URBANIZATION AND FERTILITY: AN EVENT-HISTORY ANALYSIS OF COASTAL GHANA*

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In this article, we undertake an event-history analysis of fertility in Ghana. We exploit detailed life history calendar data to conduct a more refined and definitive analysis of the relationship among personal traits, urban residence, and fertility. Although urbanization is generally associated with lower fertility in developing countries, inferences in most studies have been hampered by a lack of information about the timing of residence in relationship to childbearing. We find that the effect of urbanization itself is strong, evident, and complex, and persists after we control for the effects of age, cohort, union status, and education. Our discrete-time event-history analysis shows that urban women exhibit fertility rates that are, on average, 11% lower than those of rural women, but the effects vary by parity. Differences in urban population traits would augment the effects of urban adaptation itself. Extensions of the analysis point to the operation of a selection effect in rural-to-urban mobility but provide limited evidence for disruption effects. The possibility of further selection of urbanward migrants on unmeasured traits remains. The analysis also demonstrates the utility of an annual life history calendar for collecting such data in the field.

Although urbanization is associated with lower fertility in developing countries, the details of how urban residence and migration might actually alter fertility behavior are not well understood. Thus, while observers can generally remark on the intertwining of urbanization and the demographic transition, knowledge of the timing of changes in individual behavior, and the way in which population redistribution might determine vital outcomes, is sorely lacking. This lack of knowledge is particularly troubling given that concerns persist about the relationship between demographic processes and economic development. Moreover, although population growth and urbanization are often thought to be threats to environmental quality, research on the relationship between urbanization and the contemporary shift in rates of natural increase also remains quite limited.

In this article, we address this deficiency by presenting and analyzing event-history data on the timing of fertility change in Ghana. Concerns about demographic dynamics, economic development, and environmental quality all intersect in this analysis. We address the demographer's conventional concern about the timing of demographic events and the influence of population composition. Our statistical work attempts to identify the relative influence of various personal traits on the onset and pace of childbearing.

This study also touches on environmental concerns in the region. High rates of population growth are almost always seen as deleterious for the environment. Furthermore, urbanization is often seen as problematic. Such environmental concerns are heightened in growing and urbanizing tropical coastal zones, which harbor productive and diverse natural

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ecosystems. All of this is brought to a more acute level in sub-Saharan Africa, where population growth rates remain very high by world standards and economic development lags. Our study setting of coastal Ghana is selected to give insight into these issues.

Knowledge regarding the migration-urbanization-fertility relationship is still limited, despite the repeated documentation of fertility differences by urbanization level (National Research Council [NRC] 2003). There have been several attempts to analyze the relationship. Extensive work in Thailand, for instance, has suggested that migration to urban areas brings adaptation to new norms that accord with reduced fertility (Goldstein and Goldstein 1983). Migration seems also to be associated with delayed onset of childbearing and lower overall birthrates in China and Vietnam (Goldstein, White, and Goldstein 1997; White, Djamba, and Anh 2001). The case for sub-Saharan Africa and the associated evidence are less clear, however (Oucho and Gould 1993). Some analyses with Demographic and Health Survey (DHS) data for multiple African countries suggest that rural-to-urban migration is linked to fertility decline (Brockerhoff 1998; Brockerhoff and Yang 1994). In an analysis of over two dozen African countries using DHS data, Shapiro and Tambashe (2002) found a strong association between urbanization and fertility. They further suggested a series of mechanisms that span population composition and the availability of services, but their results were based on aggregate (ecological) analyses at the country level.

Other researchers have argued that there is no association between migration and fertility, or that fertility may actually increase with urbanward movement (Cleveland 1991; Diop 1985; Hollos and Larsen 1992; Lee 1992; see also NRC 2003:211f). Almost all of these studies—whether for Africa or other world regions—have been hampered by limited information on the timing of both geographic mobility and fertility.

Generally, expectations are that urbanization reduces fertility because urban residence would likely increase the costs of raising children. Urban housing is more expensive, and children are probably less valuable in household production in urban (vs. rural) areas. Furthermore, urbanization (or urbanism) may be associated with ideational change, that is, beliefs and attitudes surrounding large families. In addition, urban residents may have better access to modern birth control, allowing urban residents to more effectively act on any desire to reduce childbearing.

This article analyzes recently collected data from Ghana, West Africa. We exploit a life history calendar that includes both annual residence and birth information. The availability of detailed retrospective data on type of place of residence, in particular, is very limited in the region (Schoumaker, Bonayi Dabire, and Gnoumou-Thiombiano 2006). Whereas many data sources often have information on type of place of residence at destination (i.e., the time of the survey) and at one or two earlier points in life, our data include residence information over the respondent's lifetime. Such data enable our event-history analysis to more accurately assess the relationship over time between urban living, migration, and fertility, while controlling for conventional personal characteristics. In this way, we can better understand the effect of urban residence overall, and more specifically, the effect of rural-to-urban migration on fertility over the childbearing sequence.

We examine several hypotheses about the determinants of fertility change in Ghana. In the literature on the migration-urbanization-fertility relationship, three mechanisms are generally cited: selection, disruption, and adaptation (see, e.g., Brockerhoff and Yang 1994; Goldstein and Goldstein 1983). Selection operates when movers have a different set of personal traits (or *a priori* behavioral intentions) that are associated with lower fertility regardless of whether they moved. Disruption operates under spousal separation; it is most relevant for cyclical migration or in circumstances when one partner moves and establishes work and residence in the new location, followed by the other partner later. Adaptation (sometimes called socialization) operates when long-term experiences, within or across generations, operate to socialize individuals to new fertility norms. It is this final mechanism—adaptation—that is of most interest to us in this article, although we discuss results pertinent to all three mechanisms.

The literature on migrant adaptation and fertility offers very little discussion of parity-specific effects. This may be due to the paucity of data on the migration experience and its timing. Yet perhaps these processes, especially adaptation, operate in a parity-specific way. We control for parity, along with other traits, in our analysis of fertility behavior.

We have three key expectations or hypotheses about the effects of migration and urbanization (as well as other traits) on fertility. First, and most generally, we expect urban residence to decrease rates of childbearing overall. That is, women who reside in urban areas will, net of other characteristics, have lower fertility rates.

Second, drawing on the literature on adaptation, we would expect rural-to-urban migrants also to exhibit lower fertility once in urban settings; that is, these migrants should exhibit a lower rate of childbearing than comparable women in rural areas. Augmenting whatever cost considerations influence household decision-making regarding fertility, urban settings may provide social networks and access to reproductive health services that reinforce the impetus for lower childbearing (NRC 2003).

Third, we expect parity-specific effects. Since urbanization is generally associated with the demographic transition, we would expect a shift in the childbearing profile with age. We expect urbanization (in our model, urban residence covariates) to be associated with a delayed onset of childbearing and a steeper reduction in fertility at older ages and higher parities, where fertility control is more likely to be manifest. Thus, we expect to see an effect of urbanization in the first birth as well as in higher-order births (women who have already reached parity of 3 or more). Effects of urban residence might be modest for second and third births.

These expectations are advanced net of other covariates we can control in our model. In keeping with the well-established literature on fertility, we expect age effects that follow a standard age-specific curve for fertility: low at young ages, increasing to a maximum in the 20s, and declining at older ages. We also expect education to be associated with declines in fertility. Finally, we test for cohort effects; our expectation here is that more recent cohorts will show lower rates of childbearing.

To be more explicit about our expectations, we know that urban populations differ in many compositional ways (among them, age and education) from rural populations; our intent here is to determine the effect of urban residence (by parity and migration status), even after controlling for these other effects. At the same time, we know that in most societies, secular changes in education (and presumably urbanization) hasten the fertility transition. With our data, we can test whether such cohort effects persist after adjusting for residence and education.

DATA AND METHODS

Study Site: Ghana's Central Region

We analyzed data from the 2002 Population & Environment (P&E) Survey of the Central Region in Ghana, one of 10 major administrative regions in Ghana. The 2000 Ghana census recorded a national population of 18.9 million people, representing a 54% increase from the population of 12.3 million in 1984, the year of the previous census, as well as an intercensal growth rate of 2.7% (GSS 2002:1). The 2000 population of the Central Region was recorded to be about 1.6 million. The coastal Central Region was chosen because of our concern for urbanization in ecologically sensitive coastal zones in developing countries. The Central Region contains a mix of ecological, historical, and economic settings and a range of settlement patterns. Our survey is representative of the six coastal districts in the Central Region: Komenda-Edina-Eguafo-Abirem (KEEA), Cape Coast, Abura-Asebu-Kwamankese, Mfantsiman, Gomoa, and Awutu-Efutu-Senya.

The coastal Central Region of Ghana is primarily inhabited by the Fante ethnic group (an Akan subgroup linguistically related to the Ashanti), as well as other smaller groups (e.g., Ewe, Ga-Dangme). Nationally, the Fante compose about 10% of Ghana's total population. While Ghana's major sources of foreign exchange are gold, timber, and cocoa, economic activities in the study area include fishing, small-scale farming, salt production, and some tourism activities. (Tourism is concentrated around ecological sites and former slave trading castles, now open as museums, dotting the Central Region coastline.)

The 2000 census classified 37.5% of the Central Region's population as urban (GSS 2002:17). The Central Region is the third most urbanized region in Ghana, following the neighboring Greater Accra (87.7% urban) and Ashanti regions (51.3%) (GSS 2002:17). Nationally, about 44% of Ghana's population is urban, an increase from the 1984 level of 32% (GSS 2002:2). Ghana is still predominantly rural but is urbanizing steadily.

The (P&E) Survey is a representative household-based survey of these six coastal districts. The intent of the survey was to study migration, fertility, child health knowledge and behaviors, and environmental attitudes. The six districts in the sample represent approximately 4% of Ghana's total population (GSS 2002:1, 17). The survey contains 1,436 women aged 15 and older; the response rate was 93% of identified eligible women.[1] On average, these women generate about 20 years of exposure each. Because we include women who have finished their reproductive careers, the average exposure (or person-years) contributed would be greater than in other such studies that are limited to samples of women under age 50.

Survey Instruments, Sampling, and Fieldwork

The 2002 Ghana P&E survey household questionnaire contained questions on current household composition, basic characteristics of household members, and economic characteristics of the household. The women's questionnaire contained modules on the respondents' sociodemographic background, birth history, health knowledge, child health (of living children under age 6), fertility preferences and family planning, and environmental attitudes and awareness. The men's questionnaire was a reduced version of the women's questionnaire, excluding the modules on birth history and child health. While the survey instruments were similar to the DHS in form and content, the instruments incorporated unique sections on knowledge of etiology of specific childhood illnesses, household hygiene practices, and environmental attitudes and awareness.

Both the women's and men's questionnaires included a life history calendar. Data for this article are largely drawn from this component of the survey. The calendar included domains on region of residence, urban or rural residence, education, occupation, marital status, and births and deaths of children by yearly intervals. Information was collected by year, rather than month, because the life history calendar covered an individual's entire lifetime and it was not expected that older individuals would remember information on a monthly basis for events that occurred early in their lifetimes. All men and women aged 15 and older completed the life history calendar. Although the use of event-history calendars has been growing, their use in low-income, sub-Saharan African settings is still relatively limited. Rather than a more conventional sample of rural and urban women, our survey design, with its life history calendar component, gives us a sample of women who have relocated among rural and urban areas over their lifetime (as well as some who haven't moved).

We followed a two-stage stratified sampling design. Our primary sampling units were enumeration areas (EAs) drawn from the 2000 census. We sampled three EAs from each of three strata (urban, semi-urban, and rural, as classified by the Ghana Statistical Service

1. The sex ratio of our adult respondents to our individual questionnaire was 0.77—lower than the corresponding value of 0.87 for the 2000 census—reflecting the high permanent and temporary out-migration of men in this area of Ghana.

[GSS]) from each of the six coastal districts, for a total of 54 primary sampling units. We chose this design in order to spread the sample across the strata, ensuring that there would be sufficient sample size in each territorial type classified by the GSS. Within each stratum, we selected three EAs with probability proportional to size of the EA. The GSS provided the list of EAs with population information required for this process. After the EAs were selected, survey listing teams listed all of the households in the selected EAs. In addition to providing a list of households for selecting the sample, the household listing provided population information needed for the weights. Based on the lists, we randomly selected 24 households from each enumeration area.[2] Survey teams then interviewed all women and men aged 15 and older in each selected household, administering a household questionnaire, the individual questionnaire, and the life history calendar.

In order to present results that are representative of the survey population in the six districts, we apply weights to our descriptive statistics. We also weight our regression analyses. Differences between weighted and unweighted regression parameter estimates are modest. We use the "svy" procedure in Stata version 9, allowing for adjustment on the basis of stratum and household. Our sampling weights reflect sampling fractions in the EA and nonresponse.

Measures

We examine fertility over the respondent's reproductive years (ages 15–49) in a discrete-time event-history analysis, using an indicator of whether a woman gives birth in a given year. Values of this birth variable are set to 1 in years when the woman gives birth and 0 otherwise. As descriptive backdrop, we calculate the total fertility rate (TFR) based on the five years prior to the survey (1997–2001). When we turn to the event-history analysis, we include parity as a time-varying covariate; parity for a woman increases by 1 if she had a birth in the prior year.

Table 1 presents characteristics of the sample with respect to fertility outcomes and several covariates. This table includes information on all women aged 15 and older at the time of the survey, women of current reproductive age (aged 15 to 49), and women over age 50 at the time of survey. Commonly, fertility analyses such as those based on the DHS focus solely on women of current reproductive age. The inclusion of a full life history calendar in this survey means that a woman older than reproductive age will have recorded information in the calendar on her fertility and life history during her reproductive years. Given this information, we can perform fertility analyses both on women currently in their reproductive years and on those who are older. Because the life history calendar records changes in other covariates (e.g., marriage, employment, and schooling) for each year, we can include temporally relevant covariates during the reproductive span.

The fertility variables presented in Table 1 show clear differences between women of reproductive years and those over age 50. Among women over 50, the number of children ever born (CEB) is 7.0, while CEB for women of reproductive years is 2.4. The distribution of the women at different parities fits the pattern of high fertility for women over age 50 and lower fertility for those of reproductive age. More than 90% of women over age 50 are in parity 3 or higher. A much lower percentage (about 40%) of reproductive-age women had three or more children at the time of the survey. Together, the differences reflect both relative completion of reproductive exposure and secular declines in childbearing rates.

A comparison of women of reproductive age with women over age 50 in Table 1 indicates that women of reproductive age (as of the survey) have higher levels of urban childhood experience. About 66% of women aged 15–49 lived in urban areas at age 15, compared with 49% of women over age 50. Some 39% of women have resided in the

2. Our value of 24 households per EA was determined on the basis of sampling efficiency.

Table 1. Descriptive Characteristics of the Sample (women aged 15 and older): 2002 Ghana Population & Environment Survey

Characteristic	All Women	Women Aged 15–49	Women Aged 50 and Older
N	1,436	1,097	339
Proportion in Age Group	1.00 (0.00)	0.78 (0.41)	0.22 (0.41)
Age (mean)	36.37 (17.46)	28.71 (9.49)	63.78 (10.58)
Education			
None or Koranic	0.39 (0.49)	0.28 (0.45)	0.76 (0.43)
Primary or middle school (JSS)	0.49 (0.50)	0.57 (0.50)	0.18 (0.38)
Secondary school or higher	0.13 (0.33)	0.15 (0.35)	0.06 (0.23)
Fertility			
Children ever born (mean)	3.42 (3.18)	2.43 (2.47)	6.97 (2.91)
Births in the past five years (mean)	0.55 (0.82)	0.70 (0.87)	0.01 (0.10)
Parity Distribution (2002)			
Parity 0	0.26 (0.44)	0.32 (0.47)	0.02 (0.14)
Parity 1	0.12 (0.32)	0.14 (0.35)	0.04 (0.18)
Parity 2	0.11 (0.32)	0.14 (0.34)	0.03 (0.17)
Parity 3+	0.51 (0.50)	0.40 (0.49)	0.91 (0.28)
Residence (2002)			
Urban (t – 1)	0.58 (0.50)	0.60 (0.49)	0.50 (0.50)
Urban (at age 15)	0.62 (0.49)	0.66 (0.48)	0.49 (0.50)

Notes: Numbers in parentheses are standard deviations. Descriptive statistics are weighted by sample selection probability.

Central Region since birth, while 41% have been resident in the region for less than 15 years (tabulations not shown).

Several other independent variables appear in the event-history analysis of births. Descriptive statistics (for time of survey) for these variables also appear in Table 1. We measure age directly as a time-varying covariate that increases for each year in the analysis. Because age can have nonlinear effects, we add an age-squared term to the analysis. Cohort effects are measured by dividing cohorts into three groups: a young cohort (born in 1970 or later), a middle cohort (born between 1950 and 1969), and an older cohort (born before 1950).

Education is measured in three categories: (1) none or Koranic, (2) primary or middle school (in Ghana, called Junior Secondary School, or JSS), and (3) secondary school or higher. Women of reproductive age clearly have much higher levels of education than women over age 50. In Table 1, 72% of women of reproductive age have primary or more education, whereas only 24% of women over 50 have such education. This pattern reflects the development of the educational system in Ghana. The national program of education, which was designed to provide an education for every child aged 6 and older, was officially implemented in 1961 (Owusu-Ansah 1995).

We estimated separate models that either include or exclude union status. Although the inclusion of a dummy variable for currently in a union is powerful and statistically significant (as expected), other covariate effects remain broadly consistent. Our tables presented here include the union status dummy variable, although one can argue for excluding union status for two reasons. First, other covariates also work through union formation and thereby influence its effect on fertility. Second, in Ghana there is significant childbearing outside of a union; of the approximately 5,000 births we observe in our data, only 86.8% are to women who reported themselves to be in a marriage or consensual union in the year prior to the birth. Approximately 56% of all women (62% of reproductive-age women) were in a union at the time of the survey.

Methods

Our event-history analysis starts with a simple model with only age and urban residence and then moves to a more complete multivariate model. We employ a discrete-time framework with person-year data. The 1,436 women in our sample generate 28,213 person-year observations between the reproductive ages of 15 and 49 for most analyses of the full sample, and correspondingly smaller observations for analyses of person-years limited by parity. The first-stage analysis examines the effect of recent urban residence (e.g., one year ago) on fertility, net of a linear and quadratic term in age:

$$\text{logit}\ (p_{it}) = \alpha + \beta_1 U_{i(t-1)} + \beta_2 A_{i(t-1)} + \beta_3 A^2_{i(t-1)} + \varepsilon_i, \tag{1}$$

where p_{it} is the probability of a birth for woman i at time t; U_i is urban residence; A and A^2 indicate age; α is the constant; β_1 , β_2 , and β_3 are coefficients; ε_i is the error term; and logit $(p_{it}) = \log\ [(p_{it}) / (1 - p_{it})]$.

After this initial analysis, we introduce covariates for other traits of the woman. The more extensive model is of the following form:

$$\text{logit}\ (p_{it}) = \alpha + \beta_1 U_{i(t-1)} + \beta_2 A_{i(t-1)} + \beta_3 A^2_{i(t-1)} + \Sigma\, \boldsymbol{\beta}_\mathbf{x} \mathbf{X}_\mathbf{i} + \Sigma\, \boldsymbol{\beta}_\mathbf{xt} \mathbf{X}_{\mathbf{i(t-1)}} + \varepsilon_i, \tag{2}$$

where $\mathbf{X}_\mathbf{i}$ represent covariates constant over time (suppressing index subscript); $\mathbf{X}_{\mathbf{i(t-1)}}$ represents time-varying covariates (lagged one year), and $\boldsymbol{\beta}_\mathbf{x}$ and $\boldsymbol{\beta}_\mathbf{xt}$ represent the respective coefficients.

We run all the event-history models for all parities pooled and then separately by parity (0, 1, 2, and 3 or more) because the number of prior births may strongly affect the time to the next birth. Along with the tables of coefficients for each model, our conclusion presents a simulation for hypothetical women with given combinations of personal traits and urban experience.

FINDINGS

Rural and Urban Fertility Levels

In our survey population of the coastal Central Region, we find that urban women exhibited a TFR of about 1 fewer child per woman than their rural counterparts. Our finding of an appreciable urban-rural difference in recent fertility is consistent with contemporary DHS data. The 2003 Ghana DHS indicated a current TFR of 4.4 for the country overall, little changed from the 1998 DHS (GSS and Macro International 1999, 2004). Urban areas in 2003 exhibited a TFR of 3.1 for women of childbearing age, while the rural TFR stood at 5.6. This 2.5 children per woman urban-rural gap in the DHS (comparable in 1998) is, in fact, larger than the one we observe. While the Central Region does have several significant urban settlements (e.g., Cape Coast, Elmina, and Winneba), much larger cities (e.g., Accra and Kumasi) are found in other regions in Ghana. At the same time, the Central Region's rural areas are much less remote than many other rural settings in Ghana. Thus, the effects of urban residence that we find are likely to understate the urban effects one might find across the entire scale of population settlement in Ghana.

Table 2 presents our discrete-time event-history models. This analysis confirms—with the accuracy afforded by time-varying data—that contemporary urban residence significantly decreases fertility across all parities. Table 2 indicates that in the pooled parity model, urban residents bear children at about a 24% lower rate than their rural counterparts of the same age.

Fertility Differences by Socioeconomic Status

We also examined fertility differences by two separate socioeconomic status (SES) variables: a household possession index and educational attainment. The possession index, an indicator of household SES at the time of the survey, is a simple sum of 11 household possessions: a radio or cassette recorder, television, video deck (VCR), telephone or mobile phone, electric or gas stove, refrigerator or freezer, clock, sofa or chair with foam pads, bed with foam mattress, bicycle, and motor vehicle (motorcycle, car, or truck). The average number of the 11 household possessions was just under 3 (2.9), demonstrating the low SES of this population. Montgomery et al. (2000) pointed out that while such indices are problematic in some respects, they are also workable in many demographic settings. Educational attainment is an individual-level indicator of SES.

Table 3 presents TFRs by these two measures of SES. Women who have greater household SES (as measured by our possession index) and women with more education have lower fertility than their counterparts. This is true for both current fertility (e.g., TFR) and cumulative fertility (e.g., CEB;, results not shown). For those with a household SES of 4 or more possessions, the TFR is 3.5 births. For women with secondary schooling or beyond, the TFR is 2.9 births. Because educational attainment is more likely to be predetermined than the possessions index, because the two are appreciably correlated, and because we measure educational attainment over time (whereas SES is measured only at the time of the survey), we use education as the key indicator of SES in our multivariate event-history models.

Full Multivariate Event-History Model

Table 4 presents the results from our multivariate analysis. Our additional time-varying covariates are parity, age, age squared, in school, union status, and employment status; all time-varying covariates are lagged. Fixed covariates are birth cohort and educational attainment. Our results continue to point to a strong relationship between age and the probability of having a birth across all parities. The negative age-squared term indicates a diminution of the age effect such that fertility peaks, as expected, around age 27. Women in the two younger cohorts are less likely to give birth than those in the oldest cohort (the reference group). The reduction in fertility in the younger cohorts strikingly illustrates Ghana's recent fertility decline. Additionally, educational attainment, measured by both schooling attendance in the prior year (a time-varying covariate) as well as highest level of schooling attained (a fixed covariate), is associated with a decreased probability of birth. In general and when we control for all the other characteristics in the model, women with more education are less likely to give birth than those without any schooling (the reference group).

Table 2. Discrete-Time Logit Event-History Model for Fertility, Based on Urban Residence and Age for All Women, Person-Years for Ages 15–49: 2002 Ghana Population & Environment Survey

Variable	Coefficient	*p*	Odds Ratio
All Parities			
Age	0.453***	.000	1.57
Age, squared	–0.008***	.000	0.99
Urban residence	–0.274***	.000	0.76
Intercept	–7.217	.000	
N (person-years)	28,213		
Parity 0			
Age	0.867***	.000	2.38
Age, squared	–0.018***	.000	0.98
Urban residence	–0.449***	.000	0.64
Intercept	–11.666	.000	
N (person-years)	9,721		
Parity 1			
Age	0.446***	.000	1.56
Age, squared	–0.009***	.000	0.99
Urban residence	–0.119	.202	0.89
Intercept	–6.050	.000	
N (person-years)	3,699		
Parity 2			
Age	0.261**	.006	1.30
Age, squared	–0.006**	.002	0.99
Urban residence	–0.209	.114	0.81
Intercept	–4.010	.001	
N (person-years)	3,341		
Parity 3+			
Age	0.328***	.000	1.39
Age, squared	–0.006***	.000	0.99
Urban residence	–0.180*	.021	0.83
Intercept	–5.403	.000	
N (person-years)	11,452		

Note: Regression results are weighted for survey probability.
$^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$

Women who were enrolled in school in the prior year are much less likely to bear children, particularly in the pooled and parity 0 models. Notably, this effect is particularly strong for women who have yet to bear a child, suggesting that continuation in school (in a society in which educational attainment is modest) strongly competes with entry into family building. These models also control for presence in a union (marriage or cohabitation) in

Table 3. Current Fertility Levels by Socioeconomic Indicators: 2002 Ghana Population & Environment Survey

	TFR (1997–2001)	*N*
Socioeconomic Status (possession index)		
0–1	4.85	574
2–3	4.64	430
4 or more	3.52	432
Educational Attainment		
None or Koranic	5.12	606
Primary or middle school (JSS)	4.51	698
Secondary school or higher	2.89	132

Notes: Descriptive statistics are weighted by sample selection probability. *N* (women) = 1,436.

the prior year and for employment. Of course, women who are in a union are much more likely to bear a child. Net of the effects we described, employment in the prior year only modestly alters predicted childbearing probabilities; it is statistically significant only in the pooled model, but its effect is positive, perhaps indicative of resources or less competition.[3] Not all of these effects are equally strong across the various parities.

In this article, the effect of urban residence is of key interest. We find the persistence of an effect of urban residence, even when controlling for other important traits such as age, cohort, education, SES, employment, and union status. In the pooled model in Table 4, urban residence in the prior year predicts about an 11% lower probability of childbearing in any given year. This is notable given the range of other covariates in the model. The effect of urban residence quite clearly varies by parity, however. Urban residence is quite strongly predictive for women who are at parity 0. The effect remains consistently negative at higher parities, but it is not statistically significant.

We also examined several alternative model specifications, including different covariates. We found that rural-to-urban movers also exhibited lower odds of giving birth than rural "stayer" women, with the difference, again, visible at every parity except parity 3 or more. While both movers and continuous urban residents exhibit lower fertility than continuous rural residents, rural-to-urban movers' overall odds ratio is higher than that of continuous urban residents. One alternative model included a dummy variable for region of origin (Greater Accra, Ashanti, Western, and other). We considered that in-migrants from urbanized origin regions (Accra and Ashanti) to the Central Region might manifest lower fertility rates because of their prior exposure to urban settings. (Greater Accra includes Accra and its suburbs; the Ashanti region includes Ghana's second-largest city, Kumasi, as well as surrounding territory.) None of these regional origin covariates were statistically significant at conventional levels.

Another set of alternative models investigated duration of urban residence and other aspects of migratory history. In one model, we included total number of years resident in the urban area since birth, or cumulative urban experience. In another model, we included a covariate measuring the proportion of childhood (ages 0–14) spent in urban areas. These models suggested that more urban experience was associated with further fertility decline,

3. Our life history calendar measured self-reported employment for each year of a women's life. Part-time and less than full-year employment were not captured. Some of these types of employment activities might be more compatible with childrearing.

Table 4. Discrete-Time Logit Model for Fertility (dependent variable is birth in year *t*) for All Women, Person-Years for Ages 15–49: 2002 Ghana Population & Environment Survey

	All Parity					
Covariate	Coefficient	*p*	Parity 0	Parity 1	Parity 2	Parity 3+
Parity	–0.002	.888	—	—	—	—
Age	0.197***	.000	0.566***	0.364***	0.272***	0.298***
Age, Squared	–0.004***	.000	–0.013***	–0.008***	–0.006***	–0.006***
Middle Cohort	–0.326***	.000	0.113	–0.302**	–0.390*	–0.458***
Young Cohort	–0.450***	.000	–0.126	–0.544***	–0.507***	–0.794***
Primary or Middle School Education	0.014	.822	0.323*	–0.169	–0.152†	–0.097
Secondary School Education or More	–0.277*	.027	–0.029	–0.101	–0.560†	–0.576*
In School	–0.503**	.006	–0.708***	–0.541†	–0.775	–0.666
In a Union	1.432***	.000	1.830***	0.930***	0.531*	0.998***
Employed	0.134*	.049	0.004	0.175	0.372	0.096
Urban Residence	–0.114*	.031	–0.247**	–0.048	–0.129	–0.042
Intercept	–4.298	.000	–8.330	–5.556	–4.570	–5.553
N (person-years)	28,213		9,721	3,699	3,341	11,452

Notes: Young cohort = born in 1970 or later; middle cohort = born between 1950 and 1969; and older cohort (reference group) = born before 1950. Regression results are weighted for survey probability.

†$p < .10$; *$p < .05$; **$p < .01$; ***$p < .001$

but the statistical power of these specifications was weaker. Still other alternative models tested for disruption effects by including dummy covariates for migration in either of the prior two years. These lagged move covariates were generally not strongly predictive of the probability of giving birth in the current year. In some specifications, we found that first births were associated with contemporaneous or recent migration, which may reflect recent union formation (and associated migration) or relocation back to the natal community for the birth itself.

Table 5 presents a model that examines the "selection" hypothesis. Here we take the number of living children as a determinant of the probability of migration. We estimate a discrete-time event-history model that regresses the annual probability of interregional migration on a set of personal characteristics for women aged 15 and older. All categories of living children (compared to the reference category of having no living children) show a negative effect on the probability of migration. This effect is significantly negative for two, three, and four or more children (at $p < .05$). To indicate the magnitude of the effect, consider that women with three children are predicted to have a probability of mobility that is 33% lower than women with no children and 20% below those with one child.

In separate origin-destination-specific multinomial logit models (not shown here), we found similar parity-specific effects of fertility deterring migration to urban areas. All of this is completely consistent with a selection process: rural-to-urban migration patterns will tend to redistribute to urban areas those members of a population with lower realized (and perhaps lower intended) fertility. We note that further selection may operate on traits that are not measured in our data; even so, the family size (or parity) influence on population redistribution remains appreciable.

Table 5. Discrete-Time Logit Model for Migration (dependent variable = migration in year *t*) for All Women, Person-Years for Ages 15 and Older: 2002 Ghana Population & Environment Survey

Variable	Coefficient	*p*
Age	0.028	.280
Age, Squared	–0.001*	.023
In a Union	0.289	.410
Primary or Middle School Education	0.768***	.000
Secondary School Education or More	0.924***	.000
In School	–0.378	.191
Employed	–0.516***	.000
Birth in Previous Year	–0.012	.934
Child Death in Previous Year	–0.232	.345
One Child	–0.176	.229
Two Children	–0.531*	.017
Three Children	–0.398*	.039
Four or More Children	–0.460*	.031
Number of Prior Moves	0.354***	.000
Urban Residence	0.483**	.001
Middle Cohort	–0.271	.138
Young Cohort	–0.045	.794
Age × In a Union	–0.012	.325
Intercept	–3.978	.000
N (person-years)	31,995	

Notes: Young cohort = born in 1970 or later; middle cohort = born between 1950 and 1969; and older cohort (reference group) = born before 1950. Regression results are weighted for survey probability.

*$p < .05$; **$p < .01$; ***$p < .001$

CONCLUSION

In this article, we find strong evidence for the association of urbanization with lower fertility. More important, perhaps, our exploitation of an event-history calendar gives us a much more conclusive and refined view of the relationship between residence and childbearing. Our analysis also confirms and extends some of our knowledge about the other determinants of fertility in a sub-Saharan African setting. Conventional covariates show through in anticipated ways: a distinct age pattern and lower fertility associated with more education and the more recent birth cohort.

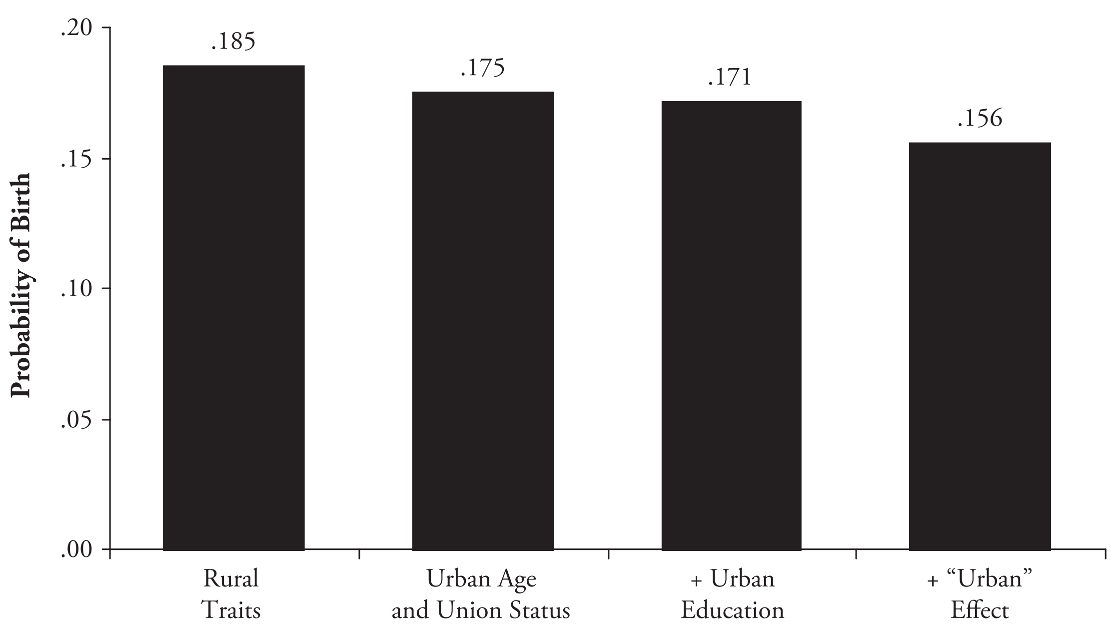
The effect of urbanization itself is strong and consistent with the adaptation mechanism. Prior to the introduction of controls for personal traits, our event-history model points to a 24% lower odds of giving birth for an urban resident. We tested an array of alternative specifications, and we only recapitulate the key findings here. The multivariate analysis confirms that, net of other traits, urban residents exhibit fertility odds that are on the order of 11% lower than otherwise equivalent rural women. This "urban" effect differs modestly by parity: urban women's first births occur with about 22% lower odds. We take this urban effect to be reflective of urban norms (delayed union), opportunity costs (education and employment), and access to family planning services. We acknowledge that further selection on unmeasured traits may operate and could emerge as apparent adaptation. A likely mechanism of this sort would be a woman with a prior intention for lifetime lower childbearing moving to the city. Finally, disruption may play a role in this process of differential fertility, but we find little evidence of it.

Urbanization is surely linked to declining fertility through broad social changes, as well. In this vein, our results point to the clear impact of cohort on fertility. Even after controlling for other individual traits, we find that fertility declines markedly with successive cohorts. What is more, we know that younger cohorts are more likely to have urban experience, while higher educational attainment is also associated with urbanization.

Urban-rural fertility differences are probably the result of both population composition and genuine residence effects. In the former category, a higher educational level in urban settings would be expected to lower fertility. In the interest of showing the relative impact of composition and the urban effect itself, we conduct a simulation, shown in Figure 1. We first calculate the predicted probability of a birth in any given year for a woman with typical (i.e., mean) rural traits. This is .185. We then substitute the mean age and union status for urban areas; this shift in composition lowers predicted fertility slightly to .175. In the third column, we shift to the urban mean for education, and this lowers fertility further to .171. Finally, we allow for the urban effect itself, and in this simulation, predicted fertility is lowered to .156 in the given year.

All this suggests important implications for both research and development policy and programs about the interwoven processes of migration, urbanization, and fertility. First, selection does operate to leave higher parity women in (predominantly rural) origins. Second, urbanization is associated with shifts in population composition (themselves linked to economic development) that favor reductions in childbearing. Third, urban residence—among

Figure 1. Predicted Probability of Birth by Rural Residence, Urban Composition, and "Urban" (mean children ever born and young cohort)



both natives and migrants—further reduces annual rates of childbearing below the level predicted by age and socioeconomic traits alone. Such a result is consistent with the adaptation mechanism. All this suggests that policymakers, particularly those interested in the pace of fertility decline in countries such as Ghana, may wish to reevaluate views of urbanward migration and urbanization. Both through direct and indirect mechanisms, urbanization hastens fertility decline. This is not to argue for special efforts to accelerate urbanization. Rather, for those with concerns about the pace of population growth, our results suggest that accommodating urbanization may have beneficial spillover effects.

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