Closing Gender Gaps in Education in Africa:
The Potential Contribution of Pregnancy-Avoidance Programs

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ABSTRACT

Plausible arguments suggest that pregnancy-avoidance programs can help close gender gaps in education in Africa, but studies have not quantified these contributions. We use recent education statistics compiled by DHS on 23 African countries to construct schooling life tables and simulate the reduction in gender gaps that would occur if these countries gradually reduced the incidence of pregnancy-related dropouts.

We find the following: For these 23 countries as a whole, the female-to-male ratio among secondary school graduates would increase by 18.3 percentage points, i.e., a 36 percent reduction of the current gender gaps. However, payoffs vary substantially across countries. By themselves, pregnancy-avoidance would not close the current gender gap, but their relative impacts are likely to be substantial in several of the countries studied. Policy and research implications are discussed.

Introduction

Plausible arguments suggest that pregnancy-avoidance programs can help close gender inequality in education within sub-Saharan Africa. One of these arguments invokes the importance of pregnancy-related school dropouts. Since many girls and few (if any) boys drop out of school because of pregnancies, policymakers could reduce existing gender gaps simply by avoiding unwanted pregnancies among schoolgirls (Hyde 1995; Odaga and Heneveld 1995; PRB 2000). Logical as the argument may be, the practical and unresolved question is whether these reductions would be large enough to warrant policy attention. In other words, *how much would African countries reduce their gender gaps in education through efforts to avert unwanted teen pregnancy*?

This question becomes salient in light of Africa's current policy commitments and demographic trends. In the year 2000, the United Nations resolved to focus development efforts around seven priority areas, one being to eliminate gender disparities in education at all levels by 2015 (UN 2000). Experts regard this goal as ambitious for sub-Saharan Africa, where gender gaps remain large and education budgets are limited (World Bank 2002). However, progress remains possible if countries implement efficient policies, for instance by integrating convergent policies such as those in the population and education sectors (Lule 2002; Wodon and Jayasuriya 2003). Given the recent declines in African fertility and teens' increasing preference to delay first births, it is timely to consider whether efforts to meet the pregnancy-avoidance needs of African youth would improve national education outcomes as well.

Recent data from Demographic and Health Surveys (DHS) provide a unique opportunity to answer this question on a large scale. In addition to their fertility and health data, the DHS have begun to compile education statistics that are relevant to this question. Our study uses these data to: (1) estimate the contribution of pregnancy-related dropouts to the gender inequality in education within each of these countries; and (2) estimate how much these inequalities would recede if countries gradually reduced the incidence of pregnancy-related dropouts.

Background

Support for female education has steadily grown within international development circles, in part because of increasing recognition of the multiple benefits associated with women's education (King and Hill 1995; AGI 2002). This support was recently crystallized in the year 2000 by the UN's adoption of female education as one of only few focal points for development efforts within the framework of its Millennium Development Goals (UN 2000). Given this support and despite a good qualitative grasp of the multiple constraints to female education (Hyde 1995; Odaga and Heneveld 1995), policy-makers need guidance on *how much impact* different policies are likely to have. Demographic research can provide such guidance by quantitatively assessing the impact of demographic factors, especially fertility.

Previous studies of the effects fertility on female schooling have focused on either one of three levels: macro-level relationships between national fertility rates and education (Birdsall 1977; Jah 2002); family-level relationships between sibship size and children's outcomes (Lloyd 1994); individual-level effects of pupils' own fertility on their schooling (Hoffmann 1998; Hoffert, Reid and Mott 2001). Our study makes three additions to this literature. The first is about geographic and thematic balance. Studies of the link between fertility and schooling in developing countries have focused on intergenerational relationships, rather than the more direct influence of one's own fertility (Lloyd 1994; NRC 1999). The rich literature on the consequences of teen pregnancy in developed countries (Keplinger, Lundberg, and Plotnick 1995; Hoffmann 1998; Ribar 1999; Hoffert, Reid, and Mott 2001) has paradoxically little parallel in developing countries where teen fertility is higher (PRB 2003). By focusing on pupil (rather than parental) fertility, we add thematic balance to the literature of fertility and schooling in Africa. At the same time, we geographically extend the existing literature on the effects of teen fertility on schooling (Keplinger, Lundberg, and Plotnick 1995; Hoffmann 1998; Ribar 1999; Hoffert, Reid, and Mott 2001) to developing countries and Africa in particular.

A second addition concerns methodology. Previous studies of the effects of teen pregnancy on schooling have relied on regression analysis. Under this framework, teen pregnancies are assumed to compromise schooling if teen mothers are found to have systematically lower schooling outcomes than youth who delay fertility. A well-recognized problem with such inference is that statistical associations between teen pregnancy and schooling may not reflect cause-and-effect relationships but rather pre-existing socioeconomic disadvantages (Ribar 1999; Levine and Painter 2002). Or perhaps, in assessing their life chances, teens-at-risk come to the conclusion that their interests are best served by embracing early motherhood as a defining identity (Friedman, Hechter, and Kazanawa 1994; Meekers and Calves 1997; PRB 2000). A life table approach offers a useful alternative in this regard. With this approach, causation is not inferred from statistical associations but directly from respondents' own reports about the reasons why children dropped out. One possible reason why schooling life tables have not been extensively applied to this area of research has to do with lack of required input data, a constraint lifted by recent DHS surveys.

A third contribution of this study is about policy relevance. Demographic analysis has benefited in recent years from an increasing availability of large data sets and from advances in statistical modeling. Today, researchers can examine the effects of fertility in great detail, e.g. for different age groups, grade levels, or sub-populations. Unfortunately, these advances do not benefit policymakers unless researchers can convert their detailed findings into aggregate and cumulative outcomes (Smith 1989; Teachman and Hayward 1993). In education planning for instance, the same policy intervention may elicit disparate and perhaps contradictory responses at different grade levels or for different sub-populations. Analysts must be able to integrate these disparate findings, and life tables can serve this purpose (Teachman and Hayward 1993). Assuming that the necessary input data exist, the section below describes how to achieve the study's objectives, i.e., (1) measure the relative contribution of pregnancies to the overall difference in educational attainment between boys and girls and (2) evaluate how reductions in the incidence of school dropout affect this gap.

METHODS AND DATA

Methods

The inequality in educational attainment between boys and girls does not emerge instantly. Rather, it builds up gradually throughout the school cycle and from different sources. The components of gender inequality can therefore be classified according to timing of emergence and sources (Table 1). For the purpose of our analysis, we divide the school cycle into two periods (primary school (roughly a pre-puberty period) and post-primary school). We divide the reasons for dropout into two groups as well ("pregnancy-related dropouts" and "non pregnancy-related dropouts"). Altogether, gender inequality therefore comprises four components: a "pregnancy-primary school" component (G_{1p}), a "pregnancy/ post-primary school" component (G_{1s}), a "non-pregnancy/ primary school" component (G_{0p}), and a "non-pregnancy/ post-primary school" component (G_{0s}).

[Table 1 about here]

The gender inequality at any grade (G_t), is a function of these four components, i.e.,

$G_t = fn\ (G_{op}, G_{1p}, G_{0s}, G_{1s})$. Elsewhere, we show that

$$G_t = \prod_{k=1}^{p-1} G_{k(0)} - G_{k(1)} \times \prod_{k=p}^{t-1} G_{k(0)} - G_{k(1)} \qquad [1]$$

where k indexes individual grade-levels,

p marks the transition between primary and secondary school

$G_{k(0)}$ and $G_{k(1)}$ represent the "non-pregnancy" and "pregnancy" components of the gender gap, respectively, with

$G_{k(0)}$ equals $\left[\frac{1-\lambda_{k(f0)}}{1-\lambda_{k(m0)}}\right]$ and $G_{k(1)}$ equals $\left[\frac{\lambda_{k(f1)}}{1-\lambda_{k(m0)}}\right]$

where λ represent the conditional probabilities of school dropout,

m and *f* index male and female pupils respectively

1 and *0* indicate pregnancy-related and non pregnancy-related dropouts, respectively

To make it easier to follow the remaining discussions, we define the labels used for gender inequality and its components. Gender inequality in school continuation (G_t) is measured by the ratio of females to males among pupils remaining in school through grade t. This ratio, labeled "F/M ratio" in the text, ranges in theory from zero to infinity, but it is generally below 1.2. Higher F/M values indicate lower levels of inequality. Inequality in school *attainment* is the value of G_t at the end of the school cycle. For both substantive and empirical reasons[1], the end of secondary school is chosen as the terminal point of schooling in this study.

[1] Given the relatively small number of pupils who advance beyond secondary schooling, (1) the variability in outcomes would be small beyond secondary school and (2) the empirical estimates of the probabilities of dropout would be unreliable because they would be based on small numbers.

The complement of G_t measured by $(1- G_t)$ is termed "gender gap" and it indicates how far a given country stands from the goal of eliminating inequality. As with the F/M ratio, the gender gap can be measured for a single grade or at the end of the school cycle, in which case it becomes a gap in educational *attainment*. Large gaps imply that a country is far from reaching educational parity, the target set in the United Nations' Millennium Development Goals. Most calculations are based on the F/M ratio, but findings discuss gender inequality both in terms of the F/M ratio and its complement, the gender gap.

The $G_{k(0)}$ components reflect the influence of "non-pregnancy" factors in generating gender inequality. They indicate how much girls out-drop boys for reasons other than pregnancy (including lack of money, poor grades, lack of interest, health, death, marriage, job opportunities, household help, etc…). Since there is no intrinsic reason why female pupils should have poorer families, grades, or health than boys, the "non-pregnancy" component will be assumed to reflect "discrimination," i.e., a differential treatment of boys and girls at the hands of families, schools, and society. As indicated above, $G_{k(0)}$ equals $[1-\lambda_{k(f0)} / 1-\lambda_{k(m0)}]$, which measures the ratio of a girl surviving a grade level (i.e., not dropping out) versus a boy doing the same, if pregnancies were not a factor. As such, the $G_{k(0)}$ represent the upper limit or "ceiling" for G_t if one eliminated all pregnancy-related dropouts. The $G_{k(0)}$ associated with individual grade levels indicate how much the ceiling is lowered by passage through the grade. Thus, a value of 0.90 for 5th grade would indicate that discrimination lowers the maximum value of G_t by 10 percent as pupils pass through 5th grade. Values of special interest are G_{0p} and G_{0s}, the cumulative effects of "non-pregnancy" factors through primary and secondary school, respectively.

A "pregnancy" component $G_{k(1)}$ measures the contribution of pregnancies to gender inequality, and it is given by [$\lambda_{k(f1)} / 1 - \lambda_{k(m0)}$], the ratio of a girl dropping out because of a pregnancy versus a boy remaining in school. Conceptually, this represents the odds of a girl dropping out (because of a pregnancy) versus her remaining in school if she experienced neither pregnancies nor discrimination. Practically, this number indicates how gender inequality is increased as a result of pregnancies when pupils pass through the corresponding grade level. A value of 0.06 for instance indicates a 6 percent decrease in the value of G_t because of pregnancies. The $G_{k(1)}$ can be evaluated at each grade but we will be most interested in G_{1p} and G_{1s}, the cumulative effects of pregnancy throughout primary and secondary school, respectively.

Assuming detailed knowledge of the probabilities of dropout at each grade, for each reason, and for each gender, Table 2 shows how these probabilities can be used to decompose gender inequality into its four components. The first column shows the input data drawn from a reference country where this information is available[2]. From this data, Eq. [1] is used to compute the value of "pregnancy" and "discrimination" components at each grade (see columns 3a and 3b). Values are then cumulated within each school cycle. These values, shown in the boxed cells in columns 3a and 3b of Table 2, correspond to the four components (G_{op}, G_{1p}, G_{0s}, G_{1s}) listed in Table 1. As these cells show, pregnancies in secondary school are by far the most important contributor to gender inequality in this setting. This setting also shows negative discrimination at the secondary level, perhaps because girls who reach secondary school are already selected.

[Table 2 about here]

[2] Name of reference withheld to preserve anonymity. The enrollments levels and gender gaps in this West African country are slightly above the African median. The data collected in this national survey made it possible to calculate detailed probabilities of school dropout by reasons and age level, as well as median age by grade for instance.

Having decomposed the gender gap, we then use schooling life tables to simulate how this gap would be affected by gradual reductions in pregnancy-related dropouts. From the probabilities of dropout (columns 2a through 2d), one derives the total number of pupils dropping out at each grade (data not shown), then by deduction, the number of pupils remaining in school after each grade level (columns 5a and 5b). The survivorship of females is compared to males' to indicate how the F/M ratio changes over the school cycle (column 5c). We pay special attention to the F/M ratio at the end of secondary school, which is used as the final measure of inequality in educational attainment. While the computations in column 5c reproduce the results found in 4b using a different computation procedure, the layout in a life table facilitates simulation. These simulations only require changing the probability of pregnancy-related dropouts (column 2b, boxed) and monitoring the changes in the gender inequality in educational attainment (boxed cell in column 5c).

Data

Up until recently, the input data required to construct schooling life tables for African countries had not been available. The DHS surveys surmounted this limitation by compiling relevant education statistics for several countries, including 23 sub-Saharan African countries. Although these DHS statistics are incomplete, they can be used to estimate the input data necessary to create schooling life tables for these 23 countries. This input data is generated through the following steps.

Step 1: Estimating grade-specific probabilities of school dropout from DHS enrollment data

- The DHS compiles enrollment figures for age groups 6-10, 11-15, 16-20, and 21-24. These figures are assigned to the groups' mid-points, i.e., ages 8, 13, 18, and 23. Data for the other ages are obtained by interpolation. The exact form of the interpolation varies depending upon age brackets. Typically, dropout rates are very small in the early grades and increase very rapidly in the later stages of primary school. The increases are more linear within secondary school, despite peaks around the critical grades where diploma-granting exams are held (Fuller and Liang 1999). Perhaps because of delays in school entry, the DHS compilations for many countries show lower enrolments for the 6-10 age group than for the 11-15 age group. To correct for this artifact, we assume that all pupils enroll by age 4 do not use the data for the 6-10 age bracket. We then assign the enrollment figures between the ages of 4 and 13 using an exponential interpolation. The enrollment figures between the ages of 13 and 18, and between the ages of 18 and 23 are obtained by linear interpolation. Having obtained enrollment figures for each age group, we convert age data into grade data, using a schedule of median age per grade from the reference country. Finally, these enrollment figures are used to compute grade-specific probabilities of dropout. This procedure introduces several biases: it overestimates the actual number of pupils enrolled at the younger ages; it smoothes out the peaks in dropouts around the grades where national examinations are held; it overlooks differences in age of entry and in duration of primary school cycle across sub-Saharan countries (Lloyd and Hewitt 2003). Still, it yields realistic estimates of the relative pattern of school survivorship, for pupils who do enter school adjusting for possible differences in age of entry and grade repetition across these countries.

Step 2: Obtaining probabilities of pregnancy-related dropout from DHS data

- The DHS also compile the distribution of dropout reasons for females, including lack of money, lack of interest, poor grades, pregnancy, or marriage (DHS 2003). Reasons are given by level of educational attainment, including “incomplete primary,” “complete primary," "incomplete secondary," "complete secondary," and "university." The percentages of pregnancy-related dropouts within each grade are easily deduced in one assumes that the distribution of these percentages is similar to the one observed for the reference country. Grade-specific percentages of pregnancy-related dropout are then applied to the total probabilities of school dropout (from step 1) to obtain the probabilities of dropout through pregnancy.

Step 3: Obtaining probabilities of dropout through other reasons

- After obtaining the total probabilities of school dropout from step 1 and the pregnancy-related probabilities from step 2, the probabilities of dropout through other reasons are obtained by subtraction. All the input information is now available to analyze the components of gender inequality and simulate the impact of pregnancy-avoidance programs. Before turning to the results of these analyses, a list of caveats is in order.

Caveats

Although a life table approach overcomes the inferential limitations of regression analysis, it has problems of its own, notably whether reported dropout reasons are reliable, whether pregnancies are really exogenous, and whether our reference country offers a valid representation of grade progression patterns for other African countries.

Respondents' reports of the reasons why children leave school may be affected by the framing of the questions. When "marriage" is offered as a response option, dropouts that could have been attributed to "pregnancy" ultimately end up in the "marriage" category. It also matters who the respondent is. Pupils may tend to blame their parents for a dropout, whereas parents may shift responsibility to children and emphasize such reasons as "poor grades," "pregnancies," or "lack of interest." Because DHS data are based on self-reports (rather than parental reports) and include “marriage” as a response option, they may underestimate the number pregnancy-related dropouts. On the other hand, respondents seldom report pregnancy as a dropout reason for males, although impending fatherhood may compromise the education of some boys. Assuming, as we do, that pregnancy-related dropouts do not occur among boys may overestimate the influence of pregnancies on gender inequality.

Our analyses also assume exogenous and random pregnancies, i.e., in cases where a pregnancy is reported as a cause of dropout, it is the sole and true cause of school dropout. Further, pregnancies do not predominantly affect girls who would have been more likely to drop out anyway. Any violation of these assumptions would also lead to overestimate the influence of pregnancies on gender inequality. Studies in the US suggest that pregnancies are not entirely exogenous (e.g. Levine and Painter 2002) but the evidence is not available for African countries to warrant and guide adjustments in our estimates.

Finally, in using data from a model country to complement the DHS data, we assume that the grade progression patterns in this country mirror patterns in the other countries studied here. The effects of these assumptions on our estimates are indeterminate but probably small since the interpolation in most cases is made over relatively small intervals.

FINDINGS

This study’s first set of findings describes the extent and sources of gender inequality for all 23 sub-Saharan African countries studied. The first two columns in Table 3 list the countries’ 2000 population size (in millions) and the percentage of female dropouts reportedly due to pregnancy, as estimated in the DHS (DHS 2003). This percentage averages 7.4 and ranges from 0.9 in Niger to 27.6 in Gabon. While these numbers seem small, their impact, as we show later, depends on several other factors including how these pregnancies are distributed across the school cycle.

[Table 3 about here]

The next two columns in Table 3 present our estimates of the extent of gender inequality, measured both by the F/M ratio and the gender gap. For these 23 countries as a whole, the F/M ratio among secondary school graduates is 0.495, meaning that only about 49 females complete secondary school for 100 male pupils who do so. In other words, the gender gap (the complement of the F/M ratio) is 50.5 percentage points. Gaps vary widely across countries from high of over 80 percentage points in Tanzania and Chad to a low of 3 percentage points in South Africa where the gap in secondary education completion has virtually closed.

The remaining four columns describe the sources of this inequality. Overall, pregnancies in primary school contribute to lower the F/M ratio (i.e. increase inequality) by 2.3 percent while other factors lower it by 8 percent. In secondary school, pregnancies lower the F/M ratio (below its value at the start of secondary school) by an average of 23.4 percent, while other factors lower it by 26.6 percent. "Discrimination" in secondary school thus appears to have the greatest impact in reducing the F/M ratio, followed closely by pregnancies in secondary school. Yet countries differ substantially in the makeup of their gender inequality. Contrary to the average pattern, pregnancy-related dropouts in secondary school are the largest factor in 8 of the 23 countries (Cameroon (26.4); the Central African Republic (60.6%), Gabon (15.7%), Kenya (40.1%), Mozambique (44.5%), South Africa (24.6%), Uganda (56.7%), and Zambia (68.8%)) while hardly apparent in Benin (8.7%), the Comoros (2.8%), and Niger (5.0%) for instance. There is also variation in the influence of pregnancies at the primary level. While this impact is negligible in most countries, pregnancies in primary school do widen the gender gap by a minimum of 5 percent in four of the 23 countries (the Central African Republic (5.1%), Chad (5.0%), Guinea (6.8%), and Mozambique (6.2%)).

Countries also differ in whether "discrimination" is a factor. In most countries, "discrimination," i.e., the male advantage on "non-pregnancy" reasons for dropping out, is considerable. In Benin, Chad, Guinea, Niger, or Togo, "discrimination" is important at both the primary and secondary levels. However, its impact is larger and more variable at the secondary level. For all 23 countries, "discrimination" lowers the F/M ratio by 26.6 percent as pupils pass through secondary school. Yet, "reverse discrimination" is observed in South Africa and the Central African Republic where girls who enter secondary school are less likely than boys to drop out of school for reasons other than pregnancy. Perhaps secondary school girls in these countries or those who delay pregnancy are particularly selected, or perhaps these countries have been particularly effective at compensating for the effects of pregnancies.

Having described the baseline situation, we now use schooling life tables to simulate how this situation would change with gradual reductions in pregnancy-related dropouts (Table 4). The first block of columns in Table 4 shows changes in the F/M ratio in response to incremental reductions in the incidence of pregnancy-related dropouts. A second block of columns focuses on results under an "eradication" scenario where all pregnancy-related dropouts are eliminated, and a "halving" scenario where only half such dropouts are eliminated. Figure 1 shows the same results graphically, contrasting the baseline F/M ratio with ratios when pregnancy-related dropouts are "halved" and "eradicated," respectively. Figure 1 also plots the original DHS percentages of female dropouts due to pregnancies alongside our estimated impacts, in order to examine the relationship between these two variables.

[Table 4 and figure 1 about here]

The impact of pregnancy-avoidance programs is evaluated on the basis of three criteria: nominal, relative, and normative impacts. The nominal impact is the absolute increase in F/M ratio (reduction in gender gap) obtained by averting pregnancy-related dropouts. The relative impact is the percentage reduction in the initial gender gap. The normative impact is defined against the UN Millennium goal of closing the gender gap; i.e., whether or not countries would close their gender gap if pregnancy-related dropouts were eradicated. To illustrate, consider a country with an initial F/M ratio of 0.40 and where the eradication of pregnancy-related dropout increases this ratio to 0.60. In this country, the nominal impact will be 0.20 or 20 percentage points (0.60-0.40); the relative impact will be a 33 percent reduction in the initial gender gap (0.20/(1-0.40)); the normative impact will not be achieved since the country will not have closed its gender gap.

Focusing first on nominal impacts, the gender gap in this group of countries (as a whole) would shrink by 18.3 percentage points if pregnancy-related dropouts were eradicated and by 8.3 percentage points if these dropouts were halved. Nominal impacts vary across countries as shown by the large differences in the impact bars in Figure 1. Impacts would be minimal in Benin (3.7 percentage points), the Comoros (2.1 percentage points), Eritrea (4.9 percentage points), and Niger (2.8 percentage points) for instance. On the other hand, several countries stand to achieve substantial gains. Zambia, the Central African Republic, Uganda, and Kenya for instance would reduce their gender gap by 60.9, 54.3, 43.0, and 30.0 percentage points, respectively.

Looking then at normative impacts, findings clearly indicate that these programs will not be sufficient to close gender gaps in the countries considered here. South Africa is the only country where parity is reached as a result of pregnancy-avoidance programs, but this country was already very close to parity. Parity is not reached despite large nominal increases in some cases simply because many countries start from a very low baseline.

Indeed, if one focuses on relative impact, the reductions in gender gaps associated with pregnancy-avoidance programs are fairly substantial. Overall, the region's baseline gender gap (50.5 percentage points) would be reduced by about 36 percent. Expectably, relative reductions can be meaninglessly large in countries where initial gaps are very small (hence the exclusion of South Africa from this calculation). Even in countries where baseline gender gaps are large, however, the relative reductions are often substantial. Excluding South Africa, current gender gaps would be halved in six countries, some of which had sizeable gaps initially. Such countries include Cameroon (60.3%), the Central African Republic (84.2%), Gabon (75.9%), Kenya (53.1%), Uganda (58.9%) and Zambia (84.9%).

The graphical display in Figure 1 highlights two additional observations. The first is that pregnancy-avoidance programs are neither always necessary nor always sufficient to close gender gaps. Only in South Africa (a country with a very small gender gap to begin with) do pregnancy-avoidance programs suffice to achieve gender parity in education. The South African example illustrates that countries can achieve educational parity even while they incur some pregnancy-related dropouts, as long as society compensates by favoring girls in other respects. The 'reverse discrimination" noted in South Africa indicates that South African girls are less likely than boys to drop out of school for reasons other than pregnancy. This is true at the primary and even more so at secondary school level. Whereas South Africa's example indicates that (further) pregnancy-avoidance programs are not always necessary, the example of other countries suggests that they are not always sufficient either. In Cameroon, the Central African Republic, Gabon, Kenya, Uganda, and Zambia for instance, these programs do not achieve the goal of parity even as they permit substantial narrowing of gender gaps.

Another insight from Figure 1 is that the raw data compiled by DHS (on the percentage of female dropouts associated with pregnancies) is not by itself a good indicator of the impact of pregnancy-related dropouts on gender gaps. While this DHS measure provides an important piece of information, the impact of pregnancy-related dropouts also depends on the total dropout rates among females, the timing of pregnancy-related dropouts, and the extent of discrimination.[3] If the "DHS percentage" was all that mattered, then countries with the largest percentages should not only (a) have the largest baseline gender gap, but also (b) show the greatest reductions in gaps when pregnancies are reduced. Figure 1 clearly shows this is not the case. If proposition (a) were true, then in Figure 1, the bottom tip of the impact bars should become lower and lower as one moved from the left to the right, i.e., as the "DHS percentage" increased. Some downward sloping is indeed visible in the first tiers of the countries in the list (from Niger to Tanzania), but this pattern subsequently reverts. Indeed, South Africa and Gabon, two countries with the highest percentages of dropouts accounted for by pregnancies, also have the *smallest* gender gaps initially. Similarly, if proposition (b) were true, the size of the impact bars should increase proportionally with the "DHS percentages" at the bottom of Figure 1. Again, this is not the case. For instance, Cameroon and the Central African Republic have the same "DHS percentage" of 11.1 percent. However, the nominal impact of pregnancy-avoidance programs in the Central African Republic would be over twice as large as it would be in Cameroon, because pregnancies occur earlier, discrimination is less severe, and total dropout rates are higher in the Central African Republic. Because the gains from averting pregnancy-related dropouts so depend on

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[3] To illustrate, two countries A and B may have the same percentage, say 20 percent, of the total female dropouts in 8th grade that are due to pregnancy. Suppose that in country A, 20 percent of all females who enter 8th grade drop out drop out by the end of the year, while the corresponding percentage in country B is 10 percent. This means that out of 1,000 females who enter 8th grade, the number lost to pregnancies will be 40 in country and only 20 in country B. Further, if pregnancies occurred earlier in country A than

several factors, complete analyses using schooling life tables are essential to reach accurate conclusions about the countries and circumstances where investments in pregnancy-reduction programs would make a difference in closing gender gaps in education.

DISCUSSION AND CONCLUSION

We find substantial variation across African countries in how much pregnancy-avoidance programs can help narrow gender gaps in education. For the 23 countries studied as a whole, the female-to-male ratio among secondary school graduates would increase from a current level of nearly 0.50 to about 0.68 if all pregnancy-related dropouts were averted. This implies a reduction of current gender gaps by 18 percentage points. While this reduction would not close the existing gender gap, it does shrink it by over a third (36 percent) and current gaps would be halved in six of the 23 countries.

Such findings warrant attention to pregnancy-avoidance programs as a possible policy option, but important reservations must be addressed. The estimates generated here assume that pregnancies are exogenous, i.e., when pregnancies are reported as a cause of dropout, they are the true and sole cause of dropout. If not true, then the impact of pregnancy-avoidance programs will be overestimated. Our procedures would also overestimate the impacts of pregnancy-avoidance programs if a substantial number of boys drop out of school because of the impending responsibilities of fatherhood. On the other hand, surveys may undercount pregnancy-related dropouts when pupils themselves serve as respondents or when respondents attribute to "marriage" dropouts that were in fact due to a "pregnancy." While averting pregnancy-related dropouts may reduce gender inequality, our study does not indicate which policies are most effective in averting these dropouts, whether family planning, the promotion of abstinence, or

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in B, then the number of years of additional education potentially lost would be accordingly in A than in B.

economic support to teen mothers. Our analyses cover only about half of the African countries and patterns may differ for the remaining 26 countries that represent 37 percent of the African population.

Our research thus points to several areas of further investigation. First is a need for detailed schooling histories or, at a minimum, the kind of education statistics collected by DHS for all African countries. In collecting and analyzing data on the reasons for dropout, researchers must examine whether pregnancies (when identified as a reason for dropout) are the sole factor, or whether they simply aggravate previous disadvantages. Much work has been done in this area in developed countries and it can guide replications in sub-Saharan Africa. Finally, analysts must examine the effectiveness of different policy options in averting school-related dropouts.

Still, based on the evidence from this study, there are reasons to believe that programs to avoid pregnancy-related dropouts would have a sizeable influence in narrowing gender gaps in several countries. Compared to programs that focus on intergenerational influences (i.e., addressing the effects of parental fertility and family size or the macroeconomic benefits of reduction in cohort size), policies to reduce pregnancy-related dropouts are likely to have more immediate effects. As such, they are better suited to helping meet the UN Millennium Development Goals of closing the gender gaps by 2015.

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Table 1. Conceptual decomposition of the gender gap in educational attainment and corresponding policies.

	TIMING OF DROPOUT	
MAIN CAUSE OF DROPOUT	**Primary school (p)** ~ pre-puberty years	**Post-primary school (s)** ~ puberty years
Pregnancy (1)	G_{1p} PREGNANCY-AVOIDANCE PROGRAMS (e.g. reduced grade repetition and improved school quality)	G_{1s} PREGNANCY-AVOIDANCE/ MITIGATION PROGRAMS (contraception, abstinence, support to young mothers)
Other causes (0)	G_{0p} PROMOTION OF UNIVERSAL PRIMARY SCHOOLING	G_{0s} REDUCTION OF GENDER DISCRIMINATION IN PARENTS' EDUCATION INVESTMENTS

Table 2. Summary table of the decomposition and simulation procedures to estimate the effects of pregnancy-related dropouts on gender inequality in educational attainment

		INPUT DATA						DECOMPOSITION PROCEDURE				LIFE TABLE SIMU	
		Probability of dropout						Components of gender inequality		Gender inequality in school survivorship		**Percent pupils re[...] school**	
		From pregnancy		Other reasons		Overall		Pregnancy	Other	In grade	Up to grade		
		M	F	M	F	M	F						M
Grade (t)	Median age	λ1m	λ1f	λ0m	λ0f	λ.m	λ.f	G_{k1}	G_{k0}	G_{k0} - G_{k1}	(Gt) Π(Gk0 - Gk1)		
(1a)	*(1b)*	*(2a)*	*(2b)*	*(2c)*	*(2d)*	*(2e)*	*(2f)*	*(3a)*	*(3b)*	*(4a)*	*(4b)*	(1a)	(5a)
K+first	5	0.000	0.0000	0.0087	0.0071	0.0087	0.0071	0.000	1.002	1.002	1.000	***First grade***	*1.00*
Grade 2	7	0.000	0.0000	0.0168	0.0159	0.0168	0.0159	0.000	1.001	1.001	1.002	***Grade 2***	*0.99*
Grade 3	8	0.000	0.0000	0.0226	0.0323	0.0226	0.0323	0.000	0.990	0.990	1.002	***Grade 3***	*0.97*
Grade 4	9	0.000	0.0026	0.0311	0.0384	0.0311	0.0410	0.003	0.992	0.990	0.992	***Grade 4***	*0.95*
Grade 5	11	0.000	0.0061	0.0431	0.0621	0.0431	0.0682	0.006	0.980	0.974	0.982	***Grade 5***	*0.92*
Grade 6	12	0.000	0.0381	0.2612	0.2554	0.2612	0.2935	0.052	1.008	0.956	0.957	***Grade 6***	*0.88*
Primary school								**0.060**	**0.973**			***Primary school***	
Grade 7	13	0.000	0.0181	0.0569	0.0372	0.0569	0.0553	0.019	1.021	1.002	0.915	***Grade 7***	*0.65*
Grade 8	14	0.000	0.0254	0.0830	0.0370	0.0830	0.0624	0.028	1.050	1.022	0.916	***Grade 8***	*0.62*
Grade 9	15	0.000	0.0357	0.0775	0.0645	0.0775	0.1001	0.039	1.014	0.975	0.937	***Grade 9***	*0.56*
Grade 10	16	0.000	0.1056	0.2368	0.1778	0.2368	0.2835	0.138	1.077	0.939	0.914	***Grade 10***	*0.52*
Grade 11	18	0.000	0.0061	0.0793	0.1346	0.0793	0.1407	0.007	0.940	0.933	0.858	***Grade 11***	*0.40*
Grade 12	19	0.000	0.0619	0.1635	0.1549	0.1635	0.2168	0.074	1.010	0.936	0.801	***Grade 12***	*0.37*
Grade 13	20	0.000	0.0284	0.2574	0.2553	0.2574	0.2837	0.038	1.003	0.965	0.750	***Grade 13***	*0.31*
Secondary school								**0.301**	**1.115**			***Secondary school***	
Grade 14	22	0.000	0.0000	0.0814	0.0658	0.0814	0.0658	0.000	1.017	1.017	0.723	***Grade 14***	*0.23*
Grade 15	23	0.000	0.0000	0.0530	0.0714	0.0530	0.0714	0.000	0.981	0.981	0.735	***Grade 15***	*0.21*
Grade 16	24	0.000	0.0000	0.2973	0.0541	0.2973	0.0541	0.000	1.346	1.346	0.721	***Grade 16***	*0.20*
Grade 17	25	0.000	0.0000	0.2754	0.2581	0.2754	0.2581	0.000	1.024	1.024	0.971	***Grade 17***	*0.14*

Source: Data from reference country survey by first author

Table 3. Extent and sources of gender inequality in education attainment, sub-Saharan African countries

COUNTRY			EXTENT OF INEQUALITY		SOURCES OF INEQUALITY			
			Gender inequality in secondary school completion		Percentage reduction in F/M ratio associated with			
					Pregnancy		Other factors	
	Population size, in millions; (a)	% female dropouts due to pregnancy; (b)	F/M ratio	Gender gap	Primary	Secondary	Primary	Secondary
			G_t	$1-G_t$	$[G_{1p}]$	$[G_{1s}]$	$[G_{0p}]$	$[G_{0s}]$
Benin 1996	6.272	1	0.312	0.688	1.0%	8.7%	46.2%	35.1%
Burkina Faso 1998-99	11.535	3.2	0.368	0.632	0.0%	18.4%	27.3%	37.2%
Cameroon 1998	14.876	11.1	0.604	0.396	1.7%	26.4%	7.6%	8.8%
CAR 1994-95	3.717	11.1	0.355	0.645	5.1%	60.6%	29.0%	-26.5%
Chad 1996-97	7.885	4.6	0.161	0.839	5.0%	23.5%	43.9%	58.1%
Comoros 1996	0.706	1.8	0.583	0.417	0.5%	2.8%	21.1%	23.4%
Cote d'Ivoire 1998-99	16.013	3.3	0.455	0.545	0.7%	25.4%	31.5%	9.8%
Eritrea 1995	3.659	5.3	0.269	0.731	1.8%	11.7%	8.9%	65.2%
Gabon 2000	1.230	27.6	0.783	0.217	2.1%	15.7%	0.4%	4.9%
Guinea 1999	8.154	6.2	0.331	0.669	6.8%	28.6%	28.7%	31.3%
Kenya 1998	30.669	9.9	0.435	0.565	1.5%	40.1%	1.9%	25.1%
Madagascar 1997	15.970	2.2	0.380	0.620	1.0%	9.2%	5.1%	55.1%
Mali 1995-96	11.351	3	0.385	0.615	1.3%	18.8%	27.7%	32.3%
Mauritania 2000-01	2.665	2.1	0.692	0.308	0.6%	11.3%	15.6%	6.8%
Mozambique 1997	18.292	7.9	0.243	0.757	6.2%	44.5%	16.5%	37.9%
Niger 1998	10.832	0.9	0.405	0.595	0.3%	5.0%	28.8%	39.1%
Nigeria 1999	113.862	5.7	0.660	0.340	3.2%	11.7%	2.5%	20.3%
South Africa 1998	43.309	23.5	0.968	0.032	1.5%	24.6%	-2.2%	-25.8%
Tanzania 1996	35.119	3.8	0.103	0.897	3.6%	15.1%	-1.2%	87.5%
Togo 1998	4.527	7.9	0.259	0.741	3.0%	26.7%	20.1%	50.9%
Uganda 1995	23.300	7.4	0.271	0.729	0.6%	56.7%	1.7%	28.7%
Zambia 1996	10.421	13.1	0.283	0.717	2.5%	68.8%	1.1%	9.8%

Zimbabwe 1994	12.627	5.8	0.449	0.551	0.4%	12.7%	2.4%	46.4%
Average (unweighted)		7.3	0.424	0.576	2.2%	24.7%	15.9%	28.8%
Average (weighted by population)		7.4	0.495	0.505	2.4%	23.4%	8.3%	26.6%

Sources:

(a) UN World Population Prospects (UN 2001); (b) DHS compiler (http://www.statcompiler.com/)

(c) computations by authors

Table 4. Results of schooling life table simulations for the impact of reducing pregnancy-related dropouts on gender inequality in education a sub-Saharan African countries

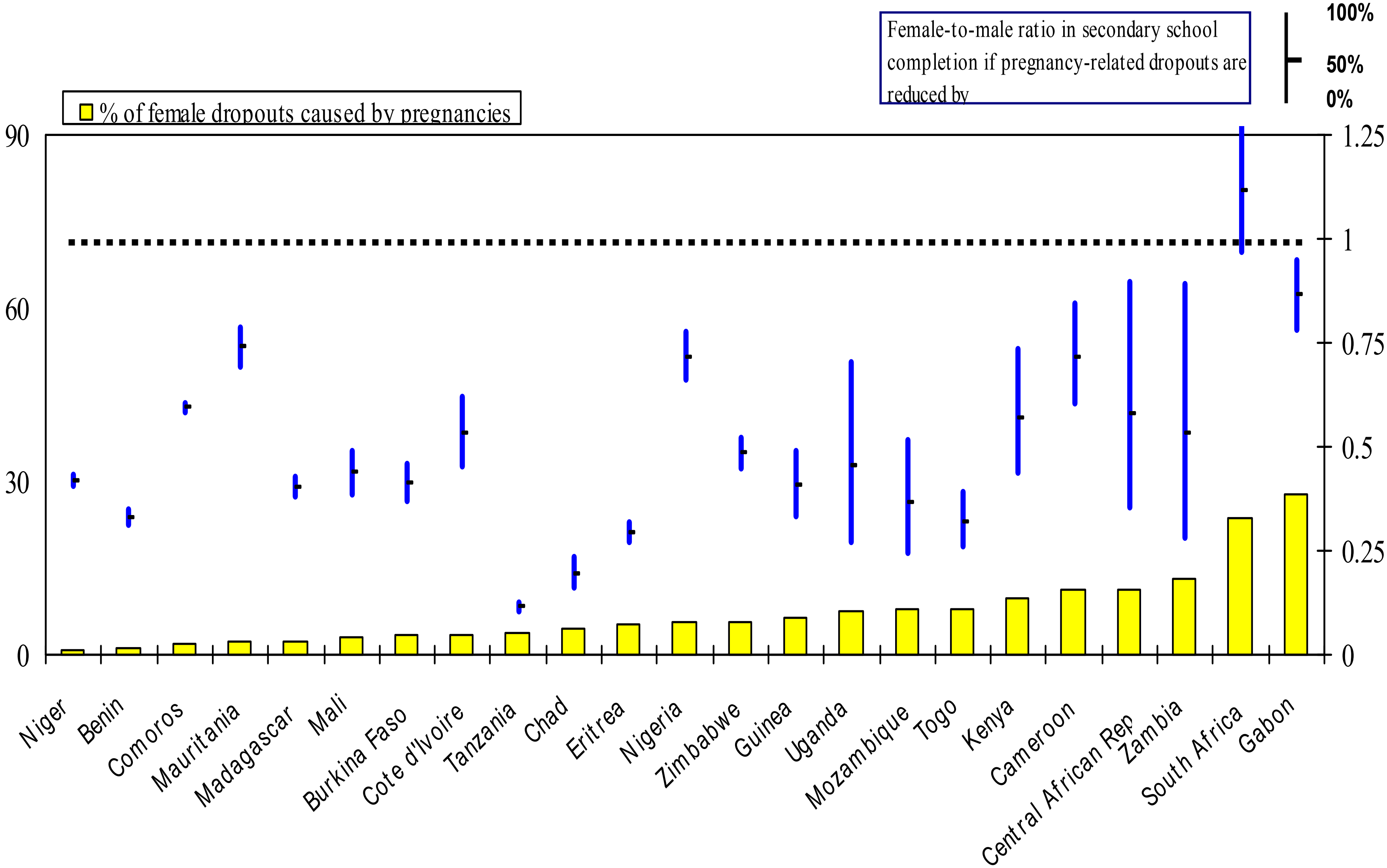
	DETAILED RESULTS FROM SCHOOLING LIFE TABLE SIMULATIONS (a)								
	Female-to-male ratio among secondary school graduates if incidence of pregnancy-related dropouts (PRD) is reduced by								
COUNTRY	0%	10%	20%	30%	40%	50%	60%	70%	80%
Benin 1996	0.312	0.315	0.319	0.322	0.326	0.330	0.333	0.337	0.341
Burkina Faso 1998-99	0.368	0.376	0.384	0.393	0.402	0.411	0.420	0.429	0.438
Cameroon 1998	0.604	0.625	0.647	0.669	0.692	0.716	0.740	0.765	0.790
CAR 94-95	0.355	0.393	0.434	0.478	0.526	0.578	0.633	0.693	0.756
Chad 1996-97	0.161	0.167	0.174	0.181	0.188	0.195	0.203	0.210	0.218
Comoros 1996	0.583	0.585	0.588	0.590	0.592	0.594	0.596	0.598	0.600
Cote d'Ivoire 1998-99	0.455	0.470	0.485	0.500	0.516	0.532	0.548	0.565	0.582
Eritrea 1995	0.269	0.273	0.278	0.283	0.287	0.292	0.297	0.302	0.307
Gabon 2000	0.783	0.798	0.814	0.830	0.846	0.862	0.879	0.896	0.913
Guinea 1999	0.331	0.345	0.359	0.374	0.389	0.405	0.421	0.438	0.455

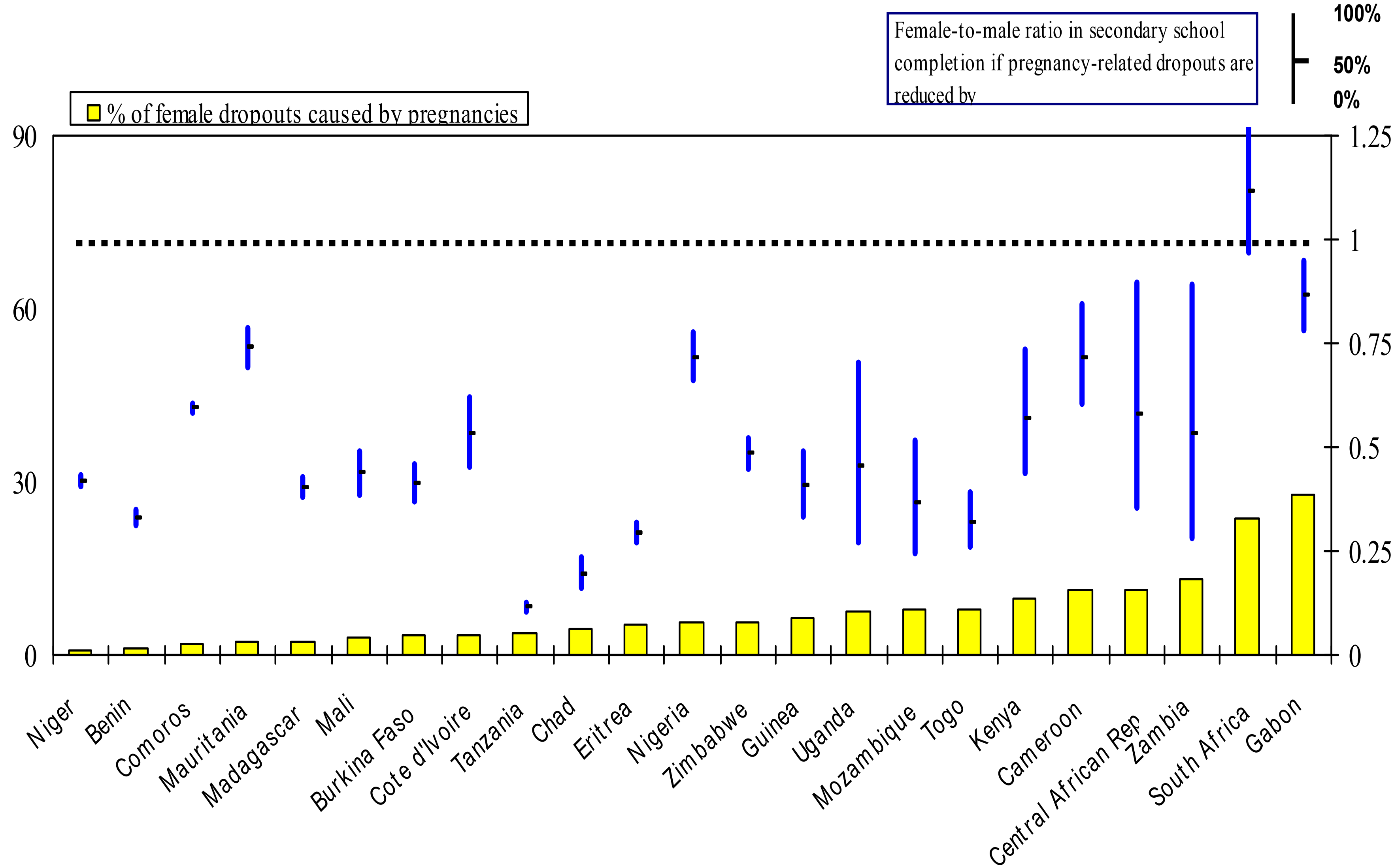
Kenya 1998	0.435	0.460	0.486	0.513	0.541	0.570	0.600	0.632	0.665
Madagascar 1997	0.380	0.384	0.389	0.393	0.398	0.403	0.407	0.412	0.417
Mali 1995-96	0.385	0.394	0.404	0.414	0.424	0.435	0.445	0.456	0.467
Mauritania 2000-01	0.692	0.701	0.710	0.719	0.729	0.738	0.747	0.757	0.767
Mozambique 1997	0.243	0.265	0.287	0.311	0.337	0.363	0.391	0.421	0.452
Niger 1998	0.405	0.408	0.410	0.413	0.416	0.419	0.422	0.425	0.427
Nigeria 1999	0.660	0.671	0.682	0.693	0.705	0.716	0.728	0.740	0.752
South Africa 1998	0.968	0.996	1.025	1.055	1.086	1.117	1.149	1.182	1.216
Tanzania 1996	0.103	0.106	0.108	0.110	0.112	0.115	0.117	0.119	0.122
Togo 1998	0.259	0.271	0.282	0.295	0.307	0.320	0.334	0.348	0.362
Uganda 1996	0.271	0.302	0.336	0.372	0.410	0.451	0.495	0.542	0.591
Zambia 1996	0.283	0.325	0.371	0.421	0.475	0.533	0.595	0.662	0.733
Zimbabwe 1994	0.449	0.456	0.464	0.471	0.478	0.485	0.493	0.500	0.508
Unweighted average	0.424	0.439	0.454	0.470	0.486	0.503	0.521	0.540	0.560
Weighted average (b)	0.495	0.510	0.526	0.543	0.560	0.578	0.596	0.615	0.635

Notes

(a) Schooling life tables and simulation sheets for individual countries available on line or on request; (b) weighted by population size

Figure 1. Results of schooling life table simulations for the effects of pregnancy-avoidance policies on the gender gap in educational attainment, sub-Saharan countries.





% of female dropouts caused by pregnancies
Female-to-male ratio in secondary school completion if pregnancy-related dropouts are reduced by
100%
50%
0%
90
60
30
0
1.25
1
0.75
0.5
0.25
0
Niger
Benin
Comoros
Mauritania
Madagascar
Mali
Burkina Faso
Cote d'Ivoire
Tanzania
Chad
Eritrea
Nigeria
Zimbabwe
Guinea
Uganda
Mozambique
Togo
Kenya
Cameroon
Central African Rep
Zambia
South Africa
Gabon