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THE DETERMINANTS OF CHILD LABOR: THEORY AND EVIDENCE

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I. Introduction

The specter of small children toiling long hours under dehumanizing conditions has precipitated an intense debate concerning child labor over the past decade and a half. As during the midst of the 19th century industrial revolution, policymakers and the public have attempted to come to grips with the causes and consequences of child labor. Coordinating a policy response has revealed the complexity and moral ambiguity of the phenomenon of working children.

Although child labor has been the norm throughout history, the fact of children working and the difficult conditions under which children work occasionally become more evident. In the midst of the 19th century, child labor became more visible because children were drawn into an industrial setting. Currently, child labor has become more visible because of the increase in the number of children producing goods for export.

Our purpose here is not to provide a definitive diagnosis of the causes and consequences of child labor, but rather to review the existing theoretical, empirical, and historical literature as to why and when children work. As will become clear, technology and other demand-side factors interact subtly with household dynamics, culture, and market and political failures to determine the labor force participation rate and educational attainment of children.

In section II, we review the theoretical literature and some incidental empirical evidence concerning household decision-making and its implications for work and school choices for children. Unitary models are analyzed first, followed by models with multiple agency. We consider household decision-making, itself, along with market characteristics that constrain the choices that families make concerning their children. In particular, considerable recent theoretical and empirical attention has focused on the role that market failures play in child labor. Failures that emerge in financial, spot labor, and human capital markets can all give rise to more child labor than is economically efficient or in the interest of families. We will also find that political failure can play a significant role in determining the allocation of children's time. We then turn, in section III, to a discussion of the empirical evidence on these and related issues based on survey research of household decision-making.

The demand side of child labor is then broached in section IV. Here we consider the role that technological change, or lack thereof, can play in creating employment opportunities for children. Central to this literature is the extent to which mothers, young women, or machines can duplicate and, therefore, replace the special labor qualities provided by child workers. Evidence of current work by children is compared to the historical record on the role of technological change and child labor during the 19th century industrial revolution.

A more thorough treatment of the rise and fall of child labor during the 19th century is presented in section V. There remains considerable disagreement among historians concerning the nature of child labor during the western industrial revolution. Historians

continue to debate issues concerning the role that child workers played in the industrial setting, the impact that the industrial revolution had on total and sectoral employment of children, and the role of legal restrictions on hours worked, the age at which children could enter the labor force, compulsory education, and the public provision of educational services. Nevertheless, there are many distinct parallels between child labor today and the experience with child labor in the west two centuries ago. We conclude section V with an attempt to draw some lessons from the historical experience.

We then turn to a series of specific issues thought to be important in affecting both the supply and demand for children. Section VI addresses the conflicting effects that trade openness has on child labor. Section VII provides a critical review of the empirical evidence on the impact of compulsory education laws in the United States. Finally, section VIII addresses the all-important question concerning the value of an education and the determinants of education quality. Conclusions follow in Section IX.

II. Theories of the Supply of Child Labor

We begin with a discussion of the supply-side determinants of child labor. First, we will consider the theory of household decision-making in a perfectly competitive context. (Empirical implementation of this model will be discussed in the following section.) We then turn to consider several market imperfections that impact households along with empirical evidence supporting the relevance of these market failures for the determining child labor.

A Basic Model of Household Decision-Making

A generic Becker (1981) type household decision model such as the one articulated by Rosenzweig and Evanson (1977), Pörtner (2001c), or Cignati and Rosato (2000) and summarized by Schultz (1997) assumes that the household acts to maximize utility, which is a function of the number of children, the schooling per child, the leisure time per child, the leisure of the parents, and a composite consumption good. These goods are produced using a composite commodity purchased in the market place and the time of household members. The time inputs to produce the composite consumption good can be supplied by the mother or by the children. Household income can be earned by selling goods produced in a household enterprise or by working as a wage laborer. Inputs to the production of the household enterprise good include physical assets owned by the family and by parent and child labor. Markets for labor, goods, and capital are taken to be perfectly competitive, at least initially.

The husband allocates time between market work and leisure; the mother allocates time among market work, child rearing, and home production; and children allocate time among market work, education, leisure, and home production.

Uncompensated cross-elasticities in this model concerning children are the following:

- An increase in the father's wage raises the implicit price of his leisure and will lead to substitution toward the child's education if the child's education and the father's leisure are substitutes. An increase in the father's wage will also raise household income. If a quality-child is a normal good, then education will rise.
- An increase in the mother's wage increases the opportunity cost of each birth, thereby lowering the optimal family size. To the extent that child quality is a substitute for child quantity, the fall in the optimal family size will raise investment in education. However, to the extent that the mother's work in the home is a substitute for child work in the home, child leisure and education may decline when the mother's wage rises. Finally, the rise in the mother's wage will raise the demand for all normal goods. Quality children may be among these, in which case educational attainment will rise.
- An increase in the child's wage works through several channels to alter the amount of education. First, an increase in the child's wage raises the opportunity cost of time spent in school. Second, an increase in the child's wage raises the return to each birth. To the extent that the subsequently larger family size leads families to trade off quality for quantity of children, educational attainment will decline further.
- The impact of an increase in the child's wage also depends on whether leisure and education are complements or substitutes. If leisure and education are complements, then the rise in the cost of leisure will induce a decline in the demand for education. However, if they are substitutes, a rise in the wage will raise the demand for education. In order to determine the net effect of the child's wage, we have to weigh the income and substitution effects. If the contribution of the child's work to household income is small, then the substitution effect will dominate and the child will increase work and reduce education.
- An increase in land holdings or other family assets should increase income, thereby increasing educational attainment.

The Quality-Quantity Trade-Off

Most, theoretical analysis hypothesizes a tradeoff between the quantity and quality of children, as reviewed by Schultz (1997). However, Rosenzweig and Evanson (1977) allow the quantity-quality tradeoff to emerge as a by-product of the impact of the mother's wage on the number of children. In this case, the increase in the mother's wage raises the opportunity cost of the labor-intensive enterprise of raising children. The fall in the number of children in the family frees resources available to increase child quality. For example, the services that children provide to their parents may be defined as the product of the number of children and their average quality. In that case, quality and quantity are inherently substitutes. However, Cigno and Rosati (2000) note that this depends on the presumption that the net cost of a child is negative.

Variation in Child Quality across Siblings

Investment in child quality typically varies across children. There are several theories as to why this would be the case, as reviewed by Ejernæs and Pörtner (2002), associated with birth order. They identify three different possible explanations, associated with household budget constraints, biology, and returns to scale in household production.

Household Budget Constraints. Even if parents would like to equalize educational expenditures across children, they may not do so if they lack access to capital markets or if they do not realize the value of borrowing against future income. In this event, the level of spending on first and last born will be higher than the family average for two reasons. First, as noted by Cigno and Rosati (2000), families that are liquidity constrained cannot spend the return on their investment in their children until they have entered the labor force. Once the oldest children in the family begin working, the household budget constraint is relaxed, permitting more investment in the human capital of younger siblings.

Second, time spent in a smaller family is longer for first- and last-born than for middle children (Birdsall, 1991). Note, however, that when a family is liquidity-constrained, the youngest children in the family receive their *bonus* in the form of greater educational attainment since their family will be smallest during their school-age years. By comparison, the oldest children will receive their bonus in the form of greater maternal attention as infants. In addition, the last children to be born in the family will enter when the parents are at the peak of their earning power, thus further biasing human capital formation in the youngest children in the family (Parish and Willis, 1993).

Birdsall's insights also suggest some interesting interactions between mother's work and child's work. She reasons that mothers who work are not at a corner solution in the time allocation across children, whereas mothers who do not work allocate all of their available time to nurturing. Birdsall finds that mothers who engage in market work outside the home spread their maternal resources across their children more evenly than mothers who engage exclusively in home production.

The impact of a mother's market work on human capital formation is reversed, however. A mother who reduces hours of market work as the number of children in the family rises, in order to increase the maternal time spent with each child, also lowers family income. The negative impact on household income may create an incentive to withdraw older children from school and send them to work. In other words, a family can use income of their older children to reallocate the mother's time from periods in which her family is small toward those periods in which her family is large. Thus, once again, we might expect to observe a first-born to begin work earlier than subsequent children.

Biology may play a secondary role. First-borns and children born to older women tend to have lower birth weight than middle children. These middle children, then, may have more potential to acquire human capital. Parents may draw conclusions concerning a child's genetic endowments and, therefore, ability to acquire human capital, by observing such factors as how prone they are to illness, genetic disorders and ability to grow physically based on birth weight. Gender, of course, may also play a role in the parent's evaluation of the earnings potential of an educated child.

Ejrnæ and Pörtner (2002) use a biology-based argument to explain birth-order effects in human capital investment. They assume that parents make fertility decisions sequentially. They have one child, then observe the genetic endowment. Based on the observed outcome of the first child, they make a decision as to whether to have a second, and so on. The objective function of the parents is to maximize an index of human capital embodied in their children. The upshot of this process is that, as soon as they have a child with higher than averaged expected genetic ability, they stop having children and focus a disproportionate amount of resources on that last child.

Thus, even if genetic abilities arrive randomly, parents stop having children or reduce the rate at which subsequent children are conceived, once an above average child is born. As a consequence, the last-born child will receive more human capital than children born higher in the birth sequence.

Returns to Scale in Household Production. Differences in innate ability are not the only reason that investment in human capital may vary across children in a single family. Up to this point, we have assumed constant returns to scale in household production. For the purposes of this analysis, this implies that children in the household in the same cohort can be assigned the same set of tasks. However, Chernichovsky (1985) suggests that there may be returns to scale for some tasks. Consequently, children within an age cohort may be assigned different tasks. Some may be engaged in household production and others in acquiring human capital.

Along a similar vein, Levison (1991) argues that parents may be diversifying their investment in children. Placing all children in school may expose the family to excess risk from income shocks. As a consequence, some children in the family may be assigned the task of acquiring skills that have immediate market value, such as that which can be acquired with on-the-job training.

Children as Insurance

The Ejrnæ and Pörtner model also offers an explanation for the inverse relationship between family size and education. Large families arise when the random birth of the above average child occurs only after multiple draws from the birth distribution. Such families, by virtue of their large size, are constrained in their ability to invest even in the most innately able of their children. Overall investment is therefore lower than for small families, and investment in above average children is also reduced.

In this model, children are being used as a savings vehicle. Parents are optimally investing in the number and quality of children to maximize the market value of the family as a whole. Of course, in some economic environments, there may be savings vehicles that are better investments than children. In countries that do not have well-developed financial markets, land holdings may offer the most attractive rate of return. If the return to education is low and the return to land is high, then family wealth is maximized by having a large number of child-farmers.

Parents are also motivated to have children as a form of insurance in economic environments in which insurance cannot be purchased at an actuarially fair price; a point made by many authors as reviewed by Pörtner (2001b). Parents may be particularly motivated to use children as insurance instruments when land tenure rights are uncertain. DeVany and Sanchez (1977) found that land reform in Mexico, which made it impossible for land to be bought, sold, leased, or mortgaged, resulted in large family size.

Having children for insurance purposes can have several consequences, as explored by Pörtner (2001b). Since it is the nature of insurance that income is sacrificed to reduce uncertainty, the return to the last child born may be negative. Thus, family size is larger than it would otherwise be. Large family size, of course, translates into fewer resources for human capital investment and, thus, early entry into the labor force. Furthermore, to the extent that children are used to stabilize income, child labor will be positively correlated with the severity and frequency of negative income shocks. By contrast, higher expected future income will lower the demand for children for insurance purposes.

The use of children as a form of insurance also provides some insight into the role of parental education in determining child labor, even after controlling for current income. Educated parents are likely to have higher expected future income and, therefore, be less likely to incur the expense today of having children to insure against low income in the future. Smaller family size for a given present income translates into more resources for human capital formation. Thus, educated parents may have fewer, more educated children because of a reduced need to insure against future poverty.

In teasing out the role of parental education empirically, we will be particularly interested in those studies that control not only for income but also for expected future income and family size. That is, is parental education positively correlated with human capital investment in their children because the parents have higher future income and a smaller number of children, or because they have a deeper understanding of the value of education?

Education, particularly of the mother, has a secondary impact on human capital formation. Child mortality is lower for educated mothers, thus requiring fewer costly births to achieve the targeted family size. More resources are therefore left to invest in surviving children. In this framework, positive income surprises raise fertility. Parents who receive what they believe to be a temporary windfall are likely to invest some of it in having more children. These additional children then provide additional income in the

future when household income returns to a more typical level. As a consequence, income surprises that ultimately prove to be permanent can produce some curious empirical results. Families that have persistently high income that is unexpected are likely to have a larger family size and less human capital formation than we would normally expect. Thus, income growth will more slowly reduce family size when it is unexpected.

Child mortality has conflicting affects on family size. On the one hand, if a child is more likely to survive infancy, the expected rate of return per birth is higher, thus raising the optimal family size. However, the increase in the probability of surviving childhood raises expected future household income, thereby lowering the optimal family size.

Human Capital Formation

The decision to educate one's children has an inter-temporal aspect, as discussed by many authors, most notably Becker (1974). Baland and Robison (2000) make a particularly direct connection of human capital formation to child labor when evaluating the efficiency characteristics of household decisions.

They note that when parents are altruistic toward their children, have the ability to leave a bequest to their children, and have free access to capital markets, then investment in their children's education will be efficient. Parents in this setting optimize by equating the earnings of the last hour of a child's labor to the present discounted value of earnings that would accrue to the family due to the last hour of human capital acquisition in school. That is, the parents act to maximize the value of the dynasty's income.

Capital Market Failure

Problems with inefficient child labor arise when families are credit-constrained, as noted by Laitner (1997), Parsons and Goldin (1989), and Jacoby and Skoufias (1997), and as analyzed by Baland and Robinson. For example, if parents expect family income to be rising over time, then they may find it optimal to borrow against the future so as to smooth consumption across time. That is, it is optimal for savings to be negative when children are young. However, if parents do not have access to credit markets, then they have to rely on internal assets. In the child-labor scenario, parents borrow from the future by putting their children to work rather than investing in human capital that will make their children more productive in the future. Such a strategy, while optimal for the family in this constrained situation, is not efficient. The present discounted value of another hour of schooling is greater than the return to another hour of work.

There is an abundance of indirect empirical evidence, discussed below, concerning the role of credit constraints and educational attainment. However, Dehejia and Gatti (2002) test the hypothesis directly. They estimate a basic model of child labor determination for a panel of 172 countries for the years 1950-60, 1970, 1980, and 1995. The credit-constraint variable is proxied by the share in GDP of private credit issued by

deposit-money banks. They find that a one standard deviation increase in the share of credit in GDP is associated with a 10 percent standard deviation decrease in child labor. They conclude that families with access to credit are considerably less likely to put children to work during a period of economic volatility than parents without access to credit.

Similarly, Jacoby and Skoufias (1997) study the effects of incomplete financial markets on child labor through their analysis of time allocation of children ages 5 to 18 included in the Village Level Studies Survey, 1975-1978, of ten villages in semi-arid India. This work is particularly interesting because it attempts to disentangle credit-market failure from insurance-market failure. This decomposition is accomplished by comparing how families cope with anticipated seasonal variations in income with unanticipated shocks due to variations in rainfall. The use of child labor to smooth seasonal income variations reflects incomplete capital markets, while the use of child labor to smooth variations in rainfall reflects the unavailability of insurance.

Jacoby and Skoufias found that parents make significant use of child labor to self-insure. Small farms were found to be particularly poorly insured. They do not have access to seasonal borrowing. In contrast, large farms appear to have access to insurance but not seasonal credit. However, it is unclear how the consequent irregular school attendance affects human capital accumulation. Over the course of three years, a typical child in a household with limited access to credit acquired 98% of the human capital of a child completely insured against household specific risk.

Nontransferability of Household Assets

The analysis of Baland and Robinson (2000) suggests that as long as asset markets are functioning and there are transfers between parents and children, parents will make efficient working decisions for their children. This is the case if the parents are altruistic toward their children and intend to leave them a bequest, or if children are altruistic toward their parents and intend to support them during retirement. However, Bommier and Dubois (2002) argue that when children have a disutility of work, then even if parents are altruistic toward their children and have access to credit, the amount of child labor will still be inefficiently high.

Bommier and Dubois consider the particular case in which parents choose the amount of child labor and that labor reduces the future productivity of their children. These children, when grown, work and provide a transfer to their parents. Children set the size of the transfer to their parents by equating at the margin their own utility of consumption to the pleasure they get from their parent's consumption.

If a parent makes the child work, that work lowers the child's future income and, therefore, the transfer to the parent. Thus, the child can punish the parent for forcing them to work as a child by reducing the size of the transfer.

They key here is that the transfer declines because child labor makes those children, once grown, less productive than they would have been had they gone to school. That is, the parents are punished for inefficient formation of human capital in their children. However, the unhappiness that the children feel while working does not affect their future income and so does not affect the size of the transfer they pay to their parents. Thus, parents pay no penalty for imposing this distress on their children, resulting in inefficient child labor even though asset markets are functioning properly.

Failure in the Markets for Land or Labor

The model of household decision-making outlined above presumes that households have access to perfectly functioning markets for land and labor. However, as a practical matter, there may be several types of market failure that will alter the optimizing decisions combining children and other household assets. Skoufias (1995) emphasizes the importance of the difficulties that families may have in employing labor or in leasing land. There may be, for example, high monitoring costs associated with the use of non-family labor. As a consequence, families may have difficulty adjusting toward the household's desired cultivated area, given their reluctance to employ labor from the spot market.

The implications of labor-market failure for child labor are significant. In a model with perfect labor and land markets, the investment in children should be positively associated with land holdings through the income effect. However, in the presence of labor and land-market failure, a family with large land holdings may use the children to work the land rather than invest in human capital. Indeed, Skoufias (1995) finds in empirical analysis of six villages in a semi-arid region of India for the period 1975-1984, that the larger the number of adult males and children in the household, the smaller the amount of land leased out and the greater the amount of land leased in by the family. This is the case even after controlling for other household assets, other work opportunities, and education level of the household head.

Market imperfections in the capital and labor markets can further interact, with adverse consequences for children. To the extent that land is used as a savings vehicle, land holdings may be dispersed over a large number of families rather than concentrated in the hands of a small number of large efficient farms. However, optimal use of the land may require child labor inputs if there are also significant monitoring and moral hazard issues with hired labor.

Labor market failure can also contribute to child labor when it is accompanied by adult unemployment, as analyzed by Basu (2000). Basu considers the impact of an adult minimum wage. If the statute specifies a wage that is above the equilibrium level, then adult unemployment may emerge. Parents may bridge the gap in earnings by putting their children to work. The analysis by Basu is part of a general observation concerning the interrelationship between income inequality and child labor. Ranjan (2001) concludes that in an economy where child labor is inefficient – that is, the return to

education outweighs the forgone earnings of a child, but poor households with an uneducated head do not have access to credit markets – then greater income inequality is associated with more child labor. In contrast, Rogers and Swinnerton (2001) emphasize the opposite. For economies that cannot support the entire population without child labor, increased inequality reduces child labor. In this case, if all families have an equal share of household income then all families will require child labor to survive. However, if income is unevenly distributed, then families in the upper half of the distribution may be viable without putting their children to work. In this case, the number of working children will decline.

Bargaining Failure

Several theories propose the possibility that bargaining failure is a contributing factor in child labor. Becker (1993) and Baland and Robinson (2000) make a compelling case that non-altruistic parents fail to invest in an efficient level of human capital in their children because the child cannot pre-commit to repay the loan made by the parent to the child while in school.

Genicot (1998) suggests that even when parents are altruistic toward their children, bargaining with the parent's employer may give rise to child labor. He argues that for households at a very low level of income in which the intake of nutrients is suboptimal, an employer may seek to increase a worker's productivity by paying a higher wage. The expectation is that the higher wage would be spent on food, thereby making the worker more productive. However, if the worker has a family, some of the increased wage may be spent increasing the consumption of family members other than the worker. Thus, the sought after productivity-enhancing benefits of the higher wage will not be realized.

In order to internalize the leakage, the employer may seek to employ all members of the family, including the spouse and children. The reward to the family of supplying the child for work is not only the child's wage but also the increment to the parent's wage because he/she is no longer sharing productivity-enhancing food with other members of the family.

Non-Altruistic Parents

Up to this point, we have, for the most part, discussed family decision-making under the assumption that parents are at least partly altruistic toward their children. However, it is interesting to examine also the possibility that parents are willing to have children only if they receive an adequate return on their investment. We consider how the two theories differ in terms of their implications for the treatment of children. Although it may seem, at first, that there should be strong testable contrasts between the two models, this is not, in fact, the case. This is akin to Becker's (1974) *Rotten Kid Theorem*, except that in the case of child labor we are considering the *Rotten Parent Theorem*.

Consider, for example, the analytical framework of Cigno and Rosati (2000). In their model of non-altruistic parents, families abide by some set of rules requiring each child to pay an amount *T* to their parents when an adult. *T* itself is a function of human capital formation activity and childhood consumption. Parents have an incentive to maximize the value of their offspring once they grow to adulthood because it also maximizes the value of their income in old age.

Concerns for the time-consistency of the arrangement presumed by Cigno and Rosati lead to the possibility that children will not make the transfer *T* to their parents as expected. That is, Cigno and Rosati have not addressed the commitment problem raised by Baland and Robinson (2000) and Becker (1993).

Lopez-Calva and Miyamoto (1999) attempt to address the child's commitment problem by constructing a social norm that produces children who find it optimal to fulfill their filial obligations to their parents. They consider an infinite-horizon over-lapping generations model. Each generation has to choose how much to educate its children, how much to save, and how much to transfer to its parents when they retire. If one generation chooses to educate its children, those children will be more productive in the future. However, the parent will get a payoff from the investment in its children only if the children decide to make a transfer back to the parent at retirement.

Whether or not the transfer in retirement is received depends on whether the family is participating in the following cultural norm: If I pay a transfer to my parents when they retire, my children will pay a transfer to me when I retire. Each generation chooses to participate in the cultural norm only if its own utility under the norm is higher than without it. Thus, an efficiency-enhancing social structure exists that requires each participant to contribute before receiving a benefit, eliminating the commitment problem identified by Becker and Baland and Robinson.

Although the Lopez-Calva-Miyamoto model is essentially a model of retirement, it gives parents a material interest in the human capital formation of their children. That is, they now have an incentive to maximize the earning power of their children even if the parents are not altruistic. Under what conditions will such a cultural norm emerge as an equilibrium? A high rate of return on education and a low rate of return on physical capital formation will raise the rate of return on the cultural norm relative to savings and the holding of physical capital as a vehicle for providing for retirement.

There is considerable statistical evidence of non-altruistic parents, such as Burra (1995), Gupta (2000), and Parsons and Goldin (1989). Ray (2000) finds mixed evidence that the altruistic feeling that parents have for their children increases with household income.

The Mother's Stature in the Household

The unified model above presumes that parents jointly solve a family maximization problem. However, alternatively, we may assume that the parents maximize a weighted family welfare function, where the weights depend on the bargaining power of the mother and father. It is well established that households in which the mother has more bargaining power than is typical spend more on children's clothes and food and less on tobacco and alcohol. (See, for example, Kanbur and Haddad, 1994).

However, Basu and Ray (2001) reason that the relationship between maternal stature in the home and the incidence of child labor is not monotonic. In fact, they find that a balance of power between parents is more likely to reduce child work than a family in which all decision-making is concentrated in the hands of a single parent. The reasoning is straightforward. Consider a household in which both parents have disutility for child labor but enjoy the goods that the added income can bring. If either parent completely controls the purse strings, then the additional income earned by children will be devoted entirely to the goods that they desire. Hence, at the margin, the powerful parent will weigh their own disutility for child work against the value they themselves place on the goods purchased by that labor.

By contrast, consider decision making in a balanced household in which each parent controls half of the household income. In this case, each parent weighs their disutility from putting their child to work against the goods that can be purchased with only half of the child's income. Clearly, both parents will chose a smaller amount of child labor when they only control half of the income, because the benefit is now smaller than before but the psychic cost of putting their child to work is just as great.

The psychic cost of child labor has a public-good quality in the household. That is, each parent suffers the cost of putting their child to work, whether or not they enjoy the benefit of the proceeds. By contrast, spending the proceeds of the child's labor has a private-good quality. When one parent controls all household spending, the powerless parent has no ability to inject his/her willingness to pay to reduce the level of child labor.

Analyzing household data from the Nepal Living Standards Survey (June 1995), Basu and Ray find that child labor is highest when the father is dominant in the household and lowest when there is a balance of educational attainment in the household. Further, while it is preferable to have an educated mother in lieu of an educated father, children fair best in a balanced household.

Children's Stature in the Household

The willingness of children to work, aside from their parents' requirement that they do so, may also play some role in determining the level of child labor. As with mothers, an increase in the share of household income earned by children may enhance their role in decision making in the family. Moehling (1995), in her empirical analysis of early 20th

century urban America, finds that working children received a larger share of household resources than nonworking children.

Indeed, some of the most challenging theory concerning child labor attempts to simultaneously determine the amount of child labor and the amount of bargaining power that the child has in the household (Moehling, 1995 and Bourguignon and Chiappori, 1994). These models are complex due to the fact that the amount of bargaining power that the child has is determined by the fraction of household income earned, but the fraction of household income earned is in turn an outcome of the bargain over how much the child works.

If we resolve this debate in favor of determining bargaining power as a function of potential earnings power, as suggested by Basu (1999), we can provide an explanation for the startling rise in the stature of the child throughout the 20th century. For it remains something of a mystery as to why current day parents continue to invest in the formation of human capital in their children well past the age of twenty years old.

For the sake of argument, assume that bargaining power in the household is a function of *potential*, as opposed to actual, earnings. In such a case, one of the impacts of an upward-trending worker productivity profile is to raise the stature of younger members of the household. This is the case because younger members of the household ultimately will be more productive and thus earn more than their older counterparts when these younger members finally do enter the labor force. Thus, one of the effects of the technology revolution was to ramp up the worker productivity profile and tilt bargaining power toward younger members of the household.

Basu (1999) notes that such bargaining games have potential to reach deeply into the sociological construction of families. For example, the game described above may not have a unique equilibrium. As a consequence, child labor may be deeply imbedded in a complex interaction between bargain and outcome that may not be readily amenable to policy intervention.

Tuttle (1999) adds a second dimension to the issue of child stature within the home. She argues that one of the effects of technological change in the textile mills was to create employment opportunities for children distinct from their parents. That is, some children were employed in the textile factories not in a subcontracting relationship with their parents, but directly by the plant manager. As a consequence of these new employment opportunities, parents found themselves in competition with mill managers for the labor services of their children. The consequent increased bargaining power of children raised their stature in the home.

Intrahousehold Externalities

Parental bargaining models raise the important question of whether members of a family are willing to share their personal capital with other members of the family. Basu,

Narayan, and Ravllion (2001) theorize that family members will share their personal capital, such as literacy, with other family members, provided that it does not alter their relative bargaining power. So, for example, a literate husband may be unwilling to share the benefits of his literacy with his illiterate wife, if sharing erodes his pre-eminent decision-making authority in the household.

However, there are cases in which sharing the external effects of literacy may improve the prospects of the literate member of the household. For example, a literate mother who is able to help her children with their schoolwork may raise the return to education. This may accrue benefits to her in the form of greater transfers from her children in her old age.

Multiple Equilibria

Models that are characterized by some discrete switching regime are commonly characterized by multiple equilibria. For example, Basu and Van (1998) model a family in which altruistic parents withdraw their children from the labor force once adult wages have reached some critical level. As a consequence, the supply of labor is increasing in the wage below this critical level. Then, once the critical level is reached, parents begin withdrawing their children from the labor force. Consequently, the supply of labor begins to bend back. Once child labor has been reduced to zero, the supply of labor resumes its upward slope.

As a consequence of this configuration, the demand for labor may intersect the supply of labor more than once. There are then two stable equilibria, a low-wage equilibrium characterized by child labor and a high-wage equilibrium in which children are all attending school. Developing countries may be stuck in this low-wage child labor trap. The low-wage child labor trap is characteristic of a number of dynamic models, including Basu (1999). Such models provide a basis for compulsory education policies designed to eliminate the low-wage equilibrium and are discussed below.

Economic Crisis

Economic volatility can affect household decision-making through a number of channels. On the one hand, a decline in economic activity that reduces current employment opportunities relative to the future may lower the opportunity cost of an education relative to its future payoff. Thus, families may decide to increase educational attainment. However, for families that are credit-constrained or lack access to employment insurance, the impact may be the opposite. Children are withdrawn from school and put to work in order to span the economic downturn.

There is considerable evidence that families in developing countries adjust labor-market activity of the children in response to shocks. Jacoby and Skoufias (1997) find that parents in rural India withdraw their children from school during an unanticipated

decline in crop income. Duryea (1998) finds that paternal unemployment during the school year reduces the probability of grade advancement for boys and girls.

Behrman, Duryea, and Szekely (1999), find that for 18 Latin American and Caribbean countries, macroeconomic instability, as measured by volatility of international terms of trade and GDP, has played a dominant role in the slowdown in educational attainment since the early 1980s. Similarly, Flug, Spilimbergo, and Wachtenheim (1998), analyzing cross-country panel data, find a significant negative correlation between schooling and macroeconomic activity.

Skoufias and Parker (2002) study the impact of economic shock variables on time use by Mexican 12-17 year olds using the National Mexican Urban Employment Survey. Analysis is conducted on families during the economic crisis of 1995 and the recovery period of 1998-1999. Shocks are measured by such variables as the male and female unemployment rate. They find that, on impact, Mexican families largely turn to older adult males and females to augment household income, though there is some measurable effect on the schooling of children. However, shocks have a significant effect on whether children continue in school in the next school year. The effect is most notable for female children, suggesting that these girls are replacing the mother's work in home production. Finally, "safety net" programs had a significant effect on the effect of macroeconomic shocks on investment in human capital.

In comparison, Cameron (2002) analyzes the effect of the economic crisis in Indonesia during the late 1990s on education, labor force participation, and health. Based on data from four villages in the 100 Villages Survey, school attendance dropped slightly at the onset of the crisis but is now higher than pre-crisis levels. Fewer children are also working, though the ones that do are working longer hours. Of children ages 15-19 in 1998, nearly half worked 35 hours or more per week, and 14% worked 55 hours or more.

However, Cameron's analysis is not entirely supported by Manning (2000). While it is true that the there is only a small change in aggregate labor-force-participation rates and enrollment rates in 1998, as compared to 1997, Manning documents a dramatic increase in the number of street children in Indonesia. Children have become a common sight, selling food, drinks, and newspapers at most intersections, particularly in Jakarta. The Department of Social Affairs estimates that children working in this capacity have risen from 10,000-15,000 before the crisis to around 50,000 in 1999.

Lim (2000) found similar results for the Philippines. Enrollment rates for primary school fell from 99.2 percent in 1997-98 to 98.1 percent in 1998-99. This change for elementary students is quite small. However, the enrollment rate for secondary students fell by 7.2 percent and the enrollment rate for high school students dropped from 76 percent to 70 percent. Labor-force-participation rates also rose for children ages 10-14, from 9.6 percent to 10.6 percent. For males, the rate rose from 11.7 percent to 13.4 percent.

Some additional evidence can be found from the way that families respond to other types of unanticipated adverse events. Pitt and Rosenzweig (1990) study the effects of an increase in infant morbidity on the time allocation of families. Based on analysis of the 1980 National Socioeconomic Survey of Indonesia, a high rate of child morbidity increases the time of teenage daughters spent in home production and reduces their formal labor-force participation and educational attainment.

III. Household Survey Research

Theories of the time allocation of children discussed in the previous section have been subject to extensive empirical testing. In a seminal contribution to the empirical literature on family structure, Rosenzweig and Evanson (1977) simultaneously estimated the relationship between fertility, sex-specific school enrollment, and child labor-force participation rates for 189 rural districts of India in 1961.[1]

Rosenzweig and Evanson's work subsequently spawned an industry of survey research on the demographic and economic variables that determine the supply of children to the labor force. Although the results vary somewhat from country to country, some underlying themes emerge consistently across all studies. This research provides us with the most consistent evidence available on the structure of the household and the determinants of the supply of child labor.

The existing body of survey research on child labor is summarized and discussed in the Appendix. Here we will confine ourselves to a report on the results obtained by Rosenzweig and Evanson and then discuss some general lessons to be drawn from this body of literature.

The fertility equations generally support the hypothesis that the returns to children are higher in larger families. A ten percent increase in the child wage rate is associated with a six percent rise in family size. Large land holdings also increase family size. However, family size declines as the opportunity cost of children rises. A rise in the wages paid to the mother by ten percent would decrease family size by almost eight percent. Furthermore, children appear to be normal goods. A ten percent rise in the wages paid to adult males raises family size by three percent. The authors attribute this to a pure income effect on the number of children, because fathers do not participate in household production. Father's education appears to have no significant impact on educational attainment of children, but mothers with education above the primary level have smaller families.

Turning now to the education equations, variables that raise the productivity of child labor, such as land holdings, land productivity, and the child wage, all lower educational attainment. However, variables that raise the opportunity cost of children also raise

[1] Numerous econometric issues arise in Rosenzweig and Evanson (1977) and are discussed in Schultz (1997).

educational attainment. Most notably, in regions where the mother's wage is high, she substitutes away from mothering toward market work. However, the children she does have are more highly educated than average. This is particularly the case for her daughters.

Finally, there are the labor force participation equations. As predicted, all variables that raise the return to child labor and increase family size also increase the incidence of child labor. However, a rise in the mother's wage that lowers family size also lowers child labor. Further, mothers who have more than a primary level of education also are more likely to educate their children.

Survey Research and Child Labor: What Have We Learned?

1. *Education Status of Parents.* Parental education plays a persistent and significant role in lowering the incidence of child labor, above and beyond the impact on family income. The results presented on this are quite robust, as reviewed by Strauss and Thomas (1995). In some cases, such as Cote d'Ivoire, the parent's level of education overwhelms all other family characteristics.

Several theoretical contributions on the determinants of child labor emphasize the importance of educating a single generation of parents and the long-term implications for decision-making in future generations. The theoretical mechanism draws attention to the impact that an education has on the parent's human capital and income. That is, educated parents earn enough income to afford to educate their own children.

However, the empirical evidence very strongly suggests that a parent's education affects future generations above and beyond the impact on household wealth. There are several possible explanations. For example, educated parents have a greater appreciation for the value of an education, whereas uneducated parents may simply want to believe that the human-capital decisions made by their own parents were correct. In any event, cost-benefit analysis of programs that concentrate on educational attainment must look beyond the impact that an education has on a future parent's income stream and incorporate the implications for human-capital formation by subsequent generations.

It has also been argued that the human capital of an education provides the family with an asset that can be used in the event of adverse economic events, or that it increases a family's access to formal capital markets. That is, the credit constraint facing a family is relaxed if there is a literate member of the household.

One might also argue that education is a family tradition or reflects family values. Becker (1991) offers us an opportunity to put some analytical structure on such a case for family tradition. It may be the case that families that have a tradition of educating their children are precisely those who have found some mechanism for solving the inter-temporal bargaining problem between parents and children. Recall from the analysis of Baland and Robinson (2000), that if parents are not altruistic toward their children or if

the optimal bequest is negative, then parents will under-invest in the human capital of their children. Children cannot credibly pre-commit to repaying education loans that the parents undertake on their behalf. However, there are, in fact, inter-temporal bargains that can be struck that resolve the impasse even when parents are not altruistic. It is arguably the case that families that have a tradition of educating their young, even though poor, are precisely those who have managed to find a solution to the inter-temporal bargaining problem.

If bargaining issues are highly relevant to understanding the education of children, then we have also found a solution to why parents with extensive land holding do not educate their children. In this case, parents can compensate their children for caring for them when old, that is, not by caring for their children when young but by manipulating the bequest of land.

2. *School Quality*. Several studies point to the importance of school quality as an important determinant of schooling and work. However, school quality is virtually never measured directly. It is quite possibly the case that, when a family is poised to move children out of the workforce into school and fails to do so, the culprit is poor schools. Poor school quality is found to be weakly important in rural Ghana (Lavy, 1996) and very important for Africa generally (Bonnet, 1993). It should be noted, though, that even if poor school quality lowers the value of formal education, there is an abundance of empirical evidence across Latin America, Africa and Asia that the return to education is still quite high and more than offsets the foregone income of children in school.

3. *The Poverty Hypothesis*. The role of household income in determining child-labor decisions needs further study. Clearly, there is a very strong cross-country negative correlation between child labor and per capita GDP. However, the role of family income is not so predominant in explaining variations within a community. We do observe, for some but not all countries, that household expenditures play a central role in child labor decisions.

At first blush, this evidence suggests that there are some external effects across families that make it difficult to put children in school even as income rises or, equally, difficult to put children to work when income is critically low. In particular, none of the studies does a very good job of measuring school quality. The role of cost of schooling, when this is measured, suggests that it may be acting as a proxy for quality. In this case, parents who have the financial ability to forgo the income from their children may still not choose schooling if the quality of schools is very poor. However, if we consider the apparent contradiction between the cross-country negative correlation between household income and child labor, together with the limited significance of income in the survey research studies, this seeming paradox is not so difficult to understand.

Theory tells us to expect a correlation between income and child labor under a couple of different circumstances. On the one hand, if a quality child is a normal good, then there should be a straightforward negative correlation between income and child labor. On the other hand, consider the income-child labor connection if credit-constrained

parents are using child labor to transfer income from the future into the present. In this case, the desire to reallocate income backward through time will occur only if current income is lower than expected future income. Thus, child labor responds not to the level of income today, but rather to the level of income today relative to future income.

As argued by Baland and Robinson, child labor is a device for transferring resources from the future into the present. Children who work do not invest in human capital that would make them more productive in the future. A family will choose to make this inter-temporal shift in household resources when current income is low *relative* to future income. Thus, it is not the absolute level of family income that matters for the child labor decision but, rather, the current level *relative* to future income. There may be families that are quite poor and do not have any reason to expect any change in the future. Such families have no reason to attempt to smooth consumption by putting their children to work.

None of the studies include income relative to expected future income, explicitly. In some cases, the researcher attempts to measure permanent income rather than current income. Such a variable should be significant only if a quality child is a normal good, since a permanent income measure washes away all information about current income relative to future income.

In contrast, nearly all of the studies include measures of household human and physical capital. We may reasonably take these assets as a proxy for the future potential of a household. In such a case, we would expect that a family with low current income, but a lot of household assets, would attempt to shift income from the future into the present through child labor. However, no such pattern emerges. Income does indeed tend to be negatively correlated with child labor. However, household assets are negatively correlated with child labor, as well. Thus, we cannot interpret income and household assets today as a measure of income today relative to income tomorrow. Rather, it appears to be the case that household assets serve to relax the borrowing constraint for otherwise credit-constrained households.

How then can we interpret the dominant role of income in cross-country comparisons? There are a large number of variables that are correlated with GDP that may, in fact, be driving the correlation between income and child labor. For example, high-income countries also have well developed capital markets. Thus, families in high-income countries may more readily smooth consumption over time without resorting to child labor.

High-income countries also tend to have adopted more sophisticated technology. As a consequence, the return to education will be higher. In a child labor force participation equation that includes some proxy for the return to education and measures of access to capital markets, income may have little additional explanatory power.

4. *Children as Complementary Inputs to Household Production.* Household assets play an important role in the child-labor decision. One might expect that the greater the

wealth a family has, the lower the probability of child labor. However, there are a number of assets that require a complementary input of labor, and families may expect to get that labor from their children. Tapping the human capital of mothers in the family also requires an increase in child-labor inputs in home production. Thus, a strategy of increasing access to capital markets may not always lower child labor, at least in the short run.

Nevertheless, the significant role of household assets lends some evidence to the possibility that incomplete credit markets give rise to inefficiently high levels of child labor. For example, the presence of older children in the home considerably reduces the probability of child labor. Note that there is a measurable impact *above and beyond* the contribution that the older siblings themselves make to family income. This is particularly the case for older brothers, who embody the greatest human capital. In addition, a parent's education reduces child labor for reasons other than the impact of education on the parent's productivity. It is possible that a parent's education is viewed as a marketable asset, or it may be a reflection of the informational externalities associated with the value of formal education.

What is not clear is why family assets matter. On the one hand, households with assets can more readily weather adverse events. That is, these assets provide the household with the ability to manage uncertainty and, as a consequence, child labor is not required for this purpose. However, families with assets may also have more access to capital markets or can, themselves, fund a child's education without a formal loan. That is, household assets help families transfer household income intertemporally.

In either case, expanding access to formal capital markets to families who otherwise lack collateral may lead to a reduction in labor force participation rates for children. However, it is also the case that placing constraints on household decision-making, such as mandatory schooling, may at least inhibit the family from turning to internal assets that can be accessed only if children work more. Providing working mothers with firm-level childcare may also help reduce the reliance on older daughters to care for their younger siblings.

5. *Age.* It is clear that older children are more likely to work than younger children. As children grow older and acquire skills, the opportunity cost of schooling rises. This is particularly the case for adolescent boys, who are increasingly able to perform physically demanding tasks as they approach maturity. Thus, it appears that it will be more challenging and costly from a policy point of view to induce older male children to remain in school.

6. *Siblings.* The role of siblings in the household does not appear to be a major deterrent to schooling *once we control for other household characteristics*. The only exception is that there is evidence in some cases that mid-aged children are caring for younger siblings.

When evidence that older children are caring for younger children is combined with the fact that the presence of an older sibling in the house generally raises the probability of schooling, it is possible to make a case that parents are diversifying their human-capital investments in their child assets. The oldest children acquire human capital in the form of on-the-job training and the youngest children receive formal education. However, this interpretation of the evidence does not accord well with the other significant result: the presence of siblings in the same age range tends to *raise* the probability of school and lower the probability of work.

Rather it seems more natural, first, to view children in the middle age range, 10-14, as complements, sharing housework and schooling opportunities. Second, when we observe older children making schooling possible for their younger siblings, this is likely evidence that older siblings help relax the liquidity constraint in the presence of capital-market failure. Third, when we observe mid-aged children caring for younger siblings, it is to help the family make optimal use of the mother's human capital in the form of marketable skills. Thus, policies that focus on lowering fertility may not be particularly effective in reducing child labor.

To the extent that parents diversify their children's assets, this appears to occur along gender lines. In Latin America, parents are more likely to engage in the formal schooling of their daughters, whereas in Africa parents are more likely to school their sons.

7. *Connections to History*. Several results from the survey literature dovetail interestingly with analysis of the British industrial revolution that we will discuss in section V. For example, family subcontracting in the textile mills and mines was common in the first half of the 19th century. As discussed below, there are a couple of possible explanations for this phenomenon. For example, employers may choose this subcontracting relationship in order to internalize the productivity benefits of food consumption. Or families may seek to internalize the benefits of hard working adults on the productivity of their assistants.

In any event, such incentive problems appear to continue to give rise to child labor today. For example, landholding families prefer to employ family members rather than hire labor on the spot market. Similar subcontracting relationships exist between parents and children in a host of production settings.

In addition, family size increased during the early part of the British industrial revolution when the return to child labor and the return to adult labor were declining. But family size began to decline in the second half of the 19th century when adult wages were raising the opportunity cost of having children.

8. *Technology*. Finally, we do not see strong evidence that child labor is driven by the needs of industry. Children are far more likely to be working in a rural setting rather than in an urban setting where factories are located. In addition, labor force participation rates rise with a child's age, strongly suggesting that the productivity of a child increases, the larger and stronger the child is. If child workers were valued for their small stature and

tiny fingers, we should have observed the opposite. To the extent that child labor is a demand-side phenomenon, it appears to occur primarily within the household. Families with a household enterprise or a large tract of land tend to want to put their children to work. That is, the household's physical assets are most efficiently employed when the child's time is used as a complementary input.

Nevertheless, it remains the case that there is some elasticity in the supply of labor by children. Many studies find that an increase in employment opportunities, as represented by a higher wage, will draw children into employment. Thus, if there are demand-side factors drawing children into employment, parents will oblige.

IV. Demand Side Factors in Child Labor

The demand side of the market for child labor has two distinct dimensions. We most commonly think of the demand for child workers arising as a consequence of specific features that children have. It has been argued that the small stature of a child's body or a child's hands make them particularly effective at performing certain tasks, e.g., Marx (1867).

However, technological advances can have effects on the demand for child labor counter to those identified by Marx. Levy (1985), for example, notes that during the 1970s, the availability of credit for Egyptian farmers lowered the cost of technology-intensive inputs. The opportunity to mechanize in sectors such as fruits and vegetables reduced production of more labor-intensive production such as cotton. The demand for child labor, therefore, declined with mechanization. Mechanization has a particularly strong impact on the work of young children who are normally assigned such menial tasks as pumping water.

Indeed, the demand for child labor can be understood as part and parcel of the demand for unskilled relative to skilled labor. Skill-biased technological change will lower the demand for unskilled labor including that provided by children. Concomitantly, the rise in the demand for skilled labor will raise the return to education, providing an additional channel through which technological parameters determine the fraction of time that a child spends working.

Turning now to Levy's empirical results, first, Levy finds, that a rise in the return to children increases family size. For the purposes of the current discussion, a 10 percent increase in cotton's acreage share in a region increased fertility by 1.5 percent. Between 1969 and 1979, cotton's acreage share declined by 28%, causing a 4.2 percent decline in the rural fertility rate. However, output and value added per acre had a significantly *positive* impact on family size. Similarly, a child's wage also raised family size, but the effect was statistically insignificant.

The female wage, as expected, lowered fertility, since the opportunity cost of rearing children rises with the mother's wage. By contrast, a higher male wage raised fertility; thus, even the number of children appears to be a luxury good.

Equations estimating school enrollment mirror results for child labor. Child labor appears to discourage schooling in this context. Interestingly, the only exception is the cotton acreage variable. Cotton picking occurs during the summer months when school is not in session. and therefore it is not in competition for the child's time spent in school.

A similar phenomenon appears to have emerged during the British industrial revolution, as will be discussed in detail below. When textile mills were powered by water and machinery was wooden, children were highly valued for their small size. In the case of waterpower, the machinery was low to the ground in order to be close to the waterpower source. In the case of wooden framed looms, legs on the machines were short in order to minimize mechanical failure due to vibrations. Children were also used in the mining sector to traverse narrow passages, perform menial tasks, and separate and wash the mined ore.

However, technological change throughout the 19th century reduced the usefulness of child workers. The switch to coal as an energy source, the introduction of metal machinery, mechanical devices for dressing the ore, and larger and more complex mines eliminated or greatly reduced the demand for child labor.

Admassie (2002) makes a similar argument concerning the cause of child labor in Ethiopia. There is a fairly strong correlation between the incidence of child labor and agriculture's share of GDP. Although there are several possible explanations for this, Admassie argues that when the production system is "backwards and labor intensive," there is a greater demand for child workers.

Corroborating evidence is provided by Swaminathan (1998) in a study of the city of Bhavnagar in the state of Gujarat (India). Based on a census-type survey of working children in 1995, rising household income was correlated with increased child labor in such occupations as diamond cutting, ship-breaking, cleaning plastic cement bags, and plaiting plastic ropes. In the case of plastic ropes, Swaminathan describes a production process by which children are used as human shuttles, weaving the ropes held by their parents.

It is debatable whether children, in fact, do possess special characteristics particularly valued in an industrial setting. Several studies, e.g., Boyden et al. (1998), have considered the issue carefully and have found little evidence that children are faster or more accurate than adults. They note, for example, that children do not make the most detailed and expensive carpets. This task is assigned to adults.

Similarly, the U.S. Department of Labor (1997) notes that children stitching soccer balls in Sialkot, Pakistan are paid less per ball stitched than adults. Adults receive 20 to 30 Pakistani rupees per ball while children are paid 20 to 22 rupees per ball. The

difference is accounted for by quality. Most high-quality balls are stitched by adults in stitching centers. Children are not assigned this task because they are not strong enough to make the required stitches.

In order to determine the extent to which children have specific and highly valued skills, Diamond and Fayed (1998) estimated the Hicksian elasticities of complementarity between adult and child labor using Egyptian household survey data for the year 1990-91. They found that adult female labor is a substitute for adult male and child labor, but child and adult male labor are complements. Indeed, the elasticity of substitution between children and adult females is estimated to be -11.4419, quite a high figure. Nevertheless, it remains the case that adult male and male child labor are complementary.[2] However, this result does not necessarily imply that there are skills that boys have that cannot be replicated by adult males. Rather, it is more likely that adult males have special characteristics that cannot be replicated by children.

The results obtained by Diamond and Fayed provide an interesting perspective on some historical evidence that will be discussed below. Several historians note that the fraction of employees who are children varied dramatically across facilities. For example, while child workers in England were found to be particularly valuable in 19th century textile factories, plant managers in Ghent, northern Massachusetts and New Hampshire viewed young women, instead, as a source of 'nimble fingers'.

Further, Diamond and Fayed found that adult males and female labor are complements with capital, but child labor is a substitute. This last piece of evidence is most relevant to our current discussion. The authors interpret the evidence to mean that children perform tasks requiring little or no skill. As a consequence, labor-saving devices most readily displace child workers.

Indeed, Nardinelli (1980) argues that the demand for child labor in the English cotton mills in the early part of the 19th century was precisely of this sort. Even though technological innovations made the machines easier to run, that task was not wholly taken over by children. Rather, child labor was complementary to adult labor. Children were assigned the task of picking up waste cotton, running errands, and assisting older workers. Better-organized plants required fewer of these secondary workers, thus depressing the demand for children.

Further, Nardinelli makes the case that the decline in child labor through the middle of the 19th century in England was largely driven by technological change. In 1830, mills began to adopt self-acting spinning mules. The self-acting mules broke threads less often than the hand-operated mules. Piecing the broken threads together had been a task performed by children, but it was no longer necessary due to the technological improvements of the self-acting mules.

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[2] Results obtained by Diamond and Fayed (1998) are broadly similar to those obtained in other studies as surveyed by Hamermesh (1993).

The fall in the demand for children around the turn of the 18th century in the cotton mills was also a consequence of technological change. Prior to the invention of steam-driven plants, mills derived their power from water and thus were often located far from densely populated areas. In order to make up for the labor shortage in rural areas, mills employed children. By contrast, steam-powered mills could locate closer to urban centers where adult labor was plentiful.

Galbi (1996) further argues that the fall in the demand for child labor around the middle of the 19th century arose from the fact that by 1835 an entire generation of children had grown up in the factories and thus was well suited to factory work. Prior to this time, factories could only employ adults without that experience, who may not have had of the mental discipline necessary to work in a factory. The evidence on this issue is discussed further below.

The above discussion leads us to two important conclusions. First, in many cases, young women are perfectly, or perhaps even more, capable of performing the tasks assigned to children. That is, child labor and the labor of young women are very close substitutes in most cases. Second, in tasks where the child's small stature is the valued characteristic, child labor is a close substitute for capital. It is evident from the history of the industrial revolution as well as from a review of current child-labor practices that child labor is rendered almost completely irrelevant by modern technology. Mechanization eliminates the need for children to perform menial tasks such as carrying water, and precision equipment substitutes for tiny bodies and fingers.

However, some of the most profoundly disturbing and depraved dimensions of child labor do, in fact, involve the special physical features of childhood. Consider the demand that arises from pedophilia or those with a peculiar taste for degrading children. Similarly, two and three year old children, used as camel jockeys in the United Arab Emirates, are prized for the precise timbre of their terrified shrieks in the ears of the racing camels. Children are also valued runners in drug trafficking because they are more difficult to detect by law enforcement officials and, once caught, the punishment is less severe than for an adult runner. Thus, child runners are less costly for drug dealers than adults.

Further, some employers believe, rightly or wrongly, that child workers are more compliant, honest and easily disciplined in the work place. For example, it has been noted by some historians of the British industrial revolution that corporal punishment, while routinely used against child workers, was rarely used as a strategy for controlling adults (Nardinelli, 1982). However, some researchers have argued, as discussed below, that employers preferred to hire entire families so that parents could be enlisted in disciplining their own children.

The level of economic activity also exercises a strong impact on the demand for child workers. Duryea and Arends-Kuenning (2001) found significant wage effects for 14-16 year old urban Brazilian children, based on a household survey for the period 1977-1998 conducted by the IBGE. The opportunity cost of schooling is measured by the state-time

variations in the wages of low-skilled males. In equations controlling for adult family income, child labor was markedly pro-cyclical. A rise in the unskilled wage increased the number of children employed. Similar wage effects have been found by Jacoby and Skoufias (1997) for Peru, by Levison, Moe, and Knaul (1999) for Mexico, and by Binder (1999) for Mexico.

However, the demand for child labor arises, perhaps most commonly, in the household. This is particularly the case when child labor is complementary with other household assets such as land, with the capital associated with a household enterprise, or with young children. As discussed above, certain types of failure in the markets for labor and land tenancy can lead parents to turn to the internal market for labor. Aunts, uncles, and the elderly, as well as children in the household who have a personal or financial stake in the enterprise, are considered to be more reliable, honest, and disciplined than labor purchased on the spot market. The empirical evidence on this point is discussed in Sections II and III.

V. Economic History of the Decline in Child Labor

In attempting to understand the phenomenon of child labor today, it is very useful to examine the evidence concerning the decline in child labor in some of the major developed countries over the past century and a half. Several historians argue that the rise and fall of child employment during the industrial revolution reveal a number of relevant lessons for dealing with issues of child labor today. The rather complex dance involving technological change, family dynamics, and social construction during the last two centuries has been explored carefully from a number of analytical and methodological points of view. Below we attempt to give at least a flavor of this analysis together with a discussion of lessons for contemporary policy formation.

The Rise and Fall of Child Labor During the British Industrial Revolution

In order to set the stage for the discussion of child labor during the industrial revolution, it is first worth documenting the extent and conditions of child labor prior to the British industrial revolution. Tuttle (1999) argues that children were already commonly working prior to the industrial revolution. She offers anecdotal evidence that, during the transition of child-labor contracts at the end of the 18th century in the rural sector from *in-kind* payments to *money* wages, the conditions and hours of work became more onerous. For example, since children increasingly came to live at home and commute to work, they may have had to add five or ten miles of walking per day on top of the tasks performed at their place of employment.

In some cases, the working hours were brutally long. Apprentice seamstresses might work from 4 a.m. until 12:00 a.m. particularly during spring and fall. Further, while it is the case that children came to work in factories, by the middle of the 19th century the range of sectors in which children worked was largely the same as it had been at the

beginning of the century. Over half of children who worked were to be found in the agricultural sector throughout the century.

The primary change in child employment pertained to the location of children who worked in textiles. When domestic jennies were replaced by large water frames, many children and their parents lost their livelihood resulting in falling wages. Textile workers responded by seeking employment in the factories, attempting another trade, or entering the unskilled labor market. In some cases, female children left home to become domestic servants. Work for girls as domestic servants was generally regarded as more attractive than factory work. The girls received payment in-kind and acquired skills for use as an adult. However, around the beginning of the 20th century, young women began to take over this occupation from young girls.

Some engagements for boys, by comparison, were quite hazardous. For example, work as a chimney sweep was dangerous and brutal. Young children were compelled to enter the chimneys often through threat of violence. In this case, the small stature of children aged 4-10 was highly valued owing to the narrowness of chimneys. The demand for the labor of small boys declined when chimneys were widened and mechanical devices were developed to sweep narrow chimneys. The practice was completely eliminated after the Law of 1875 that required chimney sweeps to be licensed and conform to all laws regulating age of work.

Factory work began for children with the introduction of water power. These plants were, of necessity, located near waterfalls in rural regions of England where there was a shortage of adult workers. Pauper children were commonly brought from the workhouses of London to operate the machinery. Working conditions in some facilities were truly appalling. Children in some factories were reportedly worked to complete exhaustion, living and working in filthy, poorly ventilated, and dangerously hot conditions.

However, over the 19th century, the pauper apprentices disappeared from the factories and were replaced by wage labor. There remains considerable disagreement as to why this transition occurred. Some have argued that the cost of maintaining apprentices became prohibitively expensive. Others have argued that the Factory Acts played a central role. It is also possible that the first children used in the factories, upon turning 18 years of age, continued to work in the factories but were no longer apprentices. Rather, they were employed as day laborers. Technological change played a role as well. Textile factories using Watt's Steam Engine, introduced in 1769, were located in urban areas and employed free labor.

Child Workers in the Early Stages of the British Industrial Revolution

While Tuttle (1999) and others argue that children were already working well before the onset of the industrial revolution, two changes began to emerge toward the end of the 18th century. First, the sectors in which children worked underwent a transition, with

child workers entering textiles, coal, copper, and tin in droves. Second, children's work became central to the operation of the plant in some sectors. Rather than working alongside their parents, children now went off to work on their own.

Was this transformation due to a change in technology that raised the marginal value product of child workers? Or was it due to parental greed, poverty, or profit-maximizing behavior on the part of firms? One can tease out some of these different influences using simple demand-supply reasoning. If the number of children rises and the wage paid to children also rises, then we have a demand/technology driven change. However, if employment rises and wages fall then we have a supply-side phenomenon.

The evidence from the earliest phases of the industrial revolution does not settle this question as neatly as we might hope. For, while we know that the sectoral composition of child employment changed, we do not know whether the number of children working and the number of hours worked rose or fell.

Horrell and Humphries (1995) analyze data on 1781 English working-class households for the period from1787 to 1872. Household budget data are available for several occupations and geographical locations, providing information on household composition, earnings, occupations, and family expenditures. They found limited evidence that industrialization lowered the age at which children entered the labor force. During the 1820s and 1830s, the labor force participation rate for children aged 5 to 9 in mining, factory work, and high-wage agricultural work rose. Perhaps most importantly for purposes of this discussion, the participation rates for 10 to 14 year olds rose for all occupations between 1781-1816 and 1817-1839. After 1840, participation rates then declined for nearly all occupations.

One might argue that children in industrial families were entering the labor force because of rising child wages, particularly relative to adults. But this is not the case after 1840. Horrell and Humphries suggest that it is more likely that putting children to work was the norm, but that families in the industrial sector had more opportunities to put their children to work than families in other sectors. It is also the case that many of the children that worked in factories were initially pauper apprentices with little say in how much they worked or what compensation they received. These children were essentially enslaved. As a consequence, it is difficult to say what wage they would have commanded in a competitive market.

Although technological change appears to be a prime candidate for explaining the pattern of child employment in the first half of the 19th century, parental selfishness is occasionally offered as a competing explanation. In fact, throughout the discourse on the evils of child labor in the 19th century, references to *lazy* and *slothful* parents are common.

Horrell and Humphries produce several pieces of evidence that dispute the lazy parent hypothesis. First, in the early stages of the industrial revolution, children in industrial households contributed less to family income than children in non-industrial households

outside of agriculture. Second, children contributed less than a third of household income. The father's wages were the mainstay of the household, contributing 60-95 percent of the household total. Furthermore, the child's contribution declined after 1840. Declines were most rapid in low-wage agriculture, mining, outworking, and trades families. The decline in the contribution made by children in industrial families occurred more slowly. The only sector in which children increased their contribution to household income during the middle of the 19th century was in high-wage agriculture. At the very least, these numbers dispute the view promulgated by some historians that child workers were the primary source of income for many industrial households.

In addition, Horrell and Humphries consider the impact of the father's wage on child labor. Interestingly, even though wages were rising and child labor-force-participation rates falling in the second half of the 19th century, one cannot make the case for causality. The problem is that child labor-force-participation rates rose in those families that also were experiencing a rise in the father's wage. The wage increase for adult males was most pronounced in industrial families during the middle of the century. However, in spite of their rising wages, these fathers were increasingly sending their children to work. This piece of evidence strongly supports the contention that children worked when opportunities existed, but that families were often constrained to supply less child labor than they considered optimal.

Horrell and Humphries offer a second argument that counters the allegations of parental selfishness as a source of the shifting sectoral employment of children, or at least that characterizes parental selfishness in a less venal form. This analysis draws from the intra-household bargaining literature. The technological change that created a market for the labor of children independent of their parents provided children a meaningful alternative to working under the terms offered by their parents. That is, parents found themselves in competition with factory owners for the labor of their children. The intensification of competition increased the bargaining power of children in the household.

According to this line of reasoning, children were attracted to the employment opportunities offered to them by the factory jobs. Thus, children willingly offered themselves for employment, and the sectoral shift arose from a desire to seek employment where compensation was paid in cash rather than in-kind, as would be the case in a household enterprise. Of course it was the case that, for most children, parents managed to control most of the wages paid. Nevertheless, children were still better off because the rise in their contribution to household income also raised their bargaining power within the household. Thus, the only sense in which parental greed enters in the story is that children would not have sought outside employment if the terms offered to them by their parents had better reflected the contribution that the child was making to household production. However, it would not have been the case, according to this line of reasoning, that parents were forcing their unwilling children into factory jobs.

The issue of autonomous agency is relevant to the debate about child labor today. For example, Iverson (2002) has argued that some child workers that migrate from rural

Karnataka (India) to urban centers do so because of a weak bargaining position in their parents' home. Iverson finds that children who migrate against their parents' will do so primarily as a consequence of household discord. The costs to these children of migrating in terms of the lost opportunity to accumulate human capital are considerable.

Technological Change

Though there are supply-side considerations in the changing role of children, Tuttle (1999) argues that the overwhelming force at work was skill-biased technological change.

As we approach the last quarter of the 18th century, children worked alongside their parents. The children were not paid directly. Rather parents were paid a premium, reflecting the greater productivity of the parent-child work team. The question then is: "what is it about the industrial revolution that changed the role of children?"

Bolin-Hort (1989) makes the case that children were originally drawn into the industrial setting by their parents in a sub-contracting arrangement. For example, textile factory managers found that they could best manage the plant by hiring a single mule-spinner. The mule-spinner would then hire and manage his own piecers and scavengers. However, Tuttle challenges this view because, while children did enter the factories as piecers, they had many other tasks as well. Rather, Tuttle (1999) makes the case for technological change on two grounds. The first concerns the nature of the industrial work setting. Among other characteristics, children were more willing to submit to the discipline of the factory floor.

Tuttle also makes the case that the inventions of the early industrial revolution embodied unskilled-labor biased technological change. For example, Arkwright's roller spinning replaced human *operated* machines with human *attended* machines. The water frame replaced an adult spinner with a machine minder. Cartwright's automation of the handloom reduced the need for effort and strength. In addition, the machines themselves were more easily tended by workers with small stature. The water frame was close to the ground, and the power-looms were situated close together on the factory floor. Further, technological change provided for a division of labor, with many small tasks none of which required more than a couple of minutes of instruction to learn.

In support of the division of labor hypothesis, Tuttle (1999) reports estimates of a return to education outside of industry on the order of 9 to 42.5 percent. However, within industry what mattered were not critical thinking skills but coordination, strength, and the willingness to do repetitive tasks.

The rise in the relative productivity of child workers was reflected in their wages. Between 1830 and 1860 child-worker wages rose relative to adults. For example, Tuttle provides evidence that, between 1833 and 1848, the wage of child piecers doubled relative to adult spinners, rising from 0.21 to 0.42. Thus, according to the technology hypothesis, in the early stages of the industrial revolution, technological change had an

unskilled-labor bias. Firms responded by hiring more unskilled labor (children) and less skilled labor (adults). Tuttle (1999) presents evidence that the relative wages of unskilled labor rose during this period, and we will discuss evidence below that the real wages of skilled workers declined, as well.

However, by the middle of the 19th century the bias began to shift toward skilled labor, thus lowering the relative demand for children, moving them into peripheral tasks and raising the return to education and experience. The shift in the bias toward skill is reflected in a rise in the real return to adult labor after the middle of the century, a process that persisted through to the end of the 20th century.

As Cunningham (2000) argues, while child labor may have been central during the first two stages of the industrial revolution, working children became increasingly marginalized by the beginning of the 20th century. By 1911, children in England were most commonly employed as messengers. By the end of the 20th century, children were allowed to keep whatever wages they earned at after-school jobs and received considerable income supplements from their parents

Technological innovation, however, is to some degree endogenous. It has been argued that some of the machine designs in the textile sector were specifically tailored to the small stature of children. This line of reasoning suggests that the driving force behind the rise in child employment in this sector is a consequence of a rise in supply. Inventors responded by constructing equipment that suited small bodies. Nevertheless, Tuttle argues that the fundamental factor was still technology.

The earliest weaving machines were low to the ground so as to be close to the water that provided the energy source. Second generation machines were set so close to the ground that even child workers were unable to operate them comfortably or safely. Deformities in the leg bones of children were common and attributed to the fact that children spent each day squatting before the looms. Thus, Tuttle asserts that the wooden framed looms were set low to the ground to minimize the vibrations that would have disrupted operations had the legs been tall enough to accommodate adult operators.

Children in the Mining Sector

As just argued, the greater demand for children in the textile sector appears to have been related to technological change. However, the demand for children in the mines appears to be largely driven by the energy and raw material demands of the growing industrial sectors. Between 1842 and 1856, coal mining in Great Britain greatly expanded, with the number of mines and workers quadrupling during this 15-year period.

Unlike in the textile sectors, children in the mines typically worked alongside their parents or other family members. Humphries (1981) argues that mining provided for a division of labor between hewers and colliers, on the one hand, whose tasks required skill and strength and those, on the other hand, whose tasks could be performed by small

children. The productivity of the child assistants was enhanced by the efforts of the adult workers. Thus, adults had an incentive to internalize the external benefits of their own hard work by hiring their own children as assistants.

In most mines, each family worked in an isolated area, permitting them to identify the product of their own labor. By contrast, in those aspects of mining in which there were large economies of scale, such as when ore was loosened by dynamite, subcontracting was less common. Humphries also argued that families had an incentive to bring their children to the mines even if they were not productive. All hewers put their coal in a single pile for transport to the surface. Once at the surface, the colliers decided what fraction went to each hewer. The larger the hewer's team of workers the larger the share of the pile received. Thus, even if children had contributed nothing, the colliers still remunerated their team with a greater share.

The intermediate demand for coal and ore increased the demand for labor in the mining sector, and there were some aspects of technology that had implications for child employment. Advances in the ventilation system beginning in the 1760s made it possible to increase the depth of a mine. A system of trap doors moved the air between the bottom of the shaft and the surface. Tiny children spent their days crouched in corners throughout the mine, opening and shutting the doors as needed. In addition, the introduction of rails and wheeled coal carts reduced the strength needed to transport the coal. Thus, even though hewing was still performed by skilled and strong adults, children took on the task of putters, moving the coal to the surface.

Interestingly, beginning in 1853, Shetland ponies were introduced into the mines, displacing child putters. As a consequence, child labor in the mines began to decline during the second half of the 19th century. In fact, in those mines with tall coal seams, such as in Cumberland, horses were always used to move the coal. Children were never used for conveyance.

The history of coal mining in Great Britain also demonstrates that technological change can alter the demand for children in some very dramatic ways. Although early technological advancement raised the demand for children in textiles, the *failure* of technological change raised the demand for children in mining.

Child workers were valued for their ability to move the coal and ore through low passages. In mines with little potential, the mine-owners did not want to go to the capital expense of building roomy passageways that could accommodate adult putters. Thus, children were substituting for capital, not adult labor. By contrast, mines that appeared to be richly endowed were more intensely capitalized with tall passageways that could be traversed by adults. In this connection, Tuttle establishes a statistically significant negative relationship between seam thickness and the child-to-adult labor ratio in English mines in the mid 19th century.

It is entirely possible that many mines that would have been unprofitable without child labor were brought into service because of the availability of children. Those mines

with thin veins of ore or coal would not produce a sufficient quantity to justify the investment in tall passages but, in their absence, could not be mined by adults. Child labor made these marginal mines economically viable.[3]

In order to tease out the relative influence of demand and supply on the employment of children in the mines, Tuttle looked at evidence on the movement of child wages. As with the textile sector, if wages are rising along with employment then demand factors are paramount. In addition, it is interesting to determine whether the demand for children is arising largely as a consequence of a demand for coal and ore generally, or whether technological reorganization of the mining industry particularly impacted child workers. If the impact is intermediate-demand driven, then wages for adults and children in mining should rise in tandem. However, if changes in the organization of the mines particularly raised the demand for children, then child wages should rise relative to adults.

Evidence from the middle of the 19th century suggests that there was little change in the relative wages of child and adult workers in the mines. However, it should be noted that this evidence is not definitive, since children were typically paid by their parents and so may not have been paid their marginal value product.

Child labor in the mines and factories of Great Britain peaked around 1835. However, the path from that point was not directly downward. After 1870, children began to leave employment, and by the 20th century children were almost completely out of the mines. Nearly all workers were 16 years old or older. In addition, there were no longer any women or children working at the surface dressing the ores.

Why Did Child Labor Decline?

Several explanations for the decline in child labor have been offered by economic historians. These include: (1) the rise of the *bread winner-homemaker* household; (2) the rise in wages of adult males that accompanied industrialization; (3) government intervention; (4) a rise in the return to education that accompanied industrialization; and (5) technological change that reduced the demand for unskilled labor.

While the bread winner-homemaker family emerged as a norm for upper-income families at the beginning of the 19th century, economic forces must underlie its adoption throughout all income strata. In this connection, Cunningham (2000) argues that however we explain the decline in child labor, we must account for the rise in stature of

[3] A similar phenomenon occurred in the decline in child labor in the fruit and vegetable canning industry in the United States, as discussed below. Child labor declined most quickly in those canneries that adopted new technology, whereas child labor persisted in the rural canneries that lacked an incentive to invest in labor-saving technology.

children throughout the twentieth century. Between 1830 and 2000, the cultural perception of children was transformed from one in which children were seen as *small* adults with much the same clothing, privileges, and responsibilities as *large* adults, to a perception of children as treasures on which all discretionary income is spent.

Change in income arguably lies behind this sea change in the perception of children. While real wages grew slowly during the first half of the 19th century, wages rose steadily throughout the second half of the century. Tuttle's (1999) review of the evidence suggests that real wages grew on the order of one percent per year for five decades, perhaps precipitating the change in family structure identified by sociologists. Similarly, Goldin (1981) found that the probability that a child was working in Philadelphia in 1880 was negatively correlated with the father's income.

Brezis (2001) carefully documents the correlation between adult wages, fertility and child labor throughout the 19th century. In an analysis of the English cotton industry, between 1800 and 1840, capital per worker in the industrial sector declined in every decade from 396 in 1800 to 335 in 1830. Real wages in the cotton industry fell during the same period from an index of 98 down to 45. By comparison, in the second half of the century, capital per worker rose in every single decade as did real wages. Family fertility decisions responded to the wage pattern with a lag. Fertility remained constant for the first four decades of the century and then began to rise, peaking in 1870 and then declining.

This u-shaped pattern of real wages observed in the 19th century may be due to the following dynamic path. At the beginning of the century, the population growth rate was higher than savings per unit of capital. Thus, capital per worker was declining, giving rise to a fall in real wages and a rise in fertility and child labor. Growing wealth in the hands of capital owners raised the savings rate so that capital accumulation accelerated. The dynamics are thus later reversed, with capital per worker and real wages rising, and fertility and child labor declining.

In contrast, education legislation is unlikely to have been an important factor in the middle of the 19th century. Mandatory education was not legislated by the British Parliament until 1876, and education was not provided free to the poor until the Free Education Act of 1891. Children had begun leaving the factories and attending school two decades prior to the enactment of these laws. Evidence of rising school enrollment began in 1833. By the end of the 19th century, most English children were attending or had attended school.

Parents' perceptions of the return to education were in part driven by changes in the demand for labor. However, the school curriculum changed as well between 1844 and 1900. Some time was spent teaching occupations and marketable skills to children, rather than simply focusing on reading, writing and arithmetic.

Rahikainen (2001) offers a similar analysis of child labor legislation in 19th century Finland. Child labor became common in Finland during the industrialization period from

1840 to 1870, but then began to decline after the mid-1870s. By 1889, just before the first Labour Protection Law came into force, children constituted only 3.4 percent of the Finish labor force, falling from a century high of 25 percent. Furthermore, while the legislation applied to children working in factories, these children made up only about one percent of all working children. Most working children worked in the rural regions of Finland without legal protections.

Nardinelli (1980) nevertheless argues that there is weak evidence of the effectiveness of the English Factory Act of 1835, which constrained the hours of work per week for a child to no more than 48. While it is true that child labor was already on the decline in the cotton mills for the two decades before the Act was passed, the decline in the employment of children occurred more slowly in the silk industry that was not subject to the Act, although child employment did decline in the 1840s and 1850s.

Change in technology over the century also caused the demand for skills possessed by children to wax and wane. Prior to the industrial revolution, children aided their parents who performed tasks that required skill and strength. The beginnings of mechanization still required skill and strength, but the assistance of children enhanced the efficiencies achieved with the new machines. By contrast, the earliest phase of industrialization at the end of the 18th century created a demand for child workers, independent of their parents. This is the case since the first industrial machines replaced the skilled craftsmen and artisans of pre-industrial England. However, as we move through to the end of the 19th century, technological change reduces the demand for all workers, particularly children.

A similar process emerged in the extractive industries. By the end of the 19th century, the essential task of preparing the material brought to the surface was completely automated. Consequently, the work of women and children was no longer required.

Cunningham (2000) also notes the absence of child labor in the new industries emerging at the end of the 19th and early 20th centuries. For example, children played no role in the electrical or chemical sectors. By 1911, one-quarter of the working boys in Britain under the age of fifteen were employed as messengers. More recently, the process of marginalizing child workers has culminated over time in the reduced use of children as newspaper carriers.

The impact of new technology that replaced child workers was also emphasized by Brown, Christiansen and Philips (1992) in their analysis of the decline in child labor in the U.S. fruit and vegetable canning industry between 1880 and 1920. During this period the proportion of workers in the U.S. fruit and vegetable industry fell from 18 to 3 percent. Family income rose over this period along with changes in technology and the emergence of laws regulating child labor and education. However, there was considerable cross-state variation, which is suggestive of the fundamental forces that reduced child labor. Brown et al. were particularly concerned with separating out the effects of technological change from the passage of compulsory schooling and child labor laws.

Fruit and vegetable processing and canning has two fundamental steps. The preparation of fruit and vegetables for processing is a somewhat haphazard and seasonal enterprise in comparison to the cooking and canning process. As a consequence, cooking was more amenable to continuous processing and was, therefore, more readily adapted to new production technologies. Workers in the cook rooms were hired from craft labor markets and standards for consistent worker performance were high. By comparison, workers in the preparation rooms were hired from the spot market and paid a piece rate. Considerable variation across workers was thus tolerated by employers.

Mothers brought their children to the preparation rooms in part to work, but also in part due to a lack of other childcare. The availability of child labor provided an important supplement to the adult workforce during peak harvesting season. Parents were also enlisted to discipline child workers.

Two types of canneries co-existed in the United States throughout the early part of the 20th century. Rural canneries processed one or two locally grown products and, therefore, were idle throughout most of the year, providing little incentive to invest in the most modern equipment and technology. By comparison, urban canneries attempted to remain in operation throughout the year by processing a wide range of products. These canneries were the first to adopt newly available technology and strove to develop an efficient and continuous production process. Child labor was seen as increasingly incompatible with developing technology that typically involved huge vats of boiling or pressurized liquid.

However, mothers continued to bring their children to these increasingly dangerous plants in order to supplement family income and due to a lack of childcare. Indeed, plant inspectors monitoring the presence of children encountered more resistance from mothers than from urban employers. In some cases, urban canners lobbied in favor of child-labor laws in order to prohibit children in the workplace that they saw increasingly as a source of annoyance, reducing the productivity of their mothers.

Notably, however, the passage of laws prohibiting children in the canneries included exceptions for rural canneries. This evidence suggests that the change in technology adopted in urban centers created an incentive to remove children from the workplace, thus generating support for child-labor laws. However, the laws did not apply to those canneries in which child labor was still productive.

It is also notable that urban employers, who supported laws regulating the presence of children, vigorously opposed restrictions on hours of work by their adult female employees. They were motivated to keep workers on the job to fully utilize their capital, particularly during seasonal peaks. Thus, laws regulating ages and hours of work were tailored to suit the technology rather than the interests of the workers.

Empirical evidence is available to support these conclusions. Child labor declined far more quickly in urban than in rural sectors. During the decline in the urban sectors, families migrated to the rural sector to find employment for their children. This fact

argues strongly for a demand-side story of the reduction in child labor, rather than forces coming from the supply side. From a statistical point of view, the rise in capital per worker had a much stronger role than the rise in family income in explaining the decline in child employment in the canning industry.

Cogan (1982) also attributes the decline in black teenage employment in the United States between 1950 and 1970 to technological advancement. Between 1950 and 1970, the labor force participation rate for black males ages 16-19 declined from 50 to 33 percent, and then declined further to 25 percent by 1978. Several possible explanations for the decline have been put forward, but none account for more than a small fraction of the decline. These include expanded coverage of the Federal Minimum Wage Law, population concentration in urban centers where employment opportunities have been declining, growth in the size of the black teenage cohort, and improved educational opportunities.

Rather, Cogan argues, based on analysis of census data, that mechanization in farming lowered the demand for low-skilled agricultural employment. In 1950, 45 percent of black teenagers were employed in agriculture, but by 1970 agricultural employment accounted for an insignificant portion of black teenage employment. Employment trends for black teenage males were mirrored for agriculture employment generally. As a consequence of mechanization, employment in the farming sector declined by 56 percent between 1950 and 1970. By contrast, in the urban north, there was a veritable explosion in the black teenage population, tripling in this period, with no attendant decline in the labor force participation rate for this group.

The fall in agricultural employment during this period is associated with a dramatic rise in urban employment opportunities. The associated rise in the cost of labor may have provided an incentive to adopt labor saving technologies. For, during this 20-year period, capital per worker in U.S. agriculture tripled. Further, technological change was most pronounced in cotton production, with the widespread adoption of the mechanical cotton-picker. In 1950, 99 percent of cotton was picked by hand, but by 1970 virtually all cotton was picked mechanically.

There is one other interesting conclusion to draw from this evidence. Technological change rather than employment opportunities in the urban sector appears to have been the primary causal factor. For if a rise in the demand for labor outside of agriculture were providing an incentive to adopt labor saving technology, labor would have flowed from north to south where the largest gains in productivity were emerging.

One might wonder, though, why rural southern black teenagers were not absorbed into other occupations. Cogan argues that the rise in the federal minimum wage in 1956 swept away jobs at the bottom end of the wage distribution. It is notable that black teenage employment also collapsed in the southern wood mills, which were covered by federal wage regulations. However, employment expanded in the exempt service sectors.

A second feature of the maturing industrial revolution that contributed to the decline in child labor has been emphasized by Galbi (1996) in England and by Rahikainen (2001) in Finland. Work in factories required new emotional skills, as enumerated by Galbi: regular attendance, consistent work effort, respect for tools and machinery used but not owned, tolerance for close supervision, and the ability to work in close quarters with other workers.

There is some evidence that factory managers preferred to hire children because they could more readily adapt to the work environment of a factory. In fact, some managers believed that if a person did not begin work in a factory as a small child, they could not acquire the necessary state of mind as an adult. According to this logic, then, child labor began to decline when the first generation of child workers matured into adult factory workers.

Of the British factory managers surveyed by the Factory Queries of 1833, 84 percent of respondents strongly preferred employees who had been working in the factory since "infancy." In fact, very few managers employed workers that had begun work in the factory as an adult. The human capital formed from experience working in a factory was well rewarded. Male migrant children ages 11-15 earned an 18 percent wage premium for two years of additional experience working in a factory and females earned a 26 percent premium.

One additional episode in U.S. history is instructive in understanding the striking roles that the demand for child labor and the endogeneity of legal institutions can play in child employment. At the onset of World War II, children once again returned to the labor force. Aruga (1988) notes that, between 1940 and 1944, school enrollment for 15 to 18 year olds declined by 24 percent and the number of employed children aged 14 to 17 rose by two million, a 200 percent increase. Obviously the labor shortage precipitated by the war effort was a driving force.

Not surprisingly, the change in economic conditions precipitated a change in law. Forty-four state legislatures considered amending their child labor laws in 1943. California and Massachusetts granted their governors broad powers to permit children to work under any circumstances they specified. In Delaware, 14 year olds were permitted to work as early as 5 a.m. and as late as midnight. Public campaigns by the federal government and the media to get children back to school were largely ineffective. In the period immediately after the end of WWII, children continued to work. In October 1946, there were nearly three times as many children aged 14 to 17 in the labor force as compared to1940.

The Supply Side of Child Labor

Although there is much evidence concerning the role of technological change on the demand for children, we must also consider the evidence on the supply side. One of the most penetrating statistical analyses of theories of human capital acquisition applied to

late 19th century historical data is that undertaken by Parsons and Goldin (1989). They tested three alternative theories concerning household decision-making.

Model I assumed that parents make child labor/education decisions to maximize family wealth. Child labor arises when the rate of return on an education falls below the market rate of interest. If a child is working, families should accumulate assets equal to the value of a child's work for transfer to the child in the future. In Model II, the families in Model I are credit constrained. Child labor arises as a mechanism for transferring household assets from the future into the present. Children will work only if household assets are zero. In Model III, parents are selfish but cannot control the income of their children once they become adults. In this case, child labor arises due to a desire to have their children earn income during a period in which parents control their children and their income. Child labor and substantial household assets will co-exist.

The theories are tested on a large-scale micro data set of 6,800 industrial families in the United States for the period 1889-1890. The results are striking.

- Model I was rejected outright. Parents appeared to move to locations where there were opportunities to put their children to work even if it entailed a more than offsetting decline in their own wages.
- Parents did not allow children to retain their own wages or accumulated assets equal to the value of their child's labor for transfer as a bequest.
- Model II was also rejected. Parents of working children accumulated substantial assets for transfer into the future but not paid as a bequest to their children.
- The evidence was consistent with Model III. Parents put their children to work even though there were assets available to school them, and the subsequent assets acquired were not transferred to the child in the form of a bequest.
- The gains from child labor were almost entirely illusory. In order to secure employment opportunities for their children, parents moved to locations in which adult wages were correspondingly depressed.

Thus, Parsons and Goldin provide compelling evidence that parents were, at least in part, motivated by their own selfish interests and sought out employment opportunities for their children.

Opposition of parents to schooling children is also discussed by Riney-Kehrberg (2001) in an analysis of public documents and first hand accounts regarding late 19th and early 20th century children in the United States and New Zealand. She evaluates the impact of compulsory schooling laws and technological change and argues that the intervention of reformers failed in part because they simply condemned the practice of requiring children to work without understanding the underlying economics. Rural children were particularly difficult to help because they worked under the close supervision of their parents. Enforcing child labor and compulsory schooling laws would have entailed overturning the authority of the parents in their home, actions that public

officials were loath to undertake. In cases where rural children actually came to class, they promptly fell asleep, probably as a result of the long hours of farm work already undertaken. Not only were parents resistant to educating their children because they were needed for farm work, parents also feared that education would open up new opportunities other than farming. This, in fact, proved to be the case.

What Can the Historical Experience Teach us About Child Labor Today?

The central question for our current purposes is what can we learn from the historical experience that can be applied to child labor today. Currently, children around the world work in a range of occupations, many similar to pre-industrial Britain such as agriculture, mining, brick making, domestic service, and in the shops of artisans and craftsmen. Children also tend to work in partially modernized labor-intensive enterprises. Cunningham's (2000) answer to the foregoing question is "not very much," at least based on our current understanding of historical events. We, however, will argue that the historical experience provides an informative perspective on the present, especially if we include a subtle interpretation of the survey research literature. But let us first consider Cunningham's conclusions.

First, were children fundamental to the development of industry during the 19th century? While it is undoubtedly the case that child workers constituted a large fraction of the industrial workforce, there are some key exceptions. In northern Massachusetts, in New Hampshire, and in the Voortmans mills in Ghent (Belgium), *young women* were thought to have the special features of nimble fingers, discipline, and malleability to work in a factory setting. Thus, while it may be the case that the particular skill-bias of technological change in the first half of the 19th century raised the employment of children, young women may have possessed the requisite skills and diminutive stature, as well.

In fact, children as a fraction of the labor force varied greatly across plants and regions. Cunningham (2000) cites the following figures: In the Voortmans mills, 3.7% of the labor force was under 15 in 1842, and 10 percent in 1859; in Alsace, one-third or more of the labor force was under 15 during the 1820's; in a sample of 43 Manchester mills, 32.4 percent of the labor force was under 16 in 1833; and for 29 mills in Glasgow, 48.3 percent of workers were under 16.

Second, the evidence on the impact of state regulations is ambiguous. We can observe several different configurations: (1) child labor in spite of regulations prohibiting it; (2) child labor declining well before regulations were enacted and (3) child labor declining precipitously in the wake of legal restrictions. As discussed above, child labor was already on the decline before the Factory Act of 1935. However, later in the century, laws appear to have had some impact. Following the 1872 Mines Regulation Act in Britain, children under 15 as a proportion of the total labor force declined from 10.5 percent in 1871 to 6 percent in 1881.

Third, the evidence on technological change is mixed. On the one hand, some technologies were specifically designed for use by children. However, on the other hand, there is considerable variation in child employment across plants using the same technology. One notable example is the use of technology in the cotton industry. In the American south, children and whole families were employed, whereas in the American north, employers relied on the employment of young women.

To some degree, these cross-region variations appear to be the result of supply-side considerations rather than demand-side considerations. In both the cotton industry in the American south and the U.S. canning industry, families insisted on having their children in the workplace. It has been argued that employers in many cases saw these children as a nuisance and thus supported laws banning children in the workplace.

Finally, deep cultural forces certainly played a role in the decline in child labor. Child labor was nonexistent in Japan throughout the end of the 19th and beginning of the 20th centuries in spite of the absence of legal restrictions. Further, the decline in child labor in the West was accompanied by the emergence of the romantic conceptualization of childhood. This phenomenon may be in part a consequence of the decline in infant mortality, as argued by Kabeer (2000). The rise in income may also have played a role in the change in the perception of children if children are a luxury good.

Contrasting views of the role of children in the industrial revolution are offered by Tuttle (1999) and Nardinelli (1991). In Tuttle's view, child labor was prevalent throughout the British industrial revolution but confined to a small number of industries. Children provided the core of the industrial work force in mining and textiles throughout the first half of the 19th century. Children were drawn into these industries because they were attractive employees from the point of view of industrialists. Children were ideally suited to work the machines, and their nature was more compatible with the new industrial regime. Furthermore, technological innovation brought changes that increased the demand for children as primary workers.

Nardinelli argues that children were key to the early phases of the industrial revolution, but were largely phased out by the 1830s. Technological change reduced the demand for children by the 1830s. Children that remained served largely to assist adult workers and did not displace adult employment.

However, it is arguably the case that the poorly capitalized mines of the 19th century and the rural canneries of the 20th century provide the most useful insight into child labor today. Inadequate capital formation that gives rise to the triplet effects of low adult wages, tasks that can be performed by children, and a low return to education lie at the heart of child labor in most developing countries. The extent of capital-market failure that accompanies macroeconomic instability, and inadequate legal institutions that lead to inefficiently low physical capital formation and technological innovation in developing countries, are as important in determining child labor as is the inability of families to borrow to cover education expenses.

There remains considerable debate both among historians and students of child labor today as to the precise role that special features of children played in early industrialization. At one extreme, one can argue that children were and still are fundamental. There are tasks that only small children can perform unless replaced by high precision machinery or other sophisticated tools. Certainly children working as chimney sweeps or putters in the marginally productive mines were performing tasks that could not also be performed by adults or even youths.

However, it is also argued that the nimble fingers, keen eyesight and small stature were fundamental to the operation of the weaving machines of the early 19th century and the knotting of fine carpets today. There is considerable anecdotal evidence, summarized by Tuttle (1999, p. 249), that many employers in developing countries prefer to employ children. Children are valued for the ability and willingness to perform minute tasks for long periods of time in cramped, poorly lit facilities. If such is the case, then child labor arises largely from the demand side due to the needs of technology.

A more moderate position is that early industrialization created the opportunity for employment of children under such circumstances. However, these tasks could be performed by adults as well. Thus, the existence of child labor must, at least in part, be a supply-side phenomenon arising as a consequence of the family's need for the income of children or similar considerations.

An ILO (1996) document supports the view that adults, or at least female adult labor, are closely substitutable for child labor. The ILO report cites as evidence a study of 2,000 weavers in the hand-knotted carpet industry, indicating that children were not more likely to make the finest knots. Further, the finest carpets with the greatest density of small knots are woven by adults, not children.

Corroborating evidence is provided by Swaminathan (1998) in a study of the city of Bhavnagar in the state of Gujarat (India). Based on a census-type survey of working children in 1995, rising household income was correlated with increased child labor in such occupations as diamond-cutting, ship-breaking, cleaning plastic cement bags, and plaiting plastic ropes. Children worked at simple repetitive tasks that did not require skill or training. In addition, the work involved drudgery and exposed the children to workplace hazards.

As argued by Horrell and Humphries in the context of the British industrial revolution, Swaminathan maintains that economic growth that accompanied liberalization created new work opportunities for children that were exploited by their parents. However, the work did not involve tasks that could not also have been accomplished by adults or machines.

While the ILO and other evidence is not conclusive, it certainly is suggestive of the fact that children are not essential to any phase of industrialization from a technological point of view. It also remains the fact that in many industries in which children work,

there is available technology employed in industrialized countries that would completely eliminate tasks that can be performed only by children.

The policy implications of the distinction between demand and supply side effects are quite sweeping. When supply-side considerations are paramount, policies that prohibit child labor in industry will likely only divert children into alternative occupations. However, if children are employed due to the needs of technology, then laws that prohibit children from certain dangerous or grueling occupations will provide firms with an incentive to adopt technological innovations that mimic the special qualities of child workers, provided such laws are enforced.

We also see a second fascinating parallel between the historical experience and evidence gleaned from survey research. In household production and farming prior to the industrial revolution, during the early stages of industrialization of textiles, and throughout the industrialization of the extractive industries, children worked alongside their parents. Several historians go to great lengths to document family subcontracting arrangements that took place in the mines and, to a lesser degree, in the textile mills. Parents brought their children to the mines as soon as they were able to make even the smallest contribution, working alongside fathers who were extracting coal or mothers who were dressing the ore. Children also worked as piecers alongside their mothers in the textile factories.

A couple of different arguments are put forward to explain the preference for employing one's own family members, including the existence of external effects from the production process. However, whatever the reason, we observe a similar phenomenon with child labor today. Parents who can employ their children in a family business will choose to do so even at the expense of the formation of human capital. Skoufias (1995) has suggested that agency problems in the employment of spot labor in the farming sector are to blame. Gennicott (1998) makes a theoretical argument that firms hire families in order to internalize the benefits of food consumption within the family.

Whatever the reason, the proclivity of parents to employ their own children in partially modernized businesses has important policy implications. Policies that promote the development of micro-enterprises may, at least in the short run, give rise to more child labor rather than less even if they raise family income.

VI. Globalization

Although globalization has raised the awareness of child labor, there is also a perception that globalization has resulted in an increase in the amount of child labor. The commonly cited mechanism is that trade between an unskilled-labor abundant/developing country and a skilled labor abundant/developed country will raise the relative rate of return to unskilled labor in the developing country. This change lowers the return to education and raises the opportunity cost of an education, thereby stimulating child labor.

There are several theoretical models of the interaction between world markets and child labor. We briefly review these below.

Trade and the Return to Labor

Maskus (1997) models an economy that produces an export and an import-competing good with some sector-specific factors. Though adult labor is mobile between sectors, child labor is employed only in an informal sector that supplies inputs to the export sector. If we take globalization to be an expanded opportunity to engage in international trade, then a larger export sector will raise the demand for child labor inputs. Presumably, the rise in the demand for child labor will be accompanied by a rise in the child's wage.

We might conclude, at first, that the rise in the child's wage will raise the return to current work relative to the return to education, thereby increasing child labor. In fact, to the extent that developing countries specialize in goods that are unskilled-labor intensive, the return to education may indeed fall.

However, Basu and Van (1998) and Basu (2002) model the child-labor decision assuming altruistic parents. Once the wages of adults reach some critical level beyond which the family's survival is reasonably assured, parents will withdraw their children from the labor force. Thus, in this context, any positive income effects that accompany trade openness will help families approach or even exceed the critical adult-wage level at which child labor begins to decline.

We must also consider the possibility that child labor is, in fact, used intensively in the production of the import-competing good or in the nontraded sectors. In this case, increased trade openness will lower the demand for child labor. If we can make the added assumption that trade is also raising income, then both the substitution effects and income effects in such cases would operate in favor of reduced child labor. However, it should be kept in mind that the returns to education may still decline for a country that is specializing in the goods produced by unskilled labor.

Trade and Credit Constraints

Ranjan (2001) considers the inter-relationship between trade and the returns to education within the context of credit constraints. He models an economy that has a comparative advantage in unskilled-labor-intensive goods. His particular focus concerns the dynamics of the transition out of child labor. Unskilled credit-constrained parents are able to make a transition out of the child-labor equilibrium only after the wage of unskilled adults rises above the subsistence level. Once unskilled wages rise sufficiently so that one generation of unskilled parents is able to educate one generation of children, the dynasty makes the transition to a high wage/educated labor path. Thus, all subsequent generations of children are educated, as well.

Openness will tend to lower the return to skilled labor and to raise the return to unskilled labor. If the return to education is strongly positive but families with unskilled labor are credit-constrained, then trade openness will relax the credit constraint. More children will become educated even though trade lowers the return to an education.

The impacts of trade openness and credit constraints are further explored by Jafarey and Lahiri (2002). They consider a two-period model in which an export good and an import-competing good are produced using fixed inputs of skilled and unskilled labor. Families are rich or poor depending on whether the household head is skilled or unskilled. Children can become skilled by receiving training rather than working in the first period. Parents decide whether to educate their children by maximizing utility over two periods, the utility deriving from both household consumption and the pleasure of having educated children.

In this context, educating a child implies loss of income in the current period, gain in consumption in the second period, and the utility of seeing one's child educated. Thus, at the margin, the pecuniary returns to education are negative, which must be balanced by the psychic value of having an educated child. As a consequence, poor parents choose less education than rich parents. This is the case since poor households have lower consumption and, therefore, a higher marginal utility of income.

A reduction in the interest rate raises the present discounted value of an education. Thus, to the extent that openness implies access to credit at a rate below that prevailing on the domestic market, child labor is reduced and educational attainment is increased.

Opening to trade also raises the price of unskilled-labor intensive goods, thereby raising the wage of unskilled workers and also the wages of child labor. On the one hand, both factors reduce the return to education. On the other hand, the income of poorer families rises, thereby increasing their demand for educated children. Thus, the impact of goods trade on child labor is ambiguous.

Basu and Chau (2002) alter the above analysis to provide for the possibility that labor markets in developing countries are not fully integrated into world markets. Thus, an increase in the supply of unskilled labor will result in a decline in the return to unskilled labor. As a consequence, families that attempt to use child labor as a form of borrowing also raise the supply of unskilled labor. The subsequent decline in family income makes child labor yet that much more likely.

The Basu-Chau analysis takes place in an agrarian setting in which each peasant household is matched with one landlord. During the off-season, families have to live on savings from the previous period. The family can augment consumption if the landlord offers the family a loan during lean periods and is repaid by the peasant household during the harvest season. The peasant family can separate from a particular landlord only after the loan is repaid.

In a particularly bad year, the size of the loan may be so large that it can be repaid only by supplying the labor of the household's children as well as the parents. Since parents are altruistic toward their children by assumption, they will undertake such a large loan only if the benefits of consumption smoothing outweigh the disutility of requiring their children to work.

Despite the benefits of consumption smoothing made possible by the credit offered by the landlord, a family may actually be worse off as a consequence of entering into the linked labor-credit contract. The increase in the supply of labor in an agrarian community causes the marginal product of labor during the harvest season to decline, reducing the going wage and lowering future consumption.

One might expect that families can anticipate the decline in harvest wages and, therefore, would refrain from entering into a linked contract. However, Basu and Chau argue that there is a prisoner's dilemma among peasant households. No single family itself has an impact on the wage. Thus, each family has an incentive to take advantage of the consumption smoothing made possible by a linked contract.

Opening to trade in this model has some surprising implications for debt bondage, the incidence of child labor, and the welfare of peasant households. We presume that expanded trade opportunities raise the return to unskilled labor, including agrarian labor.

On impact, the increase in the wage during the harvest season creates a greater incentive to smooth consumption across the lean and harvest seasons. Child labor may be required to pay off the larger loan. However, the rise in the wage will also give rise to more savings during the harvest season, to be used to sustain the family during the off-season. In the steady state, the increase in the wage raises consumption in both the harvest and off-season, eliminating the demand for more consumption smoothing. Thus, while there may be some increase in child labor accompanying the initial opening to trade, the steady-state impact is neutral with regard to child labor. Furthermore, peasant families are better off as a result of the increase in wages.

To the extent that openness also entails greater access to credit markets, peasant families may be able to borrow at less onerous interest rates. The smaller interest payments reduce the pressure on peasant families to offer their children for work in order to service the household debt.

Finally, there is one interesting twist in the Basu-Chau analysis. As noted above, peasant families have a coordination problem. They may be better off agreeing collectively to refuse linked labor-credit contracts if the subsequent decline in wages makes them worse off. To the extent that participating in the international arena also implies buying into a set of international labor standards that prohibits forced labor contracts, peasant families may find help in coordinating their labor supply decisions.

There is one import caveat to the analysis above. Most of the models discussed conclude that improved access to credit markets that might emerge with globalization

will relax the credit constraints faced by families or erode the monopolistic control of local money-lenders that gives rise to exorbitant interest payments.

However, the L?pez-Calva-Miyamoto (1999) analysis relies on a slightly different mechanism. Recall that these authors use a culturally constructed retirement scheme to create a financial interest in the schooling of children on the part of the parents. Parents invest in the education of their children because it makes them more productive in the future. That enhanced productivity will accrue to the parents in the form of larger transfers when they retire.

Now, the impact of improved access to capital markets on this retirement arrangement depends on the form that this access takes. If, on the one hand, globalization lowers the rate of return that the working generation can earn on their savings, then savings as a vehicle for providing for retirement becomes less attractive. Such families find a greater relative rate of return on inter-generational contracts. Thus, they will renew their interpersonal connections and take a greater interest in the education of their children.

However, on the other hand, if integration of world asset markets provides the working generation with greater access to high yielding investments, then the rate of return on savings will rise above the rate of return on investing in the human capital of their children. As a consequence, the social norm will begin to break down and the commitment problem that children have in bargaining with their parents over an education re-emerges.

Trade and the Political Economy of Child Labor

In the above discussion of household decision-making, child labor choices are deeply affected by institutional characteristics such as the quality of schools, the availability of credit, and laws regulating child employment and compulsory school attendance. One might argue that such institutions, while not exogenous, may be set endogenously with an eye toward maximizing GNP. However, Shelburne (2001) considers the political economy context in which such laws are set. He argues that the social and economic institutions that proscribe child labor reflect the economic interests of those in power.

An interesting example of this phenomenon is provided by Lea (1975). The U.S. Federal Child Labor Act of 1916 gained particular support from northern employers who saw a competitive advantage in supporting federal child labor legislation that would disadvantage southern producers. The advantage arose from the fact that southern employers tended to employ whole families whereas northern producers employed mostly young women.

Similarly, Walker (1970) argues that the AFL-CIO's primary motivation for supporting child labor legislation was to reduce the competition between children and adults for jobs. The interests of the children played only a secondary role.

In addition, when considering the motivation for the English factory acts of the 1830s, it has been noted by many authors (e.g., Rose, 1998) that constraining the length of the workweek for women and children favored steam mills over water mills. Long hours in water mills during some parts of the year were necessary to make up for lost time when water levels were low. More recently, the Sanders Amendment to the U.S. Tariff Act of 1930 was used to punish Sococitrico Cutrale Ltd., Brazil's largest juice exporter, for using forced child labor to pick oranges. While the amendment was seemingly virtuous, Basu (1999) argues that the causal factor driving the charge against Cutrale was not concern for Brazilian children but rather workforce reductions in their Florida plants.

Turning now to Shelburne's analysis in a closed economy context, the returns to other factors of production in the economy may be positively impacted by an increase in the supply of unskilled labor. The real return to skilled labor is certainly increasing in the supply of unskilled labor. Physical capital may benefit as well. However, capital's overall interest may be in having access to a larger pool of skilled workers, which is made possible when children attend school rather than work.

Consider now how opening to trade affects the political economy of social decision-making. The returns to capital and skilled and unskilled labor are now set on world markets and are independent of the local supply of child labor. The economic incentives to preserve institutions that predispose families to put their children to work are thus not as great as in the closed economy context.

In fact, the incentive now lies in the opposite direction. Countries that are unskilled-labor abundant enjoy an improvement in the terms of trade when the supply of unskilled labor worldwide declines. Participating in international arrangements that deter child labor has the benefit of reducing the supply of unskilled labor world-wide, thereby raising the wages of unskilled labor and improving the terms of trade of developing countries.

Empirical Evidence on Openness and Child Labor

Cigno, Rosati and Guarcello (2002) analyze cross-country evidence from the World Bank's *Development Indicators* for 1980, 1990, 1995, and 1998. They regress trade openness (exports plus imports as a fraction of GNP) on the incidence of child labor, real income per capita, health policy (public health expenditure share of GDP), and skill composition (fractions of labor force over 25 that completed primary and secondary education). Child labor is measured by the 10-14 year-old labor-force-participation rate and the primary school nonattendance rate.

If skill composition is not controlled for, trade raises the 10-14 year olds' labor-force-participation rate but has no effect on the nonattendance rate. If skill composition is controlled for, then openness has no significant effect on child labor or nonattendance.

However, if trade openness is measured by the Sachs-Warner index, then trade openness reduces child labor.

Shelburne (2001) undertakes similar empirical analysis. He regresses child labor (the ILO's labor-force-participation rate for 10-14 year olds) on per capita GDP, a measure of trade openness (imports and exports as a fraction of GNP) and economic size (GNP) for 1996 for 113 countries. Child labor is negatively correlated with income, size and openness.

Edmonds and Pavcnik (2002) review the available empirical evidence for Vietnam, focusing on the 1993 liberalization of the rice market. Rice constitutes 44 percent of food expenditures, accounts for 70 percent of all farmland in Vietnam and is the most common arena in which children work. An increase in the price of rice, therefore, raises the opportunity cost of a child's time spent in school. It also raises the opportunity cost of adult labor. Two impacts are possible. First, parents may engage in less home work, thus requiring children to replace them in the home. Second, parents may decide to have smaller families in order to reduce the time spent in child rearing. Finally, there is an income effect. The rise in household income may raise the demand for quality children and relax any credit constraints the family may face.

Given the ambiguous nature of the theoretical discussion, household survey data are analyzed to determine the impact of two rounds of liberalization in the rice market on child labor. Between 1993 and 1998, the average price of rice rose 29 percent compared to the consumer price index in Vietnam. Edmonds and Pavcnik argue that the increase was in part due to liberalization of border controls, most notably a relaxation in the rice export quota.

The empirical analysis estimates the probability of work as a function of gender and age distribution in the family, variations in the rice price, availability of schooling, labor-market conditions, land and resource endowments, and integration into the Vietnamese economy. Edmonds and Pavcnik find that a 30 percent increase in the price of rice is associated with a 10 percentage point reduction in the probability of a child working. Further, the impact is strongly pronounced for rural children who are most likely to be engaged in rice production.

However, for urban children, a rise in the price of rice corresponds to a rise in the probability of child labor. For these children, a 30 percent increase in the price of rice corresponds to a 5 percentage point increase in the probability of child labor. Furthermore, the beneficial effect of the increase in the price of rice accrues exclusively to children in land-holding families. A 30 percent increase in the price of rice is correlated with a 19 percentage point increase in child labor in households with negligible land holdings, whereas for land-holding families, child labor declines by 9.5 percentage points.

To some extent, the rise in the incidence of child labor in landless families, when rice prices rise, appears to be a consequence of the coincident increase in the wages paid to

children. Therefore, for poor families the income effect associated with the rise in the adult wages on child labor is offset by the opportunity cost of education associated with a rise in the child wages. By contrast, in land-holding families, the rise in the price of rice also raises the price of land. This either relaxes the credit constraint or it increases resources in families in which quality children are a luxury good enough to reduce child labor.

However, another factor may be in play that is suggested by the analysis of Skoufias (1995). He finds that land holdings raise the demand for child labor and increase imperfections in the market for spot labor. It is thus possible that the benefit of liberalization arises in Vietnam because it improves the functioning of the spot market. Consequently, land holders are less likely to turn to internal markets to work their land.

This interpretation of the evidence is consistent with another piece of the analysis. In landholding families, the rise in the price of rice *reduces* child labor in the home because adults are engaged in *more* home labor. This suggests that the household was able to make better use of the spot market to work the land, freeing adult family members to engage in home work and freeing children to attend school. By comparison, in landless families, the increase in the price of rice lowers the household production of all family members and increases their market work. Thus, it appears that whatever happened in Vietnam raised the employment of landless families in the production of rice at the expense of home production. Landholding families then substituted toward home production and education of their children.

VII. Compulsory Schooling and Child Labor Laws

Several justifications for these laws have been put forward. One possibility is that parents are not sufficiently altruistic toward their children. In this case, society may have a broad interest in preventing parents from extracting services from their children.

However, Dessy and Pallage (2001) note that child-labor laws have a role to play even if parents are altruistic toward their children. They argue that inefficient child labor emerges as a consequence of coordination problems between households and firms. Firms are reluctant to locate capital in markets that lack a supply of skilled labor. Parents are reluctant to educate their children if there are no jobs for skilled labor. In such a setting, laws that prohibit child labor and impose compulsory schooling can provide the needed signal to firms that the requisite supply of skilled workers will be forthcoming. Firms respond to the anticipated supply of skilled labor by installing the capital that in turn makes acquisition of the requisite human capital optimal *ex post* for the family.

A case for compulsory labor laws can also be made in an economy characterized by multiple equilibria, as analyzed by Dessy (2000). In this model, multiple equilibria arise for reasons similar to those in Basu and Van (1999). Altruistic parents use a switching rule based on the level of the adult wage to determine whether children should work or go to school. Basu and Van (1999) suggest that a ban on child labor can help move the

economy out of the low wage-child labor equilibrium. Dessy (2000) argues in favor of compulsory school laws. Parents are compelled to send their children to school rather than to work. Due to the compelled increase in education, parents respond by lowering fertility. That is, they trade off quantity for the quality of children. The law thus accelerates the transition to a high-education/low-fertility equilibrium.

The Evidence from Compulsory Education Laws in the United States

The first compulsory education law in the United States was passed by Massachusetts in 1852. All states had such laws by 1918.

It is useful to consider some of the more careful statistical analysis of the impact of laws regulating entrance to the labor market and compulsory schooling. Angrist and Krueger (1991) develop a "natural experiment" type statistical technique for evaluating the impact of compulsory schooling laws on school attendance. The 1960-1980 U.S. censuses collected information on the "quarter of birth" and "school attendance as of April 1." Angrist and Krueger argue that if compulsory school laws are effective, teenagers who are 16 years old as of April 1 and live in a state that requires students to remain in school only until they are 16 are less likely to be attending school at the time of the census than 16 year old teenagers who live in states with a mandatory school age of 17 or 18. They find a statistically significant effect of compulsory schooling laws for 1960 and 1970, thus supporting the hypothesis that laws affect schooling behavior.

Acemoglu and Angrist (1999) perform similar analysis on the same data looking for the impact of child labor laws on school attendance. They find, for example, that boys born in states that required 9 years of school before entering the work force spent 0.26 more years in school than boys born in states requiring 6 or fewer years of schooling.

The Angrist-Krueger technique was then applied to earlier periods in U.S. history. Margo and Finegan (1996) have analyzed the schooling choices of 14-year olds reported in the1900 federal census. In this study, 14-year olds are broken into two groups: (1) those teenagers who are already 14 at the beginning of the 1900 school year; and (2) those who are not yet 14 at the beginning of the school year. Margo and Finegan hypothesize that if mandatory school laws are effective, the younger 14-year olds living in a state with a compulsory schooling law should be more likely to be in school than older 14-year olds. However, no such difference should exist for 14-year olds in states without compulsory schooling laws. Margo and Finegan find that compulsory school laws have a positive and statistically significant impact on the decision to obtain *some* schooling for younger 14-year olds. However, the laws had no discernible effect on the probability of fulltime school attendance.

They then considered the impact of compulsory school laws combined with laws that regulate the minimum age of work. The addition of child-labor restrictions is likely to have an additional effect on school attendance, because child-labor laws were more aggressively enforced than mandatory education laws at that time. In this case, the

combination of laws has a statistically significant impact on school choice. Young 14-year olds were 18 to 21 percent more likely to obtain *some* schooling if their access to the labor market was legally restricted. However, the laws did not significantly increase the probability of being in school *fulltime*.

The statistical evidence presented above has been criticized, most notably by Moehling (1999). She argues that the laws mandating school attendance are, themselves, endogenous and tend to follow the decline in child labor rather than precipitate it. That is, cross-state differences in technology, immigration, and real wages are driving both the change in educational attainment and the laws regulating school attendance. Thus, despite the fact that compulsory education laws, child-labor laws, and school attendance are correlated, it is not a causal relationship.

Moehling draws on the fact that most laws around the turn of the 20th century applied to 13-year old, but not 14-year old children. Therefore, when work-school patterns for 13- and 14-year olds are similar, it is unlikely that legal restrictions are affecting household behavior. However, we can detect a role for legal restrictions if 13- and 14-year olds make different work choices particularly in those states with compulsory education laws.

Moehling looks at occupation rates – the proportions of youth that identify some form of employment as their main use of time, as opposed to school. Then, in order to control for differences in the economic conditions across states that might be driving both the legislative process and schooling choice, she first looks at the difference in occupation rates for 13- and 14-year olds in each state *prior* to the introduction of compulsory schooling laws. This gives a baseline against which to compare the difference in occupation rates for 13- and 14-year olds after some states passed compulsory education laws. Moehling also includes a number of other economic and demographic variables that have been shown to play a significant role in child labor decisions, as discussed above.

Moehling finds that the probability that a 14-year old boy would be working fell substantially between 1890 and 1900 in states with newly enacted compulsory education laws. However, she observes a statistically similar decline in labor force participation in states without such laws, thus suggesting that the laws themselves were *not* the causal factor for boys.

Similarly, the labor force participation rates for 13- and 14-year old girls in states that *did* pass compulsory education laws also fell between 1880 and 1990. By contrast, 13 and 14 year-old girls in states that *did not* pass compulsory education laws had *increased* labor force participation during the decade. *Thus, for girls, there is a negative correlation across states between the passage of laws and labor-force-participation rates*.

The above evidence, thus, suggests that compulsory education laws might be affecting work-school choices made by (or for) girls. However, Moehling argues that

such an inference is not correct. Her reasoning follows from the fact that there is no differential effect on girls covered and not covered by the law within a single state. That is, the employment choices by 13-year old girls covered by compulsory education laws are mirrored by 14-year old girls in the same state but not covered by the law. *From this, Moehling infers that the failure of some states to pass laws requiring 13-year old girls to attend school, and the increase in the employment of 13-year old girls in these same states, are being simultaneously driven by other economic factors. These other factors are similarly driving behavior by 14-year old girls not regulated by legislation.*

Moehling then goes on to consider Margo and Finegan's hypothesis that schooling is affected by the combination of child labor and compulsory education laws. Once again, the laws do not seem to be driving behavior. The only case in which 13-year olds behave differently than 14-year olds occurs for boys in states with *no* legislative change. In states with no laws regulating either compulsory education or minimum age of employment, the labor-force-participation rate for 14-year old boys rose between 1890 and 1900, whereas the labor-force-participation rate for 13-year old boys declined during the same period. Thus, the results are running precisely counter to the expectation that laws affect behavior!

In response to the rising labor-force-participation rates for girls in the last decade of the 19th century, there was a burst of legislative activity shortly after 1900. In 1900, 24 states had laws regulating minimum age of employment. By 1910, 43 states had such laws. Perhaps more importantly, by 1909, 34 states had enacted legislation providing for inspectors assigned to enforce child-labor laws.

Moehling then applies her statistical technique to the 1900 and 1910 censuses. In this case, the estimated effect of legal restrictions on school attendance, at least, appears to be positive but statistically insignificant for some groups. However, the impact is small relative to the time-series change.

What can we conclude from this evidence? First, the more carefully executed the statistical analysis, the weaker is the evident effect of legal restrictions on child schooling and labor decisions. Second, it appears that for carefully crafted laws, such as those enacted in the last quarter of the 20th century in England, there is some impact of legislation on behavior at the margin. However, when the age limits specified by the laws are substantially at odds with optimizing decisions by households, they have little effect. For example, the laws written in the United States around 1900 tended to specify 14 years as the cut-off between schooling and work. However, Moehling's evidence clearly suggests that 14 years of age was not viewed as a significant work-school boundary for many U.S. households at that time. Similarly, recently enacted laws regulating work in Brazil have had no effect on household decisions. Thus, mandatory school laws and minimum age of employment are, at best, a complement to other policies designed to alter the family's perception of the appropriate age at which children should begin working.

Finally, the results of Margo and Finegan on the one hand, and Moehling, on the other, are not as inconsistent as they may seem at first. Margo and Finegan focus on the 1900 census because it not only asks whether a child views school as the main occupation but also whether the child is in school at all. Moehling, by contrast, looks at several decades of data and, so, is only able consider whether the laws are affecting a child's perception as to whether school is the main occupation. Neither study finds an impact of compulsory schooling laws or child-labor laws on the child's perception of his/her main occupation. That is, neither study finds that the legal restrictions increase the probability of fulltime schooling.

More recent work has focused on the period 1910-1940. Goldin and Katz (1999) identify this period as the golden age of the high school movement in the United States. In 1910, 9 percent of American youth earned a high school diploma, but by 1935 this figure had risen to 40 percent. During the same period, public resources committed to education as a fraction of community income rose steadily. In 1910, the national average was 0.9 percent, but by 1925 it had risen to 2.5 percent and by 1970, 4.5 percent of income was spent on public education.

The returns to education were a fundamental factor in the high school movement during this period. Based on data from the Iowa State Census of 1915, Goldin and Katz estimated that each year of high school increased annual earnings by 12 percent. Quality education was so appreciated by parents that families often moved to districts with quality schools. Property values began to reflect the value of the educational infrastructure, making school construction a good investment for property owners.

The intrusion of the local government on private education decisions was justified primarily on the basis of imperfections in the market for human capital formation. Goldin and Katz argue that a sort of social contract was formed between the older members of the community who could fund education. The elderly would then receive benefits from an educated community during retirement.

The sustainability of the arrangement depended on educated children remaining in the community in which they were educated and providing services to the elderly. A wide distribution of income could undermine the intergenerational contract since the wealthy are not liquidity constrained. Communities characterized by ethnic and language differences or recent migrations are less likely to sustain such a commitment.

Goldin and Katz tested the social contract hypothesis by considering the role that private and public variables play in determining the high school enrollment rate. Between 1910 and 1928, the high school graduation rate was positively correlated with wealth or income and negatively correlated with the wage in manufacturing. The latter captures the opportunity cost of schooling. Greater access to public universities also increased high school enrollment. It can be argued that the availability of a college education increases the rate of return on a high school education.

High school graduation was also positively correlated with the fraction of a state's population that is 65 or older. Automobile registration per capita was introduced as a measure of income distribution and had a very powerful effect on the high school graduation rate.

One piece of evidence obtained by Goldin and Katz that runs counter to evidence of current developing countries is that the high school movement was most pronounced in rich agricultural areas that were dotted with small towns and villages. As we have seen above, the rate of return to an education in the rural sector tends to be distinctively lower than in the urban sector in most developing countries. Yet the high school movement in the United States began in the states with the largest rural sectors. Goldin and Katz's theory suggests that the cohesion of rural communities makes it easier to capture the external benefits of a high school education. Thus, even though that rate of return may be lower in rural areas, the ability to overcome the failure in financing education is greater.

Goldin and Katz also have noted that the property owners in communities that had invested in a quality school system were able to capitalize their investment into the value of their property. Families with children were attracted to communities that had quality school systems, thereby bidding up the price.

This piece of evidence suggests another form of market failure that may limit the ability of communities to develop a public school system. Families that make the original capital investment in facilities and search costs for teachers will only be able to reap the benefits of their investment during the period in which their children are in school. Such a period is almost certainly shorter than the life of the capital investment. Having future returns capitalized into the value of their homes allows the original families to capture all of the returns from their original investment. However, if property rights are not well established, as is the case in many developing countries, then families will under-invest in their property, including under-investing in community capital such as schools.

Lleras-Muney (2001) analyzes U.S. census data for 1960 to determine the impact of compulsory education laws between 1914 and 1939. She regresses the number of years of education for each individual on individual characteristics such as gender and race, a set of parameters characterizing compulsory education laws pertaining to the individual, characteristics of the state in which the individual resided when 14 years old, and a set of cohort, state and region-specific effects. Results suggest that a one-year increase in the number of years of required education raises the number of days in school by 18. Some additional results are even more revealing. First, legal changes that tightened existing restrictions had a greater impact on educational attainment than laws that initiated compulsory education in a state. Second, the laws had no effects on blacks. It is possible that this group had much lower returns to education or that the laws may not have been enforced for this group. Also, the laws may not have applied due to a lack of available schools and resources.

Lleras-Muney then considered whether educational attainment and laws regulating compulsory education were both driven by common factors or whether the laws themselves increased years in school. In order to test for endogeneity, changes in the law were regressed on average education level in the state, state characteristics, regional dummies, state effects, cohort effects, and region/cohort effects. Higher state wealth, a higher urbanization rate, and a large immigrant population resulted in more stringent laws. By comparison a larger fraction of blacks in the state gave rise to weaker laws and per capita expenditures on education, and manufacturing wages and percent of workforce in manufacturing had no significant effect on the passage of laws. These results suggest that activists groups concerned with the external effects of education were the driving factor behind legal restrictions. Finally, these results suggest that legal restrictions were most likely to affect children in the bottom half of the income distribution.

Thus, while compulsory education laws passed at the beginning of the 20th century may have had little impact, subsequent legal restrictions may have been quite effective. Indeed, Krueger's (1996) analysis of laws passed in Britain suggests a similar result. In the United Kingdom, the legal school-leaving age was changed in 1947, rising from 14 to 15 and then again in 1973, rising from 15 to 16. For each cohort, the modal age at which children left school coincided with the legal requirement and no more than 5 percent of children left school before the legal age.

VIII. The Value of an Education

Much of the literature on the education-work tradeoff for children in developing countries emphasizes the problem of poor schools or the irrelevance to future work opportunities. Boyden and Levison (2000) report on a survey of results concerning the impact of education on adult wages in developing countries. They conclude that an educated adult will earn on the order of 11 percent per year of education more than an uneducated adult in developing countries. However, the debate on this issue is intense. We turn now to consider the evidence concerning the parameters and policies that determine the return to education.

School Quality

Studies estimating the impact of school quality on the skills acquired by children have been plagued by econometric problems, as discussed in Glewwe (2002). We discuss a number of these studies below, summarizing their main results and pointing out some of the problems in interpreting these results.

Harbison and Hanushek (1992) examine the determinants of primary school performance of children in rural areas of northeast Brazil. Performance in reading and math are measured by standardized tests administered in 1981, 1983 and 1985. School quality was measured by ten characteristics: building characteristics; writing materials (e.g., chalk, notebooks, pencils, etc.); availability of textbooks; and graded classrooms.

The only variable that did *not* significantly improve test scores was the availability of graded classrooms. Children appear to learn as well or better in mixed-age classrooms than in an age-segregated environment. With regard to the characteristics of the teacher, neither the teacher-pupil nor teacher experience variables were significant, but teacher salaries were significant, and teacher training improved student performance in math.

Glewwe and Jacoby (1994) examine the 1988-89 middle school achievement test scores for Ghana in reading and math. Of all teacher quality variables measured, only teacher experience mattered to educational attainment. Experienced teachers were more skilled at inducing students to remain in school. By contrast, repairing leaky classrooms and provisioning classrooms with chalkboards were much more important to student success, with libraries providing an additional albeit smaller benefit.

A similar study of primary school for Jamaican students in 1990 found few variables that affected student performance. However, students did benefit from routine eye exams, recent teacher training, routine testing of student performance, and most importantly, the use of textbooks.

Kingdon (1996) evaluates the impact of several school-quality variables on class 8 reading and math performance for 1991. Teacher variables included years of general education, years of teacher training, marks received on official teacher exams, years of teaching experience, and salary. School variables included class size, 17 school building characteristics, and hours per week of instruction. The significant variables were teacher exam marks, teacher years of education, physical characteristics of the school building, and hours of instruction.

All of the above studies attempt to control, though imperfectly, for innate ability, motivation, and parental inputs. Econometric difficulties also arise due to omitted variables, such as teacher motivation, and sample-selection bias.

In order to address these limitations, more recent research has focused on the impact of certain policies such as vouchers or private schools using randomized trials. For example, Jamison, et al. (1981) conducted a randomized trial on a group of first-grade classrooms in Nicaragua. Forty-eight classrooms received radio mathematics instruction, twenty received mathematics workbooks, and twenty served as controls. After one year, students receiving radio mathematics instruction performed one standard deviation higher than the controls on standardized tests, and students receiving the math text performed one-third of a standard deviation higher.

Subsequently, Heyneman (1984) studied first and second graders in the Philippines. Once again, classrooms were randomly assigned to three groups. Group I received math, science, and Filipino textbooks, one for each pupil. Group II received the same textbooks, but each pair of students had to share one set of books. Group III received no additional instructional material. Students in Groups I and II performed similarly on standardized tests and about 0.4 standard deviations higher than Group III.

Glewwe (2002) reports on a series of recent randomized studies in rural Kenyan primary schools. Six studies evaluated the impact of a package of textbooks, school uniforms and construction materials; textbooks only; block grants; flip charts; a package of teacher incentives; and treatment of intestinal parasites.

Some results are as follows. The package of textbooks, school uniforms, and construction materials did not improve performance but did reduce the dropout rate. As a consequence, class size increased by an average of 35 percent. Researchers were unable to disentangle the educational impact of the program from the downward bias induced through larger class size. Textbooks alone did not have a significant impact either, although the better students did appear to benefit. It is possible, however, that the level of the textbooks chosen was not appropriate. The typical median child in grades 3-5 could not read the books provided. Nor did flip charts mounted on walls or easels affect student performance. Finally, treatment of intestinal parasites raised attendance but did not improve performance.

Natural experiments provide a third approach for studying the impact of school quality on educational performance. Case and Deaton (1999) study the impact of adding resources to schools in South Africa after 1993. They find that enough resources to reduce average class size from 40 to 20 increases grade attainment by 1.5 to 2.5 years and raises reading scores, conditional on years of schooling, by as much as two additional years of schooling in a larger classroom.

Angrist and Lavy (1999) study the impact of class size in Israel using data from the early 1990s on 3rd, 4th and 5th graders. They find a strong negative impact of class size on student performance. A one-standard deviation reduction in class size raises reading scores by 0.2 to 0.5 standard deviations and math scores by 0.1 to 0.3 standard deviations.

Policies that affect school choice have also been studied. In Colombia, vouchers were available for poor urban students between 1992 and 1997. The number of vouchers was limited. So in cases in which demand exceeded supply, recipients were determined by lottery. Angrist et al. (2001) find that lottery winners completed more grades due to reduced grade repetition, though the impact is very small. Lottery winners also had higher test scores in math and reading.

Card and Krueger (1996) argue that a natural experiment can also be found by studying the differential effects in education of segregation in the American south in the early part of the 20th century. Levels of education spending varied dramatically across students without regard for their innate ability or family wealth. There was a particularly notable difference between North Carolina and South Carolina, with discrimination against black students being particularly egregious in the latter. North Carolina was among the most progressive states in terms of black education, whereas South Carolina was one of the least. However, by the middle of the 20th century, expenditures by race were broadly similar in the two states.

Card and Krueger focus on the role that pupil-teacher ratio and expenditures per pupil play in determining educational attainment and earnings. They analyze data from the 1960, 1970 and 1980 censuses to identify trends in education and earnings for men born in the Carolinas between 1900 and 1959.

Blacks born in North Carolina between 1900 and 1909 attended classes with 14 fewer pupils per teacher than in South Carolina and acquired 0.65 more years of education. The pattern is reversed for whites. The typical white classroom in South Carolina had four fewer pupils than white classrooms in North Carolina and acquired 0.67 more years of education. Earnings reflect the greater educational attainment of black males in North Carolina, earning six percent more than black males from South Carolina. In both cases, the gaps narrowed as we move through the century.

Acemoglu and Angrist (1999) argue that a similar natural experiment was performed by U.S. states that passed compulsory education laws in the early part of the 20th century. They find, for example, that for males working between 1960 and 1980, men born in a state requiring a minimum of nine years of schooling acquired 0.26 more years of schooling than those born in a state that required six or fewer years. The exogenously imposed additional years of schooling is then used to estimate the return to education. They find private returns on the order of 6 to 10 percent.

Based on the above discussion, the evidence on school quality and school performance and how we define school quality is not definitive. Glewwe (2002) argues that we have learned a great deal about methodology but not much about school quality from the last 20 years of research.

Return to Cognitive Ability

Based on the above discussion, it seems clear that schools in developing countries are not very adept at imparting cognitive ability. That raises a second question: What are the returns to cognition in developing counties?

Bossiere, Knight and Sabot (1985) examine the returns to cognitive ability in Kenya and Tanzania. They estimate a standard wage equation including work experience and years of schooling, with the addition of scores on reading, math, and the Raven's test of abstract thinking ability. The results are quite pronounced. Measures of cognitive ability are always statistically significant and years of schooling and the Raven's test are not. However, when the cognitive measures are omitted, years of schooling become significant. The authors conclude that years of schooling raise wages because they impart skills, not because they provide credentials to innately able individuals.

Glewwe (1996) performs similar analysis on workers in Ghana and also finds that education imparts cognitive skills that are rewarded in the market place. Glewwe and Jacoby (1994) also calculate rates of return to specific educational infrastructure in Ghana. The rate of return from providing books is 6-7 percent and for blackboards 13-24

percent. More broadly, the rate of return to an additional year of schooling was estimated to be 4-6 percent.

The role of formal education in developing skills that are rewarded in the marketplace has been confirmed for Pakistan by Alderman et al. (1996), for Morocco by Angrist and Lavy (1997), and for South Africa by Moll (1998). Cognitive skills have also been found to raise self-employment income in Ghana by Jolliffe (1998). Though, interestingly, cognitive skills do not raise farm income. The authors suggest that the returns to numeracy and literacy are low in farming, which in developing countries involves routine activities unaffected by technological advances.

The results obtained by Jolliffe also caste a new light on the role of land holdings on child labor/education decisions. We hypothesized above that imperfections in the market for spot labor in the agricultural sector led families to turn to the internal market. Thus, large land holdings translated into more child labor. However, it is also the case that the returns to education in farming appear to be low, at least in Ghana. Thus, parents who expect to leave a legacy of farming to their children do not have an incentive to obtain an education for them even if they are altruistic toward their children.

Some of the econometric problems with a cross-section of schools within a country can be ameliorated with evidence from a cross-section of countries. Lee and Barro (1997) relate test scores, dropout rates, and grade repetition rates to various measures of school and family inputs for 58 countries. The key family variables are family income, parents' education level, and father's occupation. School resources include pupil-teacher ratios, expenditure per pupil, teacher salary and education level, length of school year, and teaching materials. Test scores are from examinations in mathematics, science, and reading conducted by the International Association for the Evaluation of Education Achievement and International Assessment of Educational Progress and cover primary and secondary students. Results show a very strong impact of family inputs on student achievement, including both family income and educational achievement of parents. In contrast to other studies, Lee and Barro find that the pupil-teacher ratio lowers achievement while the average salary of teachers is positive and significant. As with other studies, expenditure per pupil is not important, nor is the length of the school year. Lee and Barro find that similar factors determine the dropout and repetition rates.

Duflo (2001) finds that the school building program undertaken by the Indonesian government in the mid 1970s had a strong impact on educational attainment and wages. Between 1973 and 1978, the Indonesian government built 61,000 primary schools. Duflo finds that children aged 2 to 6 received an additional 0.12 -0.19 more years of schooling for each school constructed per 1000 children. The increase in education translates into a 1.5 to 2.7 percent increase in wages for each additional school built per 1,000 children. The implicit rate of return to education ranges from 6.8 to 10.6 percent.

The rate of return to schooling can be found from the ratio of additional income to forgone income. One estimate of the return to education in India (The Probe Team, 1999) finds that a primary education in India raises income by 20-100 percent. A

discount rate of 3.7-14.9 percent would be necessary to make education profitable. However, Basu (1997) finds that the effective interest rate faced by poor borrowers in India may be as high as 16-200 percent. Low rates of return to education in other developing countries were found by Saha and Sarkar (1999) for India and by Cohen and House (1999) for urban Khartoum.

There are a number of possible explanations for the low rate of return to education in developing countries. It may, for example, be a reflection of the absence of knowledge-using capital or technology. However, Fleisher and Wang (2001) hypothesize that the rate of return may be a consequence of imperfectly competitive characteristics of the market for skilled labor in developing countries. They base their views on the analysis of the return to education in China. In particular, the ratio of wages of skilled to unskilled workers is far smaller than the comparable labor productivity figures for urban workers. However, as is the case in other studies, the wage-productivity gap is not as pronounced in the rural sector where the returns to education are fairly small.

Fleischer and Wang argue that the skill-wage compression and low returns to schooling in China are the result of restrictions on worker mobility and unexploited economies of scale. The degree of monopsonistic exploitation is startling. They estimate that the marginal product of aggregate labor in urban markets in their sample is 7.7 times the average earnings.

However, in more fluid Chinese labor markets, the return to education appears to approach levels achieved in other countries. Wan, Maruyama, and Kikuchi (2000), based on a small sample of workers, find that in Harbin City the rate of return for managers with a college degree was 13.8 percent.

Indeed, any policy that interferes with the labor-market function deters human capital formation and encourages child labor. Access to good jobs for women will raise the return to education, as noted by Anker (2000).

Market Work and the Impact on Schooling

Child labor will be deterred to the extent that formal schooling and work are in competition for a child's time. Based on a review of the available evidence, Anker (2000) concludes that work on the order of two-three hours does not interfere with schooling. Further, it remains the case for many children that the most valuable form of education is acquired through work in apprenticeships or in the family business. In these cases, work and education coincide.

IX. Conclusions

We have presented above a description and discussion of the state of scholarly debate on the supply and demand-side determinants of child labor. Rather than attempt a

recapitulation of the above material, we would like to take the final section to draw some closing conclusions for the policy debate.

First, the evidence clearly suggests that child labor is a consequence of both the supply of and the demand for child workers. The conventional wisdom that child labor is fundamentally driven by any single cause such as poverty, greed, or 'nimble fingers' is not supported by the evidence. While it is clear, based on both cross-country and household survey research, that poverty increases the incidence of child labor, it is also the case that child labor surges when employment opportunities present themselves.

Though we might be tempted to conclude that child labor is fundamentally a consequence of supply-side forces, the sudden rise in the labor force participation rate of children and the decline in high school enrollment in the United States during World War II clearly demonstrate the powerful role that the demand for child workers can play in the overall determination of child employment. Corroborating evidence emerges from the role of technological change in the employment of young black males in the United States between 1950 and 1970.

Second, it is important to bear in mind that parents are the single largest employer of children. In many cases, parents employ their children in the household, family enterprise, family farm, or even on the factory floor in order to keep the family intact. However, it also appears to be the case that families turn to internal markets because parents face a host of incentive problems when non-family members are employed. Asset market failure provides an additional obstacle to optimal human capital acquisition.

Finally, although the theoretical and empirical evidence suggest that there are many factors that drive child labor, the precipitous decline in the hours that children worked and the improvement in the conditions under which they worked in the West between the middle of the 19th and 20th centuries suggests that in the correct economic, policy, and cultural environment, eliminating child labor is an obtainable social objective.

However, a policy response that targets a single dimension of child labor is unlikely to be efficient or even effective. Child labor may decline as incomes in developing countries rise, but there is nothing in theory or evidence that tells us such an outcome is inevitable. Perhaps more importantly, there are many policy tools available that can help alter family and firm decision making prior to a rise in income, such as a package of improved educational opportunities, increased inflow of child-displacing technologies from industrial countries, more efficient capital and labor markets, and educational attainment subsidies. Efforts to eliminate child labor must take all aspects of the problem into account and draw upon these and other mechanisms that have the potential for reducing child labor without inducing further hardship.

APPENDIX
SURVEY RESEARCH

Author: Chiswick (1986)

Hypothesis: American Jews are among the most successful ethnic group in the United States. The author attempts to determine whether the greater economic achievement is the consequence of human capital investment in children in addition to formal schooling. If this is the case, then the presence of children should have a greater negative effect on female labor supply in Jewish than in non-Jewish households.

Data: White females aged 25 to 64 in 1970 with at least one foreign born parent taken from the 1970 Census of the Population.

Model: Female labor supply is a function of the real wage, marginal productivity in the home, and other income sources, education, age, marital status, on-the-job training and number of children born younger than six and 6 to 18 and speaker of Yiddish.

Regression method: OLS

Results: Even though Jewish women have a higher labor supply than the total population, the number of children under six in the household has a strong and significant negative effect on labor supply. Having a child under six lowers the probability of working for non-Jewish women by 14 percent but lowers the probability for Jewish women by 26 percentage points. Similar results are observed for weeks of work. Jewish women with children aged 6 to 18 are also less likely to work than non-Jewish women but the impact is only about one-quarter the size. Interestingly, the labor supply of Jewish women whose children are 18 or older is the same as that for Jewish women who never worked and are more likely to be working that non-Jewish women.

Comments: Spencer (1992) undertook similar analysis for Canadian women for 1981. The Census of Canada asks respondents whether they are Jewish. By comparison, Chiswick identified Jews by whether the spoke Yiddish. Spencer claims that he finds no significant difference labor supply Jewish women with small children are and their non-Jewish counterparts. However, Chiswick (1992) disputes Spencer's interpretation of the Canadian results.

Author: Emerson and Souza (2002)

Hypothesis: Evidence form sociology and psychology literature find that siblings higher in the birth order tend to have higher innate ability and, thus, may attract more human capital investment by parents than younger siblings. However, in the presence of income constraints, parents may be unable to invest in older children but can invest in younger children with the aid of income earned by first borns.

Data: 1998 Pesquisa Nacional por Amostragem a Domicílio (PNAD).

Model: Each child in the sample is assumed to allocate time between work as a child laborer and attending school. The analysis focuses on families with three children and a mother that is 40 or older. These criteria are designed to isolate complete families and abstract away from problems associated with endogenous fertility.

Estimation method: bivariate probit. The probability of being in school or working is a function of birth order, gender of the oldest child, the child's age, the child's race, the father's and the mother's schooling, the father's and the mother's age and status as rural or urban household.

Results: For the unrestricted sample, first born boys are least likely to be in school and last born boys are least likely to work. First born girls are less likely to attend school but no more or less likely to work. The mother's age is negatively correlated with the probability that a male child will work and a larger family implies a higher probability of work for both males and females. The various restricted models give similar results.

Discussion: Last born males are less likely to work than their first born siblings. This result is consistent with the hypothesis that poor families can send a child to school only if at least some of them work. Parents send the oldest one to work because he or she commands the highest wage and, therefore, the opportunity cost of an educating older children is higher than for younger ones. First born children are less likely to be in school but no more likely to be working. However, since home production is not considered work in the survey, these girls who are not in school are likely aiding in home production.

Author: Robles-Vásquez and Abler (2000).

Hypothesis: Some theory suggests that poverty is an important contributor to child labor. Recent economic volatility in Mexico provides an opportunity to determine the extent of the role that poverty plays in child labor. In addition, in 1994 the mandatory years of schooling increased from six to nine accompanied by considerable fluctuations in education spending and a reduction in farm subsidies over the sample period..

Data: Mexican *Encuesta nacional de Ingresos y Gastos de los Hogares*. This is a household survey of socioeconomic characteristics, incomes and expenditures. Data are taken from surveys conducted in 1984, 1989, 1992 and 1996. Labor force participation is analyzed for children over 11 years of age.

Dependant Variables: The probability of full-time schooling, the probability that an employed child engages in market work (as opposed to a family enterprise), the number of hours worked for a child employed in market work.

Independent Variables: age, years of education, sibling congestion, biological offspring of head of household, children in the household 5 years or younger, males aged 18 and older, females ages 18 and older, household size, single-parent household, household head's years of education, head's age, head's gender, employment status of head, household income (net of the child's earnings), household income from corn or bean sales, profits from a family enterprise or financial assets, dummy variables for farm households and nonagricultural enterprise, ownership of a refrigerator, students per school in the community and regional dummies.

Results:

- An increase in one year of age lowers the probability of full-time schooling by 0.11 for urban boys and 0.19 for rural girls.
- An increase in the number of years of schooling increases the probability of being a full-time student by 0.03 for urban boys and 0.08 for rural girls.
- A boy in an urban household reporting profits from a family enterprise or financial assets has a 0.13 lower probability of full-time schooling than other urban boys.
- A boy in a rural household reporting such profits is 0.10 less likely to be a full-time student than other rural boys.
- Household income has little effect on child labor independent of other factors. Doubling household income only increases the probability of being a fully-time students by 0.01 for rural girls and 0.03 for rural boys.
- Household demographic and school characteristics have little impact of the probability of full-time schooling.
- Girls are less likely to be in full-time school in male-headed households than in female headed households.
- The income and wage elasticities of supply of labor by a working boy are very small. For example, a doubling of household income net of a working child's earnings decreases hours worked by rural boys by only 1.9 percent.
- An increase in one year of age raises hours worked by 7.6 percent (3.4 hours) for urban boys and 3.6 percent (1.5 hours) at the sample mean.

Discussion: As in other studies, parents with a family enterprise employ their own children rather than school them. This result is significant because one of the strategies that families have used to cope with the stresses of reform is to open household enterprises. This may have the effect of increasing child labor as parents employ their own children to run the business.

Author: Edmonds and Turk (2002).

Hypothesis: Rural reforms, removal of subsidies for capital intensive industry and the new Enterprise Law of 2000 may all increase labor intensive production. The consequent increase in the demand for unskilled labor may increase child labor. However, the rise in

income and the 1991 legislation that mandates and provides for primary school education may lower child labor.

Data: Vietnam Living Standards Surveys, 1992/93 and 1997/98.

Dependant Variables: Children ages six to fifteen working for pay; working in family agriculture; working in a household run business.

Results: Girls are more likely to work than boys, particularly for families under great financial stress. Child labor is higher in rural settings. Ethnic minority children are more likely to work than non-minority children. Children in families that have recently migrated from a rural setting to an urban setting are more likely to work. Children who work in newly established household enterprises are more likely to work than other children.

Discussion: This paper finds that the rise in living standards have played an important role in reducing child labor in the 1990s. However, the study does not control for family characteristics, etc., that may be correlated with household income.

Author: Ray (1999)

Hypothsis: There is a positive association between poverty and child labor and a negative association between poverty and schooling.

Data: Peru Living Standards Measurement Survey in 1994 and the Pakistan Integrated Household Survey of 1991.

Dependant Variable: Child labor hours of paid worked, years of schooling

Results:

- A previously non-poor Pakistani family will increase the hours worked by each child in the household by 500/year if the family drops below the poverty line. However, the poverty variable is weak and statistically insignificant for Peru.
- In both countries, urban children work less than rural children.
- Parental education status has a significant negative impact on child labor supply, with the effect being considerably more pronounced in Pakistan.
- Child labor supply is increasing in the child wage in both countries.
- In Peru, a rise in the adult wage lowers the labor supply of boys and girls.
- In Pakistan, a rise in the mother's wage raises the hours worked by her daughters. Note that this is market work, not household work.
- When household chores performed by girls are included in the definition of the supply of labor, the poverty hypothesis fails for Pakistan. Dropping below the poverty line leads Pakistani girls to reduce their time spent performing household chores and increase market work. However, the total number of hours does not rise.

- Falling below the poverty line does not reduce years of schooling for Peruvian girls but does reduce years of schooling for Pakistani children. The schooling of Pakistani girls is more negatively impacted by poverty than for boys.
- Educated parents are more likely to keep their children in school than uneducated parents.
- Rising child wages reduce schooling in Pakistan but not in Peru.
- A rise in a Pakistani mother's wage reduces schooling for her daughter. The evidence appears to suggest that when a mother's work opportunities improve, she pulls her daughter out of school and takes the girl to work alongside her.

Discussion: In the author's view, Peruvian children are not as adversely affected by poverty as Pakistani children in part due to the relatively high value placed on education by Peruvian parents and the ability of Peruvian children to combine work and school.

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