

Human Capital Development before Age Five

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1 Summary

In economics, there has been a growing realization that early life conditions can have persistent and profound impacts on later life. For example, with information of children's test scores and background variables measured as of ages 6 to 8,

- McLeod and Kaiser (2004) find that 12% of the variation in the probability of high school completion and about 11% of the variation in the probability of college completion can be predicted.
- Currie and Thomas (1999b) find that 4% to 5% of the variation in employment at age 33 can be predicted, and as much as 20% of the variation in wages.

c.f. labor economists generally feel that they are doing well if they can explain 30% of the variation in wages in a human capital earnings function.

In 2000, there were no articles on human capital and early childhood environment in JPE, QJE, or AER, but there have been five or six per year in these journals since 2005.

2 Conceptual Framework

This section describes why and how human capital investment occurs. In basic Grossman model, early childhood matters less in the future because of depreciation δ :

$$h = A(\delta I_1 + I_2), \quad (1)$$

where h is health or human capital at the completion of childhood, I_1 and I_2 are human capital investment in the period 1 and 2, and A is a production technology. In contrast, the “early influences” literature considers

$$h = A(\gamma I_1 + (1 - \gamma)I_2), \quad (2)$$

where γ represents the importance of early investment. Depending on the value of γ , early-childhood events may be more influential than later childhood events, or more generally, Heckman (2007) suggests more flexible specification:

$$h = A(\gamma I_1^\phi + (1 - \gamma)I_2^\phi)^{1/\phi}, \quad (3)$$

where ϕ represents the complementarity between investments in the different periods. Aside from equation (3), Heckman (2007) highlights two features that may affect human capital formation:

- dynamic complementarities
- self-productivity in the multidimensional outcome.

Under this setting, consider the effect of early childhood shock. That is, under equation (3), fixed total investment $\bar{I}_1 + \bar{I}_2$, and early childhood shock μ in the first period, consider $\frac{\partial h}{\partial \mu}$.

- Under the assumption that there is no endogenous response to the shock μ in the second period,

$$\frac{\partial h}{\partial \mu} = \gamma A \left(\gamma (\bar{I}_1 + \mu)^\phi + (1 - \gamma) \bar{I}_2^\phi \right)^{(1-\phi)/\phi} (\bar{I}_1 + \mu)^{\phi-1}, \quad (4)$$

implying that the early childhood shock has larger impact for those who have less human capital investment \bar{I}_1 (when $\phi \neq 1$). This prediction is consistent with the empirical finding that long-term damage due to shocks is more likely among poorer families (Currie and Hyson, 1999).

- When we allow endogenous response in the second period, complementarity determine the type of response in the second period. If substitution is relatively difficult ($\phi < 0$), parents tend to reinforce the shock, and on the other hand, they tend to compensate the shock If substitution is relatively easy ($\phi > 0$). This prediction is applicable to the allocation between siblings. For instance, when substitution is relatively difficult, parents tend to put more effort on the more endowed sibling, which may cause bias in the reduced-form estimates.

3 Methods

In this section, we discuss the sibling fixed effect model, small sample size issue, and data quality. The sibling fixed effect model is a common approaches in the literature

- e.g. Currie and Thomas (1995) find Head Start program has negative effect on children, but by eliminating unobservable heterogeneity with the sibling fixed effect model, positive effects on children are discovered.

One caveat is that they cannot control for individual-specific factors. This means difference between siblings such as parents reinforcement/compensation behaviour may bias estimates.

- e.g. compensation \implies downward bias

Empirically, whether difference in siblings affects parental investment is mixed.

- no effect of endowment (birth weight) on parental investments (Datar et al., 2010, Royer, 2009, etc) except Hsin (2010) finds that low birth weight decrease time use of mother (with 65 siblings).

More work on this field is required. Also, information about individual children and parents can help interpretation of the estimation results.

4 Empirical Literature

In this section, we look into the empirical evidence of the long-term effects of early childhood shocks and the effects of governmental intervention.

4.1 Evidence of Long-term Consequences

In the this literature, there has been extensive research in the field of epidemiology, which was criticized even within epidemiology for the lack of identification strategy. The main focus of recent research in the economic literature is the causal effects of

- environment before age five on future outcomes.
- shocks before age five on parents' response.

Two kind of mechanism have been considered: a) Prenatal environment, and b) Early childhood environment.

4.1.1 Prenatal Environment

Maternal Health

Currie and Hyson (1999) find “fetal origin” effects: low birth weight cause disadvantage in health condition in adulthood human capital accumulation (test score, IQ).

- v.s. “brain sparing” mechanism in epidemiology: when *in utero* conditions are damaged, neural development is prioritized to the body.
- Stein et al. (1975) in epidemiology find no effects of Dutch Hunger Winter on IQ.

The series of papers examine relationship between low birth weight and outcomes in adulthood.

- Conley and Bennet (2001), Behrman and Rosenzweig (2004), and Currie and Moretti (2007) consistently find negative effects on educational attainment.
- Similar evidence across different regions: Norway, Canada, Taiwan, and California.
- Identification is based on the sibling (twin) fixed effect model.
- no conclusive evidence of parents’ response (Royer, 2009)

“Fetal origin” effects are also found in other prenatal condition such as seasonal differences (Doblhammer and Vaupel, 2001) and prenatal exposure to flu (Almond, 2006).

Economic Shocks

Economic shocks around the time of birth is also considered as the source of prenatal shocks which might affect health conditions in adulthood. The evidences are rather mixed.

- Van Den Berg et al. (2006) find that economic downturns around the time of birth reduce adult survival rates.
- Cutler et al. (2007) find no long term morbidity effects of the Dustbowl era of 1930s.

- Baten et al. (2007) find effects of grain prices on numeracy based on “age heaping” in the British Censuses between 1851 and 1881.

Air Pollution

Old literature in epidemiology is criticized because of endogeneity concern.

- better air quality for high SES → overstate the effect of bad air
- richer people concentrate on city → understate the effect of bad air

Natural experiment such as

- the implementation of the Clean Air Act of 1970 (Chay and Greenstone, 2003)
- the recession of the early 1980s (Chay and Greenstone, 2003)
- exposure to monoxide with detailed location data (Currie et al., 2009)
- the introduction of ETC devices (Currie and Walker, 2009)

find negative effects of bad air conditions. The effects of pollution on fetal health was harder to be detected than on infant health, which might imply protection against toxic exposure *in utero*.

In relation to air pollution, smoking is another literature concerning the effects of prenatal health.

4.1.2 Early Childhood Environment

Infections

The effect of infections in the early childhood on economic outcomes such as height, health status, educational attainment, test scores, and labour market outcomes is commonly studied.

- Bleakley (2007) finds positive effects on the literacy, school completion, and wage.
- Chay et al. (2009) find positive effects on the test score.

Home Environment

Three aspects that may be most salient: Maternal mental health and/or substance abuse, maternal employment, and child abuse/foster care.

- Frank and Meara (2009) find the negative effects of maternal depression on the quality of the home environment and on children’s behavioural problems.
- Berger et al. (2005) and Ruhm (2004) find small negative effects of maternal employment on children’s cognitive development.
- v.s. Baker and Milligan(2010), and Dustmann and Schonberg (2009) find little effect of the maternity leave on children’s outcomes.
- Currie and Widom (2009) find that the abused children were less likely to be employed, had lower earnings, and fewer assets.

Identification are mostly based on OLS with controls, propensity score matching, and maternal fixed effect. The exception is the recent studies using variation in maternity leave policy for the effect of maternal employment.

4.2 Policy responses

The recent literature in economics finds substantial effects of early childhood shocks on subsequent human capital and health. In this section, we consider governmental intervention as a possible remedy of negative early childhood shocks.

Income Enhancement

Poverty in childhood often results in poor investment choice. The simplest intervention is cash transfer, which turns out to be hard to examine.

- Berger et al. (2009) point out that selection + high correlation between income and other home environment makes it hard to detect the effect of income.
- Levine and Zimmerman (2000) find no effect of the cash transfer on test score after controlling for the test scores of their mothers.

Alternative intervention is conditional tax credits such as the Earned Income Tax Credit (EITC) in US: poor household can get repayment of their tax.

- Dahl and Lochner (2005) find positive effects of EITC on test scores .
- Milligan and Stabile (2008) find even bigger positive effects of child benefits on test scores in Canada.

Another possible intervention is conditional cash transfers (CCTs), which has been common in developing countries. One of exception is the program in New York City by Manpower Development Research Corporation.

Overall, income transfer do have effects. Yet, there exist many in kind programs (about 10% of GDP including health care and educational program). Currie and Gahvari (2008) survey the many reasons for this phenomena and conclude that the most likely reasons are paternalism and politics.

Near-cash Programs

Programs such as Food Stamp Programs(FSP) and Housing Assistance are called “near-cash” programs. This kind of programs can be considered as a transfer of the equivalent amount of cash as long as transfers don’t exceed the optimal expenditure.

The literature finds the positive effect of FSP on food expenditure, but most of the transfer in food expenditure is crowded out by corresponding reduction in food expenditure. Positive effects on outcomes of children are also observed.

- Hoynes and Schanzenbach (2009) find that 16% of the amount of FSP goes to food while 9% of cash transfer goes to food.
- Bingley and Walker (2007) find that in the Welfare Milk Program in UK, 80% of the transfer is crowded out by reduction in milk expenditure.
- Almond et al. (2011) finds a positive impact on birth weight.

As for housing assistance, the literature finds positive effects on

- retention (Currie and Yelowitz, 2000, and Goux and Maurin, 2005)
- future earnings and employment (Newman and Harkness, 2002)
- MTO finds positive impacts on girls' mental health and school attainment.

Early Intervention

Programs such as home visiting are attempts to intervene in the lives of poor children to improve their outcomes. Famous example is Olds et al. (1997, 2007), which conduct RCTs targeting families at risk because the mother is too young, poor, uneducated and/or unmarried.

- They find that home visiting has positive effects on health, child's delinquent behaviour, maltreatment, etc.
- It is pointed out that they find strong effects because they focus on extreme subpopulation.

- Therefore, the cost-effectiveness of this intervention is still ambiguous.
- Another perspective is that Olds' results are coming from the change in parenting behaviour (home visiting as a parenting program).