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Working Papers

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ECON2004-5

Discipline of Economics

Faculty of Economics and Business

ISBN 1 86487 658 1
July 2004

ISSN 1446-3806

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ABSTRACT

This paper uses a using a nationally representative dataset to show that gender, birth order and sibling characteristics have significant effects on the schooling attainment of Egyptian children. Our analysis finds that relative to a male child, female and rural children are not only less likely to have the right schooling for age, but birth order and sibling characteristics also affect these two groups more adversely. Our empirical results show that schooling outcomes are better for earlier born (lower birth order) children, particularly for females and rural children. For example, a female child who is third in the birth order is approximately 40% less likely to have attained the right schooling for age, worsening with each increase in birth order. However, male and urban children are unaffected by birth order and sibling characteristics, the only exception being male children born sixth or higher in the birth order. Furthermore, we see that an increase in sibship size is associated with lower schooling attainment for the last born school-age child across all our samples. Finally, we see that with the exception of rural females, the sibling size effect is somewhat mitigated for the oldest school-age child having younger sisters rather than brothers

Keywords: Egypt, schooling, gender, birth order
JEL codes: J22, J23, O15, I21

CONTENTS

1. Introduction

Gender differences in educational attainment are widely observed in developing countries with females generally having lower schooling levels than males[1]. These gender differences however, are partly a consequence of schooling decisions made by resource-constrained households facing imperfect capital and labour markets. Under such circumstances, a range of child specific issues such as the child's gender and birth order, and their sibling's characteristics (for example, the number of siblings, the sex composition of siblings and the presence of pre-school and post-school age siblings), may also become important considerations in intrahousehold resource allocation decisions. These effects are also likely to be exacerbated by rural residence, since the informal nature of the production process in rural areas of developing countries, makes it possible to combine schooling with work.

This raises two related research questions. The first is whether the schooling attainment of children, in particular females is affected by the characteristics of their siblings; and two, whether these sibling size and gender composition effects depend on the gender and birth order of the child. Although there is a burgeoning literature on this issue from the US, only Parish and Willis (1993) and Morduch (2000), have studied the influence of sibling gender composition on schooling attainment in the context of developing countries. Similarly, few studies have examined the role of birth order on schooling attainment in a developing country scenario (exceptions include Birdsall, 1991; Ejrnaes and Portner, 2004)[2].

In this study we use a unique cross-sectional dataset from Egypt to examine the effects of sibling and birth order on the schooling attainment of male and female children. Egypt presents an interesting context in which to analyse these issues for several reasons. In 2000, Egyptian male youth illiteracy rates (for ages 15 -19 years) were 26%, rising substantially to 44% for females.

[1] See UNDP's Human Development Report (2002) for data on the gender gap in education and Alderman and King (1998) for a review of studies on gender differentials in educational attainment.

[2] Note that Pande (2003) examines the influence of birth order and sibling characteristics on differential access to health resources by gender, while Garg and Morduch (1998), studies the role of sibling sex composition in influencing health outcomes for males and females.

Further, approximately 12% of girls in the primary school going age-group were not currently attending school, rising to 32% in the secondary school going age- group. In contrast, the non-attendance rate for primary school age boys was 0% and 21% in the secondary school age-group (Population Research Bureau, 2003). Moreover, previous studies have shown that a strong son-preference prevails in Egyptian society (Arnold, 1992).

Specifically, our study examines a number of issues. First we examine if there a birth order effect in schooling attainment and whether it affects males and females differently. For example, how likely is a first-born child to go to school, relative to a child born higher in the birth order? What is the likelihood of a later born male child going to school *vis a vis* a female child? Do they vary by rural-urban location? Next we analyse whether schooling attainment is affected by the interaction between birth order and sibling characteristics. How does the sibling composition of a household, in particular the proportion of female children, the presence of pre-school and post-school age siblings affect children's schooling attainment? Finally, are adverse schooling outcomes more likely in rural areas where labour market returns may be low, particularly for females?

The rest of the paper is organised as follows. In Section 2 below we review related literature and outline our contribution to this literature. Section 3 describes our data set and describes the econometric methodology used in this paper. Our results are discussed in Sections 4 and the main conclusions are presented in Section 5.

2. Literature Review

The inverse relationship between schooling and family size, and the possibility that a resource constrained household may find it optimal to invest in the schooling of some of their children rather than spreading resources across all children, is well-known in the literature (see Becker and Lewis, 1973; Becker, 1991). The 'Resource dilution theory' (Blake, 1981; Powell and Steelman, 1990), and the 'Quantity-quality trade-off theory' (Becker and Lewis, 1973; Becker, 1991), posit that an increase in the number of siblings reduces the amount of resources available for each child. Under such circumstances, the child's gender, their birth order and their sibling's characteristics are likely to become important factors in decisions on intrahousehold allocation of resources.

Studies by Rosenzweig and Schultz (1982), Behrman (1988), Harriss (1990), Haddad *et al* (1994) and Strauss and Thomas (1995), all find that in traditional societies, female children are particularly disadvantaged in the intrahousehold allocation of resources. If indeed there is a gender bias operating at the household level, then for a given family size, it must be the case that a male child growing up in a household with only brothers, will have fewer resources than if he were to grow up with sisters only. This is also likely to be true in the case of females. This would imply that the educational attainment of children depends not only on their own gender but also differs depending on the gender composition of their siblings, i.e whether their siblings are male or female. Hence, siblings become rivals in a competition for greater access to household resources.

Several recent empirical studies have focused on the manner in which sibling gender composition influence the intrahousehold allocation of resources (see Parish and Willis, 1993; Butcher and Case, 1994; Kaestner, 1997; Garg and Morduch, 1998; Hauser and Kuo, 1998; Bauer and Gang, 1999; Morduch, 2000). Of these, only studies by Parish and Willis (1993), Garg and Morduch (1998), and Morduch (2000) focus on developing countries.

In studies from the Us and Germany, there is no agreement over the issue of whether sibling gender composition effects exist at all and if they do, whether or not they adversely affect female educational outcomes. Using US data, Butcher and Case (1994) for example, find that women's educational outcomes have been affected by the gender composition of her siblings, but not men's. They find that females are better off growing up with a brother rather than a sister. On the other hand, using a different data set, Kaestner (1997) finds that among Black teenagers, those growing up with sisters had relatively better educational outcomes. Similarly, using US data, Steelman and Powell (1989) also find that having brothers hurts women's high school grades and college entry chances more than having sisters. However, other studies such as Hauser and Kuo (1998) and Bauer and Gang (1999), find no evidence of sibling gender composition effects on educational attainment, in the US and Germany respectively.

Although there is little empirical research on this issue from developing countries, studies by Parish and Willis' (1993), and Garg and Morduch (1998), conclusively show that the health and educational outcomes of children are significantly affected by the gender composition of their siblings. In particular, Parish and Willis' (1993) study from Taiwan, finds that in

resource-constrained households, the presence of older sisters has a positive effect on the health and educational attainment of children, regardless of gender. One explanation for this is the possibility that older sisters may be contributing in a financial sense or may be getting married earlier and moving away, thereby reducing the strain on household resources. This is supported in studies from sub-Saharan Africa, as shown in Garg and Morduch (1998) and Morduch (2000) using Ghanaian and South African data respectively, where health outcomes are better for children growing up with only sisters rather than with only brothers. For Tanzania however, Morduch (2000) finds little evidence of gender differences in the educational attainment of males and females. Although there is a positive association between educational outcomes and the number of female siblings, he finds no variation in schooling attainment based on the child's gender, or whether the sisters are older or younger.

Closely related to this idea is the question of whether other child-specific characteristics such as the child's birth order and their gender, and the interaction between them play a role in schooling attainment. Birth order effects in schooling attainment may arise due to various factors such as parental time and resource constraints, the child's home environment and prevailing social norms. For example, assuming diminishing marginal utility from parenting, Lindert (1977) argues that lower birth order children are generally competing with fewer siblings, and therefore they are likely to have greater access to maternal time, which is an important input influencing schooling attainment. Hence, he argues that lower birth order children have greater relative benefits in the allocation of schooling resources. A recent study by Erjnaes and Portner (2004), supports this finding using Philippine data. Birdsall's (1991) study from Colombia, however finds that due to constraints on maternal time, both higher and lower birth order children benefit from belonging to smaller households, whereas middle birth order children fare worst. She however finds no evidence of birth order effects in situations where there are no constraints on maternal time.

Resource constraints and social norms may also lead to birth order effects. For example, if schooling investments are motivated by old-age security considerations or if the existing social norms require the oldest child to look after elderly parents, then lower birth order children may be relatively better-off in terms of access to schooling resources. On the other hand, higher birth order children are born when their parents are in a more secure financial situation (Parish and Willis, 1993). Alternatively it may be the case that the older siblings have left home or are contributing financially, thus increasing the potential to allocate more resources towards younger siblings or higher birth order children.

There is however some empirical ambiguity, particularly in studies from developed countries over the question of whether birth order effects in education exist at all and if they do, whether they are positive or negative. Early studies by Ernst and Angst (1983) and Sewell and Hauser (1980) find no significant or systematic effects of birth order on schooling. Typically, studies from the US find support for adverse educational outcomes for later born children. For example, Behrman and Taubman's (1986) study using US data finds strong birth order effects on schooling. They find that being first or second-born was associated with an increase in schooling, whereas schooling appears to decline for higher order births. This finding is supported by Blake (1991), However, Hanushek's (1992) study finds that in large households being the last born child has greater advantages relative to being first born, as the last born child is less likely to be competing for parental time with other siblings.

The interaction of gender and birth order, and its influence on schooling attainment is noted in a study by Kessler (1991). He points out that in some situations, gender may interact with birth order in a way that favours males and children born lower in the birth order. For example, parents may prefer to spend more on their son's education, either due to their higher labour market returns or owing to cultural norms requiring sons to look after elderly parents. In this case, regardless of the child's birth order, parents with an expectation of higher direct benefits from sons may favour male children and transfer greater resources towards them (Anderson *et al,* 1996). Similarly, Parish and Willis' (1993) study from Taiwan also finds that females born in large households or later in the birth order are particularly disadvantaged in educational attainment. Hence, relative to females that are only children, females from large families suffer from both an income effect (due to a large number of siblings) and a substitution effect (due to greater resources substituted towards male children). Males from large families, on the other hand, only suffer from an income effect. In such situations, we expect birth order to only affect lower order male children from large households.

Our study contributes to the literature in several important respects. Our analysis is the first to examine intrahousehold gender differences in schooling

investment in Egypt, by explicitly combining studies on birth order effects with ones that examine the role of sibling characteristics in influencing schooling attainment of children. We take into account not just current schooling enrolment but also include information on those children who may have dropped out of school. By linking schooling attainment to age and grade, we provide a measure of current schooling outcomes that is appropriate for a developing country such as Egypt, where there are opportunities for combing schooling with work. Furthermore, we focus on the differential impact of birth order and sibling characteristics on males and females, factoring in their place of residence (i.e. rural/urban).

Our measure of schooling outcomes is grade-for age, which gives an indication of whether or not the child has attained the age appropriate level of schooling. We estimate the probability of attaining the right grade for age given a range of household level, child and sibling characteristics. Note that previous studies have analysed the influence of sibling and birth order characteristics on schooling attainment using data for older individuals, who have completed their formal education. However, this would be especially inappropriate in the Egyptian context, where there have been many recent efforts to expand school enrollment throughout the country, and where schooling enrollment continues to expand at a rapid rate with declining gender imbalance in educational attainment. Hence, our study only examines children in the school-going age group.

The econometric results show that gender, sibling characteristics, birth order and geographical location all affect schooling outcomes significantly, and differently, depending on the child's gender and geographical residence. We find that being female and living in rural areas significantly increase schooling disadvantage. A female child is not only less likely to have attained the right schooling for age, but relative to a male child, birth order and sibling characteristics also affect a female child more adversely. Furthermore, we note that schooling outcomes are better for earlier born (lower birth order) children. We show that for the first born in households with five other children, having sisters rather than brothers improves the schooling outcomes across all our samples. Finally, we see that an increase in the number of pre-school age siblings has a negative effect on the schooling attainment of female and rural children.

3. Data and Econometric Methodology

A. Data

The data for this study comes from the 1997 Egypt Integrated Household Survey (EIHS). The EIHS is a multi-topic, nationally representative household survey carried out by the International Food Policy Research Institute (IFPRI) in conjunction with the Ministry of Agriculture and Land Reclamation (MALR) and the Ministry of Trade and Supply of the Government of Egypt. The sample consists of 2,500 households and 14,231 individuals from 20 governorates (provinces).

The use of this data set is unique and ideal for our analysis, as it is nationally representative and contains detailed unit record data on various demographic, social, economic, health and labour market characteristics for every household member. Our analysis is based on data for 2748 children in the school going age group of 7-15 years, for whom complete information is available on schooling and household characteristics. Thus, we exclude those households who have no child in the school-going age or if data is missing. Although the starting age for schooling in Egypt is 6 years, we do not include 6 year olds in our analysis because of incomplete information in a large part of that sample. The data may be missing for a number of reasons. Firstly, the child may not have started school yet. It is possible that at the time of the survey, the child was 6 years old but may not have been 6 years at the start of the school year. Secondly, it is likely that the household did not intend to send the child to school at 6 years. Furthermore, there are no explanations as to why some children at age 6 are in school and others are not.

Schooling outcomes are measured using the dichotomous variable grade-for-age. We use this rather than current schooling attendance as our dependent variable to account for the possibility that some children may be combining schooling with work. As these children may not have attained the age-appropriate expected level of schooling, there is likely to be some age-grade distortion in the sample. For example, if the starting age for schooling is 6, we expect a child progressing at the right age to have completed 4 years of schooling by age 10. Hence, following Patrinos and Psacharopoulos (1997), we define a schooling-for-age variable:

$$\text{Schooling-for-age} = 100*[\text{Years of schooling}/(\text{age} - 6)]$$

Accordingly, all dispersions in age are measured from age 6 years. A measure of 100 indicates complete schooling attainment and a zero indicates none

(complete falling behind), which can only occur if the child has never attended school. Some of the children in the sample have a value greater than 100 for the schooling-for-age variable, which is possible if the child has been to some form of pre-school.

Using this, we calculate the dummy variable Grade-for-age: if schooling-for-age $\geq$ 100, then Grade-for-age equals 1, and 0 otherwise. This dichotomous variable is the dependent variable used in our empirical analysis. This measure of schooling outcomes takes into account all the available information on school attendance and drop out, and gives us an indication of those children who may have fallen behind in schooling attainment.

The means and standard deviations of the explanatory variables used in the analysis are presented in Table 1 below. As seen in Table 1, a little over half (52%) the children in our sample are boys, with 64% of all children living in rural areas. An average household in our sample has approximately 4.6 children, with the mean education level of household heads being just over 8 years. A large proportion of the households in our sample also have pre-school age children (76%).

Using our grade-for-age measure (Table 1), approximately 41% of the children in our sample have fallen behind in their schooling attainment. Of these children, 71% live in rural areas as compared to 59% among children who have attained the right grade-for-age. Interestingly, relative to children with the right amount of schooling, the prevalence of female headship is over 3% higher among children with adverse schooling outcomes. Furthermore, the household head's schooling is also not reported in a higher proportion of these children.

Table 1 provides some evidence of an intergenerational transmission of schooling, with the education levels of household head's being higher in households where children's schooling attainment was higher (8.7 years), relative to households (7.5 years) where children who have fallen behind in schooling attainment.

B. Empirical specification

The binary choice model in this paper is derived using underlying behavioural assumptions, which imply a latent variable representation of the model. The latent variable, y*, is assumed to be a linear function of the observed *x*'s using the following model.

$$y^* = x_i'\beta + \varepsilon_i$$

where x_i' is a vector of explanatory variables and ε_i is the error term. Consider the child's (*or more probably the household's) propensity for schooling. The assumption here is that the household chooses the age-appropriate level of schooling depending on whether the utility difference exceeds a threshold value that, without loss of generality, can be set to zero. All that is observed is whether the grade-for-age is greater than or equal to 100 ($y_i = 1$) or less than 100 ($y_i = 0$).

$$y_i = 1 \quad \text{if} \quad y_i^* > 0$$
$$= 0 \quad \text{if} \quad y_i^* \leq 0$$

Thus, we have $P\{y_i = 1 \mid x_i\} = P\{y_i^* > 0 \mid x_i\} = P\{x_i'\beta + \varepsilon_i > 0 \mid x_i\}$

and $$p_i = \frac{\exp(x_i'\beta)}{1+\exp(x_i'\beta)} \quad \text{where} \quad p_i = P\{y_i = 1\}$$

Discrete logistic regression techniques are thus used to estimate the effects of gender, birth order and sibling characteristics on schooling attainment, with the dichotomous variable Grade-for-Age as the dependent variable. We estimate the model for the entire sample as well as separate sets of male-female and rural-urban regressions to examine possible effects of gender and geographical location on the determinants of schooling.

The logistic coefficients are transformed by exponentiating them, so that the coefficients shown in the parentheses in Tables 2-4, are the multiplicative effects on the odds of having attained the age-appropriate level of schooling. A coefficient of 1.00 indicates no effect on the odds, a coefficient greater than 1.00 indicates a positive effect on the odds, and a coefficient less than 1.00 indicates a negative effect on the odds.

The econometric model is derived from the theory of household demand for schooling. Parents are assumed to invest in the schooling of their children to the extent that the marginal benefits of schooling exceed the costs of the schooling investment. The outcome of this decision is determined by a set of individual and household characteristics. Thus:

$$E_i = f(I_i, S_i, H, G)$$

where *E* is the decision variable- schooling investment. *I* is a vector of individual child characteristics (such as age, age-squared, gender and birth order); *S* is a vector of sibling characteristics (such as the number of pre-school age siblings, the number of siblings over 15 years of age and the proportion of female children in the household). *H* is a vector of household

head characteristics (which includes the household head's education level, a dummy for no schooling reported for household head and a dummy for female headship). The term *G* refers to geographical location, i.e. whether the household resides in a rural or urban area.

The explanatory variables used in the bivariate analysis include those child, sibling and household characteristics that are commonly thought to influence schooling. These are discussed further below.

Child characteristics

One of our main aims is to empirically test for the influence of gender and birth order on children's schooling attainment. Hence, we compute dummy variables for both the child's gender and their birth order. The child's gender is a dichotomous variable that takes on a value of 1 for males and 0 for female. This allows for the possibility that the child's gender may influence parental decisions on schooling, leading to gender differentiated schooling investment.

Since our data also includes information on all the children in the household, we use the absolute birth order of each child in the household to compute six dichotomous birth order dummy variables - second-born, third-born, fourth-born, fifth-born and sixth or higher order born (with the first- born child being the base). Other child characteristics such as age and age-squared are included as control variables.

Sibling characteristics

The use of sibling data makes it possible to examine if there are gender differences in intrahousehold schooling attainment. Hence, to analyse the effect of sibling characteristics on schooling attainment, we include three sibling-related variables: the gender composition of siblings (the proportion of female children in the household including the child under consideration), the number of pre-school age and post-school age siblings. As previously discussed in the literature review, the gender composition of siblings is found to be an important determinant of schooling investment.

Furthermore, previous research has identified the presence of younger siblings in the household as reducing the likelihood of school attendance, particularly for earlier born (i.e lower birth order) females [3]. One explanation for this phenomenon is the possibility that children, in particular female children with pre-school age siblings may be required to look after their younger siblings, thus combining child care with schooling. On the other hand, for later born (higher birth order) children, the presence of older siblings may increase the probability of going to school. This is more likely if the older child is contributing financially, or it may simply be the case that the school-age child has less competition for parental time and resources. For example, studies by both Garg and Morduch (1998) and Parish and Willis (1993), find that the presence of an older sister increases the likelihood of a younger sibling going to school, regardless of gender.

Household characteristics

In addition to child and sibling factors, parental characteristics such as their age and schooling levels also affect the probability of whether or not the child will go to school [4]. Although some studies find that parental schooling affects girls and boys differently [5], we only include the household head's age and level of education because the education levels of the household head's spouse is low and relatively similar across our sample.

Further, we also include dummy variables for 'no head's schooling reported' and female headship because our summary statistics (see Table 1) show that close to 38% of the households in our sample have no information on household head's education and approximately 10% of our households have female heads. Interestingly, there is a higher incidence of 'no head's schooling reported' and female headship, among children who have fallen behind in their schooling attainment. The effect of female headship on schooling outcomes is the subject of some empirical ambiguity, with researchers divided over the questions of whether or not female headship has a negative influence on schooling outcomes of children, and whether it influences the schooling outcomes of female children in particular. While studies by Patrinos & Psacharopoulos (1997) show that female-headship increases the likelihood of a child working in Peru, others such as Lloyd and Gage-Brandon (1994) and Canagarajah and Coulombe (1998) find that, in sub-Saharan Africa and Ghana, female-headship improves a child's chances of being able to go to school.

[3] See Patrinos and Psacharopoulos (1997), Lloyd and Gage-Brandon (1994). In particular, Lloyd and Gage-Brandon (1994) find that schooling outcomes in sub-Saharan Africa, particularly for girls, is likely to be adversely affected by the presence of younger siblings.

[4] See studies by Psacharopoulos and Arriagada, 1989; Grootaert, 1998; Dreze and Kingdon 2001.

[5] See for example, Handa 1996; Rosenzweig and Wolpin, 1994; Lillard and Willis, 1994; and Unni, 1998.

Finally, because the informal methods of rural production make it possible to combine work with schooling, we are more likely to see rural children with lower levels of schooling. Hence, a dummy variable is used to incorporate the influence of rural residence, taking on a value of 1 if the child lives in an urban area.

4. Results

I. Econometric results

Table 2 presents the results of our analysis for the entire sample, and Tables 3 and 4 report the results by gender and rural- urban residence. The coefficients are transformed through exponentiation, and the resulting coefficients are the odds-ratios that show the magnitude of the variable's impact on the probability of the outcome occurring. Accordingly, we report the coefficients, the odds-ratios (in parentheses) and p-values.

It is immediately obvious from Tables 2-4 that being female and living in rural areas, significantly increases schooling disadvantage. The econometric results support our central hypothesis that gender, sibling characteristics, birth order and geographical location all affect schooling outcomes significantly and differently. In keeping with much of the literature, our analysis also finds that schooling outcomes are better for earlier born (lower birth order) children.

A. *The effect of gender on schooling outcomes of males and females*

We begin by first considering the role of gender on the schooling attainment of children. Gender effects on schooling outcomes are captured through the child's gender, the differential impact of the explanatory variables on male and female children and the dummy for female-headed households.

In the overall sample (Table 2), a child's gender is significant (p-value of 0.004) at explaining adverse schooling outcomes among children. The coefficient on the gender dummy shows that relative to a female child, a male child has a 31% greater odds of having the age appropriate level of schooling. From Table 3, we note that relative to a male child, birth order and the presence of pre-school age siblings also affect a female child more adversely. The differential impact of sibling characteristics and birth order effects on male and female children are discussed further in Parts B and C below.

Surprisingly, we find no evidence of female headship having any influence on the schooling attainment of either male or female children. Female headship however, has a small adverse impact on the schooling attainment of urban children.

B. The effect of sibling characteristics on males and females

We use the gender composition of siblings, and the presence of pre-school age and post-school age siblings in the household to examine the effects of sibling characteristics. There is a significant difference in the manner in which sibling-related variables affect males and females in the overall sample as well as in individual groups.

Sibling gender composition (i.e. the proportion of female children in the household) appears have a significant and positive effect on the schooling outcomes of all children, regardless of their gender (see Table 2 for results on the overall sample and Table 3 for males and females). This variable however, has a slightly greater positive effect on female children. For example, an increase in the proportion of females in the household improves the odds of a child attaining the right grade for age, by approximately twice as much at the national level (Table 2), by over twice as much for females (Column 4, Table 3), and by over one and a half times for males (Column 2, Table 3). This is consistent with the findings of Garg and Morduch (1998), where having sisters rather than brothers improves the health outcomes of children. This could indicate that parents do not discriminate among their daughters in terms of schooling investments, thus increasing the likelihood of a more equitable distribution of schooling resources among females.

The regression results in Table 3 however, show that relative to male children, female children are more adversely affected by the presence of pre-school age siblings. An increase in the number of pre-school age siblings increases the probability of female children having grade distortion by around 84%. This could suggest that the schooling of females is valued less relative to the schooling of males, and also that relative to males, female children are more likely to be combining work and schooling.

Interestingly, the presence of siblings over the ages of 15, significantly increases the odds of age-appropriate grade attainment both in the overall sample and for females. Although the magnitude of the odds ratio is modest, for the entire sample, a child with siblings over 15 years is 19% more likely to have a favourable schooling outcome, increasing to approximately 30% for the female sample. The schooling attainment of male children however, is not affected by the presence of either older or pre-school age siblings.

C. Birth order effects on males and females

With regard to birth order effects, as previously noted, they also differ depending on the gender of the child. From Tables 2 and 3 we observe that, relative to the first-born child, higher order children are less likely to have attained the grade consistent with their age. Specifically, the child's birth order is both statistically and economically significant at influencing schooling decisions in the overall sample, for females and in rural areas, where being third-born or higher born in the birth order, significantly reduces the probability of attaining the right grade for age. For example, in the overall sample, relative to the first child, a third born child is 27% less likely to have attained the right grade for age. Moreover, the birth order effects get stronger for children from large households, with a sixth or later born child approximately 3 times less likely to have attained the age appropriate level of schooling relative to a first born child.

Table 3 shows that these birth order effects are significant and much stronger for third or higher born females. To put the results in perspective, observe that relative to a first born female child, a female child who is third in the birth order is approximately 40% less likely to have attained the right schooling for age, worsening with each increase in birth order.

However, for male children, birth order effects are only ever significant for higher order male children, i.e. males born sixth to tenth in the birth order. It is possible that this birth order effect is in essence capturing the adverse effect of a large sibship size. Our logit estimates show that relative to a first born male child, a male child who is sixth to tenth born in the birth order is over 2.5 times less likely to have attained the right grade for age. A female child born sixth to tenth in the birth order, is however, 4 four times less likely to have the age appropriate level of schooling. This may be because as Kessler (1991) points out, birth order effects in the male sample may reflect an income effect from belonging to a large household, whereas among females, birth order effects may be a combination of an income effect and a substitution effect, owing to poorer households substituting resources towards their male children. Hence, the birth order effect is relatively larger for females from big households.

D. The influence of Rural-urban residence

Urban residence also emerges as a strong factor at increasing the likelihood of attaining age-appropriate level of schooling (p-value of 0.00, see Table 3). Table 3 illustrates that an urban child has a 34% greater odds of having the right grade for age relative to a rural child.

We note however that in our study, the disparities in rural-urban schooling levels cannot be attributed to differences in access to schools. While previous studies (such as Ilahi, 2001) have included access and average distance to school as important determinants of schooling costs, our data show that in both rural and urban areas, over 98% of the households are within walking distance of primary and intermediate schools. Moreover, the average walking time to school is only around 12 minutes for the entire sample.

Interestingly, a comparison of schooling outcomes between rural and urban areas (Table 4), shows that the dampening effect of gender on schooling attainment is also marginally greater in rural areas. For example, relative to rural females, rural males are nearly 49% more likely to have the right amount of schooling.

We also find that an increase in the number of pre-school age siblings has a significant and negative effect on schooling attainment in rural but not in urban areas. Although the p-value is significant at the 10% level and the odds ratio is modest, we find that relative to urban children, rural children with siblings below 6 years have a 9% lower probability of a favourable schooling outcome. This may be due to

greater opportunities for rural children to combine work and schooling, so that older children may be taking care of younger siblings and hence falling behind in schooling attainment. Further, an increase in the number of older siblings improves the odds of rural children's schooling attainment (approximately 26%).

Similarly, as discussed above, birth order effects are not significant in urban areas. In rural areas on the other hand, relative to a first born child, third and higher birth order children have a significantly lower probability of having the age-appropriate level of schooling.

E. Household characteristics

Surprisingly household head's characteristics such as age, female headship and no schooling reported for household head appear to have no influence on the rural sample. However, an urban child living under female headship has an approximately 59% lower odds of having the grade that is age-appropriate.

However, the variable, no education reported for the household head, is statistically and economically significant at reducing the odds of attaining the right amount of schooling, at the national level, and for the urban and female samples by between 40% and 60%. Although small in magnitude, an increase in the household head's schooling level has a positive influence on increasing the odds of a favourable schooling outcome at the national level (by 4%), in rural areas (by approximately 9%), and in the male and female sample by 5% and 3% respectively. The estimated coefficients for the head's age on the other hand are only significant for males and the urban sample. However, these coefficients are not economically significant.

II. Predicted effects of changes in birth order and sibling gender composition

Table 5 illustrates the predicted effects of changes in birth order, sibling gender and size composition. The experiment involves predicting each child's schooling attainment if we changed their birth order, gender, sibling size and gender composition relative to the base case of an urban male only child. We fix all the variables at the mean. Coefficients are taken from the logit results for the entire sample (Table 2). For oldest children in households with six or more children, we assume that there are two pre-school age siblings. For the youngest child in a household of six children, we assume that there are two siblings over 15 years of age. The second and fourth columns give predicted outcomes for males and females respectively by rural and urban location. The third and fifth columns show the percentage change of moving from the base case to a range of different scenarios.

Four clear results emerge from this experiment. First, we see that an increase in sibship size is associated with lower schooling attainment for the last born school-age child across all our samples. Gender and urban/rural differences however persist, with first-born female and rural children having a slightly lower probability of schooling, relative to males. For example, relative to an only male child, the schooling attainment of children born sixth or higher in the birth order with five older male siblings is more than 26% lower (than the base case) across all our samples. The most disadvantaged group are higher birth order (sixth and above) female rural children with 5 older brothers. This group has a 42% lower probability of achieving a favourable schooling outcome, relative to an only child.

The birth order effects however, differ depending on whether the younger siblings are male or female. For example, an urban school-age male or female child with 2 older sisters has a slightly greater probability of schooling attainment, relative to an only child. However, this is not the case if the older siblings were school-age males instead.

Further, we observe that the effect of sibling size is somewhat mitigated for the oldest school-age child. Again, these effects differ depending on whether the younger siblings are male or female. For example, with the exception of rural female children, for children born first in the birth order, having younger sisters rather than brothers always improves schooling outcomes relative to the base case. A first-born school-age female urban child with five younger sisters has a 7% higher probability of a better schooling outcome, which declines to approximately 10% (relative to the base case) if she had five younger brothers instead.

Finally, we see that being the youngest school-going child in a household with five older siblings is associated with lower schooling attainment across all the groups. However, these negative effects are greater if the older siblings were male rather than female. They range from –26% in the case of urban males to –42% in the case of rural females.

5. Conclusions

This paper uses a using a nationally representative dataset to show that gender, birth order and sibling characteristics have significant effects on the schooling outcomes of Egyptian children. Our finding that gender, birth order and sibling characteristics have strong effects on schooling attainment is consistent with previous findings. However, unlike previous research from developing countries, we specifically examine the extent to which gender differentials in schooling attainment may be exacerbated by rural/urban residence.

Our analysis shows that large gender and rural-urban differentials exist in schooling attainment in Egypt, with females and rural children particularly disadvantaged. Our research shows that not only are female and rural children more likely to fall behind in schooling attainment, but birth order and sibling characteristics also adversely affect the schooling attainment of these two groups. The significant coefficient on the gender (p-value .004) and the urban dummy (p-value .001) supports our hypothesis that the child's gender and urban residence are important factors in influencing schooling investment decisions. For example, relative to a female child, a male child is 31% more likely to have the age appropriate level of schooling. Likewise, an urban child has a 34% higher probability of a more favourable schooling outcome relative to a rural child.

The effect of birth order on schooling attainment show similar differences, with birth order and sibling-specific variables having a differential impact depending on the child's gender and rural/urban residence. Schooling outcomes for urban and male children are largely unaffected by birth order and sibling characteristics. The only exception being male children born sixth or higher in the birth order, who are over two and a half times less likely to have attained the right grade for age, relative to a first born child. Among females however, birth order effects are negative and significant in the case of all females born third or higher in the birth order. For female and rural children similarly, schooling outcomes are shown to be better for earlier born (lower birth order) children, steadily worsening for children born third or higher in the birth order.

Furthermore, sibling characteristics, particularly the female composition of children in the household and the presence of older siblings improve schooling outcomes for females and rural children, but have no effect on children in urban areas or males. In the overall sample and among females, an increase in the proportion of female children in the household improves schooling outcomes by approximately twice as much. An increase in the number of pre-school age siblings however, has an adverse effect on schooling attainment, in the overall sample and for female and rural children.

Our results also show that having sisters rather than brothers significantly improves schooling outcomes. Finally, our study finds that the dampening effect of gender on schooling attainment is also marginally greater in rural areas.

6. Notes

We are indebted to IFPRI for giving us the data set, Egyptian Integrated Household Survey 1997 (EIHS). The EIHS survey was funded under USAID Grant No. 263-G-00-96-00030-00. Part of this paper was written when the first author was visiting Rutgers University. We would like to thank them for their hospitality. We would also like to thank Ira Gang for his comments on an earlier version of this paper. All remaining errors are our own.

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TABLE 1: DESCRIPTIVE STATISTICS

Variables	Total (n = 2748)	Grade for age = 1 (n = 1631)	Grade for age = 0 (n = 1117)
	Proportions	Proportions	Proportions
Grade-for-age (=1 if grade ≥ 100)	0.59		
Gender (= 1 if male and 0 if female)	0.52	0.52	0.51
Urban (= 1 if child lives in urban areas, 0 otherwise)	0.36	0.41	0.29
No head's schooling reported (=1 if head's schooling is not reported, 0 otherwise)	0.38	0.30	0.49
Female headship (=1 if household head is female, 0 otherwise)	0.10	0.09	0.12
Birth order 1	0.21	0.22	0.20
Birth order 2 (=1 for second born and 0 otherwise)	0.24	0.24	0.24
Birth order 3 (=1 for third born and 0 otherwise)	0.23	0.22	0.23
Birth order 4 (= 1 for fourth born and 0 otherwise)	0.17	0.17	0.17
Birth order 5 (=1 for fifth born and 0 otherwise)	0.09	0.09	0.08
Birth order 6+ (=1 for sixth-tenth born and 0 otherwise)	0.06	0.06	0.07
Proportion of female children	0.47	0.48	0.45

	Mean (St. Dev)	Mean (St. Dev)	Mean (St. Dev)
Child's age, in years	11.09 (2.50)	10.58 (2.48)	11.83 (2.34)
Head of household's education, in years	8.31 (4.71) (n = 1707)	8.70 (4.76) (n = 1138)	7.52 (4.52) (n = 569)
Head of household's age, in years	45.31 (8.92)	45.01 (8.64)	45.75 (9.31)
Number of children in the household	4.61 (1.64)	4.42 (1.56)	4.89 (1.72)
Number of Siblings > 15 years	1.05 (1.27)	0.99 (1.24)	1.14 (1.29)
Number of Pre-school age Siblings	0.76 (0.98)	0.74 (0.99)	0.78 (0.97)
Number of female children	2.17 (1.32)	2.12 (1.29)	2.24 (1.37)

Note: Standard deviations are in parentheses.

TABLE 2: LOGISTIC ESTIMATES OF SCHOOLING OUTCOMES FOR THE ENTIRE SAMPLE

	Coefficient (Odds ratio)	p-value
Constant	4.223	0.000***
Child's age	-0.579 (0.77)	0.000***
Age Squared	0.014	0.057*
Gender (= 1 if male)	0.268 (1.31)	0.004***
Number of siblings < 6 years	-0.075 (0.93)	0.101
Number of siblings > 15 years of age	0.172 (1.19)	0.007***
Proportion of female children in the household	0.645 (1.91)	0.001***
Urban (=1 for urban residence)	0.295 (1.34)	0.001***
Head of Household's education level	0.038 (1.04)	0.002***
No education reported for household head	-0.416 (0.66)	0.001***
Head's age	0.009 (1.01)	0.115
Female headed household (=1 if female headed)	-0.020 (0.98)	0.883
Birth order 2	-0.106 (0.90)	0.407
Birth order 3	-0.320 (0.73)	0.028**
Birth order 4	-0.454 (0.64)	0.014**
Birth order 5	-0.589 (0.55)	0.014**
Birth order 6+	-1.115(0.33)	0.001***

Note: For all the Tables, *** indicates significant at 1% level, ** indicates significant at 5% level and * indicates significant at 10% level. The odds ratios are in parentheses and the odds ratios for age is calculated at the mean of 11.

TABLE 3: ESTIMATES FOR MALE AND FEMALE CHILDREN

	Males (N= 1421)		Females (N= 1327)	
	Coefficient (Odds Ratio)	p-value	Coefficient (Odds Ratio)	p-value
Constant	3.724	0.007***	5.458	0.001***
Age	-0.534 (0.75)	0.024**	-0.706 (0.80)	0.003***
Age squared	0.011	0.309	0.021	0.049**
No. of siblings < 6 years	0.019 (1.02)	0.759	-0.175 (0.84)	0.011**
No. of siblings >15 years	0.096 (1.10)	0.278	0.261 (1.30)	0.005***
Proportion of female children in the household	0.490 (1.63)	0.075*	0.752 (2.12)	0.009***
Urban	0.238(1.27)	0.066*	0.345 (1.41)	0.010**
Household head's education	0.048 (1.05)	0.006***	0.029 (1.03)	0.082*
No schooling reported for household head	-0.192 (0.82)	0.285	-0.653 (0.52)	0.000***
Household head's age	0.023 (1.02)	0.008***	-0.043 (1.00)	0.585
Female headed household	0.024 (1.02)	0.999	-0.065 (0.94)	0.758
Birth order 2	-0.119 (0.84)	0.318	-0.059 (0.94)	0.752
Birth order 3	-0.152 (0.86)	0.461	-0.530 (0.59)	0.011**
Birth order 4	-0.413 (0.66)	0.114	-0.530 (0.59)	0.044**
Birth order 5	-0.427 (0.65)	0.224	-0.788 (0.45)	0.020**
Birth order 6+	-0.942 (0.39)	0.028**	-1.405 (0.25)	0.002***

TABLE 4: LOGIT ESTIMATES FOR RURAL AND URBAN SAMPLES

	Rural sample (N= 1749)		Urban sample (N= 999)	
	Coefficient (Odds Ratio)	p-value	Coefficient (Odds Ratio)	p-value
Constant	4.323	0.000***	3.903	0.023**
Age	-0.603 (0.75)	0.003***	-0.549(0.81)	0.060**
Age squared	0.014	0.134	0.015	0.251
Gender (=1 if child is male)	0.396 (1.49)	0.000***	0.033 (1.03)	0.837
Number of siblings < 6	-0.087 (0.92)	0.087*	-0.037 (0.96)	0.741
Number of siblings > 15 years	0.234 (1.26)	0.003***	0.058 (1.06)	0.610
Proportion of female children in the household	0.823 (2.28)	0.001***	0.364 (1.44)	0.269
Household head's education	0.087 (1.09)	0.000***	-0.011 (0.99)	0.543
No schooling reported for household head	-0.097 (0.91)	0.539	-0.871 (0.42)	0.000***
Household head's age	0.002 (1.00)	0.754	0.030 (1.03)	0.008***
Female headed household	0.209 (1.23)	0.216	-0.457 (0.63)	0.069*
Birth order 2	0.018 (1.02)	0.991	-0.275 (0.76)	0.184
Birth order 3	-0.387 (0.68)	0.034**	-0.214 (0.81)	0.393
Birth order 4	-0.591 (0.55)	0.009***	-0.252(0.78)	0.456
Birth order 5	-0.681 (0.51)	0.020**	-0.552 (0.58)	0.213
Birth order 6+	-1.385 (0.25)	0.000***	-0.593 (0.55)	0.284

TABLE 5: PREDICTED EFFECTS OF CHANGES IN SIBLING COMPOSITION AND BIRTH ORDER ON SCHOOLING OUTCOMES

Urban	Males	% change	Females	% change
Base Case	0.70			
Birth order 2: 1 male- 1 female	0.74	6.28	0.69	-1.58
Birth order 3: 2 older sisters	0.72	3.35	0.71	1.74
Birth order 3: 2 older brothers	0.62	-10.27	0.61	-12.13
Birth order 6: 5 older brothers	0.51	-26.13	0.47	-31.81
Birth order 6: 5 older sisters	0.64	-7.50	0.61	-12.82
Birth order 1: 2 younger sisters	0.78	11.94	0.77	10.56
Birth order 1: 2 younger brothers	0.70	0	0.68	-1.69
Birth order 1: 5 younger brothers	0.66	-4.66	0.63	-9.86
Birth order 1: 5 younger sisters	0.77	10.79	0.74	6.61
Rural				
Birth order 2: 1 male -1 female	0.68	-2.45	0.62	-11.20
Birth order 3: 2 older sisters	0.66	-5.75	0.64	-7.54
Birth order 3: 2 older brothers	0.55	-20.53	0.54	-22.48
Birth order 6: 5 older brothers	0.44	-36.70	0.40	-42.24
Birth order 6: 5 older sisters	0.57	-17.59	0.53	-23.20
Birth order 1: 2 younger sisters	0.72	4.04	0.71	2.45
Birth order 1: 2 younger brothers	0.63	-9.46	0.62	-11.31
Birth order 1: 5 younger brothers	0.59	-14.54	0.56	-20.09
Birth order 1: 5 younger sisters	0.71	2.71	0.68	-2.07