

The Relationship between Household Health and Child Educational Achievement

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Abstract

Due to the vast amount of literature on both education and health within individuals, the positive effects of each are well-known. Higher educated people earn higher wages, are more civically engaged, and can better provide for their children, and healthier persons enjoy higher quality of lives. Conversely, the literature focusing on the intergenerational transmission of human capital from the parent to the child has only made conclusions on the effect of education, disregarding the importance of health. The research on the effect of parental health status and child outcomes has been largely neglected. As a result, intergenerational spillover effects of healthy outcomes need further understanding. Specifically, the question remains as to the effect of a guardian's health on her ability to transfer human capital to her child. To what extent can a healthy guardian invest human capital inputs more efficiently than an unhealthy guardian? Using longitudinal data from the Panel Study of Income Dynamics, I hope to explore this relationship using rich information on education and health within and across families. Here, I present a brief literature review and a theoretical model of educational achievement. I also include plans for future work.

1 Introduction

Due to the vast amount of literature on both education and health within individuals, the positive effects of each are well-known. Higher educated people earn higher wages, are more civically engaged, and can better provide for their children, and healthier persons enjoy higher quality of lives. Conversely, the literature focusing on the intergenerational transmission of human capital from the parent to the child has only made conclusions on the effect of education, disregarding the importance of health. The research on the effect of parental health status and child outcomes has been largely neglected. As a result, intergenerational spillover effects of healthy outcomes need further understanding. Specifically, the question remains as to the effect of a guardian's health on her ability to transfer human capital to her child. To what extent can a healthy guardian invest human capital inputs more efficiently than an unhealthy guardian? Using longitudinal data from the Panel Study of Income Dynamics, I hope to explore this relationship using rich information on education and health within and across families. Here, I present a brief literature review and a theoretical model of educational achievement. I also include plans for future work.

2 Motivation

Researchers have long been interested in the relationship between education and health. A higher level of education is positively correlated with healthier living at the individual and aggregate levels, measured by self-evaluated health status, physiological indicators of health, and rates of morbidity and mortality. Researchers postulate three theories as to why this correlation exists. First, economists have argued the existence of a spurious relationship between education and health, where preference and upbringing (Rosenzweig and Schultz, 1983) or the rate of time preference (Fuchs, 1982) lead to higher levels of educational attainment and healthier life outcomes. Second, researchers have theorized that better health leads to more schooling. (Edwards and Grossman, 1979; Berger and Leigh, 1989; Kenkel, 2000) While this effect is believed to be limited compared to the reverse causal effect, it is continually found to have significant impact throughout the literature. Third, there is a direct effect on the level of schooling on health. First theorized by Grossman (1972), this direction of causality is the most pronounced in the literature. More recently, publications citing a causal effect of education on health utilize IV and 2SLS analysis. Employing compulsory education

laws (Leras, 2002; Adams, 2002), school reform (Spasojevic, 2003), state unemployment rate (Arkes, 2001), and the risk of induction into the Vietnam war draft (de Walque, 2007) researchers have found a positive causal effect of education on a variety of health outcomes, regardless of time preference.

I know of only two studies, however, which analyze the effect of both parent's education and health on child outcomes. Using the Vital Statistics Natality files from 1970-2000, Currie and Moretti (2003) measure intergenerational transmission in health at birth and analyze its effect on socioeconomic status. By instrumenting for maternal education through the construction of an availability measure of college admission in a woman's 17th year of schooling, they conclude a positive effect of maternal schooling on birthweight which exceeds in magnitude the effect found from OLS analysis. The IV coefficient implies an added year of education decreases the probability of having a low birthweight child by a full percentage point. Further, they conclude a negative effect of maternal education on the probability of smoking during pregnancy, with the coefficient on the IV analysis exceeding that of OLS. They conclude an additional year of schooling reduces the probability of prenatal smoking by 5.8%. As prenatal smoking is the most identifiable risk factor for poor pregnancy outcomes in the U.S., they identify a plausible mechanism through which poor maternal health affects child birth outcomes. In a later study, Currie and Moretti (2007) analyze the intergenerational transmissions of health and education to the child through three pathways: the extent to which intergenerational correlations in low birth weight reflect SES, the effect of low birthweight on future economic status, and the strength of these intergenerational transmissions across socioeconomic status. Utilizing a sample of white women in California, they first reaffirm the causal effect of maternal health on infantile health through birthweight, and find this effect is two-fold in high areas of poverty. Further, they find the LBW infants born in 1970 have significantly inferior economic outcomes to their healthy counterparts. Women born LBW to LBW mothers experience annual income loss of \$290 (in 1970 dollars) compared to their normal birthweight peers, even after controlling for maternal income. As a result, the authors conclude there is a strong intergenerational correlation in birth weight that is not due to omitted variables. These results suggest that parental attainment in education and current health status play a role in the intergenerational transmission of human capital. However none of these studies are able to make conclusions on the "value-added" of these inputs throughout the life of the child, and only compare

outcomes at birth to outcomes as an adult. I propose that the complexities of these relationships need further insight.

3 Theoretical Model

The endogeneity of health and education into production functions has long been the subject of in-depth analysis, as previous research has revealed a strong relationship between education and health. Here, I present a theoretical model in the framework of Becker (1965) on the effects of parental education and health on child academic achievement, allowing for endogeneity between education and health.

I assume there are two individuals in the household: a guardian (1), and a child (2). The child lives in the household for $t=T$ periods. The time-specific utility function from $t = 0$ to $t = T$ for the guardian can be described as:

$$U_{1t} = U_{1t}(C_{1t}, C_{2t}, l_{1t}, l_{2t}, a_{2t}, H_{1t}, H_{2t}, X_{1t}) \quad (1)$$

where C and l represent *Consumption* and *Leisure*, respectively. The guardian also gains utility from the child's educational achievement, a_2 , and from the health status of both the guardian and the child, represented by the *Health Stock* of the guardian, H_1 , and the child, H_2 . Exogenous characteristics affecting guardian utility are represented by X_{1t} .

Assume the child is born at $t = 0$, and the guardian makes all choices in the household until $t = s$. As the child grows older, she begins to "break away" from the guardian and make individual-specific decisions in order to maximize her own utility while continuing to live in the same household. At the beginning of time $t = s+1$, the child maximizes utility:

$$U_{2t} = U_{2t}(C_{2t}, l_{2t}, a_{2t}, H_{2t}, X_{2t}). \quad (2)$$

I assume the child's utility is not dependent upon the welfare of the guardian. Exogenous characteristics affecting child welfare are represented by X_{2t} . The guardian continues to maximize Eqn. (1) throughout $t=T$, regardless of the child's choice-making ability.

3.1 Health Stock

The guardian works to produce a *Health Stock* for both the guardian and child, regardless of time period. I model *Health Stock* using framework provided in Gilleskie and Adams (1998). Current *Health Stock* for both the guardian and child follows a Markov process and is defined by:

$$H_{it} = H(H_{i,t-1}, I_{it}, M_{it}, \eta_{it}; E_1) \quad (3)$$

such that previous *Health Stock*, current illness state I_t , and current medical expenditures M_t form *Health Stock* at time t . The individual's health stock depreciates at rate η_t . The guardian's level of time-invariant *Education Stock*, represented by educational attainment, E_1 , serves as a technology parameter, and aids in the efficiency of *Health Stock* production.

The child's health production, like her guardian's, is aided by the guardian's level of educational attainment. A guardian with better health is more likely to send signals to the child which encourages a healthier lifestyle, and is more likely to provide a healthier home environment for the child to dwell.

3.2 Educational Achievement

Both the guardian and the child receive utility from the child's educational achievement. As a result, the guardian may choose to invest educational inputs r_1 into the child $\forall t$, and the child may invest educational inputs $r_2 \forall t > s$. These educational inputs by the guardian and the child produce additions to the educational stock, e_t , specified by:

$$e_t = e_t(r_{1t}, r_{2t}, H_{1t}, H_{2t}, F_t, P_t, S_t), \quad (4)$$

where r_{it} represents the amount of time spent into improving the child's educational achievement by either the guardian or the child. Family (F), Peer (P), and School (S) effects, as well as the *Health Stock* of both the child and the guardian are both inputs into the child's educational production function. A healthy child can learn more and perform better in school than an unhealthy child. Conversely, a healthy guardian can aid the child's educational production through both the time allotted to educational inputs and the efficiency with which the guardian can do so.

As a result of her utility function, the guardian may choose to invest educational inputs r_{1t} into

the child. The amount r_{1t} invested by the guardian is represented by:

$$r_{1t} = r_{1t}(H_{1t}, E_{1t}, Z_{1t}, \rho_t), \quad (5)$$

such that inputs into the child's educational production function are affected by guardian health, guardian educational attainment, a vector of exogenous variables, Z_t , and the cognitive ability of the child known to the guardians ρ_t . For the child, inputs into *Education Stock* are represented by r_{2t} . Like the guardian, the child must choose these inputs into her education, represented by:

$$r_{2t} = r_{2t}(a_{2t}, r_{1,t-1}, \rho_t, Z_{2t}), \quad (6)$$

such that the child's choice of inputs is a function of her known level of achievement, her known ability, and various socio-demographic characteristics. The child's inputs are also a function of the parent's choices, through the reception of signals (whether explicit or implicit) sent by the parent indicating the importance of educational achievement.

Summing the additions into the education production function, e_t , provides a measure of *Education Stock* to the child at time t :

$$E_{2t} = \sum_{i=0}^T e_{it}. \quad (7)$$

I assume *Education Stock* for the child does not depreciate. We also form a model of educational achievement:

$$a_{2t} = a_{2t}(E_1, E_{2t}, X_t; \mu_2, \Phi). \quad (8)$$

The child's educational achievement at time t is a function of the guardian's time-invariant educational attainment, the child's *Education Stock* at time t , a vector of socio-demographic variables X_t , and is aided in production by a child-specific ability parameter μ_2 and a household-specific ability parameter Φ .

3.3 Constraints

Both the guardian and the child in the household face time constraints:

$$\Omega_{1t} = h_{1t} + l_{1t} + r_{1t} \tag{9}$$

$$\Omega_{2t} = l_{2t} + r_{2t} \tag{10}$$

such that the parent must choose to allocate her time between *Hours Worked*, *Leisure*, and *Educational Inputs*. Beginning at time $t = s + 1$, the child chooses to allocate her time between *Leisure* and *Educational Inputs*.

The guardian of each household must choose the amount of *hours worked* and the amount of time r_{1t} to invest in the child's education production function. The *hours worked* decision is dependent upon the wage function:

$$w_t = w_t(Exp_t, E_{1t}, \tau_t), \tag{11}$$

which is a function of *experience*, *guardian educational attainment* and *tenure* (τ) at the guardian's current place of work. I assume the child does not work and earns no income.

Therefore, the per-period household budget constraint is given by:

$$w_t h_{1t} + A_t = p_c C_t + p_m M_t, \tag{12}$$

where A_t represents the amount of assets owned by the household at time t , and M_t represents medical expenditures. I assume the price of consumption, p_c , and the price of medical care, p_m , are exogenous, and that all consumption and medical expenditures for the household are made by the guardian. I also assume no intertemporal borrowing or lending.

In each time period before the child is able to make input choices ($t \leq s$), the guardian makes all choices for the household. The guardian must allocate her time between inputs into the educational production function, hours working, and leisure. The guardian must also make choices on consumption and medical care. The guardian's utility function remains the same after time s ,

therefore the forward-looking guardian makes decisions which maximize:

$$\sum_{t=0}^T U_{1t} = \beta^t [U_{1t}(C_{1t}, C_{2t}, L_{1t}, L_{2t}, a_{2t}, H_{1t}, H_{2t}, X_t)] \quad (13)$$

After $t = s$, the child begins to make choices about the amount of time in leisure and adding to the educational process. I assume the child is forward-looking and maximizes:

$$\sum_{t=s+1}^T U_{2t} = \beta^{t-(s+1)} [U_{2t}(C_{2t}, L_{2t}, a_{2t}, H_{2t}, X_t)] \quad (14)$$

4 Data

The Child Development Supplement (CDS) of the Panel Study of Income Dynamics (PSID) provides valuable data concerning the welfare of children in the PSID sample. The supplement contains tests of both cognitive ability and academic achievement as well as physical and mental health information. Measures of the learning environment in the home and school resources are also included. The supplement also contains comprehensive accounts of the caregiver’s time inputs into the child, as well time accounts for the child herself. Three waves of the CDS have been conducted: 1997, 2002, and 2007. The PSID was conducted biannually from 1968-1996, and 1997-2007, and includes outcomes for both the family and individuals across a broad variety of measures, most importantly general measures of health and income. Those in the CDS sample who have departed the household after either the first or second wave are included in the 2005 Transition to Adulthood (TA) sample which includes information on educational attainment (including scores on college entrance exams, income, and health outcomes. A strength of the data set is the ability to link observations across families, as many in the CDS share grandparents.

5 Future Work

I cite two pathways, education and health, that affect a parent’s transmission of human capital to the child, and affect the child’s educational production function. In future work, I hope to explore these pathways and distinguish educational and health effects in the transmission of human capital from the parent to the child by developing and solving a proper empirical framework, which may

be comprised of either a dynamic or static simultaneous-equations methodology. In essence, I hope to add to the body of literature which suggests estimates of returns to health that focus only on wages understate the total return.

6 References

- Arkes, J, (2001) Does schooling improve adult health? Working Paper, RAND Corporation, Santa Monica, CA
- Auster, R., I Leveson, and D Sarachek. (1969) "The production of health: an exploratory study" *Journal of Human Resources*. 4, 411-436.
- Becker, G.S. (1965). "A theory of the allocation of time". *Economic Journal* 75, 493-517.
- Currie, J and E. Moretti. (2003) "Mother's education and the intergenerational transmission of human capital: evidence from college openings." *Quarterly Journal of Economics* 118, 1495-1532.
- Berger, M and JP Leigh(1989) Schooling, self-selection, and health. *Journal of Political Economy* 24, 433-455.
- de Walque, D. (2007) "Does education affect smoking behaviors?: evidence using the Vietnam draft as an instrument for college education." *Journal of Health Economics* 26, 877-895.
- Edwards, L and M Grossman (1979) "The relationship between children's health and intellectual development." *Health: What Is It Worth?* ed Mushkin, S and D Dunlop. New York: Pergamon Press.
- Fuchs, V. (1982) "Time preference and health: an exploratory study" *Economic Aspects of Health* ed. Fuchs, V. New York, Columbia University Press.
- Gilleskie, D and A. Harrison. (1998) "The effect of endogenous health inputs on the relationship between health and education" *Economics of Education Review*. 17, 279-297.
- Grossman, M. (1972) "On the concept of health capital and the demand for health" *Journal of Political Economy*. 80, 223-255
- Grossman, M. (1976) "The correlation between health and schooling" *Household Production and Consumption*. ed. Terleckyj, N.E. New York, Columbia University Press.
- Kenkel, DS. (2000) "Prevention" *Handbook of Health Economics*, eds. Culyer, AJ and JP Newhouse, vol 1B, Elsevier, Amsterdam.
- Lleras-Muney, A (2005) "The relationship between education and adult mortality in the United States" *Review of Economic Studies* 72, 189-221.
- Rosenzweig, M and TP Schultz. (1983) "Estimating a household production function: heterogeneity, the demand for health inputs, and their effects on birth weight." *Journal of Political Economy*. 91, 723-746.
- Spasojevic, J (2003) Effects of education on adult health in Sweden: results from a natural experiment. Ph.D. Dissertation, City University of New York Graduate Center, New York.