



Quantity–quality trade-off of children and school finance[☆]

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ABSTRACT

To understand income inequality and intergenerational mobility of income, it is essential to account for the fertility differential between the poor and the rich because it affects the human capital investment through the quantity–quality trade-off of children. We develop a dynamic general equilibrium in which parents choose the quantity of children, transfer a preschool ability to their children, determine the quality of children by choosing private expenditures on basic education (in addition to public expenditures), and leave a bequest that could be used to finance college education. We find that incorporating fertility behavior, especially differential fertility is crucial to capture human capital formation in the U.S. economy. We also analyze the impact of basic education subsidies and college subsidies on welfare, inequality, and intergenerational mobility.

1. Introduction

Regardless of whether it is the basic education system (K-12) or higher education, governments around the world subsidize schools heavily. Not surprisingly, U.S. is not an exception. In 2013, the U.S. had public direct expenditures for public elementary and secondary education (K-12) of approximately 3.3% of GDP, out of which 1% was spent on college.¹ Given the very large magnitude of education subsidies, government intervention in education has recently received a growing research attention.

Considering the objective of redistributive motives, Hanushek et al. (2003) finds a limited general support for college subsidies. An alternative justification for college subsidies revolves around credit constraints for human capital investment (e.g. Becker, 1993 [1964] or Garratt and Marshall, 1994) and has been further studied in Fender and Wang (2003), Caucutt and Kumar (2003) and Hanushek et al. (2014). In a separate stream of literature, some studies (e.g. Hanushek and Yilmaz, 2013 or Epplé and Platt, 1998) have developed models to analyze a series of both the past and present school finance policies for K-12. The separation of those two literature lines seems to be artificial and hence, it is natural to think of the education system as a whole while designing school finance policies. After all, a change in K-12 policies would have substantial impacts on college outcomes or vice versa. Our paper attempts to fill in this gap in the literature.

A broad consensus exists that children in families with more resources enjoy considerable advantages in their development and long-term prospects (e.g. Mayer, 1997; Duncan et al., 2001, and Duncan and Magnuson, 2005). Wealthy parents invest more resources than ever before in their children (in weekend sports, ballet, music lessons, math tutors, and in overall involvement in their child's schools), while lower-income families, which are more likely to have more children, are highly stretched for resources (e.g. Kornrich and Furstenberg, 2013). As a result, an achievement gap between rich and poor children exists (for example, see Hanushek, 1992). The empirical evidence is consistent with what is known as the “quantity–quality trade-off theory”, advanced by

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¹ National Center for Education Statistics, 2017.

Becker (1960), Becker and Lewis (1973), and Willis (1973), that predicts poor (rich) parents are likely to have many (few) children and provide little (good) education.

Our objective is to develop a general equilibrium model in which both fertility and basic education decisions are interdependent. Our work is based on Hanushek et al. (2014). We use a similar overlapping generations framework, but model endogenous fertility decisions along the lines of Becker and Barro (1988), and de la Croix and Doepke (2003). We begin in a world where ability determines labor productivity, and is produced through a basic education production function that uses preschool ability and expenditures (both public and private) on basic education as inputs. The preschool ability of a child is transmitted from her parents and assumed to be correlated with her parent's preschool ability. Parents face a quantity–quality trade-off in decisions regarding their children. Poor families tend to have more children and provide little basic education. Later, the child becomes an adult, and as an adult, she makes a college attendance decision depending on whether attending college provides her with a higher level of utility. After all, the college attendance decision is risky -the adult could fail and become an unskilled (uneducated) worker in the end. The probability of success is determined by the ability of the adult. If the adult chooses not to attend college, she is employed as an unskilled worker during her college years. Once the college outcome is realized, she provides skilled or unskilled labor in the labor market for the rest of her life, depending on her college outcome. Moreover, she makes a decision so as to the quantity and quality of children, savings and her consumption. As she moves to the last period, she becomes old and decides on her consumption as well as the size of the bequest she leaves for her children to finance their college tuition in case of college attendance. A child without sufficient bequests to pay off college tuition has the option to attend college by borrowing from a government loan program and paying the loan back to the program with interest in the future.

Incorporating fertility behavior into our model is clearly an important feature of our model. Our paper finds that to understand income inequality and intergenerational mobility of income, it is essential to account for the quantity–quality trade-off between the poor and the rich in human capital formation. The degree of quality-quantity trade-off is determined by fertility behavior.² We also find that the impact of government subsidies on education depends on fertility behavior and without fertility behavior, any model with human capital formation would produce biased results.

This paper is organized as follows: In Section 2, we develop the model. Section 3 calibrates the model to the U.S. data. We describe the base outcomes in Section 4. In Section 5, we show the importance of fertility behavior in human capital formation by shutting down the fertility channel. We perform a sensitivity analysis under different fertility parameters in Section 6. In Section 7, we conduct three policy experiments: basic education subsidies, college subsidies, and a combination of both. We then study their impact on welfare, inequality and intergenerational mobility under different settings. Finally, Section 8 concludes our analysis.

2. An overlapping generations model

Our economy is populated by individuals who live for three periods: childhood, adulthood, and old age. Individuals in the second period of their lives, with newborn children, form a household unit that lasts for two periods. An important aspect of the paper is endogenous fertility. The poor have more children and invest less on the basic education of their children than the rich. The individual dies at the end of third period of her life, and the child becomes an adult. As a result of endogenous fertility, the population changes over time. At any time t , three successive generations of a dynasty co-exist: the grandparents in old age period, the children of grandparents in the adulthood period (parents) and the children of parents in the childhood period (grandchildren).

Individuals differ in their human capital, which determines their earnings in the second and third period of their lives. At the beginning of the second period, a decision as to whether to attend college or not is made. Attending college is a risky decision. Depending on an individual's human capital, the individual attending college either succeeds (skilled worker) or fails (unskilled worker). The individual who chooses not to attend college is employed as an unskilled worker during her college years and consumes all of the bequests left by her parents. In the rest of the second period, individuals are employed as either skilled or unskilled workers depending on their college decision outcomes. Besides, individuals decide on the amount of consumption and saving, the number of children, and the amount of resources devoted to their children's basic education in addition to public education (K-12). In the third period, individuals make consumption and bequest decisions. Bequests are then used by their children either (i) to pay for college, or (ii) to be consumed. For children without sufficient funds to pay off college tuition, there is a government loan program to help them out in case they choose to attend college. If a child borrows from the program to attend college, the program pays a portion of her college tuition depending on the level of bequest she receives from her mother and she pays the loan back to the program with interest after college.

Children are born with preschool abilities, that are also correlated with their parent's preschool abilities. Our model allows siblings to differ by preschool ability. In the first period (childhood), their human capital is formed and depends on three things: preschool ability, private and public expenditures on basic education.

The output is produced through a constant returns to scale production function, that uses skilled and unskilled workers as inputs. Our model abstracts from physical capital, and assumes that the interest rate is constant. The role of the government is solely to tax the labor and use tax revenues to provide basic public education and to subsidize college. More importantly, the quality of education

² The U.S. has gone through a major demographic transition over the last 200 years. A long term reduction in overall fertility has occurred. The decline was substantial, falling from 5.5 children per woman born in 1828 to about two children per woman in 1958 (Jones and Tertilt, 2009). Besides, a negative relationship between fertility and income is found to exist. More importantly, the fertility gap between the poor and the rich has been continuously narrowing, and fertility has become less income-sensitive over time (known as the compression of fertility).

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