ACCOUNTING FOR THE SOCIAL AND NON-MARKET BENEFITS OF EDUCATION

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1.   INTRODUCTION

The contribution of human and social capital, especially schooling, to economic growth and well-being have typically focused on market outcomes, particularly labor market returns.   In this paper, we focus on the social and non-market effects of education. We argue that these effects are large, perhaps as large as the marketed effects of education, and hence must be considered in order to correctly evaluate the optimum level of social (and public-sector) investment in schooling. We first catalogue the non-market and social outcomes of schooling,

and identify the literature that discusses the evidence of such impacts. A number of published studies have attempted to assess the non-market effects of schooling.[2] This paper updates their results where possible and expands the discussion to include results from the experiences of developing countries.

The catalogue of the non-market and social effects of education is long, and includes such relationships as:

- a positive link between one's own schooling and the schooling received by one's children;

- a positive association between schooling and the health status of one's family members;

- a positive relationship between one's own education and one's own health status;

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[2]These include Haveman and Wolfe (1984), Michael (1982), McMahon (1997) and Wolfe and Zuvekas (1997). A recent volume by Behrman and Stacey (1997) discusses a variety of sources of these non-market effects.

- a positive relationship between own education and the efficiency of choices made, such as consumer choices (which efficiency has positive effects on well-being similar to those of money income);

- a relationship between own schooling and fertility choices (in particular, decisions of one's female teenage children regarding nonmarital childbearing);

- a relationship between schooling/social capital of one's neighborhood and youth decisions regarding their level of schooling, nonmarital childbearing, and participation in criminal activities.

After presenting the catalogue of non-market effects of schooling, we discuss the research that has documented one channel in this long list, namely the intergenerational effects of schooling. This literature reveals that educational attainment in one generation has positive effects on the human capital attainments of youths (including schooling, nonmarital childbearing, and crime related activities) in the next generation. Both the direct relationship of parental human capital (e.g. parental schooling) to the attainment of their children, and the indirect effect through improving the human/social capital environment in the neighborhoods in which children grow up are discussed. The literature on the intergenerational effects of education is generally neglected in assessing the full impact of education.

Finally, we propose a method for valuing these social and non-market effects of schooling, and present some illustrative estimates of these values.

Evaluation of the optimal level of social investment3 in education requires a comprehensive assessment of all of the returns to schooling, both market (primarily earnings) and non-market effects. We do not discuss the traditional returns to education in the form of earnings, as we concentrate on the oft-neglected non-market impacts.

2.   NON-MARKET EFFECTS OF EDUCATION: A CATALOGUE

OECD countries spend between 3.3 and 6.9 percent of their GDP on public direct expenditures for education. **Table 1** presents these estimates, using data drawn from the 1998 and 1999 Digest of Education Statistics (see Snyder 1999, table 412).[4] Turkey is at the low end, while the Nordic countries are at the high end. At the primary level of education, the variance ranges from 0.8 percent of GDP for Germany to 2.5 percent for Norway. Absolute spending for

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[3]Traditionally, the amount of schooling provided has heavily depended on the public sector. In the cases of elementary and secondary education, public colleges and universities, and public subsidies, the price charged tends to be far below the marginal cost of schooling.

[4]http://nces.ed.gov/pubs99/digest98/d98t412.html.

primary education is the highest in Switzerland – $5,835 per student (in 1993 in 1993 dollars) –

with the United States close behind (at $5,492). At the secondary level, Switzerland again

records the highest per student expenditure at $7,024, while Austria, United States, Germany and

Denmark all spent more than $6,000 per student in 1993. For higher education, Switzerland and

the United States have the highest expenditures per pupil at $15,731 and $14,607, respectively. 5

For the United States, 80.6 percent of total expenditures on schooling were allocated by the

public sector in 1993-94, including 92.3 percent of the expenditures for elementary and

secondary education. This large absolute and proportional public expenditure pattern also exists

in most other OECD countries, suggesting the relatively small contribution of private spending in

this area. A result of this lack of private market activity is the absence of evidence on beneficiary

willingness to pay for education — or the individual private value of an additional year of

schooling --- even though private willingness to pay may be very high.

The traditional form of evaluation has focused on market returns, particularly labor

market returns, for an additional year of schooling. This focus neglects a large number of

benefits (or costs) lying beyond labor market returns. By looking at the non-market impacts of

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[5]Canada's expenditures for higher education dropped from $10,182 per pupil in 1990 to $7,701 in
1994 (constant 1995 US dollars.) http://nces.ed.gov/pubs2000/digest99/d99t418.html.

education, we act upon the belief that a "full accounting must consider all of schooling's effects, positive and negative, not simply those recorded in a single market." (Haveman and Wolfe 1984, p. 379).

In **Table 2**, we list a number of market and non-market benefits of schooling, together with a description of existing research on the magnitude of these benefits. In general, these studies control for other characteristics such as age, race, and income (where appropriate) in estimating the magnitude of schooling benefits. The first two benefits reflect the traditional measures — labor market productivity and nonwage labor market remuneration. We then shift to direct influences on other members of the household. The third impact listed is the relationship between a wife's schooling and her husband's earnings, where the table describes the positive association between the two.

The educational level of the next generation is clearly tied to the schooling of the parents (item 4). Children of parents who graduate from high school are themselves far more likely to graduate from high school than are children of less well educated parents, and parental schooling beyond the high school level increases this probability (see Sandefur, McLanahan, and Wojtkiewicz 1989). Better-schooled parents appear to have children with a higher level of cognitive development as well as children with higher future earnings. There is also some evidence that living in a community in which the young adults have more education increases the probability that the children living in the community will complete secondary schooling.

Complementing these estimated relationships is recent evidence that grandparent's schooling also is associated with higher levels of children's cognitive development (Blau 1999).

Increased schooling of parents, particularly mothers, seems to lead to improved health (in the form of lower infant mortality rates and lower rates of low birth-weight) among infants and children (item 5). Another contribution of parental schooling is the higher rate of vaccinations among children of better-educated parents. Evidence on this link also appears in studies of the effects of schooling in developing countries.

Level of schooling also seems to be related to the probability that one's child will give birth out of wedlock as a teenager (item 6). Children living with mothers who have at least a high school education appear to be significantly less likely than other children to become teen parents out of wedlock (see Sandefur and McLanahan 1990, and An, Haveman and Wolfe 1993).

For the individual, increased schooling appears related to better health and increased life expectancy (item 7). This may be due to occupational choices (choosing occupations with relatively lower occupational hazards), locational choices (electing to live in less polluted areas), more information or skills in acquiring health-related information, better nutrition, fewer health-reducing behaviors (cigarette smoking), and/or more appropriate medical care usage. The improvement might, of course, simply reflect a third factor which "causes" both more schooling and better health. However, the statistical relationship between the two appears quite strong. A study using sibling data from Nicaragua finds evidence in both fixed and random effect models

that the relationship between more schooling and better health is not due to unobserved or unmeasured factors but instead is causal (Behrman and Wolfe 1987). While a portion of the benefit of better health is reflected in higher labor market earnings, a non-market effect is reflected in the value of better health — from reduced pain and suffering, reduced mortality, lower medical care expenditures, less time allocated to treatment of illness. Some of the benefits of better health are likely to have externalities ranging from reduced spread of contagious disease to increased utility of others (i.e. those who have other persons' health in their utility function). Some studies also indicate that one's schooling has a positive impact on the health of one's spouse (item 8).

A related benefit is the development of lifestyle habits that promote good health. Although economists are hesitant to see a causal link, a recent study suggests that persons with more schooling are less likely to smoke, and among persons who do smoke, those with more schooling smoke less per day. An additional year of schooling reduces average daily cigarette consumption by 1.6 for men and 1.1 for women. Better educated people are also less likely to be heavy drinkers and tend to engage in more exercise per week (about 17 minutes for each additional year of schooling) than are less educated people (see Kenkel 1991).

An additional benefit accruing to the "better schooled" individual is increased consumer efficiency (item 9). Michael (1982) translated the finding that a person with an additional year of schooling was significantly more efficient as a consumer into dollars of additional income. Similarly, Benham and Benham (1975), analyzing only the market for eyeglasses, found that

persons with more schooling tended to pay less for glasses than those with less schooling. Rizzo and Zeckhauser (1992) found that the charge per unit of time that an M.D. spent with a patient was lower for better-educated individuals than for those less well educated.

Items 10 through 12 in Table 1 refer to one's success in making choices involving the labor market, marriage, and family size. In all of these cases more schooling has a positive influence, probably through gaining information that promotes more efficient decisions. Part of this gain may be simply in the ability to accomplish better matches — in the labor market, for example — but another part may be in the reduction of time spent in the search. Studies of assortative mating suggest that schooling leads to "better" choices regarding marital partners (Becker, Landes and Michael 1977). Better-educated people tend to be more successful in securing desired family sizes; it is likely that more schooling enables one to gather information on how to avoid unwanted births and possibly also to reduce the probability of subfecundity. Evidence of this effect also exists for developing countries.

Beyond the gains to one's self and family are broad gains to society that may go unmeasured. There is evidence that the amount of time and money devoted to charity is positively associated with the amount of schooling one has, after controlling for income, the other primary determinant of donations (item 13). For example, one study found that college graduates volunteered nearly twice as many hours and donated 50 percent more of their income than high school graduates (see Hodgkinson and Weitzman 1988). The positive contribution to savings (item 14) has a public-good aspect to the extent that the capital market is imperfect and

aggregate savings are less than optimal. Greater education may lead to social cohesion and may enable one to use new technologies.[6] Persons with more schooling are likely to make more informed choices when voting, and to participate in their communities.

There are other ways in which attaining a high level of education may enhance the public good. For instance, there is evidence that more schooling is associated with a lower probability of receiving transfer benefits, either disability-related benefits or welfare (item 17). Recent analyses have found that higher education of mothers reduces the probability that their daughters will, if eligible for welfare benefits, elect to receive them. Studies of applicants for disability transfers also find that more education decreases the probability of receiving disability-related transfers. Criminal activity may also decrease as schooling increases (item 18).

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[6]Wozniak (1987) argues that "early adopters [of new technology] must acquire and process a better quality and larger quantity of information than others" (104). His results on a group of farmers provide some evidence that "increases in education enhance innovative ability" and that with "an additional year of schooling the likelihood of (…) being an early adopter increases by about a percentage point (or about 3 percent." (107).

All of these, then, are areas in which there has been some research on the nature of the relationship between schooling and non-market impacts, although in many cases the evidence is sketchy. Some impacts pertain to the individual and their family, while others relate to society. Among the largest influences are the impacts of parents' schooling on their children, particularly in terms of health, schooling, childbearing, and on one's own health. Schooling also effects efficiency in consumption and the ease with which one uses new, sophisticated products, such as personal computers, or adapts to changes in the workplace. There also appear to be gains that benefit society in general, such as social cohesion and crime reduction. One is left with the impression that schooling has substantial benefits beyond those usually tabulated by measures of labor market productivity and fringe benefits. On the other hand, schooling may also have costs that are largely noneconomic, such as job-related stress.

3.   THE ROLE OF INTERGENERATIONAL HUMAN AND SOCIAL CAPITAL TRANSFER

The relationships identified in items 4, 5, and 6 in Table 2 concern the effect of education in one generation on the human capital and choices of people in the next generation. Most of the research on this intergenerational linkage focuses on the effects of parental schooling

on the education and other indicators of attainment of their children. Two channels by which parental education affects the attainment of their children are identified: a direct effect operating through improvements in the choices and investments made by parents, and an indirect effect operating through the effect of parental schooling on the quality of the human/social capital of the neighborhoods in which children grow up.

A large body of recent research has attempted to understand the process by which the human capital embodied in young adults is related to the education of their parents and the level of social capital present in the communities and neighborhoods in which they grow up. Neighborhood social capital is often identified with the average level of schooling in the neighborhood in which youths grow up, or in the average income or occupational status of the residents of the neighborhood. This research attempts to answer the following questions:

- Is the level of schooling of parents related to the human capital (education, probability of engaging in unproductive fertility and crime behaviors) of youths?

- Is the level of social capital in the communities in which youths grow up related to their level of human capital, again broadly defined?

- Is the level of parental schooling related to the size of the cohort of siblings with which any child grows up (and to overall population growth)?

In **Table 3**, we summarize the methods and findings of a large number of such studies published since 1980. The studies identified in this table provide the detail behind the patterns identified in items 4, 5, and 6 in Table 2. The data on which the studies rest, the specification of the models estimated, the independent variables included in these models, and the outcome in terms of (1) youth schooling, (2) teen nonmarital childbearing, (3) youth criminal behavior, (4) child health, and (5) the number of siblings with which a child grows up are all summarized in Table 3. The final two columns present the estimated effects of parental education and neighborhood human/social capital variables on these youth human capital-type outcomes.

Three criteria have guided our decisions regarding which of the many existing studies to include in our discussion. The first criterion is the quality of the studies, based on our appraisal of the data and estimation methods used. Second, all of the studies adopt an intergenerational 'production function' approach to understanding the process by which youth human capital is generated, and hence reveal the patterns of non-market effects of parental education and neighborhood human/social capital in terms of youth human capital outcomes. Finally, we have emphasized those studies that rely on longitudinal (panel) micro-data.

Several characteristics of these studies and their findings should be noted. First, the

variation among the studies in the extensiveness of variables describing family characteristics

and choices and neighborhood attributes is substantial. While all of the studies listed indicate the

effect of parental education on children's human capital and attainments, there is wide variation

in the extensiveness of other control variables included in the studies. Third, for most of the

studies in the table, we note the focus on aspects of social capital in the form of the level of

education, income, and occupation of the citizens that form the neighborhood community in

which children are reared.

Two dominant findings are revealed in these studies. First, a strong and positive

relationship between parental education (often measured by years of schooling) and the several

broadly defined human capital attributes of offspring – youth schooling, youth nonmarital

childbearing, youth criminal behavior, health of offspring, and youth cohort size – is revealed in

virtually all of the studies. Second, there is a persistent (though not universal and often

nonsignificant) effect of neighborhood human and social capital variables on youth human

capital in the form of schooling, nonmarital childbearing, and criminal behavior.

4.   ON ESTIMATING THE VALUE OF NON-MARKET IMPACTS OF
EDUCATION

In order to translate these benefits into guidance for the public sector decisions on allocation of resources to education, it would be useful to be able to value the full set. Haveman and Wolfe (1984) have developed a method to estimate the marginal value of schooling. This method exploits the relationship (derived from economic theory) between schooling and marketed inputs in producing non-market outcomes. Existing studies that establish a relationship between education and a non-market outcome such as health, consumer efficiency, education attainment of children, and so forth, can be used with this method to generate estimates of the marginal value of schooling. Each of these studies must have a coefficient estimate relating schooling to the outcome of interest, as well as control for other additional variables likely to be associated with that outcome. In addition, each study must include another input which has a market value to the non-market outcome of interest. Examples of marketed inputs include physician visits, spending on police in the community, private music lessons, and so forth. When such inputs are not available, income is used under the assumption that income will be spent on the output only until the marginal product per dollar spent is equal to that of other inputs including schooling. The coefficient on income then represents the marginal product of income spent on the outcome under study.

We present a simplified version of the Haveman-Wolfe model to illustrate the method, using a single non-market good. The model makes the standard economic assumption that individuals or households efficiently combine schooling with other market inputs to produce the

non-market outcome. A well-known result in economics is that efficient producers will equate the ratio of the marginal product to input price, across all inputs. This relationship also holds in the production of the non-market outcome, with schooling and at least one other marketed input. That is,

$$\frac{MP_{SCH}}{P_{SCH}} = \frac{MP_X}{P_X} \qquad (1)$$

where MP_{SCH} is the marginal product of schooling in producing the non-market outcome, MP_X is the marginal product of any input X with market price P_x, and P_{SCH} is the implicit price or willingness to pay for additional schooling in producing the non-market outcome. A little rearranging yields the following formula for computing the implicit price or willingness to pay for additional schooling in producing a non-market outcome:

$$P_{SCH} = \frac{MP_{SCH}}{MP_X} x P_X \qquad (2)$$

This equation for the implicit value of additional schooling is intuitively appealing. If the marginal products of schooling and the other input are equal, the implicit willingness to pay for schooling will be equal to the price of the other input. If the marginal product of schooling is double that of the other input, the implicit value of schooling is twice the unit price of the other input.

The extension of the simple model presented here to the production of multiple non-market and market outcomes, such as wage income, is straightforward and is fully developed in Haveman and Wolfe (1984). To compute the total willingness to pay for additional schooling across all non-market and market outcomes, one simply sums the implicit willingness to pay in producing each individual outcome.[7]

Implementing this method involves estimating the productive relationship (MP_{SCH}) between schooling and each outcome. It also requires estimating the productive relationship (MP_X) between each outcome measure and another input. The latter input should be one that is competitively marketed. Once these marginal productivities are estimated, they are combined with the private cost of the privately purchased input in order to estimate the implicit willingness

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[7]Haveman and Wolfe's fully developed model accounts for the non-exclusivity (non-divisibility) of schooling in producing multiple outcomes.

to pay for additional schooling for each outcome, using the formula given in equation (2). The implicit value for each individual outcome can then be summed to produce the total incremental value of additional schooling.

We use this approach to generate estimates of the value of non-market impacts in **Table 4**. We converted a small number of impacts into the marginal relationship or further into a willingness-to-pay estimate, basing our results on coefficients obtained from the studies listed in the third column of the table. We do this for cognitive development of children, consumption efficiency, own health, reduction in criminal activity and charitable giving (volunteer hours).

For example, a recent study by John Ermisch (Ermisch and Francesconi 2000 and special tabulations, 1999) provides estimates of the impact of mother's education and household income on the level of schooling achieved by their children (output 4 in Table 2) in the United Kingdom, using data drawn from the British Household Panel Study. The coefficient estimate for household income (the input with market values) is 0.098 (t-statistic = 1.668) for girls indicating that, at the margin, an additional dollar of household income is positively related to the expected level of schooling. Mother's education is represented by dummy variables for six levels of schooling ranging from less than O level to first and higher (with no qualification as the omitted category) in an ordered logit estimation. The simulation of the effects of mother's education and family income (at the youngest age which they observe it, mainly around age 16) on the distribution of daughter's qualifications is 0.218 for a mother's vocational degree on the probability that the daughter will have a vocational degree, and 0.255 for a mother's first or

higher degree on the probability of the child having a vocational degree, while the relationship of

family income to a vocational degree is 0.187. Using the formula of equation (2), we derive the

marginal value of a mother's vocational degree on the probability that the daughter will have a

vocational degree, in terms of annual family income as follows:

$$P_{SCH} = \frac{MP_{SCH}}{MP_X} x P_X = \frac{.218}{.187} x \text{ú}1{,}000 = \text{ú}1166$$

This translates into a pound value of £1,166. The pound value of a mother's first or higher

degree on the probability that the daughter will have a vocational degree, in terms of annual

family income, is £1,364.[8]

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[8]Similarly, the simulated value of a mother's vocational degree on the daughter's first or higher

degree is 0.107, and that for a mother's having a first or higher degree on her daughter achieving the same

degree is 0.152. In this case, family income has a simulated relationship of 0.088 providing economic

estimates of mother's additional schooling of £1,216 and £1,727, respectively (both mother's levels of

schooling are statistically significant at the 1 percent level). These point estimates of the value of

These estimates are provided only to illustrate a possible procedure for valuing non-market effects of schooling. In Haveman and Wolfe (1984), the authors conclude that a conservative estimate of the value of non–labor market influences is "of the same order of magnitude as estimates of the annual marketed, earnings-based effects of one more year of schooling" (pp. 400-401). Given the growing evidence on the non-market effects of schooling, including intergenerational and social capital effects, this assessment seems likely to hold, indicating again that traditional estimates of the market returns to schooling fail to capture the full social return to education.

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additional schooling, and those shown in Table 4 should be interpreted with caution given the large standard errors on some of the relevant coefficients.

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Table 1

Total public direct expenditures for education as a percentage of GDP,

by level of education, 1990 and 1994

	All\1\		Primary		Secondary		Higher	
Country	1990	1994	1990	1994	1990	1994	1990	1994
Australia	4.3	4.4	---	1.4	---	1.8	1.0	1.1
Austria	5.2	---	0.9	---	2.5	---	1.0	---
Belgium	5.1	5.5	0.9	1.2	2.2	2.6	0.8	1.0
Canada	5.4	6.0	\2\	\2\	\2\	\2\	1.5	1.6
Denmark	6.2	6.5	1.7	1.5	2.7	2.8	1.3	1.4
France	5.0	5.6	1.0	1.1	2.4	2.9	0.7	0.9

Germany\3\	---	4.5	---	0.8	---	2.1	---	0.9
Ireland	4.9	5.1	1.4	1.4	2.0	2.2	1.0	1.0
Italy	5.2	4.6	1.1	1.1	2.2	2.2	1.0	0.7
Japan	3.4	3.8	---	1.4	---	1.6	---	0.5
Luxembourg	---	---	---	---	---	---	---	---
Netherlands	5.7	4.5	1.3	1.2	2.2	1.8	1.6	1.2
New Zealand	6.2	5.4	1.6	1.5	1.5	2.4	2.2	1.1
Norway	5.9	6.9	1.5	2.5	2.4	1.6	1.1	1.4
Portugal	---	5.3	---	1.8	---	2.1	---	0.8
Spain	4.3	4.8	1.0	1.0	2.3	2.5	0.7	0.8
Sweden	5.3	6.6	1.9	2.0	2.3	2.5	1.0	1.5
Switzerland	---	5.5	---	1.6	---	2.5	---	1.1
Turkey	---	3.3	---	1.4	---	0.7	---	1.2
United Kingdom	4.7	4.6	1.2	1.6	2.1	2.2	0.9	0.7

United States	5.3 _	4.8	1.7	1.6	1.9	---	1.4	1.1

\1\Includes primary, secondary, and higher education and other expenditures

\2\ Primary and secondary combined were 3.7 and 4.2 in 1990 and 1994 respectively

\3\Data prior to 1991 are for the former West Germany.
---Data not available.

SOURCES: Organization for Economic Cooperation and Development, unpublished data.

(This table was prepared July 1998 and is reported in

http://nces.ed.gov/pubs99/digest98/d98t413.html）and

http://nces.ed.gov/pubs2000/digest99/d99t419.html

for data on Canada and 1990 data for Australia.

TABLE 2

Catalogue of Outcomes of Schooling

Outcome	Economic Nature	Existing Research on Magnitude
1. Individual market productivity	Private; market effects; human capital investment	Extensive research on the magnitude of market earnings (Schultz 1961; Hansen 1963; Becker 1964; Mincer 1962; Conlisk 1971)
2. Nonwage labor market remuneration	Private; market and non-market effects	Some research on differences in fringe benefits and working conditions by education level (Duncan 1976; Lucas 1977;

Freeman 1978; Smeeding 1983)

3. Intrafamily productivity	Private; some external effects; market and non-market effects	Relationship between wife's schooling and husband's earnings apart from selectivity is established (Benham 1974)
4. Child quality: level of education and cognitive development	Private; some external effects; market and non-market effects	Substantial evidence that child education level and cognitive development are positively related to mother's and father's education (Dawson 1991; Haveman, Wolfe, and Spaulding 1991; Haveman and Wolfe 1994; Duncan 1994; Wachtel 1975; Murnane 1981; Sandefur, McLanahan, and Wojtkiewicz 1989; Ribar 1993; Angrist and Lavy 1996; Ermisch and Francesconi 2000 Lam and Duryea 1999). Some evidence that child education is positively related to grandparents' schooling (Blau 1999). Some evidence that education of adults in neighborhood increases probability of a child's graduating high school (Clark 1992; Duncan 1994; Ginther, Haveman, and Wolfe 2000).

Outcome	Economic Nature	Existing Research on Magnitude
5. Child quality: health	Private; some external effects	Substantial evidence that child health is positively related to parents' education (Edwards and Grossman 1979; Wolfe and Behrman 1982; Shakotko, Edwards, and Grossman 1981; Behrman and Wolfe 1987; Grossman and Joyce 1989; Strauss 1990; Thomas, Strauss, and Henriques 1991; Glewwe 1999; Lam and Duryea 1999; King and Hill 1993)

6.	Child quality: fertility	Private; some external effects	Consistent evidence that mother's education is related to a lower probability that daughters will give birth out of wedlock as teens (Sandefur and McLanahan 1990; An, Haveman, and Wolfe 1993; Antel 1988; Hayward, Grady and Billy 1992; Lam and Duryea 1999)
7.	Own health	Private; modest external effects	Considerable evidence that own schooling positively affects one's health status (Leigh 1981; Berger and Leigh 1989; Leigh 1983; Kemna 1987; Grossman and Joyce 1989; Kenkel 1991; Strauss, Gertler, Rahman, and Fox 1993); also increases life expectancy (Feldman et al. 1989; King and Hill 1993); also lowers prevalence of severe mental illness (Robins 1984)

8. Spouse's health	Private; modest external effects	Some evidence that own schooling influences spouse's health as well as decreases mortality (Auster, Leveson, and Sarachek 1969; Grossman 1975; Grossman and Jacobowitz 1981)
9. Consumer choice efficiency	Private; some external effects; non-market effects	Some evidence that schooling leads to more efficient consumer activities (Michael 1972; Rizzo and Zeckhauser 1992; Benham and Benham 1975; Pauly 1980). Home-production schooling may have long-term impacts (Corman 1986)
10. Labor market search efficiency	Private; non-market effects	Some evidence that costs of job search are reduced and regional mobility increased with more schooling (Greenwood 1975; Metcalf 1973; DaVanzo 1983)

11.	Marital choice efficiency	Private; non-market effects	Some limited evidence of improved sorting in marriage market (Becker, Landes, and Michael 1977)
12.	Attainment of desired family size	Private	Evidence that contraceptive efficiency is related to schooling (Michael and Willis 1976; Ryder and Westoff 1971; Easterlin 1968; Rosenzweig and Schultz 1989). In developing countries, fertility declines (King and Hill 1993; Lam and Duryea 1999.

13.	Charitable giving	Private and public; non-market effects	Some evidence that schooling increases donations of both time and money (Hodgkinson and Weitzman 1988; Mueller 1978; Dye 1980; Freeman 1997)
14.	Savings	Private; some external effects	Controlling for income, some evidence that more schooling is associated with higher savings rates (Solomon 1975)
15.	Technological change	Public	Some evidence that schooling is positively associated with research, development, and diffusion of technology (Nelson 1973; Mansfield 1982; Wozniak 1987)
16.	Social cohesion	Public	Descriptive evidence to suggest that schooling is positively associated with voting (Campbell et al. 1976; Gintis 1971); with reduced alienation and social inequalities (Comer 1988)

| 17. | Less reliance on income (and in-kind) transfers | Private and public | More education associated with reduced dependence on transfers during prime working years (Antel 1988; An, Haveman, and Wolfe 1993; Kiefer 1985) |
| 18. | Crime reduction | Public | Some evidence that schooling is associated with reduced criminal activity (Yamada, Yamada, and Kang 1991; Ehrlich 1975) |

TABLE 3

Intergenerational Effects of Parental Human Capital and Neighborhood Human/Social Capital

Study	Data and Sample	Specifications	Outcome	Control Variables	Parent Education Variables	Neighborhood Human/Social Capital Variables
				Parental and Neighborhood Human/Social Capital Effects on Youth Education		
Datcher (1982)	PSID-552 male household heads ages 23–32 in 1978 who lived with parents in 1968, in SMA	OLS, race specific	Years of schooling	Family income, number of siblings, region, family receipt of welfare, parental expectations, parental efficacy/ambition, urban/rural, percentage white in neighborhood	Father's' education (+; 10%) Mother's education (+; 10%)	Average family income in neighborhood (-; 1%)

Study	Data and Sample	Specifications	Outcome	Control Variables	Parent Education Variables	Neighborhood Human/Social Capital Variables
Crane (1991)	1970 Census PUMS 92,512 16–19 year olds (schooling) 44,466 16–19 year olds females (teen child bearing)	Reduced form logit, race specific	Probability of dropping out of high school Probability of teenage childbearing	Family income, family head's occupational status, household structure, family size, rural origin, gender	Parents' education (+; 1%)	Percent of neighbors in managerial/professional jobs (+; 1%)
Haveman, Wolfe, Spaulding (1991)	PSID: 1258 children aged 0-6 in 1968, 19-23 in 1987	Probit model	Graduated high school by 1987 = 1	Nonwhite, Female, nonwhite×female, father schooling, mother schooling, firstborn, head foreign born, grandparents poor, years in SMSA, parental time in preschool years, years mother worked,	Father's schooling (+; 1%) Mother's schooling (+; 1%)	NA
Clark (1992)	1980 Census-22,534 males aged 15 to 18 who live in SMA	Logistic regression	Probability of dropping out of high school	Age, race, ethnicity, nativity, family structure, family income, welfare use, parents' occupation, parents' labor force participation, parents' earnings, whether	Parents' education (-; 1%)	Each neighborhood human/social capital variable is significant when entered alone in equation with extensive individual, family, and SMA control

Study	Data and Sample	Specifications	Outcome	Control Variables	Parent Education Variables	Neighborhood Human/Social Capital Variables
				disabled, and parents nativity,		variables
				Neighborhood variables: SMA returns to education, SMA race-specific dropout rate, SMA % of adults who are prof./manag, SMA % of families with incomes > $40,000, SMA male unemployment rate, SMA % female headed families, SMA % families on welfare, SMA % individuals in poverty		
Brooks-Gunn, Duncan, Klebanov, and Sealand (1993)	PSID-2,200 black and white women observed ages 14–19, for schooling outcome	Reduced form	Dropped out of high school Had an adolescent out of wedlock birth	Family income-needs ratio, female head, race Neighborhood variables: percent of families with income < $10,000, percent of families with income > $30,000, percent black, percent of female head with kids, percent with public assistance, percent males not in labor force, 40 percent + poor and ≤ 10 percent with families	Mother's education (-; 1%)	Percent of neighbors in managerial/professional jobs < 5 percent (-; 1%)

Study	Data and Sample	Specifications	Outcome	Control Variables	Parent Education Variables	Neighborhood Human/Social Capital Variables
				>$30,000		
Duncan (1994)	PSID-3,439 metropolitan teens ages 16 to 22 in 1968–1991; Census geocode for neighborhood characteristics	OLS, gender and race-specific	Years of completed schooling	Family income/needs ratio, percent years in mother only family, percent income from welfare, percent years mother worked, calendar year child turned 16, Neighborhood variables: percent black in neighborhood, percent female headed families with kids in neighborhood, percent of adult women in neighborhood working 26+ weeks	Mother's education (+; 1%)	Percent of neighborhood families with income > 30,000 (+; 1%) Percent of neighborhood families with income < 10,000 (-; 1%)
Aaronson (1997)	1968–1985 PSID-2,178 individuals with a sibling at least 3 years apart in age and in respondent household for at	Linear probability; sibling fixed effects	High school graduation	Race, gender, household income, parental marital status, whether child worked, number of children in household, county unskilled wage rate, whether family moved	Whether father or mother graduated from high school (+; 1%)	Percent of neighborhood young adults who dropped out (-; 1%) Percent of neighborhood households in poverty (-; 5%)

Study	Data and Sample	Specifications	Outcome	Control Variables	Parent Education Variables	Neighborhood Human/Social Capital Variables
	least 2 years in adolescence					
Manski et al. (1992)	NLSY: 2800 males and females aged 14-17 in 1979	Probit, bivariate probit, trivariate probit, nonparametric models	High school completion by age 20 = 1	Black, Hispanic, female, nonintact family at age 14, region of location, region of birth	Mother high school grad (+;1%) Mother some college (+;1%), Mother college grad. (+;1%) Father high school grad. (+;1%)	NA
Plotnick and Hoffman (1999)	PSID-764 women who turned 26 between 1976 and 1987, with at least one sister and 1970 and 1980 Census neighborhood	Logistic regression; sibling fixed effects (sisters)	Obtained any post-secondary schooling	Grew up in two parent family, region, race, family income/needs, percent of female headed families with kids, racial composition of neighborhood.	Parents' education (+; 5%)	Percent of female headed families with kids (NS) Percent of families with income < $10,000 (NS) Percent of families with income > $30,000 (+; 5%)

Study	Data and Sample	Specifications	Outcome	Control Variables	Parent Education Variables	Neighborhood Human/Social Capital Variables
	information					Neighborhood nonelderly poverty rate (NS)
						Percent of families receiving welfare (NS)
Lillard (1993)	NLS72-4,611 males of '72 graduating class	OLS	Years of college attended	Race, family income, ability, school quality, full time occupation, parental education expectations, family size,	Parental education (+)	Household earnings in school district (NS)
			Years of college planned	Neighborhood variables: Percent Mexican American in high school, percent black in high school		Occ. spec. difference bet. mean neighborhood earnings and national mean. (Significant for professionals/managers)
	1970 Census of Population and Housing-zipcode (1,339) and school district (486) information					Percent professionals/managers in zipcode Percent craftsmen in zipcode (NS)
						Average adult education in zipcode (NS; -S)
						Variance in education in zipcode (NS)
						Percent college bound in high school (S)
						Number of library hours in high school (S)

Study	Data and Sample	Specifications	Outcome	Control Variables	Parent Education Variables	Neighborhood Human/Social Capital Variables
Ermisch (1999)	British household panel study (1991) sample of mothers of 666 men and 597 women children	Ordered logit	Child's highest educational qualification	Date of birth, seven age dummies, even in a non-intact family during childhood by development state, even in a stepfamily during childhood by development stage, number of siblings, firstborn, only child, age of mother and father at birth, mother and father's part-time and full-time work by development stage, father's education, whether father is missing, whether father's work history is missing	Mother's education (+; 2%) (2% significance level for vocational degree and first and higher degrees)	NA
Lam and Duryea (1999)	Brazil's PNAD (1984) survey of women 30-44 years old (sample size ranged from 5000-7000 depending on specifications)	OLS	Schooling of 10 and 14 year olds	Seven regions, urban, white, age at first marriage, husband's earnings	Schooling of 10 year olds: Father's schooling (+; 1%) Mother's schooling (+; 1%) (effect significant for 15/16	NA

Study	Data and Sample	Specifications	Outcome	Control Variables	Parent Education Variables	Neighborhood Human/Social Capital Variables
					single years of education)	

Parental and Neighborhood Human/Social Capital Effects on Youth Fertility Outcomes

(See also Crane and Brooks-Gunn et al. above)

Study	Data and Sample	Specifications	Outcome	Control Variables	Parent Education Variables	Neighborhood Human/Social Capital Variables
Duncan and Laren (1990)	PSID-1,548 black and 2,194 white babies born between 1972 and 1985; Census geocode information	Reduced form logit	Low birth weight	Mother's age, mother marital status, mother smoking, family welfare receipt, mother's pre-natal employment, poverty status of mother's family, crowdedness of mother's household, mother grew up	parents' education (-)	High poverty incidence significant when entered alone; disappears when background, family, and risk controls introduced
Duncan, Connell, and Klebanov (1997)	About 700 children from the 1990 IHDP; 2464 individuals from	OLS; "transactions model" (several	IQ at age 3	Family income/needs ratio, mother's age at child's birth, ethnicity, birth weight, neonatal health, gender, whether teen	Mother's education (+;1%)	"Low SES" (NS for both outcomes) "High SES" (S for both outcomes)

Study	Data and Sample	Specifications	Outcome	Control Variables	Parent Education Variables	Neighborhood Human/Social Capital Variables
	PSID with completed schooling	variants)	Completed schooling	pregnancy Neighborhood variables: male joblessness, family concentration, ethnic diversity		
Chase-Lansdale and Gordon (1996)	1986 NLSY-673 black and white children ages 5 or 6 who live with their mothers	Multivariate analyses of variance	Cognitive functioning at age 5–6 Behavioral functioning at age 5–6	Region, family income, number of adults in household, number of children in household, mother working, race, gender, child's age, child in school Neighborhood variables: male joblessness, population concentration, racial similarity	Mother's education (+;1% For cognitive devel.) (-;5% for behavior probs.)	Neighborhood SES (S for cognitive and internalizing behavior but "wrong" sign for behavior
An, Haveman, and Wolfe (1993)	PSID: 872 females aged 0-6 in 1968 and older than 21 in 1988	Bivariate probit model	Out-of-wedlock birth, ages 13-18 = 1	Black, any religion, no. of years in SMSA, county average unemployment rate, average state welfare generosity, no. of siblings, mother's age at 1st birth, mother out-of-wedlock birth, no. of household location moves, no. of parental	Mother high school graduate (-) 1%	"Bad" neighborhood (NS)

Study	Data and Sample	Specifications	Outcome	Control Variables	Parent Education Variables	Neighborhood Human/Social Capital Variables
				separations, no. of parental remarriages, predicted average welfare ratio, parental welfare recipiency		

Parental and Neighborhood Human/Social Capital Effects on Youth Criminal Behavior

Study	Data and Sample	Specifications	Outcome	Control Variables	Parent Education Variables	Neighborhood Human/Social Capital Variables
Case and Katz (1991)	NBER Survey of Youth, 1989–1,200 youths aged 17–24, in low income Boston neighborhoods	OLS; Probit	Any crimes committed last year, use illegal drugs, single parent status, idle, high school dropout, attend church often, friendship with gang members	Presence of mother and father at age 14, parents' years of schooling, parental marital status, mother a teen at child's birth, family member drug and alcohol use history, family member in jail, family church attendance, age, gender, race; behavior/outcome variables of neighbor youths (defined as youths that are in the same and adjacent neighborhoods, and in the survey) matched to own outcomes	Parents' education (NS, most outcomes) Use illegal drugs (+, 1%) Parent idle (-, 10%)	Most outcome matched neighborhood behavioral characteristics are significant and "right" signed

Study	Data and Sample	Specifications	Outcome	Control Variables	Parent Education Variables	Neighborhood Human/Social Capital Variables
				Parental Human Capital Effects on Child Health		
Strauss (1990)	World Bank's LSMS and the Ministry of Finance in Cote d'Ivoire, 447 children under 6 years living in 154 households in rural villages	Fixed Effects	Height and weight-for-height standardized	Child age, male child, mother's height, mother's age, child of senior or junior wife, interaction of distances (to doctor, to nurse, to primary school) with mother's education	Weight-for-height outcome: Father's education (+; 10%) Mother's education (+; 20%) (without interactions)	NA
Thomas, Strauss, and Henriques (1991)	Brazilian Demographic and Health Survey (1986) on 1306 children aged five or less and their mothers (794 women) in northeast	OLS; 2SLS	Child height standardized	Income: partner and total household income, literacy: mother: semi-literate and literate, information usage: mother regularly listens to radio, watches TV, and reads paper; Community covariates: preschools and primary schools per thousand,	In rural Northeast: mother's education (+; 1%) (not significant when controlling for mother's information)	NA

Study	Data and Sample	Specifications	Outcome	Control Variables	Parent Education Variables	Neighborhood Human/Social Capital Variables
	Brazil			student:teacher ratio for both;		
				Health establishments: without specialists per capita and beds per facility, and with specialists per capita and beds per facility;	In urban Northeast: mother's education (+; 1%)	
				Infrastructure: proportion buildings with and without piped water, with electricity, central sewage, septic tank, rudimentary sewage, public garbage disposal; and population	partner's education (+; 1%) (not significant when controlling for mother's information)	
Glewwe (1999)	Morocco's Enquete Nationale sur le Niveau de Vie des Menages (1990-91) of 1495 households with children age 5 or younger	OLS; IV; community fixed effects; 2SLS with fixed effects	Height for age	Sex, age, age squared, mother's height, father's height, mother's schooling, father's schooling, rental income, children overseas, irrigated crop land, unirrigated crop land, tree crop land; Arabic, French, math, mother's health	Mother's schooling outcome: OLS estimate (+; 1%) Fixed effects (+; 5%)	NA

Study	Data and Sample	Specifications	Outcome	Control Variables	Parent Education Variables	Neighborhood Human/Social Capital Variables
				knowledge, mother's ability to read a medicine box		
King and Hill (1993)	United Nations' WISTAT and the World Bank's UNESCO and WHO datasets of 152 countries, 1960-1985	OLS	Infant mortality (deaths per 1,000 births)	Female/male enrollment ratio, GNP, total population, population per physician, percentage of population with safe water, seventeen regions of the world	Female enrollment (-; 1%)	NA
Lam and Duryea (1999)	Brazil's PNAD (1984) survey of 33,457 women 30-44 years old whose first birth was at least one year and five years before survey	Probit	First child's survival at age one and five	Seven regions, urban, white, age at first marriage, husband's earnings	Child's survival to age five outcome: Father's schooling (+) (significant at the 5% level for 10/16 single years of schooling)	NA

Study	Data and Sample	Specifications	Outcome	Control Variables	Parent Education Variables	Neighborhood Human/Social Capital Variables
					Mother's schooling (+) (significant at the 5% level for 8/16 single years of schooling)	

Parental Human Capital Effects on Family and Cohort Size

Study	Data and Sample	Specifications	Outcome	Control Variables	Parent Education Variables	Neighborhood Human/Social Capital Variables
Lam and Duryea (1999)	Brazil's PNAD (1984) survey of 13,519 women 30-34 years	OLS	Number of children born by age 30	Seven regions, urban, white, age at first marriage, husband's earnings	Father's schooling (-; 1%) Mother's schooling (-; 1%)	NA
King and Hill (1993)	United Nations' WISTAT and the World Bank's	OLS	Total fertility (number of children)	Female/male enrollment ratio, GNP, total population, population per physician, percentage of population with safe water,	Female enrollment (-; 5%)	NA

Study	Data and Sample	Specifications	Outcome	Control Variables	Parent Education Variables	Neighborhood Human/Social Capital Variables
	UNESCO and WHO datasets of 152 countries, 1960-1985			seventeen regions of the world		
Schultz (1994)	Summers and Heston, RAO country surveys, 1991 World Development Report, from 68 low income countries in 1972, 1982, and 1989	OLS; fixed effects	Age standardized vital rates: total fertility, child survival, and survivors' fertility	Family-planning activity score, (exports-imports of fuel)/GDP, agriculture - percentage of labor force, percentage urban, calories per capita	Adult female schooling (-;1%) Adult male schooling (+; 1%)	NA

Glossary

AFDC-Aid to Families with Dependent Children

IHDP-Infant Health and Development Program

LSMS-Living Standards Measurement Studies

NLS72-National Longitudinal Surveys, 1972

NLSY-National Longitudinal Survey of Youth

PNAD-Pesquisa Nacional de Amostra de Domicilios

PSID-Panel Study of Income Dynamics

PUMS Public Use Microdata Samples

SMA-Statistical Metropolitan Area

UNESCRO-United Nations Educational, Scientific, and Cultural Organization

WHO-World Health Organization

WISTAT-Women's Indicators and Statistics

TABLE 4

Estimates of the Annual Value (Willingness to Pay) or Impact of Additional Schooling

Outcome	Value or Impact	Source of Coefficients
Cognitive development of children	$350 in family income for high school diploma (vs. no diploma) and $440 for some college (vs. high school diploma).	Angrist and Lavy (1996)[1]
	$860–$5,175 per year in future family income for an additional year of schooling.	*Murnane (1981)[2]; *Edwards and Grossman (1979)[3]
	£1,166–£1,727 in family income for mother's educational attainment of vocational/first and	Ermisch (1999)

higher degrees.

$4008 in permanent family income for an   Blau (1999)

increase in 4.8 years of grandfather's schooling;

$2692 in permanent family income for an

increase in 3.6 years of grandmother's schooling.

Consumption efficiency $290 in household income for an additional   *Michael (1975);

year of schooling. Save approximately $5.50   *Benham and Benham

per pair of eyeglasses for an additional year   (1975)[4]

of schooling.

Own health $8,950 in increased net family assets for an   *Lee (1982)

additional year of schooling.

1.6 (1.1) fewer cigarettes smoked per day men   Kenkel (1991)[5]

(women) for an additional year of schooling.

Thirty-four more minutes of exercise per two

Weeks.

1.85 (1.25) (1.37) greater relative risk of death   Feldman et al. (1989)[6]

from heart disease, those with 8–11 years of

schooling compared to those with 12 or more,

males 45–64 (65–74) (females 65–74).

Reduction in criminal activity	$170 reduction in per capita expenditure on police for an additional mean year of schooling in community.	*Ehrlich (1975)
Volunteer Hours	$51 for males per year; $30 for females per year.	Freeman (1997)

Source: *Table 2, Haveman and Wolfe 1984, p. 396. All other values and impacts estimated by authors based on coefficients in studies listed in third column of table. All values in 1996 dollars except as noted.

[1]Based on National Longitudinal Survey of Youth (NLSY) (Table 8, column 4 estimates).

[2]Based on measurement of cognitive development on Iowa Test of Basic Skills using children in grades 3–6 whose families participated in the NIT experiment in Gary, Indiana. For conversion see Haveman and Wolfe (1984).

[3]Based on data from cycle II of the Health Examination Survey using mean of estimated value of mother's and father's education.

[4]Based on 1970 Health Interview Survey (HIS); n = 10,000, of which 1,625 obtained eyeglasses in 1970.

[5]Based on 1985 Supplement to the HIS on Health Promotion and Disease Prevention; n = 14,177 males and 19,453 females.

[6]Based on 62,405 persons in Matched Records Study, whites only.