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Transition into first intercourse, marriage, and childbearing among Ethiopian women

1. INTRODUCTION

Demographic decompositions of recent fertility decline in urban Ethiopia identify delayed marriage among recent cohorts of women as a major component of the decline in urban fertility (Sibanda *et al.*, 2003; Lindstrom and Woubalem, 2003). Studies conducted in other sub-Saharan African countries find that as age at marriage increases, premarital sex becomes increasingly common, often leading to a rise in premarital fertility (Bledsoe and Cohen, 1993; Gage-Brandon and Meekers, 1993; Meekers and Ahmed, 2000). This increase in premarital fertility typically is linked to increases in the autonomy of women (education and labor force participation), a weakening of family controls over the sexual behaviors of daughters associated with migration to cities, and the opportunities and lifestyles associated with urban residence. A rise in adolescent premarital sexual activity in the context of delayed marriage, however, is far from universal in African countries. A recent comprehensive analysis of adolescent transitions into adulthood using Demographic and Health Surveys (DHS) found that in 7 of the 27 African countries examined, no inter-cohort change had occurred in the percent of women who had premarital sex by age 18, even though the percent marrying by age 18 had declined in 24 of the countries (National Research Council, 2005:199). Mensch, Grant and Blanc (2006) also report in a similar multi-country analysis of the DHS that the data do not support the claim that the delay in marriage in Africa has resulted in a pervasive shift toward earlier sexual initiation.

In Ethiopia, a society in which childbearing outside of marriage traditionally has not been tolerated, the rise in age at marriage has not been accompanied by a rise in premarital fertility. In fact, in an analysis of fertility change in Addis Ababa based on the 1984 and 1994 censuses, Lindstrom and Woubalem (2003) find that non-marital fertility actually declined during the

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inter-censal period. In this article we examine successive birth cohorts of rural and urban women to document change in the timing of women's transitions into sexual activity and adult family roles, and to identify the underlying relationships between these transitions and education and place of residence. We use data from the 2000 and 2005 Ethiopia Demographic and Health Surveys to test theories of role competition, human capital, and social dislocation, and we offer plausible explanations for the patterns of reproductive behavior observed.

2. BACKGROUND AND THEORY

Delayed marriage is now a well-established trend in African countries. The increase in age at marriage is largest in urban areas, but there is evidence of a rise in age at marriage in rural areas as well (Blanc and Grey, 2002). Delayed marriage is widely believed to be associated with increases in school enrollment at the secondary level and above, rural-urban migration, and increases in female non-agricultural employment (Ikamari, 2005; Jejeebhoy, 1995; Kaufman and Meekers, 1998; Kinfu, 2000; Lesthaeghe *et al.*, 1989). In general, delayed marriage is an important component of the decline in total fertility in societies where childbearing occurs largely within marital unions. The actual contribution of delayed marriage to fertility decline depends in part on what happens to premarital fertility. There is no consensus on the predicated and observed effects of education and urban residence on premarital sexual activity and premarital childbearing in Africa (Meekers, 1994a), although evidence emerging from developing countries tends to show that school enrollment and educational attainment delay the initiation of sex (National Research Council, 2005).

Three general hypotheses dominate the literature on education and family formation (Lindstrom and Brambila-Paz, 2001; Yabiku, 2005). First, *role incompatibility* between the status of student and that of wife and mother reduces the risk that young women who are enrolled in school will marry and begin childbearing. Second, education is an investment in *human capital*: it decreases a woman's expected dependence on a husband's earnings, and it increases the opportunity costs of foregoing employment to take on the roles of wife and mother. The improved earning power that education offers women, therefore, encourages them to delay marriage and childbearing. Third, the *social dislocation* hypothesis argues that schooling is a transformative experience for young women; it increases their awareness of alternative roles to those of wife and mother; it promotes independence and a greater say in choice of husband; and it weakens the hold of traditional

norms regarding the timing and desirability of first sexual intercourse in relation to marriage and may increase the acceptability of premarital motherhood. The human capital and social dislocation hypotheses predict that the effects of education are strongest among women living in urban areas where there is a wider array of employment opportunities for educated women, an expanded marriage market, and a less restrictive socio-cultural environment compared to village life. The social dislocation hypothesis suggests that education, urban residence, and economic change gradually breakdown traditional means of social control over adolescent sexual behavior and socialization by bringing boys and girls together outside of the supervision of parents and traditional rural based kinship groups, and by eroding traditional moral codes through exposure to Western values about sex, sexual autonomy, and marital life (Caldwell *et al.*, 1982; Cherlin and Riley, 1986; Gueye *et al.*, 2001; Meekers, 1994b; Rwenge, 2000; Shell-Duncan and Wimmer, 1999; Zabin and Kiragu, 1998). In the absence of effective contraceptive use early premarital sexual activity raises the risk of premarital births.

However, there are also reasons to expect education and urban residence to be associated with a delay in the start of sexual activity. Women in urban areas typically receive more schooling and are in school until later ages than rural women, increasing the likelihood that the roles of student and wife/mother will conflict. Schooling and employment opportunities in the urban sector encourage girls to develop occupational and economic aspirations that would be jeopardized by early marriage and childbearing. The risk of an early, unplanned pregnancy posed by premarital sexual activity encourages girls who would have higher opportunity costs to delay first intercourse. The knowledge and skills that girls acquire in school and the experience of being with boys in the classroom also enhances girls' sense of control over their lives and their ability to negotiate with boys, all of which increase their ability to decide when to begin sexual activity.

Evidence in support of both the social dislocation hypothesis and the prediction that schooling delays the onset of sexual activity can be found in sub-Saharan Africa. Meekers and Ahmed (2000) found in a survey of urban youth in Botswana that for girls, being in school is associated with a lower risk of initiating sexual activity. In Cameroon, Calvès (1999:291) found that premarital pregnancies and births were on the rise, especially in urban areas and among educated youth. In a study of youth in Accra, Agyei *et al.* (2000) found that unmarried girls in urban areas were at a higher risk of pregnancy than girls in peri-urban and rural areas, but that schooling was associated with a later age at first intercourse. Kebede *et al.* (2005) found in a survey of youth in Addis Ababa that the risk of pre-marital sex was substantially lower

among in-school youth compared to out-of-school youth. Studies reviewed by a recent National Research Council study of adolescent transitions into adulthood also provide contradictory evidence of the relationship between urban residence and adolescent sex (2005:200). In a wider analysis of DHS data for seven sub-Saharan African countries Gage-Brandon and Meekers (1993) found that the impact of education on sexual activity among never-married women was inconsistent across countries. The evidence seems to suggest that school enrollment delays premarital sexual activity, but that level of completed education has a less consistent impact.

The presence of substantial variation in the relationship between education, place of residence, and the onset of sexual activity suggests that context plays a fundamental role in how education affects the timing of first intercourse and the relationship between sexual initiation and entry into marriage. Although a positive relationship between education and age at marriage is found in diverse national and cultural contexts, there is little evidence to suggest that higher education is leading to a convergence towards the Western model of courtship and marriage that is implicit in early formulations of the demographic transition. In spite of the spread of secondary and higher education, there continues to be considerable variation in the role of parents and elders in spouse selection, how prospective spouses meet, and norms regarding premarital sexual behavior and courtship (see Meekers, 1995 for the case of Togo).

Studies in many non-European countries find that arranged marriages or the close involvement of parents in selecting or approving a spouse remains common among highly educated young people (Banerjee, 1999). We suspect that the social dislocation hypothesis regarding the role of Western education in eroding traditional norms regulating premarital sexual behavior is problematic as well. The resiliency of traditional norms regarding premarital sexual behavior and in particular the uneven application of these norms to women and men, are likely to be an important source of variation in the relationship between education and premarital sex, and premarital sex and marriage.

3. CONTEXT

Ethiopia is an ethnically and linguistically diverse country with over 80 ethnic groups and nine major language families. The Amhara, a Semitic speaking people, and the Oromo, a Cushitic-speaking people, are the two largest ethnic groups with 30 and 32 percent of the population respectively. The next two largest groups, the Tigray and the Somali each constitute approximately 6 percent of the population. Roughly 50 percent of the

population is Orthodox Christian, 10 percent is Protestant, and 33 percent is Muslim, with followers of traditional African and other religions accounting for a small percentage of the population (CSA, 1998). In spite of the ethnolinguistic and religious diversity, centuries of social, economic, and political interaction have produced common cultural traits and forms of social organization and expression that provide the foundation for a greater Ethiopia culture area (Levine, 1974).

Although there remain distinctive ethnic differences in access to education, rural-urban migration and marriage practices (age at marriage and the prevalence of polygamy and divorce), entry into marriage is near universal among all groups, with only 1 percent of men and women age 35 and above having never married (CSA, 2001:77). Marriage is of central importance to all aspects of life in Ethiopia; in one way or another, practically all essentials are organized, procured, and guaranteed through the institution of marriage (Weissleder, 1974:72). A strict sexual division of labor that makes the performance of tasks not of one's gender almost taboo, provides a compelling pragmatic rationale for entry into marriage. For women, in particular, being single or in a household without a man is associated with marginalized social status, dependence on kin, and greater vulnerability (Pankhurst, 1992). Among the Amhara, who for centuries have been the most dominant cultural and political group, very early age at marriage is common. According to the 2005 Ethiopia DHS the median age at first marriage for women in the Amhara region ages 20-49 was 14.4 years compared to a median of 17.1 years among women in the Oromiya region (CSA, 2006:83). Parents view early marriage strategically because it provides a means to extend the family's social networks, which are a critical source of aid during times of crisis and household need. Because first marriages generally involve a bond between households, a bride's virginity is not simply a matter of honor; it has an economic value to parents and to the young women themselves (Pankhurst, 1992:122). In societies, such as Ethiopia, where family networks function as mutual support groups, how well a young woman and man marries has long-term consequences for the families involved as well as for the bride and groom.

According to Dagne (1994:36) the competition to find desirable partners for one's own children means that the earlier a marriage is arranged, the less parents have to worry about. At the same time, depletion of family resources associated with war, political turmoil and economic and environmental crisis has made it more difficult for families to secure a suitable husband for their daughters, and for young men to attain the economic independence desirable in a marriage partner. To the extent that marriage is delayed, individual autonomy in partner selection is likely to be

greater for both men and women. Because grooms bring most of the assets into a marriage, their outcome in the marriage market is not as important in determining their future economic well-being as it is for brides (Fafchamps and Quisumbing, 2005a).

Marriages in many parts of Ethiopia can be divided into six types: ceremonial marriage (serg), religious marriage (k'urban), civil marriage (semanya), marriage preceded by the provision of labor (k'ot'assir), paid labor marriage (gered or demoz), and marriage by abduction (t'ilf). The types of marriages differ in terms of the involvement of parents in the match; the level of formality, ceremony and expense; and expectations of labor exchanges (Pankhurst, 1992:106-07). Marriage by abduction and civil marriage are now the standard forms of marriage, although ceremonial marriage which involves considerable expense remains common in urban areas. In rural areas arranged marriages are the norm whereas abduction marriage provides a socially acceptable way to circumvent the parents' or the bride's disapproval of a match (Fafchamps and Quisumbing, 2002).

While there are strong social and economic pressures on girls to comply with their parents' desires, there are also opportunity costs and risks associated with early marriage and the early initiation of sexual intercourse, especially premarital sexual intercourse that does not lead to marriage. Very early age at first marriage and premarital first sex are associated with marital instability and divorce, multiple partners; poverty, and subsequent drift into prostitution or paid domestic work (Duncan *et al.*, 1993; Tilson and Larsen, 2000). Women who begin childbearing at very early ages are more likely to die in childbirth or to suffer reproductive exhaustion, and their husbands are more likely to take secondary wives, endangering the social standing and economic security of these women and their children.

Young women in urban areas, and especially with higher levels of education, are more likely than rural girls with little or no schooling to exert independence in spouse selection and marital timing because they have more opportunities for economic independence. In many instances, highly educated urban girls will have greater earning power than their parents because of the recent growth of employment opportunities for well-educated women. An intergenerational shift in girls' influence over entry into marriage, however, does not necessarily mean there will be a concurrent shift in social norms regarding the conditions for marriageability, and the importance of marriage for social status.

Contraception is one way young women can become sexually active before marriage and reduce the risks of an unwanted pregnancy. According to the 2005 Ethiopia DHS the two most common modern contraceptive methods ever used by sexually active unmarried women under age 25 were

the condom (42.3 percent) and the pill (16.8 percent). Overall, 62.2 percent of sexually active unmarried women under age 25 had ever used any modern contraceptive method. However, less than 1 percent of unmarried women under age 25 were reported by the survey as having sexual intercourse within the last four weeks (CSA, 2006:60,80); 3.8 percent were reported as having sexual intercourse within the last year; and 6.1 percent were reported as ever having sexual intercourse (CSA, 2006:86). Although unmarried women who become sexually active appear to have access to contraception, the prevalence of reported sexual activity among unmarried women at the time of the survey was extremely low. Even with access to contraceptives, contraceptive use does not protect the reputation of young women when a premarital sexual relationship ends without transitioning into marriage.

In the analysis that follows, we look at inter-cohort shifts in the timing and context of sexual initiation, marriage, and the start of childbearing; and we check whether there are parallel inter-cohort shifts in the influence of education and urban residence across the different sexual and family life transitions. In particular, we are interested in delineating the interrelationship between delayed marriage and the initiation of sexual activity.

4. DATA AND METHODS

Data for this analysis come from the 2000 and 2005 Ethiopia Demographic and Health Surveys. The surveys were conducted by the Central Statistical Authority of Ethiopia and were designed to be nationally representative. A total of 15,367 women age 15-49 were interviewed for the 2000 survey and 14,070 women age 15-49 were interviewed for the 2005 survey. In this article we use information on age at first intercourse, age at first marriage, and age at first birth for 14,653 women from the 2000 survey and 10,164 women from the 2005 survey who had valid responses (no missing values) on all of our dependent and independent variables of interest. The advantage of using both the 2000 and 2005 surveys is that they provide independent estimates of the same sets of measures and relationships, and greater statistical power when pooled. We restrict our analysis of the 2000 survey to women born between 1950 and 1984 and the 2005 survey to women born between 1955 and 1984. Because the DHS are limited to women ages 15-49, women born between 1950 and 1954 were not interviewed in the 2005 survey. Based on quality checks of DHS surveys in general performed by other investigators and extensive checks we performed on the 2000 survey, we conclude that there is no evidence of bias in a direction that would lead us to overestimate the delay in sexual initiation and

entry into marriage. We provide a fuller discussion of data quality issues in the appendix.

We divide our analysis into four parts. First, we examine the distribution of early life course transitions and how these distributions have changed across cohorts. Second, we examine the social determinants of the timing and marital context of first intercourse using discrete-time hazards models. Third, we examine the social determinants of entry into marriage among women who begin sexual activity before marriage. Finally, we model the hazard of a first birth after the start of marriage. We first estimated our models separately for each of the two sample surveys in order to check whether the basic cohort trends and underlying relationships were consistent across the surveys. After finding no evidence of substantively important differences between the two surveys, we pooled the surveys and included a dummy variable for survey year in the multivariate analyses. We also use interactions between our key explanatory variables and birth cohort to determine whether the underlying processes of sexual initiation and family formation have changed across cohorts.

We use discrete-time hazard regression models to analyze the transition of women into sexual activity, marriage, and childbearing. To estimate the discrete-time models we constructed a person-year file in which every woman contributes one record for each year she is exposed to the risk of the event in question. In situations where more than one outcome is possible, we use multinomial logistic discrete-time models. In the analysis of first intercourse, we start the risk period at age 10 for all women. For the few women who reported first intercourse at an age less than 10, we recode age at first intercourse to 10. In all of our models we include as covariates birth cohort, student status, level of education, place of residence, religion, and ethnicity. Student status, level of education, and place of residence are time-varying to capture changes in roles, status, and social context that influence the risk of transitioning into adult roles. To construct the student status variable we assume everyone enters school at age six, and then we add the number of years of schooling completed to determine the last age at which girls were still in school. Girls who start school after age six or repeat a grade will be incorrectly identified as not being in school at older ages when in fact they were still in school. This misclassification of student status will produce some upward bias in the estimated effect of student status if girls who start school late or repeat grades are more likely to initiate sexual activity or enter into a union while they are still in school compared to other girls. We also include in all of the models time-varying measures of duration since first exposure to the event and a term for duration-squared to allow for duration dependence in the underlying hazard of each event.

In specifying these models there is a concern that the time-varying variables may in fact reflect endogenous relationships rather than causality. The problem of endogeneity is most likely to occur with student status and the timing of first marriage and first birth. For example, a woman might quit school in response to a planned marriage. To check the possibility of this type of endogeneity, we identified all the transitions that occurred within one year of the completion of school. This type of close correspondence in events occurs in less than one percent of the transitions into first intercourse, first marriage, and first births. We are confident, therefore, that the regression results reported here for student status are not biased by problems of endogeneity. Nevertheless, the initiation of sexual intercourse may occur in anticipation of marriage. We regard this as an important social phenomenon, and we investigate this type of endogeneity in our models of union formation.

5. RESULTS

5.1 *Descriptive analysis*

The changes in age at first intercourse, entry into marriage, and start of childbearing investigated in this paper occur in the context of a gradual increase in girls' education and slow but steady urbanization in Ethiopia. Although progress has been made in expanding educational opportunities to women, particularly at the primary level, a very high percentage of Ethiopian women continue to have no formal schooling. Table 1 presents educational levels and other background information for three cohorts of women interviewed in the 2000 and 2005 Ethiopia Demographic and Health Surveys. Sixty-four percent of women in the most recent cohort have no education compared to 91 percent of women in the oldest cohort. The percentage of women with a primary-level education has almost quadrupled across the three cohorts, from 6 percent of women in the oldest cohort to 22 percent of women in the youngest cohort; and the percentage of women with a secondary or higher-level education has increased from 3 percent to 14 percent of women.

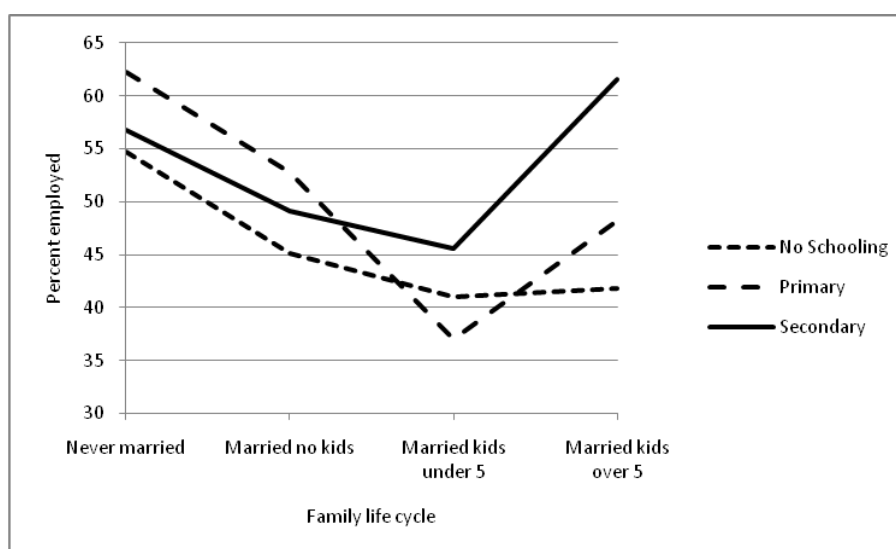
The relatively low levels of education are related to the predominantly rural nature of the country. Eighty-two percent of the women in the DHS samples live in rural communities. In the more remote rural areas many women did not have access to primary schools, let alone secondary schools. The percentage of women living in towns and cities increases slightly across the three cohorts, indicating the slow but steady pace at which Ethiopia is urbanizing.

Table 1 – *Selected descriptive statistics for women by cohort, 2000 and 2005 Ethiopia demographic health surveys*

	Cohort			Total
	1950/55-64 %	1965-74 %	1975-84 %	
<i>Education</i>				
No formal education	90.7	74.5	64.3	74.0
Primary	6.0	15.8	22.0	16.1
Secondary	3.3	9.8	13.6	9.9
<i>Place of residence</i>				
Rural	85.4	83.5	79.9	82.4
Town	6.9	7.8	9.2	8.2
City	7.6	8.6	10.9	9.4
<i>Religion</i>				
Christian (Orthodox, Prot., Catholic)	66.9	67.2	67.3	67.1
Muslim	29.7	29.6	29.8	29.7
Traditional/other	3.4	3.2	2.9	3.1
<i>Ethnicity</i>				
Affar	1.0	0.8	0.6	0.8
Amhara	32.5	30.1	29.3	30.3
Gurage	5.3	4.8	5.4	5.2
Oromo	32.8	32.8	36.7	34.6
Sidamo	3.9	4.6	3.9	4.1
Somali	1.8	2.5	2.0	2.1
Tigray	7.0	7.0	6.3	6.7
Welaita	1.8	2.7	2.5	2.4
Others	13.9	14.6	13.4	13.9
<i>Year of DHS</i>				
2000	64.5	55.9	56.3	58.3
2005	35.5	44.1	43.7	41.7
Number of women = 24,817				

In the human capital approach to marriage, employment is a key mediating factor in the relationship between education and the transition into marriage and childbearing (Lloyd, 2005). Figure 1 presents the percentage of women currently working by the stage of family life cycle and level of education. The figure is based on cross-sectional data reflecting the employment and family status of women in the sample at the time of the survey. The cross-sectional nature of the data is well-suited for characterizing the opportunity costs of early marriage and childbearing as perceived by young unmarried women. In contemplating the employment consequences of entering into marriage and motherhood young women will

Figure 1 – *Employment status by level of education and stage of family life, women ages 15-49, 2000 and 2005 Ethiopia demographic health surveys*



look at the work status of married women with children who have the same level of education as their own.

Overall, employment among women in Ethiopia is relatively common. Employment includes work on family plots or a family business as well as wage employment. At any stage of the family life cycle and any level of education at least 40 percent of the women in the pooled sample are working. A u-shaped curve describes the relationship between employment and the stage of the family life cycle. The level of employment is highest among never married women and is lowest among married women with toddlers. Employment appears to recover among married women with education once children age, and in fact the highest level of employment is achieved by married women with a secondary education or above who have children over age five. While marriage and childbearing are disruptive of employment for women of all educational levels, the relative opportunity costs of early marriage and childbearing are greatest for the most educated women if one takes into account the greater earning power of these women.

The descriptive statistics show a significant inter cohort rise in education, a more gradual rise in urban residency, and predictable differences in women's employment according to marital status and the presence of young children. We now look at inter-cohort differences in the

Figure 2 – *Survival curves for women’s early life course transitions by cohort, 2000 and 2005 Ethiopia demographic health surveys*

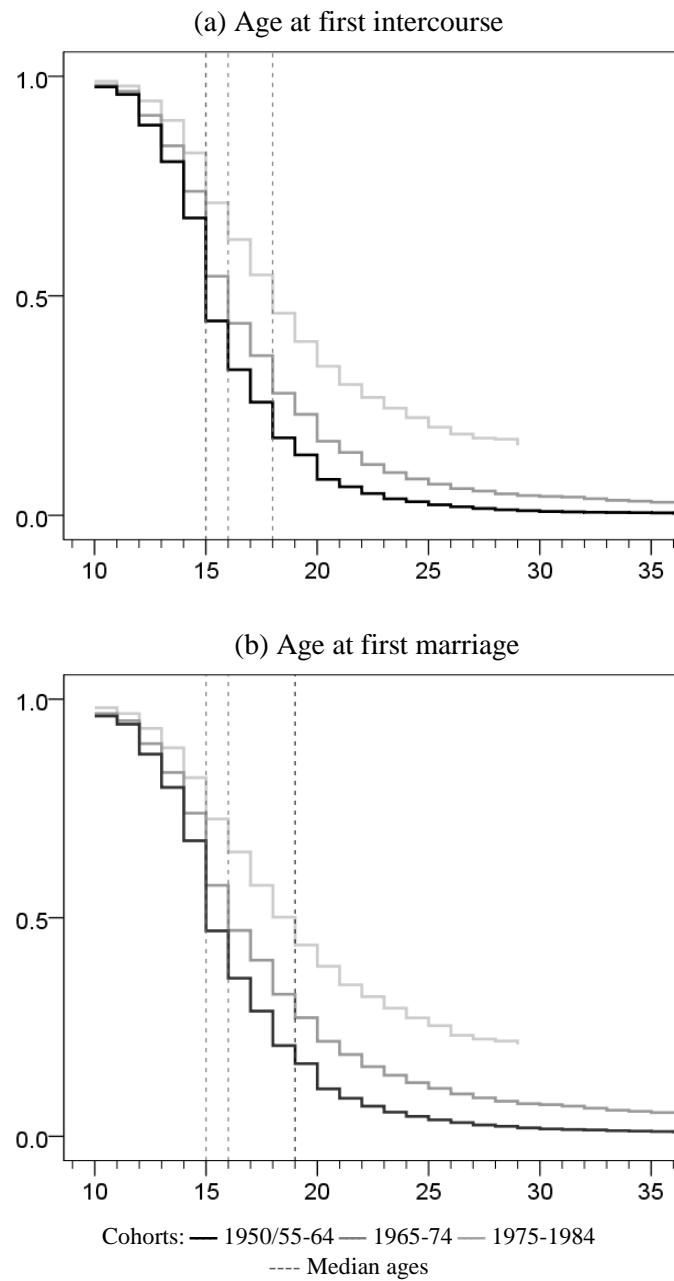
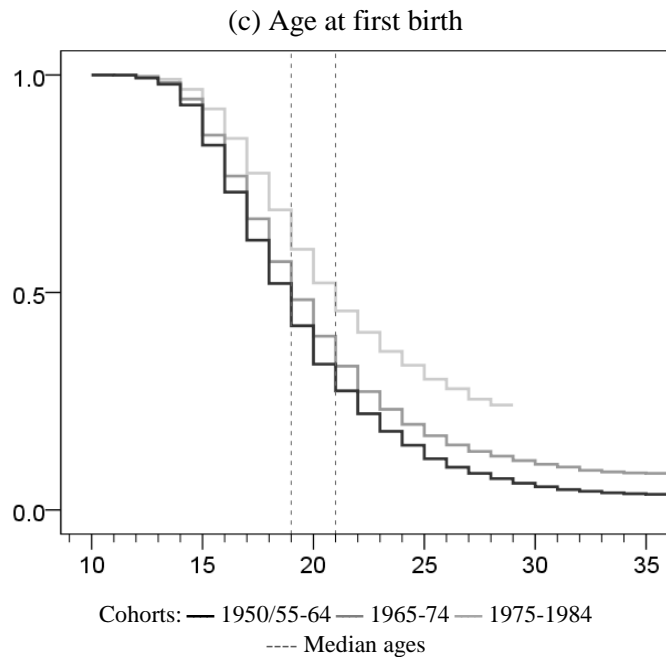


Figure 2 – cont'd



transitions into sexual activity, marriage, and childbearing. Figure 2 presents Kaplan-Meier estimates of the survival functions for age at first intercourse, first marriage, and first birth by cohort. The vertical dashed lines that bisect each of the curves indicate the median ages at each event. The survival curves for all three events have shifted to the right across cohorts, with the largest change occurring between the second and most recent cohorts. The log-rank tests of the equality of the distributions by cohort are all highly statistically significant. The median ages at first intercourse have increased from 15 to 16 years, and then to 18 years; and the median ages at first marriage have increased from 15 to 16 years, and then to 19 years. Along with the rise in age at marriage there has been a significant rise in the age at first birth. The median age at first birth rose from 19 years among women in the first two cohorts to 21 years among women in the most recent cohort.

The near equivalence in the shape of the survival curves for first intercourse and first marriage indicates that marriage and the start of sexual activity are very closely linked in Ethiopia, as is the start of childbearing. The parallel shift in the curves across cohorts suggests that the close linkage between these three early life course events has not fundamentally changed over time.

Table 2 – *Pre-marital intercourse, pre-marital births, and time to marriage for women by cohort, 2000 and 2005 Ethiopia demographic health surveys*

	Cohort			Total
	1950/55-64 %	1965-74 %	1975-84 %	
<i>2000 DHS</i>				
<i>Pre-marital intercourse</i>	38.5	39.7	22.9	32.1
<i>Pre-marital birth</i>	2.6	3.0	0.6	1.8
Number of women = 14,653				
<i>Interval between first intercourse and marriage among women with pre-marital intercourse</i>				
Less than 1 year	75.4	67.0	71.6	71.2
1-2 years	14.1	16.6	18.6	16.4
3-5 years	6.4	7.7	8.0	7.4
6+ years	4.1	8.7	1.8	5.0
Number of women = 5,105				
<i>2005 DHS</i>				
<i>Pre-marital intercourse</i>	48.5	48.4	43.0	45.9
<i>Pre-marital birth</i>	6.2	5.8	2.2	4.2
Number of women = 10,164				
<i>Interval between first intercourse and marriage among women with pre-marital intercourse</i>				
Less than 1 year	62.0	63.4	64.1	63.4
1-2 years	16.8	16.1	19.7	17.8
3-5 years	10.9	11.5	12.2	11.6
6+ years	10.3	9.0	4.0	7.2
Number of women = 3,192				

To explore in greater depth the linkages between the initiation of sexual activity and family formation, Table 2 presents the prevalence of pre-marital intercourse, pre-marital births, and the interval between first sex and first marriage among women who enter into a union after first sex. Because the cohorts sampled in 2005 are five years older at the time of the survey than the same cohorts sampled in 2000, we disaggregate the results by survey year. Pre-marital intercourse is relatively common among women in Ethiopia. Close to one-half of women in the two oldest cohorts had first sex before marriage. Among the most recent cohort the figure is lower (43 percent in 2005), but will rise as women in the cohort age and enter into sexual activity. The eventual percentage of women in the youngest cohort with premarital sexual experience, however, is unlikely to exceed the level of earlier cohorts since close to three-quarters of the women in this cohort were already married by the time of the survey. In spite of the relatively high

percentage of Ethiopian women who have first intercourse before marriage, relatively few have had premarital births. As of 2005, approximately six percent of women in the two oldest cohorts had a premarital birth.

One reason for the low prevalence of premarital births is that most women who begin sexual activity before marriage enter into marriage soon afterwards. In the 2005 sample, 63 percent of the women who are married and had premarital sex, married within one year of the start of sexual activity, and an additional 18 percent married within 1-2 years of first intercourse. Although the DHS does not allow us to determine whether a woman's first sexual partner before marriage was the man she married, the short interval between first intercourse and marriage suggests that in most instances premarital sex is a prelude to marriage. There is some evidence that the interval between the initiation of sexual activity and entry into marriage will likely increase among the youngest cohort of women as the cohort ages. Whereas the median age at first intercourse and entry into marriage were the same for the two oldest cohorts, among the youngest cohort the median age at marriage is one year greater than the median age at first intercourse.

5.2 *Age at first intercourse*

The descriptive analysis clearly indicates that the start of sexual activity, marriage, and childbearing are occurring at progressively older ages among recent cohorts of women in Ethiopia. Although the median age at marriage has increased across the three cohorts by four years, the prevalence of premarital sexual intercourse does not appear to be rising substantially, and premarital births remain relatively uncommon. We interpret the low level of premarital fertility and the relatively short interval between first intercourse and marriage among women who engage in premarital sex as evidence of the persistence of conservative norms and values regarding the acceptability of premarital sex, and in particular premarital sex with men to whom a woman is not engaged. In this section we use discrete-time hazard regression models to estimate the nature and strength of the relationship between schooling, place of residence, and the transition into sexual activity and adult family roles; and to determine whether these underlying relationships have changed across cohorts.

We begin with a discrete-time multinomial logistic regression model to examine the occurrence of first intercourse by marital status. Table 3 presents the estimated odds ratios for the covariates included in the model.

The first and second columns in the table correspond to the risk of first intercourse at the time of marriage, and the risk of first intercourse before

Table 3 – Odds ratios for predicting hazard of first intercourse for women, 2000 and 2005 Ethiopia demographic health surveys

	First intercourse at time of marriage vs not started sexual activity	First intercourse before marriage vs not started sexual activity	First intercourse before marriage vs at time of marriage
	Odds ratio	Odds ratio	Odds ratio
<i>Cohort (ref.=1950/55-64)</i>			
1965-74	0.80**	0.88**	1.10**
1975-84	0.46**	0.55**	1.19**
<i>Currently attending school</i>	0.58**	0.29**	0.49**
<i>Education (ref.=No formal education)</i>			
Primary	0.60**	0.72**	1.20**
Secondary	0.23**	0.46**	1.96**
<i>Place of residence (ref.=Rural)</i>			
Town	0.88**	1.21**	1.37**
City	0.79**	1.23**	1.55**
<i>Religion (ref.=Christian)</i>			
Moslem	1.29**	0.75**	0.58**
Traditional	1.16*	0.85*	0.74**
<i>Ethnicity (ref.=Amhara)</i>			
Affar	0.77**	0.49**	0.64**
Gurage	0.43**	0.33**	0.77**
Oromo	0.58**	0.44**	0.76**
Sidamo	0.56**	0.55**	0.98
Somali	0.47**	0.21**	0.46**
Tigray	0.58**	1.10*	1.89**
Welaita	0.75**	0.21**	0.28**
Others	0.68**	0.43**	0.64**
<i>Duration (years)</i>	1.92**	2.03**	1.06**
<i>Duration squared</i>	0.97**	0.97**	0.99**
<i>DHS Survey (ref.= 2000)</i>			
2005	1.14**	1.15**	1.04
Number of women = 24,817			
Number of life years = 199,735			
LR Chi-square = 13,073**			

Note: * $p < .05$ ** $p < .01$

marriage, respectively, compared to remaining single and sexually inactive. These two columns describe the influence of cohort, schooling, and place of residence on the relative timing of the start of sexual activity. The third

column in the table presents the odds ratios for the risk of first intercourse prior to marriage compared to first intercourse at the time of marriage. These odds ratios compare the odds ratios in column 2 to the odds ratios in column 1. They describe the influence of cohort, schooling, and place of residence on the context of first intercourse (pre-marital or marital).

Consistent with what we saw in the survival curves, the duration-specific risk of first intercourse (whether within marriage or prior to marriage) decreases across cohorts. Women in the youngest cohort are around one-half as likely to marry and begin sexual activity at a given age as women from the oldest cohort, and they are around one-half as likely to begin sexual activity outside of marriage. These results are net of differences in education and place of residence. Although younger cohorts are delaying the initiation of sexual activity (whether inside or outside of marriage), when they do begin sexual activity it is more likely to occur before marriage than is the case of the oldest cohort of women. The odds ratios in the last column indicate that women born in 1975-1984 are 1.2 times as likely to have first intercourse before marriage compared to at the time of marriage than women born in 1950-1964.

The effects of education are consistent with the role conflict and human capital hypotheses, and are similar to the effects of cohort. Girls who are in school are at a significantly lower risk of marriage, and they are even less likely to become sexually active outside of marriage than girls who are not in school. Even after they exit school, adolescent girls and young women with a primary or secondary education are at a lower risk of entry into marriage or first intercourse before marriage than girls with no schooling. Controlling for student status, girls with a secondary level education are at one-fourth the risk of marriage at a given age compared to girls with no schooling, and they are at less than one-half the risk of having first intercourse outside of marriage. As Ethiopian girls become more educated they not only are delaying marriage, they also are delaying the start of sexual activity. This result is similar to patterns found in other sub-Saharan countries by Mensch, Singh, and Casterline (2005) and Blanc *et al.* (2005). However, similar to what we observed among the youngest cohorts of women, young women with primary and secondary education are significantly more likely than women with no education to initiate sexual activity before marriage. In particular, women with a secondary education or beyond are roughly twice as likely to have first sex before marriage compared to at the time of marriage than women with no schooling.

As expected, urban residence is associated with a lower risk of initiating sexual activity through marriage at any given age. Also, consistent with the dislocation hypothesis, young women who live in towns or cities are more

likely than rural women to engage in premarital sex for the first time at earlier ages, and to experience first intercourse before marriage. The results for schooling and place of residence suggest that while urban living is associated with greater opportunities for premarital sexual activity, the opportunity costs associated with premarital sex are sufficiently large to discourage more educated adolescent girls and young women to begin sexual activity before marriage at young ages. Even with the overall higher risk of premarital sex in urban areas, girls with a secondary level education living in cities are still at a lower risk of first intercourse before of marriage at any given age ($0.46 \times 1.23 = 0.57$) than girls with no schooling living in rural areas.

We next ask whether the effects of education and urban living have changed across cohorts. Specifically, are the opportunity costs of early marriage or premarital sexual activity at young ages even higher among more educated women in the youngest cohort compared to older cohorts? Or is the underlying relationship of education and urban residence with premarital sexual activity reversing itself and heading more in the direction predicated by the social dislocation hypothesis? To answer these questions we estimated a model with interactions between level of education and cohort, and a model with interactions between place of residence and cohort. The models include all the variables included in the main effects model shown in Table 3. Table 4 presents the odds ratios for the education and place of residence main effects and interaction terms only. The interaction terms have a multiplicative effect on the odds ratios for education and place of residence.

The results for the cohort and education interactions indicate that the delaying effects of secondary education on marriage and the start of sexual activity are stronger among women in the two most recent cohorts compared to the first cohort, and the delaying effects of primary education are stronger among women in the most recent cohort compared to earlier cohorts. Although younger women with secondary education are delaying marriage and first sex compared to other women, when they start sexual activity they are much more likely to have first sex before marriage. However, there is no evidence to suggest that more educated girls among the most recent cohort are more likely to have premarital sex than similarly educated girls in earlier cohorts. The interaction models also indicate that women from the most recent cohort who live in cities are delaying both marriage and the start of sexual activity more than city women from early cohorts, and that the effect of living in a city on the risk of first sex before marriage as compared to at the time of marriage has not changed across cohorts.

The results from the models of first intercourse suggest that the costs of

Table 4 – Odds ratios for effects of education and place of residence interacted with cohort on the hazard of first intercourse for women, 2000 and 2005 Ethiopia demographic health surveys

Interactions models for predicting fist intercourse	First intercourse at time of marriage vs not started sexual activity	First intercourse before marriage vs not started sexual activity	First intercourse before marriage vs at time of marriage
	Odds ratio	Odds ratio	Odds ratio
<i>Interaction Model 1: Education × Cohort^a</i>			
<i>Education</i> (ref.=No formal education)	1.00	1.00	1.00
Primary	0.65**	0.78**	1.19
Secondary	0.37**	0.64**	1.72**
<i>Interactions</i>			
Primary × Cohort 1965-74	1.04	1.04	0.99
Primary × Cohort 1975-84	0.81*	0.81*	1.00
Secondary × Cohort 1965-74	0.62**	0.80**	1.31*
Secondary × Cohort 1975-84	0.56**	0.61**	1.08
LR Chi-square = 13,176**			
<i>Interaction Model 2: Residence × Cohort^a</i>			
<i>Place of residence</i> (ref.=Rural)	1.00	1.00	1.00
Town	0.91	1.25**	1.36
City	0.94	1.34**	1.42**
<i>Interactions</i>			
Town × Cohort 1965-74	0.95	1.02	1.07
Town × Cohort 1975-84	0.94	0.90	0.96
City × Cohort 1965-74	0.83*	1.04	1.25*
City × Cohort 1975-84	0.75**	0.79**	1.03
Number of women = 24,817			
Number of life years = 199,735			
LR Chi-square = 13,118**			

Notes: ^a Interaction models include all variables from main effects model in Table 3.
* $p < .05$ ** $p < .01$

early marriage and premarital sexual activity are large enough, and increasingly large, to encourage women and especially women with higher levels of education to delay marriage and the start of sexual activity. These costs have apparently increased in recent years among the most educated women in Ethiopia, and they have risen in major urban areas to the point where the liberalizing effects of city life on women's early premarital sexual activity have actually been reversed. Nevertheless, highly educated women in Ethiopia, and especially in the youngest cohorts are more likely to have

had premarital sex than other women, even though they are initiating sexual activity at increasingly older ages.

5.3 *Age at first marriage*

In the descriptive analysis we found that most women who have premarital intercourse marry shortly afterwards, although there is some evidence to suggest that the interval between first intercourse and marriage has increased in the most recent cohort. In this next section we examine the transition into marriage among women who have first intercourse before marriage. Table 5 presents the odds ratios for the hazard of entry into marriage among this group of women. For this analysis exposure to the risk of marriage begins with the year in which first intercourse occurs. Our purpose here is to determine whether the initiation of premarital sexual activity and entry into marriage are more closely linked for some groups compared to others. The dislocation hypothesis would suggest a decoupling of sexual debut and marriage among more recent cohorts of women, more educated women, and women in urban areas. On the other hand, the human capital perspective in the Ethiopian context would suggest a close linkage between first sex and marriage among those women who stand to lose the most from engaging in premarital sex with a partner that does not lead to marriage.

Similar to what we found in the case of first intercourse, more recent cohorts of women are delaying marriage as are women with a primary level education. However, in contrast to the risk of first intercourse, women with secondary education are much more likely to marry at every age after first intercourse than women with no schooling. The substantially higher risk of marriage among this group of women is likely related to their relatively older age at first intercourse. Because women with a secondary level education begin sexual activity at significantly older ages than less educated women, once they become sexually active they are more likely to marry soon afterwards. This finding may also reflect the higher opportunity costs of engaging in premarital sex with someone to whom they are not engaged. Because women with a secondary education or beyond have more to lose in terms of diminished marriage prospects than women with little or no schooling, they are more likely to delay sexual intercourse until they are in a relationship that they are confident will rapidly transition into marriage.

In contrast to the effect of secondary education, urban residence is associated with a substantially lower risk of marriage after first intercourse. Women living in towns and cities are between one-half and one-third as likely to marry in a given year after first intercourse as women living in rural

Table 5 – Odds ratios for predicting hazard of entry into marriage after first sex, women who had premarital first sex, 2000 and 2005 Ethiopia demographic health surveys

Independent variables	Entry into marriage vs remaining single
	Odds ratio
<i>Cohort</i> (ref.=1950/55-64)	
1965-74	0.81**
1975-84	0.85**
<i>Currently attending school</i>	0.36**
<i>Education</i> (ref.=No formal education)	
Primary	0.54**
Secondary	3.22**
<i>Place of residence</i> (ref.=Rural)	
Town	0.48**
City	0.38**
<i>Premarital birth</i>	1.84**
<i>Religion</i> (ref.=Christian)	
Moslem	1.86**
Traditional	1.22
<i>Ethnicity</i> (ref.=Amhara)	
Affar	1.67**
Gurage	0.83*
Oromo	1.35**
Sidamo	2.32**
Somali	1.69**
Tigrai	1.20**
Welaïta	2.29**
Others	1.47**
<i>Duration (years)</i>	0.74**
<i>Duration-squared</i>	1.01**
<i>DHS Survey</i> (ref.= 2000)	
2005	0.86**
Number of women = 7,077	
Number of life years = 25,318	
LR Chi-square	6,514**

Note: * $p < .05$ ** $p < .01$

areas. Because the effect of secondary education is so strong (odds ratio = 3.2), even after taking into account the delaying effect of living in a town or city, women with a secondary level education are still much more likely to marry in a given year after first intercourse than less educated women regardless of where they live. The predictions of the dislocation hypothesis

in terms of a greater likelihood of premarital intercourse and a longer time to marriage after premarital sex hold true for women with little or no schooling living in urban areas, but not for women with higher education.

Having a premarital birth also increases the likelihood that a relationship transitions into marriage. Women with a premarital birth are 1.9 times as likely to marry in a given year as women without a birth. We could not determine whether this relationship weakens as the duration from birth increases because of the relatively small number of premarital births. We did, however, test whether the effect of a premarital birth on entry into marriage has changed across cohorts. Neither of the two cohort interactions with premarital birth were statistically significant, nor were any of the cohort interactions with education and place of residence.

5.4 Age at first birth

In our final analysis we examine the risk of a first birth after entry into marriage. In preliminary work we estimated models of first birth that started the risk period at age 12, and included a time-varying dummy variable for marital status. However, because very few births in the sample occur before marriage, our estimates of the effect of marital status and their standard errors were extremely large. The very low level of premarital births suggests that much of the effects of the socioeconomic and background variables on age at first birth operate through their effects on age at marriage. For example, in Table 6 we see that cohort differences in the risk of a first birth after marriage are relatively small and in fact women in the two most recent cohorts are at a slightly higher risk of a first birth in any year after entry in marriage. Similarly, once women enter into marriage, education is no longer a significant factor in determining the timing of a first birth. Residence in a city is associated with a higher risk of a first birth compared to residence in rural areas. Because city living is associated with delayed marriage, once women marry they tend to accelerate the timing of a first birth.

We again estimated models with interactions between cohort and education, and cohort and place of residence to test for changes over time in the effects of education and urban residence. Only the interactions between education and cohort were significant. Once again we find evidence that the effects of secondary education on the transitions into adult family roles are changing across cohorts. Women with a secondary education in the more recent cohorts are increasing the spacing between marriage and a first birth. In fact, the odds ratio associated with a secondary education drops from 1.6 in the first cohort to 1.0 ($=1.55 \times 0.65$) in the second cohort and to 0.9 ($=1.55 \times 0.55$) in the most recent cohort. This switch in directions accounts

Table 6 – Odds ratios for predicting hazard of first birth after entry into marriage, ever married women, 2000 and 2005
Ethiopia demographic health surveys

	First birth after marriage vs no birth	
	Main effects model	Interaction model
	Odds ratio	Odds ratio
<i>Age cohort</i> (ref.=1950/55-64)		
1965-74	1.10**	1.12**
1975-84	1.06**	1.10**
<i>Currently attending school</i>	0.98	0.92
<i>Education</i> (ref.=No formal education)		
Primary	1.01	0.96
Secondary	1.03	1.55**
<i>Interactions</i>		
Primary × Cohort 1965-74		1.03
Primary × Cohort 1975-84		1.07
Secondary × Cohort 1965-74		0.65**
Secondary × Cohort 1975-84		0.55**
<i>Place of residence</i> (ref.=Rural)		
Town	1.01	1.02
City	1.32**	1.31**
<i>Religion</i> (ref.=Christian)		
Moslem	0.98	0.99
Traditional	0.83**	0.83**
<i>Ethnicity</i> (ref.=Amhara)		
Affar	1.01	1.01
Gurage	1.33**	1.34**
Oromo	1.52**	1.52**
Sidamo	1.62**	1.62**
Somali	1.61**	1.60**
Tigrai	1.11**	1.11**
Welaita	1.84**	1.85**
Others	1.51**	1.51**
<i>Duration (years)</i>	1.48**	1.48**
<i>Duration-squared</i>	0.98**	0.98**
<i>DHS Survey</i> (ref.= 2000)		
2005	1.16**	1.16**
Number of women = 19,141		
Number of life years = 80,747		
LR Chi-square	3,174**	3,227**

Note: * $p < .05$ ** $p < .01$

for the lack of a significant secondary education effect in the main effects model. Even though the most educated group of women are delaying entry into marriage, they are also delaying the start of childbearing after marriage. We believe this may be related again to the opportunity costs of exit from the labor market that often occurs when women begin childbearing.

6. DISCUSSION

In our analyses of women's early life course transitions we find that the age-specific risks of transitioning into sexual activity, marriage, and childbearing decline across cohorts. The progressively lower risks of entry into marriage and having a first birth are expected. The lower risk of first intercourse prior to marriage is contrary to the predictions of the dislocation hypothesis, but similar to what has recently been observed in a small number of other sub-Saharan African countries where the age at marriage has risen. The result is also consistent with the very low levels of non-marital fertility in Ethiopia. The gradual rise in educational levels across recent cohorts of women is an important factor behind the delay in the transitions into adult roles. The effects of education operate through both prolonged enrollment in school and higher levels of completed schooling. The incompatibility of student and adult family roles reduces the risk of early marriage, and the experience and skills that girls acquire in school have lasting effects on how they assess the costs of early marriage and childbearing and how they negotiate the timing of transitions into adult roles. In the context of Ethiopia where marriage and the onset of childbearing traditionally occur at young ages, even a modest increase in girls' education can have a significant impact on age at marriage and first birth.

We find especially strong effects of secondary education. However, rather than moving in the direction of more permissive premarital sexual behavior as predicted by the social dislocation hypothesis, we find that unmarried women with a secondary education are becoming more cautious. The age-specific risk of premarital first intercourse among women with a secondary education is lower in the most recent cohort compared to earlier cohorts, and in all three cohorts of women the waiting time until marriage among those women who engage in premarital sex is shortest among women with a secondary education.

We interpret this pattern as a response to the opportunity costs of early marriage and childbearing. The expansion of educational opportunities for girls, particularly at the secondary level and beyond, is a very recent development in Ethiopia. Less than 10 percent of women age 15-49 have

more than 8 years of schooling in Ethiopia. Enrollment in secondary schools showed little sign of growth in the late 1980s and early 1990s because of the disruptive effects of the civil war (Degefe and Nega, 1999). The recovery and growth of the urban sector during the years following the end of the civil war has improved the employment opportunities for women with higher levels of education. Because the supply of well-educated women remains relatively limited, the economic incentives for educated women to delay marriage and childbearing are strong.

The absence of a rise in premarital intercourse and births in Ethiopia in the face of delayed marriage derives in part from what ethnographic research has described as the continued sway of traditional values that severely admonish adolescent women's sexual experimentation before marriage but are more permissive towards men's. The emphasis placed on the chastity of unmarried girls and young women does not mean that premarital intercourse is uncommon. Approximately 50 percent of the women in the sample began sexual activity before marriage. The vast majority of these women, however, married soon after first intercourse suggesting that intercourse often is considered a prelude to marriage. Girls' desire to avoid or delay sexual activity before marriage stems not only from a desire to avoid an unwanted pregnancy but also from the desire to protect their reputation and preserve their marriage prospects.

The individualistic model of adolescent sexual behavior implicit in the dislocation hypothesis assumes that adolescent boys and girls hold gender-neutral views about the appropriateness of premarital sexual behavior and in particular the effect of prior sexual partners on one's suitability as a potential spouse. The hypothesis also locates social control of sexuality in the parental generation, and downplays the important role that age peers play in regulating sexual behavior. When decisions about marriage shift from the parents to the individual, young men's preference for a future spouse who has not had sexual relations with another man may have as much influence on a young woman's decisions about premarital sex as what her parents think. In contexts where men value virginity in a prospective wife the potential cost of premarital sexual activity for a young woman may be a decline in her marriage prospects. This is a very high cost in societies where status is conferred through marriage and virtually all aspects of adult social and economic life are organized around marriage. Girls who engage in premarital sex are at risk of damaging their reputation if the relationship does not progress to marriage and other potential suitors learn of her sexual history. The risk of damage to a woman's reputation is greatest among women who operate in more restricted marriage markets where there is greater connectivity of social networks. This describes well the situation of

more educated women in societies with relatively low levels of education. More educated women also operate in more restricted marriage markets because of the tendency of men to marry women with levels of education equal or lower than their own. For more educated women the opportunity costs of premarital sex may be greater than among less educated women, even if they are more autonomous of traditional parental control.

Our results are consistent with Meeker's (1994a) observation that a rise in premarital sexual intercourse does not require nor necessarily signal the deterioration of social controls on adolescent sexual behavior: it can occur simply through increased exposure to the risk of premarital sex brought about by a delay in marriage. The Ethiopian experience has important implications for how we think about the role of education in transforming adolescent sexual behavior. The emphasis on the individual in Western education may very well encourage young people to question the value of traditional norms that regulate premarital sexual behavior. However, *a priori* there is no compelling reason to expect that young men will become more accepting of prior sexual experience in a prospective wife, particularly if it is customary for unmarried adolescent males to access sex through prostitution. The risk of HIV/AIDS may even reinforce the value placed on the sexual chastity of a prospective marital partner. The maintenance of the double standard in men and women's premarital sexual behavior is derived in part from the disadvantaged position of women in the marriage process. In Ethiopia, a woman's future depends more on whom she marries than is the case for men. While education provides women a degree of economic independence, social recognition and status is still derived from marriage.

The Ethiopian experience points to the close inter-relationship between family formation behaviors and systems of social stratification. Ethnographic research sets the study of demographic behavior in the larger system of economic rewards, prestige, and social honor. Too often survey based demographic research has neglected these key aspects of communities and societies. The implications of this research is that it is not simply enough to look at a woman's own characteristics (school enrollment, education, labor force participation and earnings) and the improved opportunities available to urban residents to understand women's family formation experiences. Modernization theories and ideas of economic maximization are attractive in the current intellectual climate, and evidence from other parts of sub-Saharan Africa supports the centrality of these ideas. But women's own education and earning power tell much of the story of changes in marriage age and premarital sexual activities and childbearing only in situations in which the prestige and financial security of young women depend on their natal family or on their own actions. In situations where successful marriage remains the

only practical avenue to social recognition, economic security, and social honor available to women, education discourages early premarital sexual activity by increasing what women have to lose from having their reputation and therefore their marriage prospects damaged. Women who are enrolled in school and with greater education use their personal and natal family resources to delay marriage and childbearing, and only engage in premarital sex once their marriage is assured.

These observations about family change in Ethiopia have particular importance to the study of family formation in the nations of northern Africa and northern sub-Saharan Africa as well as in many of the nations of Central and West Asia where marriage is central to the definition of a satisfactory and secure adult life. In societies that value virginity and the sanctity of the marriage bond for women, marriage will have even greater centrality in women's lives. In these situations we expect that the initiation of sexual activity for women will continue to be very closely linked to entry into marriage, even as the age at marriage increases and women acquire increased premarital educational and work experience.

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Appendix

In any analysis that uses retrospective data on the timing of early life course events, the quality of the data is an issue. In an analysis of World Fertility Survey data, Lesthaeghe *et al.* (1989) found that older women tend to over-report their age at first marriage. Blanc and Rutenberg (1990) report a similar tendency among older women in the DHS as well as a tendency to over-report age at early births. Gage (1995) in a comprehensive assessment of the quality of data on age at first union, first birth, and first sexual intercourse in the Demographic Health Surveys in 26 countries (not including Ethiopia), found that numerous patterns of error are found in reports of age at these events. Surveys in sub-Saharan Africa had the highest rate of non-response and their respondents were most likely to misreport dates, particularly when only information on age (and not months and year) were available. The errors were of generally greater magnitude in reports of age at marriage and age at first birth; reports of age at first sexual intercourse were typically of higher quality. Gage (1995) also found that older women tended to over-report age at first marriage, particularly in cases in which the first union was informal and of short duration. The presence of these types of reporting error in the data would bias downward estimates of inter-cohort increases in the age at marriage and first birth.

We did a number of quality checks on the 2000 Ethiopia DHS data. Non-response to the key events was quite minimal only 0.6 percent of women did not report age at first intercourse, 0.2 percent did not report age at first union, and less than 0.1 percent failed to report age at first birth. A careful examination of the information on age at first birth (using progression to first birth by year and duration) shows that 4.6 percent of the information on age at first birth is inconsistent or likely in error. We also checked for digit preference: the Myer's blended index of digit preference is 16.2 for age at first intercourse, 14.7 for age at first union, and 14.3 for age at first birth. The index provides an estimate of the proportion of persons in the sample who report an incorrect final digit. Because the index is based on the assumption of a rectangular distribution of last digits, which may not be appropriate for age at first intercourse or first marriage, relatively small values of the index should not be treated as evidence of misreporting.

In situations where the current age and age at particular event distributions have comparable error patterns (in the numerator and denominator) investigators often proceed directly with the calculation of rates. Sibanda *et al.* (2003) took this approach in a decomposition analysis of the proximate determinants of fertility in Ethiopia using the 2000 DHS. Their analysis generated predicted values of the total fertility very close to

observed values, which is a good indicator of relatively complete coverage of key proximate determinants by the Ethiopia DHS, including age at first union. Sibanda *et al.* (2003) did not find evidence of significant childbearing outside of marriage nor of abortion for the Ethiopian population. Calculations undertaken as part of the paper by Sibanda and his colleagues also did not reveal major differences in the age patterns of first marriage within cohorts between the 1990 National Family and Fertility Survey and the 2000 DHS (that is, little evidence of change in reported ages at first marriage and first birth for cohorts as they age). These prior findings provide assurance that women did not tend to increase their reported age at first marriage as they grew older, making it very unlikely that the intercohort trends described in this paper are an artifact of age-related error in reported age at first marriage.

In our analysis, we find the greatest cohort differences in age at first event among the most educated women and between the two youngest cohorts. These are the women for whom age displacement and digit preference are least likely to be an issue. Another possible source of bias in our estimates of change is that more educated women are more sensitive to societal norms and thus more likely to underreport premarital sexual activity. But, our analysis shows an inter-cohort *increase* in the percentage of educated women initiating sex prior to marriage. The close correspondence and spacing between age at first intercourse and age at first marriage reported in this paper is also consistent with the relatively low and declining levels of non-marital fertility in Ethiopia found by Lindstrom and Woubalem (2003) in the 1984 and 1994 population censuses.

Finally, the Kaplan-Meier estimates of survival functions for the age at each event do not display patterns of digit preference in the timing of these events that would be present if there was systematic distortion due to digit preference. Nor do we find that rates of events are disproportionately higher at particular ages for any one of the transitions. We conclude from all of these checks of data quality and the distribution of the survival functions that the data in the 2000 Ethiopia DHS are of sufficiently good quality that the findings from the multivariate hazard analysis undertaken in this paper are not compromised by poor data quality. Given the close similarities between the 2000 and 2005 surveys in terms of design and implementation we did not perform the same quality checks on the 2005 data.