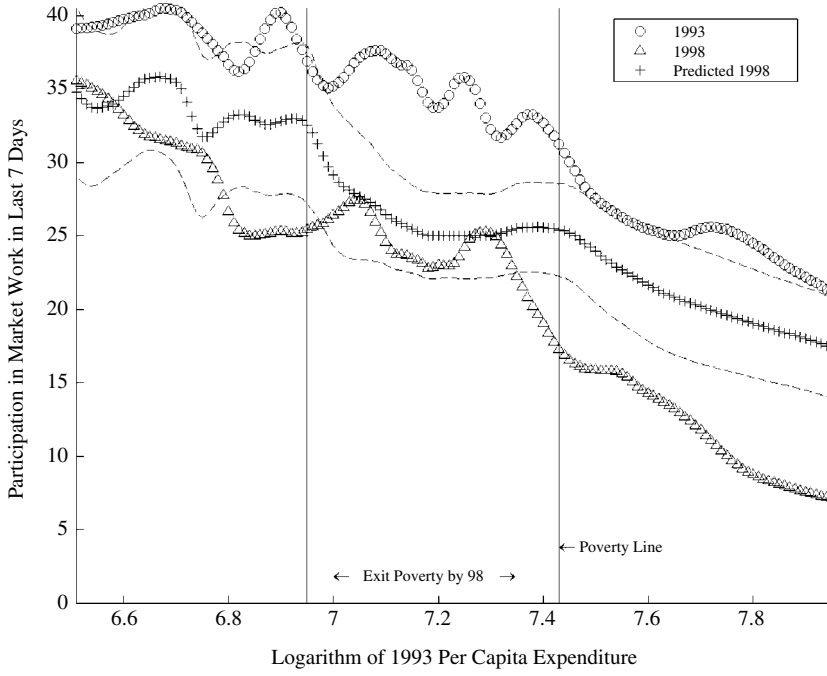

Figure 4
Explaining Changes in Child Labor with Changes in Per Capita Expenditure Decomposition (local regression) results

expenditure in 1998. Overall 59 percent of the observed declines in child labor can be explained by the 1993 mapping of the association between per capita expenditure and child labor supply.[14] The strongest predictive power comes for households that move from below the poverty line in 1993 to above the poverty line in 1998. For children in these poverty exiting households, 80 percent of the observed, approximately 13 point (or 36 percent) decline in child labor can be explained by improvements in per capita expenditure. If the poverty line is a meaningful measure of household perceptions of subsistence levels, the model of the previous section would predict that per capita expenditure improvements should have the most predictive power for this poverty exiting group. The weakest predictive power of improvements in per capita expenditure is for households above the poverty line in 1993. In these households, improvements in per capita expenditure explain less than half of the observed decline in child labor. There are two potential explanations for this. First, children may not be working

14. I calculate the fraction of the decline in child labor that can be explained by living standards improvements by calculating the fraction of the decline in child labor explained by the *predicted* line for each point on the per capita expenditure grid. I then take the weighted average of these fractions using kernel density estimates of the 1993 per capita expenditure distribution.

because of poverty in these households. Hence, I would not expect per capita expenditure to explain inter-temporal variation in child labor. Second, mechanically, these households achieve per capita expenditures that are so high in 1998 that I do not have the data in 1993 with which to make accurate projections of what child labor should look like (based on cross-sectional variation in child labor and per capita expenditure) in households that are so well off.

IV. Interpretation

A. Alternative explanations of the results for households that exit poverty

The finding that economic status improvements can explain declines in child labor in households that exit poverty is consistent with the Basu and Van framework articulated in Section IIIB where children work to help families meet subsistence needs.[15] However, it is possible to explain the findings observed in Figure 4 in a model where child labor is not a bad in parental preferences. For example, suppose the mapping between child labor supply and per capita expenditures in 1993 reflects differences across communities in local labor demand. This explanation is possible, because there is significant geographic clustering in per capita expenditures. Moreover, suppose that the communities in which households exit poverty between 1993 and 1998 experience a shock to child labor demand that reduces child labor to levels that coincidentally match those observed in households above the poverty line in 1993. This model might generate a result such as Figure 4 without any impact of improvements in economic status on child labor.

Two pieces of evidence in the data suggest that this spurious correlation explanation may be incorrect. First, the relationship between per capita expenditures and child labor supply in 1993 in Figure 2 does not seem consistent with this story. Child labor does not appear to vary with per capita expenditures until households can meet their food needs, and it then declines dramatically. It would be surprising if employment opportunities began to decline at the same point that households became wealthy enough to afford their basic needs. In fact, a number of authors have suggested that the employment opportunities for children are greater in wealthier households and communities because of greater economic activity (Bhalotra and Heady 2003, Basu and Tzannatos 2003, Edmonds and Turk 2004). Thus, if child labor were entirely demand driven, the cross-sectional relationship should be the opposite of that in Figure 2. Second, as described in further detail in the working paper version of this paper (Edmonds 2003), I have controlled for community fixed effects in a semiparametric version of this decomposition methodology and found a relationship similar to that observed in Figure 2. With community fixed effects, the association between child labor and per capita expenditure in 1993 is identified by within-community variation in per capita expenditures. These two pieces of evidence rule out a story based on labor demand only.

However, a modification to this spurious correlation story would be that the relationship in Figure 2 reflects variation in tastes for child labor that have nothing to do

15. An observationally equivalent explanation would come from a model with continuous child labor supply and an Engel curve for food in family preferences. I am grateful to Andrew Foster for pointing this out.

with the causal relation between economic status and child labor, and by coincidence, other changes in the household's environment affect declines in child labor that happen to correspond to child labor participation rates that match the improvements in per capita expenditures observed in on average in poverty-exiting households in 1998. I can exploit the heterogeneity in the changes in per capita expenditure that occur across households in a neighborhood of a given per capita expenditure in order to consider this alternative explanation of the findings. I bifurcate the sample into households that experience increases and decreases in per capita expenditure between 1993 and 1998.[16] If the changes in child labor are unrelated to the household's improvement or decline in per capita expenditure, then the observed changes in child labor should not depend on whether a household's real per capita expenditure increases or decreases between 1993 and 1998.

Figure 5 shows that the declines in child labor occur in households that experience increases in per capita expenditure among the households that exit poverty between 1993 and 1998. Figure 5 displays the decline in participation rates in market work (a positive number is a decline in child labor between 1993 and 1998) against per capita expenditure in 1993 for households that experience increases in real per capita expenditures and (separately) households that experience decreases in real per capita expenditures between 1993 and 1998. Confidence bounds are pictured for households whose per capita expenditures increase. The sample size is small for households with declines in per capita expenditures. Thus the confidence bounds are very large for that relationship and generally overlap the confidence interval for households that experience increases in per capita expenditures. That said, throughout the range of households where per capita expenditure improvements are most successful in explaining declines in child labor, the declines in child labor are in the households that actually experience the improvements in per capita expenditures. In fact, child labor is generally increasing in households that become poorer between 1993 and 1998. Hence, the spurious correlation explanation for the explanatory power of economic status improvements does not appear consistent with the data.

B. The significance of nonparametric methods

Nonlinearity is clearly important in the relationship between economic status and child labor. The basis for the decomposition in this study is the relationship in Figure 2 which is highly nonlinear. The obvious question is how much additional explanatory power is coming from the use of nonparametric techniques relative to the standard linear regression techniques that are ubiquitous in most decompositions. To compare the two methods, I run a linear regression of the work indicator on the log of expenditure per capita for the 1993 data: $y_{i,93} = \beta_{0,93} + \beta_{1,93} X_{i,93} + \varepsilon_{i,98}$.[17] At any given point, x_{93}, I can compute the expected child labor in 1993 as $E[\hat{y}_{93}|x_{93}] = \beta_{0,93} + \beta_{1,93} x_{93}$. This is comparable to the calculation in Equation 4. I can compute

16. There is an obvious endogeneity problem in this bifurcation. If a child exogenously stops working, then per capita expenditures may decline. Hence, it is plausible that declines in child labor will be concentrated in households that experience declines in per capita expenditure.

17. This regression estimates $\beta_{1,93}$ as −0.13; the *t*-statistics is 12.08 for the test of the null-hypothesis that $\beta_{1,93}$ is 0.

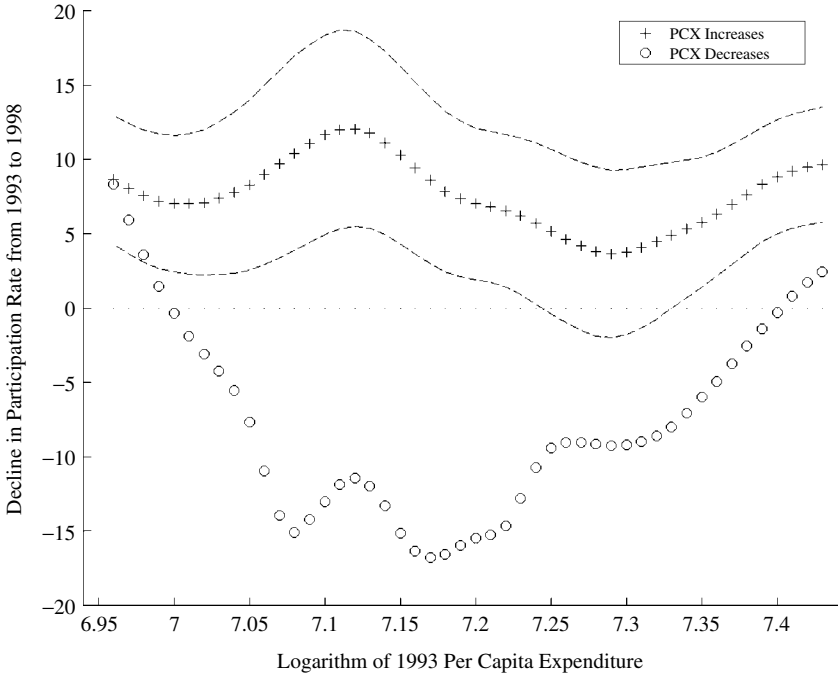

Figure 5
Declines in Child Labor by Per Capita Expenditure in 1993 and whether Per Capita Expenditures Increase or Decrease between 1993 and 1998
Limited to children in households with 1993 per capita expenditures that on average exit poverty between 1993 and 1998

the linear analogue to Equation 6 as $E[\bar{y}_{98}|x_{93}] = \beta_{0,93} + \beta_{1,93} E[x_{98}|x_{93}]$ where I estimate $E[x_{98}|x_{93}]$ using the local regression techniques described above. Thus at any point x_{93}, the fraction of the decline in child labor that can be explained by improvements in per capita expenditure is:

$$(8) \quad \frac{E[\bar{y}_{98}|x_{93}] - E[\hat{y}_{98}|x_{93}]}{E[y_{98}|x_{93}] - E[y_{98}|x_{93}]}.$$

The two expectations in the denominator are the nonparametric estimates from Section IIIC. With this approach, I compute the fraction of the reduction in child labor that can be explained by linear regression for various parts of the per capita expenditure distribution. These results are in Table 3. I use kernel weights that put greater weight on values of per capita expenditure with a greater density in computing the explanatory power of the linear regression.

The standard linear model explains a remarkable fraction of the decline in child labor. The first column of Table 3 contains the results from the linear regression, and the second column contains the equivalent of Equation 8 calculated by replacing the

Table 3
Percent of Decline in Child Labor Explained by Improvements in Per Capita Expenditures: Comparison of Linear and Local Decompositions

	Linear	Local
Poorest 25 percent	83	58
Poorest 50 percent	66	71
Poorest 75 percent	58	64
Households exit poverty	51	80
Population	52	59

Each cell contains the fraction of the actual decline in child labor that can be explained by improvements in per capita expenditure using the methodology described in the text. The percent of the decline explained for the range indicated by the row label is computed by taking a weighted average over the specified range, where the weights assigned to any point in the range are kernel density estimates of the mass in the neighborhood of the point in 1993 (as in the 1993 distribution in Figure 1).

linear expectations in the numerator with the nonparametric expectations calculated in Section IIIC (Figure 4). In the relatively dispersed bottom quartile of the population, the linear estimator does better than the nonparametric estimator, because the linear functional form solves the problems of low density that plague the nonparametric regression. In the rest of the distribution, the local regression techniques developed in this paper have greater explanatory power.

The difference between the local and linear results is greatest for households that exit poverty. While the local regression techniques explain 80 percent of the decline in child labor for this group, linear techniques explain only 51 percent of this group's decline. The reason for this large difference between techniques in predicting declines in child labor for poverty exiting households is evident in Figure 2. There is a distinct change in slope and acceleration in the decline in child labor associated with per capita expenditure for households in the neighborhood of the poverty line in the local regression line for 1993 in Figure 2. In households that exit poverty between 1993 and 1998, per capita expenditure improve across this region of dramatic declines in child labor. The linear regression misses this region of rapid decline in child labor, and hence dramatically under-predicts the decline in child labor that occurs in households that move out of poverty.

V. Conclusion

The main finding of this paper is that economic status improvements can explain much of the dramatic decline in child labor that occurred in Vietnam during the 1990s. While child labor declines in households throughout the per capita expenditure distribution, improvements in economic status appear to explain the declines in child labor in poorer households more so than in rich households. For households that emerge from poverty between 1993 and 1998, per capita expenditure improvements can explain 80 percent of the observed decline in child labor.

These findings differ from much of the recent evidence on child labor and economic status in four ways. First, the nonparametric tools used in this study allow for (and find) important nonlinearity in the correlation between economic status and child labor. Failing to account for this nonlinearity may lead to misleading results and conclusions. For example, in Vietnam in 1993, I do not find that child labor is sensitive to economic status in the very poorest and very richest households. If most households fell into one of those two regions of per capita expenditure (in reality, they do not), then with parametric methods, I might conclude that there is no link between economic status and child labor as does much of the recent empirical literature on child labor and economic status.

Second, the relationship between economic status and child labor that explains the decline in child labor through time is based on a single point in time. Hence, new technologies, relative price shifts (including the market return to education), and policy—all factors likely to be correlated with economic growth—by construction cannot be the source of the ability of improvements in economic status to explain child labor. Thus, the results of this study provide a rare piece of evidence linking the process of becoming richer to declines in child labor that is not driven by the confounding factors that have drawn so much attention in the recent literature.

Third, the explanatory power of this paper comes from observing the same set of households through time, rather than through comparing fundamentally different households. Thus, the results of this study are based on within-household declines in child labor explained by within-household changes in economic status. As a result, the findings of large reductions in child labor associated with improvements in economic status reject theories that posit child labor to be driven by preferences or norms that are invariant to the household's economic environment.

Fourth, I am not aware of any other study that examines how child labor responds to a shift in the economic status distribution. This is of considerable policy interest. The process of economic growth and international market integration may include shifts in the economic status distribution of a county, and the empirical evidence on how households respond to this appears to be virtually nonexistent outside of the present study. If improvements in economic status do not reduce child labor, then to the extent that child labor damages long-term human capital accumulation, improvements in economic status may be transitory and unlikely to lead to long-term or multigenerational improvements in household well-being. Long-term development policy is then better focused on an activist social policy targeted to providing households with incentives to keep children in school and out of work. On the other hand, if improvements in economic status translate into decreases in child labor, then a more activist social policy may be unnecessary. Resources may be better targeted to ameliorating the worst forms of child labor and encouraging more immediate income generation. Further, punitive policies such as trade sanctions designed to punish counties with high levels of child labor may actually increase child labor if trade sanctions lower economic status.

I have ignored econometric issues associated with the effect of child labor on per capita expenditure and with the joint determination of expenditure and the allocation of child time. To interpret Equation 4 as anything more than a conditional expectation, I would need a set of instruments that impact expenditure per capita but not independently child time. This seems difficult in the present case, because as is explicit in

Section IIIB, anything that affects expenditure also affects child labor supply. The consequence of the joint nature of per capita expenditure and child labor for my analysis is that I cannot in general identify the mechanism through which the 1993 cross-sectional relationship between per capita expenditure and child labor predicts child labor in 1998.

A natural question arises about how these results generalize. First, nonlinearity in the relationship between child labor and economic status appear very important. Much of the growth in Vietnam between 1993 and 1998 appears to push household economic status across an area of dramatic declines in child labor. I would hesitate to extrapolate from the results found here to economic status levels outside of the data. Second, the growth in rural areas that took place during the period of the panel appears to stem from agricultural liberalization and growth in the productivity of the agriculture sector. Improvements in economic status from growth in agriculture may have very different consequences for children than other types of growth. For example, since 1999, Vietnam may have experienced a massive surge in small and medium sized enterprises. This may result in additional, new earning opportunities for children. Whether children take these earnings opportunities depends on the payoff the household perceives to having the child work in these new enterprises. The household must weigh the disutility of having the child work versus the additional income the child's work may bring. The contribution of this paper is not to predict that the desire for less child work will dominate all additional earnings opportunities. Rather, this paper shows that it is not inevitable that the need for additional income will dominate even among the very poor households considered in this paper. In fact, in the present case, improvements in economic status, even in the face of rising earnings opportunities for child laborers, are associated with a very dramatic decline in child labor.

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