



Older siblings' contributions to young child's cognitive skills



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ABSTRACT

This work finds that older siblings as well as early parenting influence young children's cognitive skills directly or indirectly, for example, Mathematics, and English. Our findings challenge a pervasive view in the economical literatures that early parenting plays a dominant role in explaining child development. In economics, early environmental conditions are important to demonstrate the evolution of adolescent and adult cognitive skills (Cunha and Heckman, 2007; Knudsen et al., 2006), and it establishes causal impacts of early parental inputs and other environmental factors on cognitive and non-cognitive skills (Borghans et al., 2006; Cunha et al., 2010; Heckman et al., 2006b). Early parenting as well as older siblings should explain a diverse array of academic and social outcomes, for example, Mathematics, English, marriage and pregnancy. In fact, older siblings' characteristics are as important, if not more important, than as parenting for child development. Our analysis addresses the problems of measurement error, imperfect proxies, and reverse causality that plague conventional approach in psychology. We find that older brother contributes much more than older sister to child's mathematical achievement, while older sister contributes much more to child's English achievement. Our evidence is consistent with psychology literature, for example, Hetherington (1988), Jenkins (1992), Zukow-Goldring (1995), Marshall et al. (1997), Maynard (2002), and Brody et al. (2003) for siblings' direct contributions to child development, Bronfenbrenner (1977), East (1998), Whiteman and Buchanan (2002), and Brody et al. (2003) for siblings' indirect contributions, and Reiss et al. (2000), Feinberg and Hetherington (2001), and Kowal et al. (2002) for parental differential treatment.

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1. Introduction

Numerous economical literatures establish that early parenting from parents, grandparents and maternal grandparents contributes to children's cognitive skills and non-cognitive skills, for example, Mathematics, English. Less is well known in economics for the contribution of older siblings to children's cognitive skill, non-cognitive skill, and social behavior.

It is emerging in economics to demonstrate the importance of early environmental conditions on the evolution of adolescent and adult cognitive and non-cognitive skills (Cunha and Heckman, 2007; Knudsen et al., 2006). These skills determine educational attainment, crime, earnings, and participation in risky behaviors (Heckman et al., 2006b). It considers environmental influences on development over the entire life cycle of the child and into adulthood (Heckman, 2007). Cognitive and non-cognitive skills, including self-regulation, motivation, time preference, far-sightedness, adventurousness and the like, affect the evolution of health capital through choices made by parents and children. Aspects of personality and cognition

determine health and healthy behaviors beyond their direct effect on education (Heckman et al., 2006b; Ryff and Singer, 2005).

The economic literature on personality and preference formation establishes causal impacts of early parental inputs and other environmental factors on cognitive and non-cognitive skills (Borghans et al., 2006; Cunha et al., 2010; Heckman et al., 2006b). Early childhood interventions can affect personality traits and cognitive skill that promote health. A simple investment framework can analyze synergies in producing cognitive and non-cognitive skills (Heckman et al., 2006b).

A growing psychology literature contributes sibling relationships for child and adolescent development. Interactions with older siblings promote young children's language and cognitive development, their understanding of other people's emotions and perspectives, and, conversely, their development of antisocial behavior (Brody et al., 2003; Hetherington, 1988; Jenkins, 1992; Marshall et al., 1997; Maynard, 2002; Zukow-Goldring, 1995). Parents with older child contribute to their rearing of younger child, which in turn contributes to the younger child development (Brody et al., 2003; Bronfenbrenner, 1977; East, 1998; Whiteman and Buchanan, 2002). Thus children may receive differential treatment from their parents (Feinberg and Hetherington, 2001; Kowal et al., 2002; Reiss et al., 2000). In psychology, younger siblings' outcomes are more accurate to predict if it is

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based on older siblings' characteristics plus parenting, rather than parenting alone.

This work presents an analysis of the influences of early parenting as well as older siblings on Mathematics, English, and cognitive skill. Our work concentrates, in economics, on younger siblings' outcomes considering older siblings' characteristics plus parenting. We find that both early parenting and older siblings influence child's cognitive skills directly or indirectly, for example, Mathematics, and English.

Our model differs from previous models (Borghans et al., 2006; Cunha et al., 2010; Heckman et al., 2006b) in including gender and kindergarten, in particular, older siblings, in the model as explainable variables, except for early parenting from parents, grandparents and maternal grandparents. We allow those variables to influence Mathematics, English, and cognitive skills.

We find that early parenting as well as older siblings are important in explaining a variety of cognitive skills, for example, Mathematics, and English. There are important gender differences in older siblings for child development, but older siblings play an important role for both male and female children. In particular, we find that older brother contributes much more than older sister to young child's mathematical achievement, while older sister contributes much more to young child's English achievement.

For a variety of cognitive skills, a change in older siblings has an effect on skills comparable or greater than a corresponding change in early parenting. This evidence challenges a pervasive view in the economical literatures that early parenting plays an important role in explaining child development (Borghans et al., 2006; Carneiro and Heckman, 2003; Cunha et al., 2006, 2010; Heckman and Masterov, 2004; Heckman et al., 2006b).

Our approach recognizes that test scores measuring Mathematics, English and cognitive skill may be fallible. It also recognizes that a child's gender and kindergarten, in particular, older siblings, at the time of the test are taken to affect test scores. Observed parenting-ability and older-sibling-ability relationship may be the consequences of ability causing measured ability rather than the other way around. We correct measured test scores for these problems.

Our analysis supports that early environment affects the evolution of adolescent and adult cognitive and non-cognitive skills (Cunha and Heckman, 2007; Knudsen et al., 2006), we find that gender, early parenting, and kindergarten determine the measures of cognitive skills that we study. We find that older siblings affect young siblings' cognitive skills through their direct effects as well as through their indirect effects via the parents. Our evidence is consistent with psychology literature. For example, Hetherington (1988), Jenkins (1992), Zukow-Goldring (1995), Marshall et al. (1997), Maynard (2002), and Brody et al. (2003) find siblings' direct contributions to child development. Bronfenbrenner (1977), East (1998), Whiteman and Buchanan (2002), and Brody et al. (2003) find siblings' indirect contributions. Reiss et al. (2000), Feinberg and Hetherington (2001), and Kowal et al. (2002) find parental differential treatment with their children.

The remaining is organized as follows. Section 2 relates our analysis to previous work in the literature. Section 3 introduces the data used in our analysis and presents empirical results only considering the early parenting from parents, grandparents and maternal grandparents. We then discuss problems that plague this model. Section 4 presents our model including the contributions of gender and kindergarten, in particular, older siblings, its implementation, and empirical evidence. Section 5 is for concluding remarks.

2. Related literature

Cognitive and non-cognitive skills can influence a variety of abilities, for example, schooling choice, wages, employment, occupation choice, and risky behaviors such as teenage pregnancy and marriage, smoking, marijuana use, and participation in illegal activities

(Heckman et al., 2006b). Early parental inputs and other environmental factors influence cognitive and non-cognitive skills. Knudsen et al. (2006) find that early environment influences the development of cognitive and social skills. Cunha and Heckman (2007) and Cunha et al. (2010) apply nonlinear factor method to non-parametrically identify production function for children's cognitive and non-cognitive skills. Those economic literatures leave open older siblings' contribution to child's development. Our work finds that early parenting as well as older siblings contribute to child's cognitive development. In the side of early parenting, our result is consistent with previous work. In our work, we need to carefully consider measure error and reverse causality, since econometric model cannot distinguish older siblings' direct contribution from indirect contribution, where reverse causality arises differently from the previous situations.

Psychology literature suggests that naturally occurring teaching and early-parenting experiences benefit cognitive and psychosocial development in both older and younger siblings. Jenkins (1992) compares the frequency of negative and positive sibling relationships in disharmonious and harmonious homes. Hetherington (1988), Zukow-Goldring (1995), Marshall et al. (1997), and Maynard (2002) find that older siblings directly contribute to younger siblings' development. Parents' experiences with older children influence their expectations of subsequent children and the child-rearing strategies that parents consider effective (Whiteman and Buchanan, 2002). Bronfenbrenner (1977), East (1998), and Brody et al. (2003) confirmed the operation of indirect effects on younger siblings' development. In addition, parental differential treatment contributes to child's development (Feinberg and Hetherington, 2001; Kowal et al., 2002; Reiss et al., 2000). Those literatures fall in the contribution of siblings to child development in psychology. We examine those results in economics. In economics, both small sample and reverse causality plague conventional approach which was often applied in psychology. Therefore, on the siblings' contribution to child's development, our methodology is reasonable and much more approximate to real world.

It is instructive to compare our results on the influence of early parenting as well as older siblings on child's cognitive skills to the results from conventional approaches. The conventional approach suffers from several problems. First, Mathematics, English, and cognitive scores are imperfect proxies of Mathematics, English, and cognitive skills. We should consider measure error here. Second, since older siblings can influence younger siblings through their parents, there may exist reverse causality. Finally, small sample plagues psychometrics in child development. All these problems likely bias the estimates. Our work differs from the economical literatures till now in including older siblings' contribution, and from the present psychology literatures in treating with imperfect approximation, and reverse causality.

3. Some evidence for classical model

This section presents a standard ordinary least squares analysis of the contributions of gender and early parenting from parents, grandparents and maternal grandparents on child's Mathematics, English and cognitive skill. We obtain the similar qualitative results to previous reports.

3.1. Data

Our data are from the people in Wuhan, Hubei, and P. R. China, which include students and neighbors from all around China. It contains cross-sectional data on gender, number of older siblings (female or male), length of education in kindergarten, early parenting from parents, grandparents and maternal grandparents, records of mathematics and English for a number of young persons, ages 19 to 30 in

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