Literacy, Numeracy and Household Economic Well-Being in Ghana[†]

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Abstract

This paper examines the impact of literacy, numeracy and schooling on household economic well-being in Ghana. The analysis considers per capita household expenditures and per capita household expenditures in adult equivalents. Previous studies of the determinants of household expenditures have mostly been limited to investigating the impact of schooling only and, as a consequence, largely have not considered skills and also have ignored alternative routes to acquiring skills, such as adult literacy programs. Analyzing a recent household survey for Ghana from 1999, this paper addresses both of these issues. To address endogeneity, the skills, schooling and household expenditure equations are estimated jointly using the Mroz-Guilkey correction approach (Mroz and Guilkey, 1992). Preliminary results indicate statistically significant effects from numeracy skills on household expenditures independent of the effects from schooling.

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1. Introduction

This paper investigates the linkages between literacy and numeracy skills and household economic well-being as measured by per capita household expenditures. Previous studies of the determinants of household expenditures have mostly been limited to investigating the impact of schooling only and, as a consequence, (1) largely have not considered skills and (2) have ignored alternative routes to acquiring skills. The only relevant studies that I have been able to find for Ghana are subject too all of these shortages (Teal, 2001; Litchfield and Waddington, 2003). More generally, the literature as a whole rarely, if ever, considers these issues. The much cited study by Glewwe (1991) for the case of Côte d'Ivoire, for example, does not consider the impact from skills and therefore also does not consider adult literacy course participation as a pathway of obtaining skills. This paper contributes to this literature by (1) analyzing the impact on household expenditures from education as well as the skills obtained through education, namely reading, writing and numeracy skills and that for both the case of English and Ghanaian languages and (2) including adult literacy course participation as a pathway of achieving income generating capacity. Again, the contribution of this paper to the economics literature is therefore both to that specific for Ghana but also more broadly to that of income generation capacity creation more generally, trying to understand the possibly differential effects of indigenous and foreign language and numeracy skills on household expenditures. Additionally the role played by adult education is examined.

The remainder of this paper is structured as follows. The next section briefly sketches the conceptual framework and section three presents the data. A description of estimation issues follows in section four. Section five presents the preliminary results and section six summarizes and concludes.

2. Conceptual Framework

I consider a household production model (Becker, 1965) in which a single-person household has preferences over multiple commodities, such as nutrition and housing services. The commodities are produced in home production using market goods and time inputs. The time available to the household may either be spent working in the market or engaging in home production. The household faces a budget constraint, whereby income for purchasing market goods comes from the household's participation in market work or from transfers and remittances to the household. The household's decision problem therefore is to decide the amount of time and goods inputs in the production of commodities and the amount of time devoted to market work so as to maximize utility subject to the set of constraints. If imposing some more structure on the model, including functional forms of the utility and (home) production functions, the model may be solved to obtain the reduced form market goods demand and production time supply functions. Multiplying these with prices, household expenditures effectively end up being the (observable) measure of household welfare in this model. It will depend on all exogenous variables and parameters and preference and production shifters in the model: wages, transfers and remittances, input prices, literacy, numeracy and other skills and taste and needs effects.

So how do human capital production enter in this model, and therefore, ultimately affect household expenditures? Most importantly, participation in childhood schooling or adult education generates literacy and numeracy skills for participants. In turn, I suggest this gives rise to the following four literacy and numeracy skills effects.

First, there is a direct wage or earnings effect: literacy and numeracy skills (obtained from childhood or adult schooling, as case may be) affect productivity in the labor market, which affects earnings, and in turn translates into higher consumption possibilities; this is the standard

human capital story. Here, additionally, the overall effect of literacy and numeracy skills on household income can be decomposed into effects within income generating activities (including farming, non-agricultural self-employment and wage employment) and access to these activities (Appleton, 2001). The impacts of the different literacy and numeracy skills will vary according to location: in urban areas, especially the capital of Accra, English would seem to be the more important skill relative to Ghanaian languages. The reason for this is that English, here almost fifty years after independence, remains the "official" language of the government and the public administration. In rural areas, therefore, one would expect Ghanaian language skills to be more—or at least no less—important than English language skills. Whether the increased consumption possibilities necessarily translate into higher household expenditures, however, is uncertain; indeed, without further assumptions it will be an empirical issue altogether. Specifically, due to the change of efficiency in production coming from the wage increase effectively causing time to become more "expensive", individuals will substitute from time inputs to goods inputs, whereby the net effect on labor supply—and therefore ultimately on household expenditures—is ambiguous.

Second, literacy and numeracy skills may give rise to a home productivity effect, whereby an increase in literacy and numeracy skills will increase the efficiency in home production. While the immediate effect may be a decline in per capita expenditures as a result of increased efficiency in home production, at the same time more time will be available for market work. In turn, the income effect will increase consumption so that the net-effect on expenditures will most likely be positive.

Third, literacy and numeracy skills may generate a "needs" or "taste" effect coming through via the utility function or production function(s). For example, literacy and numeracy skills may

decrease actual and/or desired fertility and, in an extended multi-person model, therefore, reduce the number of dependent children. The net-effect on per capita household expenditures is unambiguously positive.

Fourth, literacy and numeracy may cause a "transfers and remittances effect": if the adult remaining in the household is literate and/or numerate, it is likely that migrated family-members are, too. In turn, this affects the earnings of migrants and therefore possibly their transfers or remittances back to the household. Since this leaves the relative prices unaffected, the impact on household expenditures will depend on whether commodities are normal or inferior goods, as well as the relative time intensity in their production. If they are normal, household expenditures will unambiguously increase; if one or more are inferior, household expenditures will decrease. However, if a sufficient number of commodities are inferior and time intensive, labor supply may actually increase, resulting in higher household expenditures.

So far only effects on household expenditures from literacy and numeracy skills have been considered. Are there other effects from child schooling or adult literacy course participation on household expenditures? That is, do students obtain skills above and beyond (the observable) literacy and numeracy skills as a result of attending either formal (child) schooling or participating in adult literacy programs? While literacy and numeracy skills are likely to be the major outcomes from schooling, which subsequently affect household expenditures, I suggest that there are several additional channels through which schooling may affect household expenditures.

First, schooling may create other income generating attributes, thus generating an indirect wage or earnings effect. In formal schooling, these attributes include credentialism or "signaling", which affect household expenditures through its impact on wages, transfers and remittances (Spence, 1973). In literacy courses, on the other hand, these attributes include productive skills:

(1) the courses include instruction in "income generating activities" including farming, fishing and pottery, and (2) the participants are often encouraged to participate in income generating activities initiated by the instructor in collaboration with the participants. Literacy course participants may, therefore, increase their income generating capacity even without achieving the literacy and numeracy which were the original objective of the program.

Second, formal (childhood) schooling may equip students with "socialization" and "discipline" skills, thus generating a "socialization" or "discipline" effect. These skills may positively impact future income generating activities in and by themselves. This effect will work through the budget constraint by increasing earnings but may also increase productivity in home production. By contrast, due to the limited duration and less frequent meetings of adult literacy programs, as well as participants being older and therefore more "set in their ways", participation in adult literacy programs is much less likely to be accompanied by socialization and discipline skills.

Third, adult literacy course participation may generate a "literacy course home productivity effect". This effect stems from adult literacy course participants also achieving skills which would primarily increase efficiency in home production. For example, two of the topics taught are "Environmental Hygiene" and "Hygienic way of preserving and selling fish", which primarily would seem to affect the efficiency of home production of the two "example commodities", housing and nutrition services. As was also the case from the home productivity effect from literacy and numeracy skills, the literacy course home productivity effect also is likely to increase household expenditures, since more time is available for market work.

There are other reasons why education might be related with household expenditures even after skills are taken into account, however. First, the skills might be prone to measurement error,

in turn leading to the associated parameter estimate(s) being biased towards zero. Second, the functional relationship between household expenditures and skills may be misspecified by, for example, skills being entered linearly, while the "true" functional relationship is non-linear. Third, the model may be misspecified, so that omitted variables, which are correlated with education, have been left out. This will cause the education variable(s) to be correlated with the error-term, thus violating the standard assumptions, and possibly leading to omitted variables bias. All of these factors may cause the impact from skills to erroneously be picked up by the education variable(s) even in the absence of any causal relationship.

Lastly, it should be emphasized that this is a greatly simplified model, in two dimensions in particular. First, being a static model, there is no room for savings in this model. In a life-cycle framework, however, savings become important in terms of households' welfare. Second, the present model operates with a single-person household. There may be indirect effects, however, either from having a school or literacy course in the area or from having literates and/or literacy course participants in the household (and/or in the community). Both of these factors may affect either skills or consumption possibilities of households, as non-participants (and/or non-literates) learn from school or literacy course participants (and/or literates).

Research Questions:

Based on the conceptual framework above, I pose the following set of research questions: (1) do literacy and numeracy skills indeed "matter"—in a way consistent with the model—that is, by increasing household per capita expenditures and if so, what is the relative efficiency of the five different skills in increasing household per capita expenditure? (2) is the impact from literacy and numeracy skills mainly a direct effect or has it merely a mediating effect (through its impact on

wages, fertility and remittances as discussed previously)? (3) Does schooling, be it in the form of formal education or adult literacy program participation, have any impact on household per capita expenditure once the impact from skills has been controlled for (through their indirect wage/earnings effects, socialization/discipline skills effect and literacy course home productivity effect)? and (4) if so, which of the two types of education is the most efficient vis-à-vis increasing household per capita expenditure through the different types of skills and skills effects? (5) are there indirect effects on household expenditures either from having a school or literacy course in the area or from having literates and/or literacy course participants in the household (and/or in the community), stemming from the possibility that these factors may affect either skills or consumption possibilities of households, as non-participants (and/or non-literates) learn from school or literacy course participants (and/or literates)? and (6) are there asymmetries in the impacts of literacy and numeracy skills related to location due to English reading and writing skills (maybe even literacy and numeracy skills more generally) being more valuable in urban areas?

3. The Data and Descriptive Analysis

The Ghana Living Standards Survey (GLSS) is a nationally representative, stratified multi-purpose household survey, carried out in 1987/88, 1988/89, 1991/92 and 1998/99 as four independent cross-section surveys. In addition to the household survey, each round also includes a community and a price questionnaire. The household part of the GLSS contains modules on education and household expenditures among other things.

The module on household expenditures includes information on food and non-food expenditures, where the former is additionally divided into frequently and less frequently

purchased items. Ideally, utility would be the measure applied as the measure of household economic well-being. Failing that, consumption or household expenditures would seem preferable to earnings or wages as a measure of economic well-being. The reason for this is two-fold. First, due to the presence of consumption smoothing, the link between latent household economic well-being and earnings or wages may be weaker than that between latent household economic well-being and consumption expenditures. Second, consumption expenditures are likely to be more accurately measured than earnings or income (Appleton, 2002). Two measures of per capita household expenditures are available: unadjusted per capita household expenditures (Expcap) and per capita household expenditures in adult equivalents (Welfare), where the latter measure takes into account the different needs from households of different age compositions. Table 2.1 shows cross-tabulations of means of the two measures across individual literacy and numeracy skills, schooling and literacy course participation—"starred" means have been found to be statistically different from the base-category (not reading Ghanian, not writing Ghanaian, and so on) by means of t-tests. The overall impression from the table is that there is a substantial positive association between the two measures and individual skills, schooling and adult literacy course participation. This is especially so, since the clustering and stratificationof the survey has been taken into account in the estimations, whereby the sample has *not* been treated as a simple random sample.

Table 2.2 Mean Per Capita Household Expenditures (Cedis) and Incidence of Children's Morbidity, Vaccinations, Pre- and Post-natal Care and Mortality Across Maternal Literacy and Numeracy Skills, Schooling and Literacy Course Participation

	Full Sample Average	Ghanaian Reading	Ghanaian Writing	English Reading	English Writing	Written Calculations	Attended School	Adult Literacy Course Participation
Expcap	1,100,047	1,322,485***	1,334,969***	1,351,223***	1,358,863***	1,296,016***	1,232,057***	892,255***
Welfare	1,526,289	1,786,410***	1,798,738***	1,820,101***	1,828,670***	1,756,510***	1,682,187***	1,291,474***
# Obs	13,403	5,812	5,363	6,635	6,403	8,085	9,617	954

Notes: Sample is individuals 15-65 years of age; ***: statistically significant from reference category (not proficient in Ghanaian reading, Ghanaian writing and so on) at a 10 percent level of significance **: statistically significant from reference category at a 5 percent level of significance, *: statistically significant from reference category at a 1 percent level of significance.

4. Estimation Strategies and Issues

From the previous section household expenditures were explained by literacy and numeracy skills, an indirect wage or earnings effect, socialization or discipline skills and a home productivity effect. Due to the nature of the available data, the estimating equation therefore is:

$$E_i = \alpha + \beta_1 S_i + \beta_2 T_{1i} + \beta_3 T_{2i} + \beta_4 W_i + \beta_5 R_i + \beta_6 X_i + \varepsilon_i \qquad (4.1)$$

where E_i, is household expenditures per capita (unadjusted) or household expenditures per capita in adult equivalents; S_i is literacy and numeracy skills; T_{1i} is childhood schooling; T_{2i} is adult literacy course participation; W_i is wages; R_i is remittances; X_i is a vector of other controls, including gender, age, geographical location, ethnicity and religion and ε_i is and error-term capturing unobservables.

Endogeneity is a potentially important issue in the estimation of (4.1): childhood schooling, adult literacy course participation and literacy and numeracy skills are all explanatory variables in a regression of household expenditures. The Mroz-Guilkey random effects correction approach (Mroz and Guilkey, 1992) is a relevant and feasible approach. A main advantage of this approach is that it offers a competitive alternative to efficient models in terms of precision and bias—and even more so if the disturbances are non-normal, thus enabling avoiding false inferences due to incorrect joint distribution assumptions having been imposed (Mroz, 1999). As an added bonus, this method gets around the issue of "searching" for instruments, a task which is hard and often impossible. Particularly for the analyses in this paper this is a clear advantage of this approach, since it does not appear possible to come up with a reasonable instrument for literacy and numeracy skills. Among the main drawbacks of this method is the possibility of the existence of multiple local optima, of higher orders factor approximations being judged as identical to lower order ones and finally the possibility of the Prob(d = 1) having a point mass, where d is the

endogenous explanatory variable (Mroz, 1999). I will compare the results from this approach with those of the "naïve" approach, that is, the results when not instrumenting, using a standard OLS-regression.

After now describing in detail the possible estimation problems and issues as well as the way they will be addressed, it is time to describe how the research questions posed previously will be answered. Specifically, the estimation strategy is to proceed in stages: first, include only literacy and numeracy skills (and the additional control variables) in the estimation. Next, allow for an intermediating effect from literacy and numeracy skills to wages and remittances by including these additional variables in the regression. Were literacy and numeracy skills statistically significant in the stage one regression but fail to be so after inclusion of these additional variables, this will be taken as evidence that the effect from literacy and numeracy skills on household expenditures were not direct effects but rather mediating effects. In stage three, child schooling and adult literacy participation is included so as to test for the relevance of skills above and beyond literacy and numeracy skills as laid out in the description of the conceptual framework. Note, however, that the socialization/discipline and credentialism effects cannot be disentangled empirically, since they will be jointly captured by the childhood schooling variable. Similarly, the indirect wage/earnings effect and the home productivity effects cannot be disentangled empirically, either. Additionally, one or both of the education variables may come out statistically significant even if it really is the case that "only skills matters", namely in the presence of one or more of: (1) measurement error in literacy and numeracy skills, (2) misspecification of functional form of literacy and numeracy skills and (3) model misspecification.

5. Results

NOTE: These are VERY preliminary…

(1) Only skills variables:

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Survey linear regression

pweight:  weight                                  Number of obs    =      5282
Strata:   strata                                  Number of strata =         6
PSU:      clust                                   Number of PSUs   =       300
                                                  Population size  =   5342.64
                                                  F(   9,    286)  =     81.50
                                                  Prob > F         =    0.0000
                                                  R-squared        =    0.2863

------------------------------------------------------------------------------
     lexpcap |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -.0873741    .007713   -11.33   0.000    -.1025538   -.0721944
       agesq |   .0009306   .0000868    10.72   0.000     .0007598    .0011013
      female |   .1539982   .0325907     4.73   0.000     .0898575    .2181389
Dreadghana~n |   .0347888   .0625861     0.56   0.579    -.0883848    .1579624
Dwriteghan~n |    .077601   .0645161     1.20   0.230     -.049371     .204573
Dreadenglish |  -.0184599   .0879156    -0.21   0.834    -.1914837    .1545638
Dwriteengl~h |   .2029382     .07491     2.71   0.007     .0555104    .3503659
Dwrittenca~s |   .2411116   .0549531     4.39   0.000     .1329604    .3492629
       urban |    .555785   .0593964     9.36   0.000     .4388891    .6726809
       _cons |   15.10008   .1802117    83.79   0.000     14.74541    15.45475
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(2) Both skills and education variables:

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Survey linear regression

pweight:  weight                                  Number of obs    =      5276
Strata:   strata                                  Number of strata =         6
PSU:      clust                                   Number of PSUs   =       300
                                                  Population size  = 5337.0247
                                                  F(  16,    279)  =     53.59
                                                  Prob > F         =    0.0000
                                                  R-squared        =    0.3048

------------------------------------------------------------------------------
     lexpcap |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -.0901473   .0085349   -10.56   0.000    -.1069446   -.0733501
       agesq |   .0009657   .0000953    10.13   0.000      .000778    .0011533
      female |   .1584805   .0319962     4.95   0.000       .09551    .2214511
Dreadghana~n |  -.0044622   .0581063    -0.08   0.939    -.1188192    .1098948
Dwriteghan~n |   .0557432   .0614132     0.91   0.365    -.0651221    .1766084
Dreadenglish |  -.0719451   .0914468    -0.79   0.432    -.2519184    .1080282
Dwriteengl~h |    .115166   .0793317     1.45   0.148     -.040964     .271296
Dwrittenca~s |   .1659943   .0600584     2.76   0.006     .0477954    .2841932
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primary	.1758724	.0601872	2.92	0.004	.0574199	.2943248
middle	.2323092	.0740726	3.14	0.002	.0865294	.3780889
jss	.123222	.0982142	1.25	0.211	-.0700699	.3165139
sec_and_ab~e	.5170534	.0819313	6.31	0.000	.3558073	.6782995
voc	.3631936	.097906	3.71	0.000	.1705081	.5558791
other_edu	.5835855	.1602138	3.64	0.000	.2682744	.8988967
lit_course	.0668013	.0573089	1.17	0.245	-.0459864	.179589
urban	.5205293	.0588292	8.85	0.000	.4047496	.6363089
_cons	15.12447	.1941698	77.89	0.000	14.74233	15.50661

6. Summary and Conclusion

Examining the impact of literacy, numeracy and schooling on household economic well-being, as measured by household per capita expenditures using data from a recent household survey, this paper fills a void in the previous literature: Previous studies of the determinants of household expenditures have mostly been limited to investigating the impact of schooling only and, as a consequence, largely have not considered skills and also have ignored alternative routes to acquiring skills, such as adult literacy programs.

Preliminary results suggest that numeracy skills have positive and statistically significant effects on per capita household. Literacy skills has a positive and statistically significant effect, as well—this effect, however, disappears once schooling is controlled for. Adult literacy programs do not appear important for per capita household expenditures judged from these preliminary results.

One problem with these preliminary current analyses, however, is that they do not adequately address issues of endogeneity. This issue will be rigorously addressed in an extended empirical analysis, applying the Mroz-Guilkey correction (Mroz and Guilkey, 1992).

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