Extended Abstract for Paper to be Presented at the PAA Meetings 2007:

Skills, Schooling, and Fertility in Ghana: Do Adult Literacy Programs Matter?

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1. Introduction and Motivation

One of the strongest and most consistent findings in demography, development, health, and labor economics is the negative relationship between schooling and fertility. This empirical relationship has been confirmed in numerous studies across different time periods and countries. These studies generally treat education as a "black box", however. What is measured is not what a person has learned in terms of skills such as for example literacy and numeracy but rather what level or grade has been completed. Two main

issues are involved here. First, the link between schooling and fertility really goes from schooling to skills and knowledge to fertility. As the link between schooling and skills is more tenuous in developing countries due to often poor school quality, it is imperative that this part of the process receive particular attention in empirical analyses in this context. Second, policies focusing on education rather than on skills and obtained knowledge might be misdirected. With multiple paths to achieving skills (including formal education and adult literacy programs) and with limited public budgets, cost-effectiveness of programs is essential.

In response to these issues, I suggest that literacy, numeracy and other skills be viewed as intermediate outputs in a production process where the main inputs are formal (child) schooling and non-formal (adult) literacy course attendance. Subsequently, literacy, numeracy and other skills enter as inputs in a production process to generate fertility. The overall purpose of this study is to further investigate this conjectured two-pronged production process by addressing the two main issues raised above for the case of Ghana.

Ghana is an ideal candidate for investigating these issues. First, the Ghanaian education system is one of the most developed in Sub-Saharan Africa, so there is ample opportunity to study more closely the individual components of the schooling-skills/knowledge-fertility process. Second, it has been a priority for the Ghanaian government to provide basic literacy and numeracy skills for adults who never (or only briefly) attended child schooling by means of adult literacy programs so that the multiple paths to literacy and numeracy skills may be studied.

Similarly, the fourth round of the Ghana Living Standards Measurement Survey (GLSS), collected in 1998/99, is well-suited to study human capital processes more closely. First, the survey includes information on the main inputs of child schooling as

well as adult literacy course participation. Second, it includes information on the intermediate outputs of literacy and numeracy skills. Third, the survey contains information on fertility and contraceptive use.

2. Empirical Methodology

One potentially important econometric issue is that maternal skills and schooling may be endogenous. Previous studies have mostly taken maternal education to be predetermined. However, for several reasons, maternal education may more appropriately be regarded as endogenous. While simultaneity may be one motivation for this, particularly for adult literacy course participation (since the timing of this lies closer to the decision regarding fertility decisions), the main motivation is possible omitted variables bias.

Ability, for example, is unobserved and at the same time also a main determinant of the formal educational attainment of the mother. The same is true for the health endowment of the mother, which through her health status during childhood would seem to affect her formal educational attainment, while also affecting the health status of her potential children, therby affecting her fertility. Further, formal educational attainment and adult literacy course participation are related since only few mothers who have completed formal education participate in adult literacy programs. As a result, both formal educational attainment and adult literacy course participation may potentially be affected by omitted variables bias. If this is the case, the resulting estimates will be biased and therefore misleading as far as establishing links between maternal skills and schooling and fertility is concerned.

One widely applied approach to deal with endogeneity involves instrumental variables. The choice of instruments, however, is crucially important. Arguably, human capital accumulation and literacy and numeracy skills acquisition depend on the

availability of schools as well as their quality. This has led researchers to include variables for current availability and quality of schools in the local area.

Especially when analyzing issues related to the human capital accumulation of adults, however, these measures differ from the relevant school supply and school quality variables in at least two dimensions. First, the relevant school supply and school quality variables are those at the time of attending school, rather than current school supply and school quality. Second, the relevant school supply and school quality variables are those of the geographical area where the individual grew up, rather than school supply and school quality of the current area of residence. Additionally, current measures of school supply and school quality may not be truly exogenous due to purposive migration to areas with better access to or better quality of schools, so that in practice one runs the risk of substituting one set of endogenous variables with another.

The instruments proposed here, interactions between maternal birth cohort and maternal region of birth, which are similar in spirit to those applied in Angrist and Krueger (1991) and Duflo (2001), attempt to address these concerns. First, maternal birth cohort and region of birth both are closer in time to the relevant time period for school attendance and skills acquisition than are school supply and school quality variables of the current time period. Time and region of birth are likely to explain school supply and school quality through differential effects for different cohorts and regions following changes in economic and political conditions in Ghana at the time relevant for school attendance and skills acquisition. Second, birth cohort and region of birth are also spatially closer to the relevant school supply and school quality variables than are school quality and school quality variables of the geographical location of residence in adulthood and therefore appear more likely to explain schooling attainment and skills level of an individual than are school supply and school quality variables of the current

residence.

These considerations lead me to estimate a linearized fertility model by 2SLS using maternal birth cohort and region of birth interactions as identifying instruments. The first stage equations are all of the form:

$$Q_i = \alpha_0 + \alpha_1 B_i + \alpha_2 A_i + \varepsilon_i, \tag{2.1}$$

where Q_i is the potentially endogenous explanatory variable in question (literacy and numeracy skills, formal schooling attainment or adult literacy course participation), B_i is a vector of maternal birth cohort-region of birth interactions and A_i is a vector of all additional controls from the second stage regression (primarily included for efficiency). ε_i is an error-term capturing unobservables. The second stage equations (the estimating equations) then include the predicted values of the potentially endogenous explanatory variables from the first stage:

$$F_i = \beta_0 + \beta_1 \hat{Q}_i + \beta_2 A_i + \nu_i, \tag{2.2}$$

where F_i is fertility, measured as children ever born; $\hat{Q}_i$ is a vector of fitted potentially endogenous explanatory variables from the first stage equation (2.1); A_i is a vector of all additional controls, including birth cohort, rural-urban location, region of residence and availability of hospitals, health clinics, doctors, nurse and midwives in the local community; and ν_i is an error-term capturing unobservables.

Another important issue in the estimation strategy is whether equations (2.2) should be estimated for the full sample only or whether it should also be estimated for one or more sub-samples. I perform two sub-analyses in addition to the analyses for the full samples. There are several reasons for this. First, from a methodological viewpoint adult literacy programs appear particularly relevant for rural areas due to the generally lower access to formal education and resulting lower human capital stocks in rural areas.

Additionally, rural areas are generally poorer than urban areas, and are typically associated with lower access and utilization of health care, as well. From a policy perspective, it would therefore be interesting to do a sub-analysis specifically for the rural areas, as well.

Similar reasoning applies to focusing on mothers who received no formal education. Methodologically, the correct counterfactual for mothers who have attended adult literacy programs is not merely mothers who did not attend adult literacy programs but rather mothers who did not attend adult literacy programs *and* have not received any formal (childhood) education, either. This motivates a separate analysis for mothers, who did not receive any formal education. Additionally, from a policy perspective, these mothers would also seem to be more at a disadvantage in terms of providing health care for their children and therefore the experiences of this group should be of special interest to policy makers. For completeness, however, I will also estimate (2.2) for the urban sub-sample and for mothers who have completed some formal education.

3. Data

The Ghana Living Standards Survey (GLSS), is a nationally representative multi-purpose household survey, carried out in 1987/88, 1988/89, 1991/92 and 1998/99 as four independent cross-section surveys. The most recent round of these (GLSS 4) is used for the analyses in this paper. The household survey contains information on health and fertility, formal educational attainment, adult literacy course participation, literacy and numeracy skills proficiency, as well as information on background variables such as age, gender, tribal association/ethnicity and region, which are also important factors in an analysis of the fertility-education link.

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