

Empirical Analysis of the Prevalence of Child Marriage in Uganda

Economic Theory

by Sako Abdoulaye

(8043994)

Major Paper presented to the

Department of Economics of the University of Ottawa

in partial fulfillment of the requirements of the M.A. Degree

Supervisor: Professor Roland Pongou

ECO 6999

Ottawa, Ontario

January 2020

1. Introduction

The marriage defined by being a solemn act by which a man and a woman establish between them a union whose conditions, effects and dissolution are governed by the civil code on the one hand or by religious laws on the other hand¹. To this definition, we can add customary marriage which results from ancestral traditions which is of great importance in Africa.

However, it is through this sacred act that is marriage that many young girls lose their most basic human rights by marrying before the age of 18 which is the legal age of marriage for women in Uganda. Indeed, Uganda ratified the Children's Rights Act in 1990, which sets a minimum age for marriage at 18. In addition, in 1985, this country ratified the law on the elimination of all forms of discrimination which obliges states to guarantee the free and full consent to the marriage of women². Unfortunately, Children in Uganda continue to face several challenges that have had a constant impact on their lives, including early marriage being one of the most prevalent challenges, according to UNICEF (2014).

Some of them decide to marry, probably due to the lack of advice, education or available resources. However, in some cases, these children are simply forced to get married by parents or manipulated by friends who are in the same situation.

This is what we see from the analysis of Uganda's 1995 and 2016 from The Demographic and Health Surveys (DHS) Program data. There are 42% of girls who are married before their 18th birthday for economic, social and customary reasons. Walter (2012) mentions in his report that the context of early marriage in Sub-Saharan Africa must be understood in an environment of poverty, gender inequality, cultural taboos against premarital sex for girls, religious beliefs. He judges it to

¹ The marriage defined by the online French Larousse dictionary

² U.S. Agency for International Development (USAID) (2009)

be a patriarchal predisposition to control female sexuality. It is in this context that his study suggest that the question of how economic realities interact with culture, religion and gender roles in traditional settings requires in-depth consideration through empirical investigation. Precisely, the more traditional the society is, the greater the likelihood that religious and ethnicity tenets will be used to justify early marriages for girls. Such a context renders progress against early marriage difficult for males; and in some cases, older female custodians of culture and religion must be persuaded to abandon their support for this harmful traditional practice³. Public policies rely on the personal development of women, among other things through their education, to prevent this phenomenon, but the effect of the phenomenon persists. Which brings us to two questions in our brief:

1. Can we estimate the effects of policies that affect the gains of early marriage?
2. And how is the marriage market affected by early marriage?

According to Dessy, Diarra and Pongou (2018), they suggest that it is necessary to bring awareness to the men who participate in this marriage market by educating them. Indeed, their study shows that an additional year of schooling reduces from 1 to 18% the probability that a man will enter into early marriage. Using micro data from Nigeria, the study analysis the effect of education of a man on the probability of marrying a young girl using both the age of circumcision and the exposure of individuals to in utero shock as imperfect instruments. For these authors, early marriage is linked to the endogeneity effect between decisions relating to education and the time of marriage. By developing a model that explains a causal effect from both father's and mother's

³ "Harmful traditional practices refer to behaviours and practices which have been committed primarily against women and girls in certain communities and societies for so long that they are considered, or presented by perpetrators, as part of accepted cultural practice" (*Wodon, Quentin 2016*)

education, this will result in a child quality. This effect on educated men makes them value the health, cognitive abilities and, physical and emotional maturity of women.

In addition, a growing number of studies are developing and making connections between education and the marriage market using the transferable static utility method of the marriage market introduced by Becker (1973, 1974 and 1981) in economics. For example, Chiappori, Costa Dias and Meghir (2018) used panel data from the British Household Survey to estimate a life-cycle model of education, marriage, supply and consumption in a context of transferable utility. It is a model where marriage has a dual role of providing public goods and sharing the risks by the fact that the individual chooses his investment in education by anticipating changes in the labor market and the marriage market. Individuals are then matched based on the economic value of the marriage and their preference. In this model, equality of opportunity in the marriage market determines the allocation of resources within the household and household savings, providing labor and consuming public and private goods in all uncertainty.

Another way of analyzing the American marriage market was done by Angrist (2002) who uses the variation of immigrant rates as a natural experiment to study the effect of sex ratios on the children and grandchildren of immigrants, based on the idea that the relative number of men and women can influence marriage, labor force participation and other economic and social variables. For him, immigrants had a big impact on the marriage market, especially of the second generation, because before these waves of immigration, individuals married between members of the same group. These results suggest that the number of men raised had a significant positive effect on the probability of marriage for women and a significant negative effect on women's participation in the labor market; but that this seems to have increased men's gains and the incomes of parents of young children.

Also, Wahhaj (2015) develops an early marriage market model using data from Bangladesh, where a desirable attribute for young women is openly observed to explain the high prevalence of honeymooners in developing countries. He finds that age indicates a poorer quality of woman and requires higher dowry payments. The findings of his analysis show that government and intergovernmental interventions that increase the opportunity costs of early marriage lessen the association between the quality and the age of women, causing a virtuous cycle of delayed marriage. In addition, he finds that the decline in fertility increases marriage among future cohorts and in turn worsens the position of older women in the labor market.

In developing our model, we will mainly use Choo and Siow (2006), who proposes and estimate a non-parametric static transferable utility model of the marriage market by rationalizing the standard interpretation of rate regressions and showing the limits of their models. Indeed, their estimates use data from US marriages between 1971-1972 and 1981 and 1982 to show that marriage gains for young adults have fallen over the decade and the legalization of abortion has had a significant impact on the decline in marriage gains for the latter. And also, we will use Bergstrom and Bagnoli (1993) general equilibrium model, which start from the idea that women marry on average older men, assuming that men who consider their future prospects maids will choose to wait until their economic success is revealed before getting married. In the contrary, unlike women who are able to get married at an early age in a society where the economic roles of men are broader than the roles of women. Therefore, we adapt the static non-parametric model of the marriage market of Choo and Siow (2006) including Bergstrom and Bagnoli (1993). In our early marriage analysis, the individuals are matched based on their education level. Then the systematic net gains are calculated. After words, we add the effect of the estimation of the probability of a man marrying a minor girl by region, ethnicity, year, place of residence, education,

religion and age at first marriage to the systematic net gains while looking at the evolution of this phenomenon over time.

To assimilate the identification problem, let's consider a society where there are M groups or types of men, indexed by i; F groups or types of women, indexed by j where a type is defined by an age range, ethnicity, education, geographic location and so on.

The marriage market participants observe everybody's full characteristics but the economist does not. Choo and Siow(2006) show that the utility of a man m of type i who marries a woman of type j can be written as $\tilde{\alpha}_{ij}^r - \tau_{ij}^r + \zeta_{ijm}^r$; where $\tau_{ij}^r =$ utility transfer in equilibrium, and ζ_{ijm}^r is a standard type-I E.V. unobserved heterogeneity. If single, he gets the utility $0 + \zeta_{ijm}^r$; (0 is a choice of normalization without loss of generality). Similarly, the utility of a woman f of type j who marries a man of type i can be written as $\tilde{\gamma}_{ij}^r - \tau_{ij}^r + \eta_{ijf}^r$, and she gets utility $0 + \eta_{ijf}^r$ is she is single. Denote μ_{ij}^{rt} the number of marriages between men of type i and women of type j; μ_{i0}^{rt} the number of single men of type i; and μ_{0j}^{rt} the number of single women of type j. The matching surplus $\tilde{\alpha}_{ij}^r$ is not observed; only matching patterns μ_{ij}^{rt} are observed.

The restrictions on the surpluses are proved by Choo and Siow (2006) by the following result:

In equilibrium, if there are very large numbers of men and women within each type,

$$\exp\left(\frac{\Phi}{2}\right) = \frac{\mu_{ij}^{rt}}{\sqrt{\mu_{0j}^{rt} \mu_{0i}^{rt}}}; \text{ where } \Phi_{ij} \text{ denotes the total systematic net gains to marriage:}$$

$\Phi_{ij} = \tilde{\alpha}_{ij}^r + \tilde{\gamma}_{ij}^r$. Therefore, marriage patterns directly identify the gains to marriage Φ_{ij} in such a model.

The Ugandan government has put in place several measures to end early marriage. Despite this, the number of children affected by this problem in the country has increased rapidly. Using

our framework, we show that limiting the legal age to 18 in Uganda may explain that the net gains at marriage decreased considerably with the age at first marriage. Moreover, it shows that each additional year of schooling for a man reduces the gains from the probability of marrying a minor girl by 2.95 percentage points. On the other hand, the gains are reduced by 0.85 for a young girl who marries before 18 years of age.

The rest of the article is organized as follows. Section 2 describes the economic theory concerning our model, section 3 presents the data and the empirical strategy. Section 4 presents the results of the estimates. Section 5 concludes the document.

2. A model of timing in marriage

The model combines the literature on matching developed by Bergstrom and Bagnoli (1993) which explains the age difference between husbands and wives; and the econometrics of transferable utility matching econometrics, preferences are idiosyncratic in terms of stochastic structure for marriage where agents are age/education-matched applied by Choo and Siow (2006); and possibly extensions of this model.

We make some simplifying assumptions about the early marriage market given the current trends in marriage in Uganda.

There are I types of men and J types of women. The type i man initiates the matching process in the marriage market through an intermediary or matchmaker who initiate the search. He also provides a communication line, and facilitates negotiations, between the two parties (White 1992).

For a type i man to marry a young or mature type j woman, he must transfer the amount of his income to her. The transfer is agreed by negotiation between the two parties. Those who marry

young are considered to marry between the ages of 14 and 18 and those who marry mature are deemed to marry between the ages of 19 and over. The model does not take divorce into consideration. Evidence also shows that boys / men tend to marry at much older ages than girls / women. (UBOS and ICF International Inc, 2012)

We assume that the young woman's economic capacities are revealed by her participation in traditional tasks (domestic work) and are perfectly known for mature women. On the other hand, the economic capacities of men are revealed only after they have entered the labor market⁴.

There are mixed I * J marriages markets for all combinations of young and mature men and women. The marriage market disappears when it is given equilibrium transfers, the demand of type i men for type j spouses is equal to the supply of type j women for type i men for all i; j. In our model, young working women and men are more desirable marriage partners than others, especially in a population where early marriage is deeply rooted in the culture and traditions where poverty predominates. Indeed, in Uganda, in a review of data from 68 developing countries, the International Center for Research on Women (ICRW) found that Uganda ranked ninth in terms of the high proportion of women married before 18 years old⁵.

We also assume that the characteristics of each type j woman are known to all people when they reach maturity and that of the type i man does not become public information before maturity (18 years and over)⁶.

⁴ Bergstrom et Bagnoli (1993): Courtship as a Waiting Game

⁵ Jain et Kurz (2007): New Insights on Preventing Child Marriage: A Global Analysis of Factors and Programs

⁶ Bergstrom et Bagnoli (1993): Courtship as a Waiting Game

2.1 Descriptions of the Marriage market

2.1.1 The model of Choo and Siow (2006)

The marriage market is made up of four types of people: young men, young women, mature men and mature women⁷. The number of individuals of each type at time t is given respectively by μ_{i01}^{rt} , μ_{0j1}^{rt} , μ_{i02}^{rt} et μ_{0j2}^{rt} and where r denotes the marriage market which takes into account the region, ethnicity, year, place of residence, education, religion and age at first marriage assuming that two individuals of the same type are exactly alike in their observable characteristics.

Furthermore, the matrimonial matching function here is a reduced form approach which is used by demographers to finesse the identification problem to estimate the behavior of the entire marriage market⁸. Thus, the vector M^{rt} with element m_i , the vector F^{rt} with element f_j and Π^{rt} the vector of parameters.

A marriage function is a $2 \times I \times J$ matrix $\mu (M^{rt}, F^{rt}; \Pi^{rt})$ whose element i, j is μ_{ij}^{rt} respectful of accounting:

$$\sum_l \mu_{lj}^{rt} + \sum_{i=1}^I \mu_{ij}^{rt} = f_j^{rt} \quad \forall j \quad (1)$$

$$\sum_k \mu_{ik}^{rt} + \sum_{j=1}^J \mu_{ij}^{rt} = m_i^{rt} \quad \forall i \quad (2)$$

$$\sum_l \mu_{lj}^{rt}, \sum_k \mu_{ik}^{rt}, \mu_{ij}^{rt} \geq 0 \quad \forall i, j \quad (3)$$

⁷ Wahhaj, Zaki (2015): A theory of child marriage

⁸ Pollak 1990a.

Also, certain characteristics are revealed such as age, education and others that are not observable such as what Zaki (2015) called character which is either good or bad, designates the set of distinctive signs, of individual personality of bride and groom.

Let a young or mature g-type i man who marries a young or mature g-type j woman depends on marital transfers and the character of the partners:

$$V_{ijg}^r = \tilde{\alpha}_{ij}^r - \tau_{ij}^r + \zeta_{ijg}^r ; \text{ where}$$

$\tilde{\alpha}_{ij}^r$: Systematic gross yield of a young or mature man of type i married to a young or mature woman of type j in relation r.

τ_{ij}^r : Balance transfer made by a young or mature man of type i to his young or mature spouse of type j in relation r.

ζ_{ijg}^r : random variable with an extreme value distribution of type I or called character.

We do not differentiate between the marriage decision made by families and that of the bride and groom to avoid considering the objective functions of families⁹.

The gain of the young or mature man g of remaining single, noted by j = 0, is:

$V_{i0g} = \tilde{\alpha}_{ij} + \zeta_{i0g}^0$ where ζ_{i0g}^0 is also a random variable i.i.d. with a distribution of extreme type I values.

Each individual considers matching with a member of the opposite gender. The young or mature individual will choose according to:

$V_{ig} = \max_{j,r} \{ V_{i0g}, \dots, V_{ijg}, \dots, V_{ijg} \}$ is the maximization of the utility of male g of type i who marries a female of type j.

We have different tribes in Uganda whose members organize marriage in a similar way.

⁹ Wahhaj, Zaki (2015): A theory of child marriage

The main purpose of these marriages is to create a union between the families of the bride and groom.

Marriage is described as the process where there is a highly respected person to negotiate the marriage of the bride and groom.

The matchmaker is responsible for dealing with the bride's family, presenting the husband's interests and ensuring that the request is accepted. And once the request is accepted, he will still be responsible for providing information to the groom.

The matchmaker conducts a pre-check to ensure that the wife's characteristics are good.

A discussion ensues as soon as the bride announces her acceptance. Nothing more than to discuss the level of transfer of the bride between the two families commonly called "dowry".

Indeed, "Parents prefer that girls marry to have cows or that boys marry so that the few remaining cows go for dowry and are free from dowry problems. (FGD the mother of a teenager - Kapchorwa)¹⁰.

Usually, the bride's family members, especially the mother, also give her gifts to take away as farewell.

Right after, a group of girls and boys escort the bride to the husband's home.

Knowing that the bride keeps her virginity for marriage is respected and appreciated until today, because losing it before marriage would be an abomination¹¹.

The marriage market disappears when, considering equilibrium transfers τ_{ij}^r , the demand for men of type i for spouses of type j is equal to the supply of women of type j for type i for all (r, i, j)

¹⁰ Government of Uganda, UNICEF (2015) where (FGD): was a focus group that took place with adolescents, at school and out of school, with parents of adolescents.

¹¹ Wahhaj, Zaki (2015): A theory of child marriage

We obtain a quasi-demand function for a spouse of type i:

$$\ln \mu_{ij}^{rd} = \ln \mu_{i0}^{rd} + \tilde{\alpha}_{ij}^r - \tilde{\alpha}_{i0} - \tau_{ij}^r = \ln \mu_{i0}^{rd} + \tilde{\alpha}_{ij}^r - \tau_{ij}^r$$

The expected gain to enter the marriage market and the marriage rate:

$$V_i = EV_{ig} = c + \tilde{\alpha}_{i0} + \ln (1 + \sum_j \exp (\tilde{\alpha}_{ij}^r - \tau_{ij}^r))$$

$$\text{with } n_i = \ln (1 + \sum_j \exp (\tilde{\alpha}_{ij}^r - \tau_{ij}^r)) = \ln \left(\frac{m_i}{\mu_{i0}^{rd}} \right) \approx \frac{\sum_j \mu_{ij}^{rd}}{m_i} = r_i$$

$$V_i = EV_{ig} = c + \tilde{\alpha}_{i0} + \ln \left(\frac{m_i}{\mu_{i0}^{rd}} \right)$$

The quasi-offer function of the spouse of type j: $\ln \mu_{ij}^{rs} = \ln \mu_{i0}^{rs} + \gamma_{ij}^r + \tau_{ij}^r$

When the competitive marriage market for all i; j pair disappears, the request for i; j marriages are equal to the offer: $\mu_{ij} = \mu_{ij}^{rd} = \mu_{ij}^{rs}$

Overall, we believe that the marriage process described above confirms the view that a transferable use model is appropriate for studying the Ugandan marriage market. Using the model described above, we therefore explore the systematic net gains on marriage in two recent Ugandan marriage markets for which we have sufficient data - namely either t the census year, {t = 1995, 2016}. Each year, individuals are differentiated by region, ethnicity, year, place of residence, education, religion and age at first marriage. Let j denote the type j women and i denote i type i men. $j = 1.2. \dots J$ and $i = 1.2. \dots I$. F^{rt} is the population vector of women at time t with the typical element f^{rt} , the number of women of type j in year t. M^{rt} is the population i vector of men at time t with the typical element m_i^t , the number of men of type i in the year t.

μ_j^{rt} is the number of married women of type j year t. μ_i^{rt} is the number of married men of type i year t. Either the number of single men of type i is $\mu_{i0}^{rt} = m_i^{rt} - \mu_i^{rt}$; and the number of unmarried type j women is $\mu_{0j}^{rt} = f_j^{rt} - \mu_j^{rt}$. Let μ_{ij}^t be the number of type I men married to type J women.

There are $I \times J$ types of marriages at time t . Let μ^{rt} , the distribution of marriages, a matrix $I \times J$ whose typical element is μ_{ij}^{rt} .

In order to predict changes in the distribution of marriages due to changes in population vectors, M^{rt} and F^{rt} , and other parameters that affect the marriage market, π^{rt} economists estimate the marriage matching functions (MMF):

$$\ln \frac{\mu_{ij}^{rt}}{\sqrt{\mu_{0j}^{rt} \mu_{0i}^{rt}}} = \pi_{ij}^{rt}; i = 1, 2, \dots, I; j = 1, 2, \dots, J$$

The total systematic gains to an $i; j$ marriage, π_{ij}^{rt} , has the interpretation: on date t , choose a i type of man and j type of woman at random. Also, π_{ij}^{rt} is the difference between the expected gain $i; j$ and the $i; j$ utilities that this randomly chosen pair will derive from marriage and the sum of the expected utilities they will derive from the fact that they will remain single.

The Choo-Siow (2006) model has many interesting properties such as allowing unrestricted substitution effects between types of marriage when the vectors of population change. And because it is static in the sense that any cultural, social or political change affecting the distribution of marriage will result in a change in systematic net gains from marriage over time, but the anticipated changes in these gains or in the vectors of population will not affect the behaviour of individuals in a given marriage market. Also, the gain in the model relating to remaining single at a given time will implicitly capture the optional value of participation in future marriage markets, but only in reduced form¹².

¹² Loren Brandt, Hongbin Li, Laura Turner and Jiaqi Zou (2018)

The properties of the static approach and the substitution effect are well known as the limits of this model; Choo's model (2015) circumvents these two limitations by using a dynamic estimator.

3. Data and empirical strategy

This section describes the data we use to analyze the effect of systematic net gains on the probability of a man marrying a minor girl by region, ethnicity, year, place of residence, education, religion and age at first marriage. It also describes our empirical strategy.

3.1 Description of the data

For the construction of our data, we use The Demographic and Health Surveys (DHS) Program data from Uganda, one of the countries of sub-Saharan Africa of 1995 and 2016. Our analysis is based on retrospective reports of the age at first marriage provided by women interviewed, their education and the education of their husbands as well as information collected on their demographic and socio-economic characteristics.

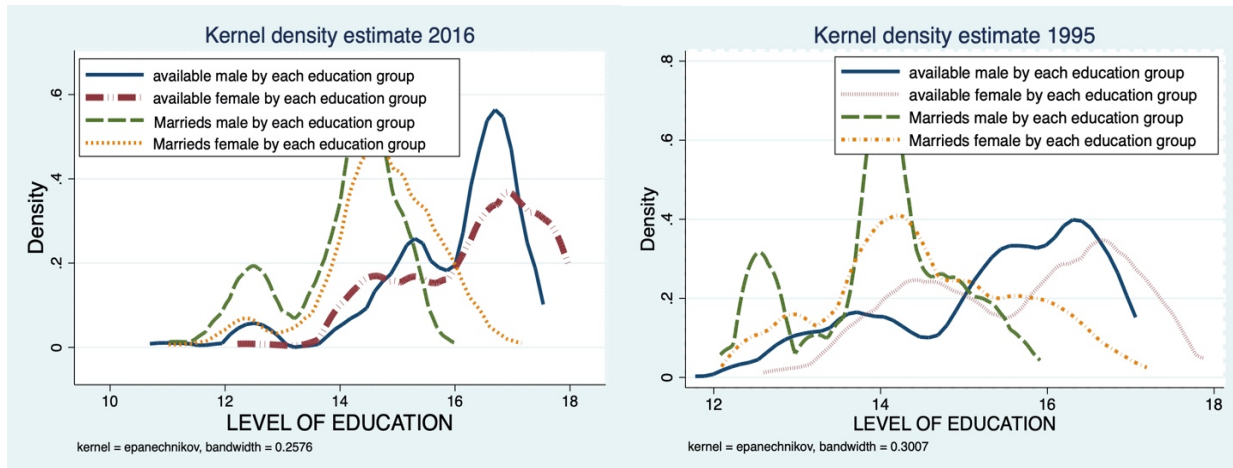


Figure 1: histogram of single and married male and female

Source: data collected from DHS

For the purpose of examining the causal relationship on the effect of systematic net gains from early marriage and the education, religion and ethnicity of a young or mature man and a young or mature woman, and the probability whether the wife is a minor girl, we use the Couple's Recode (CR), individual women Recode, household member Recode and men's Recode datasets. The Couple Recode dataset contains information on couples of people (men and women) married or living in union, describing Uganda as a country with significant transregional disparities, both in the average number of years of schooling accomplished by both men and women. We divided our sample (assigned individual weight for women v005 and mv005 individual weight for men) between men and women under 18 and another over 18. Indeed, we build our sample by first including all married women aged between 10 to 18 years and their spouses of all ages and all married men aged 25 to 50 and their spouses of all ages (figure 1). The exclusion of all men married before the age of 25 allows us to limit ourselves only to those whose educational attainment is more likely to be exogenous at the time of their marriage. Indeed, to correctly identify the effect of a man's education, we must exclude the mechanical effect that an uneducated man can marry young and can choose a minor wife, not because he lacks education, but simply because he got

married early. Similarly, it is possible that a man with more years of schooling may choose an older wife, not because he has more years of schooling, but because he has delayed his participation in the wedding market in order to focus on her education (Dessy, Diarra, Pongou (2018)).

We then sample singles in such a way that the age distribution of singles corresponds to the age distribution of spouses for each sex (figure 1).

We used Kernel density estimation because it is a technique for estimation of probability density function that is a ‘must-have’ enabling the user to better analyze the studied probability distribution than when using a traditional histogram. Unlike the histogram, ‘the kernel technique produces smooth estimate of the pdf, uses all sample points’ locations and more convincingly suggest multimodality¹³.

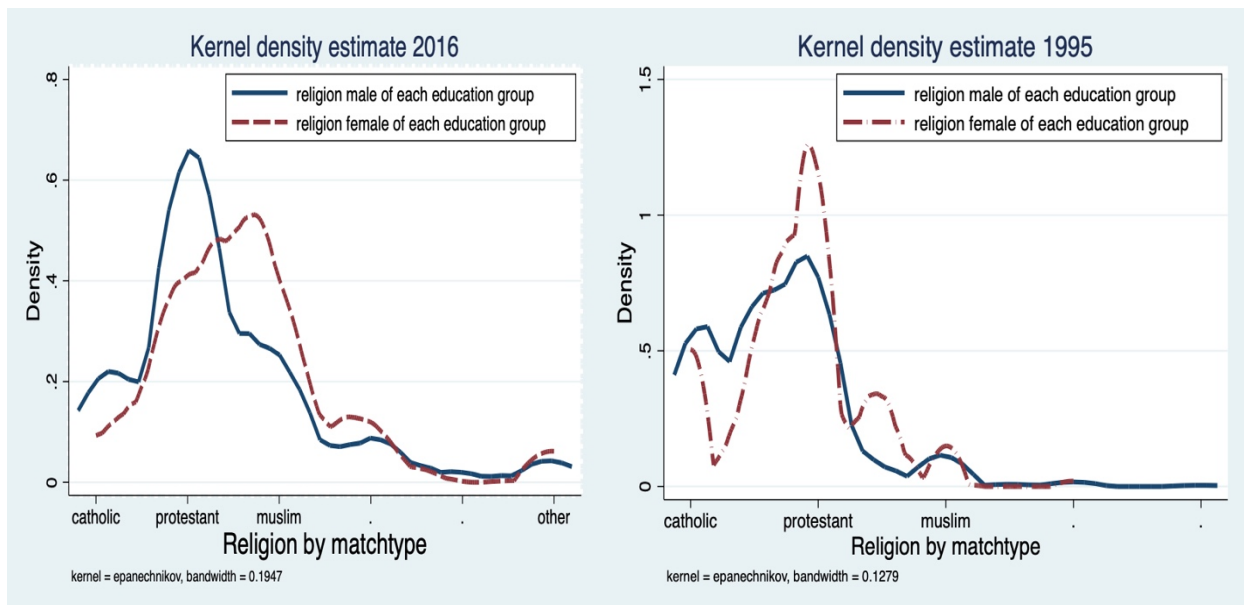


Figure 2: histogram of Average religion group by married male and female

Source: data collected from DHS

¹³ <http://creativecommons.org/licenses/by/4.0/>

Education is categorized between those with no education, those with primary education, those with secondary education and those with higher education. The North region is the most affected by the marriage of minors where the prevalence of child marriages is estimated at 59%, 58% in the West region, then 52% in each of the Central East and the East, 41% in the Central region, 37% in the Southwest and 21% in Kampala (United Nations June 2015). Below, we will eventually verify the impact of those regions on our systematic net gains of child marriage.

Table 1 show summary statistics for variables such as region, place of residence, religion and ethnicity used later in the regressions (under 18 for women and 25 to 49 for men).

Figure 6 and 7 show the marriage rate by education level for a sample of young people women under 18 and 25 to 49 for men from the 1995 and 2016 census from DHS.

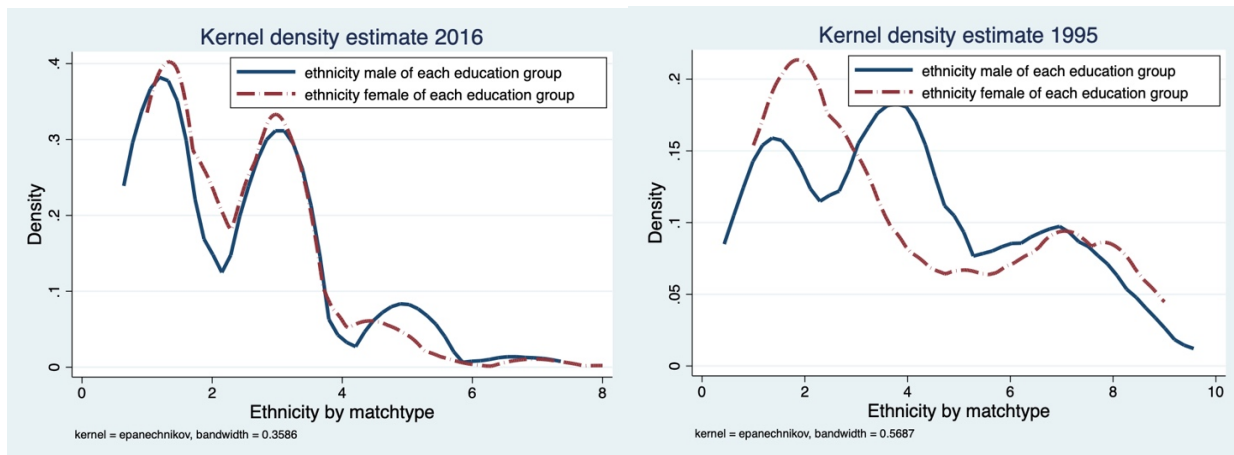


Figure 3: histogram of Average ethnicity group by Married male and female

Source: data collected from DHS

In 1995/2016, uneducated women and women who dropped out of elementary school were both more likely to be married than their high school counterparts and more. Also, the leading ethnic groups practicing early marriage are the Baganda, the Bagisu, the Bakiga, the Basoga and the Iteso (Figure 3). Similarly, at the level of religions, Catholics occupy an important place and are likely

to marry before the age of 18. The Muslim religion is less present and shows fewer young girls married before their 18 years (Figure 2).

The scheme had changed for men whose age at marriage was 25 or higher in Uganda. Indeed, the marriage rate is now increasing with the level of education completion. This is the result of a slightly smaller decline for men with little or no education and a small increase in marriage rates for men with education; which is usually confused with an increase in age at first marriage. Girls' marriage rates declined relatively from 1995 to 2016 considering ethnicity and religion, but there has been little change (figure 4/5).

Figure 8/9 shows regional differences based on the fact that a man's attitude towards child marriage may be linked to characteristics such as gender norms which may be more restrictive in rural communities. Indeed, this shows that, at all levels of education of men and women, the probability of marrying a minor girl is greater in a rural area than in the urban area.

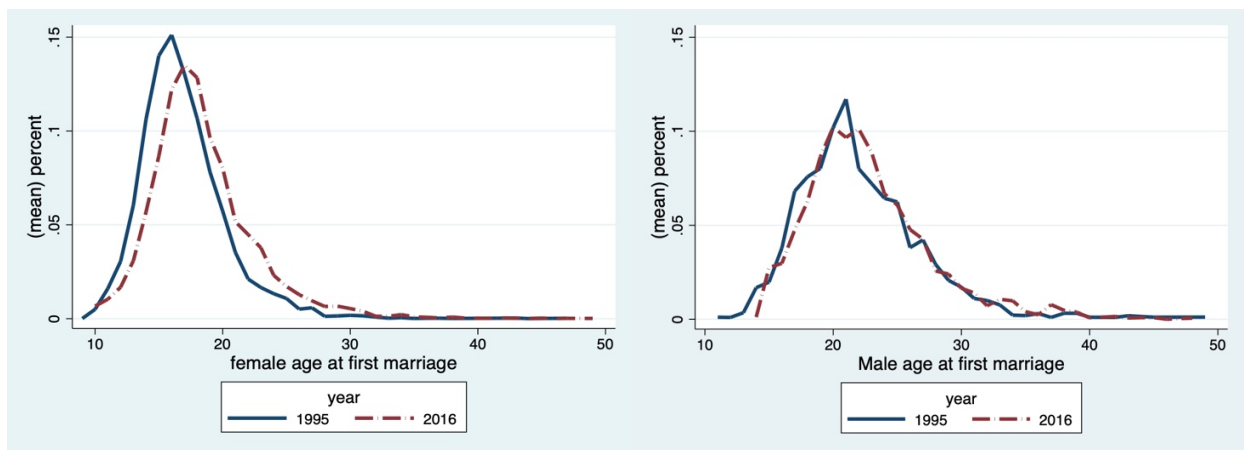


Figure 4. Distribution of age of first marriage for Women and adult Men, 1995 and 2016

Source: data collected from DHS

Figure 4 shows the percentage of individuals by age at first marriage from 1995 to 2016 in Uganda.

There are more young people aged 15 to 25 and under 45 and over among men and women. The

two age groups are quite similar and reflect a very young population with one of the highest birth rates in the world (around 4.5 children per woman) according to DHS.

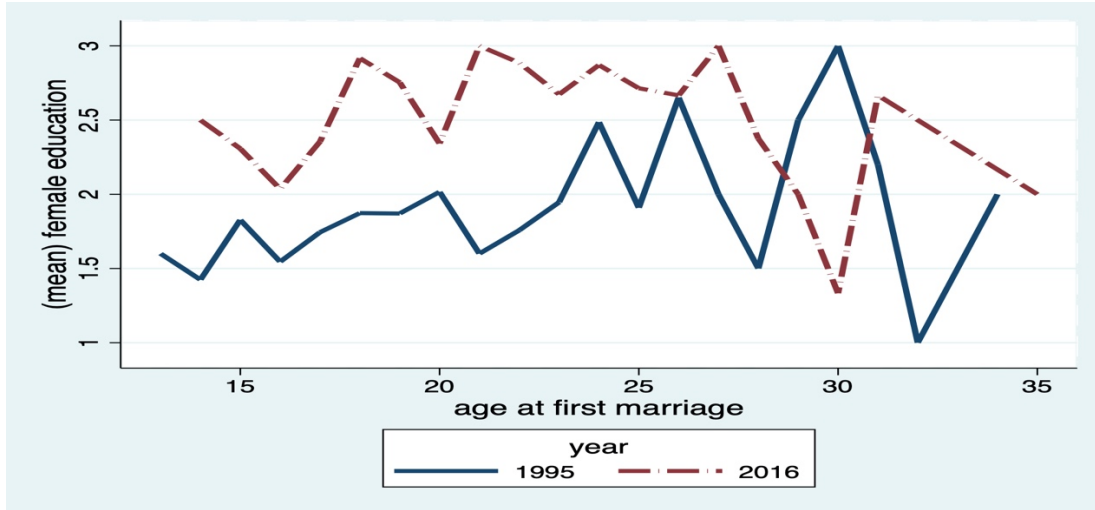


Figure 5. Marriage Rates for woman by education group, 1995 and 2016

Source: data collected from DHS

Figure 5 shows the education level of the woman according to the age at first marriage. We find that there is a decline in the number of years of study as the woman's age increases. It gives meaning to these arguments relayed by the DHS health review: some parents think that educating the girl is a waste of time and resource.

3.2 Identification Strategy

Consider the following regression model for total systematic gains from marriage i, j :

$$\pi_{ij}^{rt} = X'_{ij} \beta + u_{ij},$$

Where X_{ij} denotes the vector of variables (region, ethnicity, year, place of residence, education, religion and age at first marriage including policy variables) that affect the systematic total gains to a marriage i, j . u_{ij} is an error term and not correlated with X_{ij} . Since we can construct and estimate π_{ij}^{rt} using the formula $\frac{\mu_{ij}^{rt}}{\sqrt{\mu_{0j}^{rt} \mu_{0i}^{rt}}}$, we can estimate β in the regression equation.

Policy changes and other variable factors will induce changes in π_{ij}^{rt} captured by the regression equation. Also, variations in π_{ij}^{rt} will be affected by marital behaviour through the marriage matching function described in the regression equation.

So, given the estimates of β , one can predict the effect of changes in marital behaviour including marriage rates, as simple as estimating regressions of the marriage rate.

The benefits of marriage rate regressions for evaluating the policies of factors affecting the marriage market are preserved because we do not estimate sets of regressions for different types of individuals or genders. Choo and Siow (2005) Thus, we will not meet interpretation difficulties linked to regressions in the marriage rate, i.e. the problem of interdependence between the marriage rate of women and the marriage rate of men (This interdependence is ignored in regressions of the marriage rate).

In addition, we do not include the sex ratio as a regressor in our regression because when $\frac{m_i}{f_j}$ varies, in general the set of population vectors, M and F are also variable. It is therefore difficult to generalize with the estimated coefficient of marriage rate, β_j^f , on the sex ratio, $\frac{m_i}{f_j}$, from a particular sample if we assume that $\frac{m_i}{f_j}$ and τ_{ij}^r are correlated. Instead, the section below examines the impact of changes in population vectors on the distribution of marriages as in Choo and Siow (2006).

4. Estimation results

4.1 variations in estimated marriage gains

The objective of our empirical work is to estimate the distribution of early marriages in Uganda by region, ethnicity, year, place of residence, education, religion and age at first marriage in 1995 and 2016 using DHS data to construct the population vectors.

For each period, we examine the marital behaviour concerning the early marriage of women by their age at first marriage from 10 to 49 years according to the population vectors and preference parameters estimated from our model.

In Figure 10, women between the ages of 18 and 25 receive the highest systematic net gains when they marry when compared to other age groups.

We observe that net gains at marriage have declined considerably with age at first marriage. The distribution of net gains at marriage aged 30 to 35 for women married in 1995 is similar to the age distribution at first marriage for women married in 2016.

From Figure 11, comparing the distribution of the systematic net gain for the 1995 female supply with its counterparts in 2016, we find the distribution for the 1995 female supply to be more dispersed and to receive less gains.

From Figure 12, if we consider the distribution of systematic net gain for women in function of ethnic groups, we also find the distribution is dispersed as for its counterparts of 2016. But the

gains increase in 1995 according to the marriage of the woman by ethnic group. The opposite is the case for women in 2016, where gains fall according to variations.

In Figure 13, on the other hand, if we consider the distribution of systematic net gain for women in religious positions, the distribution is dispersed but the gains fall than its 2016 counterparts. Indeed, the gains of married women in according to religions in 2016 increased slightly to leave in the negative.

From Figure 14, we observe that the estimated net gains are positive, reflecting the fact that systematic net gains from marriage are higher than staying single.

This is not surprising because at any age, most people get married in Uganda, especially children. According to Choo and Siow (2005), the general hypothesis on the model's marital behaviour predicts that a correspondence will only occur when the specific correspondence of idiosyncratic utility is large and that the model provides a normative interpretation of these distributions in recalling that estimates of net gains reflect both preferences and equilibrium transfers in marriage.

4.2 Estimating systematic gains from marriage

We report OLS estimates of the equation $\pi_{ij}^{r,t} = X'_{ij} \beta + u_{ij}$, using DHS 1995 and 2016 census data. Knowing that most men marry younger women¹⁴, our main respondents are men who married at the age of 25 to 50 and women who married at the age of 10 to 18 by building a sample that reflects all of the potential partners available to men and women in this age group.

¹⁴ Choo et Siow (2005)

We use the number of matches, the supply of singles, regions, place of residence, religion and ethnicity per year, by level of type of match in our sample in order to construct the equation

$$\frac{\mu_{ij}^{rt}}{\sqrt{\mu_{0j}^{rt} \mu_{0i}^{rt}}}$$

Our measures are the averages of education level of male and female, religion and ethnicity for any year, education level, region, place of residence and age at first marriage. We use these potential metrics to summarize the girl's decision in the early marriage market based on total net gains.

Table 2 show the results of the variant estimation of the equation of our regression, using both logarithm of education with and without interaction terms. The regressions include some dichotomous variables such as the region, place of residence, year, and age at first marriage, and their fixed effects. We note that total marriage gains vary by type of match and year similarly to Cornelson and Siow (2016).

In the four columns, the R^2 exceeds 0.4 and 0.7 for 1995/2016. Column (1) controls only for male education, female education and age at the first marriage. It shows that each additional year of schooling for a male reduces the gains of the probability that he marries an underage girl by 2.95 percentage points. On the other hand, the gains are reduced by 0.85 for a young girl who marries before 18. In column (2), (3) and (4), with and without the interaction term, the signs remain unchanged and significant for education male/female. The negative interaction term in column (2) is not significant but the one in column (4) increased the gain of child marriage.

The regressions are capable of capturing variations in the marital distributions with the exception of the estimated coefficients of age at first marriage between 15 to 18 and 14 to 16 are not statistically significant for columns (1), (2) and column (4) respectively.

Also, Column (3) and (4) controls for a female/male's religion, region, ethnicity and place of residence where the ethnicity is significant except Basoga and Banyankole are not significant. On the other hand, the average level of ethnicity and religion (Catholic, Protestant and Muslim) of minor women are negatively linked to total gains and they are significant with the interaction term for the year 1995 and 2016. We can conclude that education and ethnicity/religion affect the marital distribution of women and men: one lowers total gains while the other increases it. Education and Religion discourage the girl's marriage by reducing the gain of child marriage while some ethnicities encourage it. These results are consistent with those reported earlier in the literature. The results obtained clearly showed that education has a statistically significant and strong delaying effect on marriage and the effect remained robust in the presence of a number of controls.

5. Conclusion

This document proposed an adaptation of the nonparametric static model of the marriage market in relation to early marriage, age at first marriage and education, place of residence, region, religion and ethnicity. We used data from the DHS censuses for 1995 and 2016 for Uganda to analyze the average age of marriage (cohabitation) for men and women. We found that early marriage persists in this country about 42% of young girls marry before the age of 18 and that women between 18 and 25 years receive the largest systematic net gains when they marry by comparing other age groups. In addition, education is an element that discourages the girl's marriage while some ethnicities encourage it.

The good news is that the marriage age of young girls improves over time for an average of 18 years in 2016. The main reasons for early marriage mentioned in our paper are the level of poverty of families, the low level of the education of young girls and the traditional customs still inked in this country.

From our point of view, in addition to the empirical evidence, it is clear that the education and awareness of young girls obviously remains one of the main threads to eradicate this scourge which affects women in Uganda and by ricochet which plagues the economy of this country.

Appendix: Data

The data used were extracted from The Demographic and Health Surveys (DHS) Program is a global program coordinated by ICF in Rockville, Maryland, USA. Technical and financial support for the 1995-2016 UDHS were provided by the Government of Uganda, the United States Agency for International Development (USAID), the United Nations Children's Fund (UNICEF), and the United Nations Population Fund (UNFPA).

The 1995 datasets have been appropriately scaled to be comparable with the 2016 files. To maintain consistency between region, ethnicity, place of residence, education, religion and age at first marriage reporting marriages, certain religion, ethnicity, region should be excluded. As a result, data from the following religions, ethnicity and regions are used:

Ethnicity: Baganda, Banyankole, Basoga, Bakiga, Iteso, Langi, Acholi, Bagisu, Lugbara

Religion: catholic, protestant, Muslim, seventh day adventure for 1995 and Anglican, catholic Muslim, seventh day Adventist, orthodox, Pentecost for 2016. We work with both datasets separately.

we give the same meaning to legal marriage and cohabitation in our data given the Uganda context where the majority of marriages are unofficial.

The age at first marriage studied range for man was from 26 to 48/49 and for woman from 9/10 to 18.

we create the main sample of married and single couples, the number of people by year and education group and data on the number of matches region, ethnicity, place of residence, religion and age at first marriage and type of match.

For samples, Education level was identified using the mv106 and v106 variables in the 1995 and 2016. This variable allowed us to assign each person one of the following schooling types: no education, primary(low), secondary(medium) and higher. And we use the v502 and mv502 variables in the census to identify a person as either: never married, currently married, or formerly married. Also, to calculate the number of unmarried, marrieds individuals of each type, collapse the census data into counts by match type.

We use Stata's collapse command to allow to convert our data set to a much smaller data set of means, sum by region, ethnicity, place of residence, education, religion and age at first marriage and match type:

- we use collapse to sum the number of marriages with weight (mv005 and v005) by region ethnicity, education group, year, religion, place of residence and age first marriage

- we use collapse to have the mean of religion and ethnicity with weight (mv005 and v005) by region, education group, year, place of residence and age first marriage.

we have two categorical variables of education (male and female) we want to create one composite categorical variable that can take on all the possible joint values. We essentially count the number of distinct combinations of the values of the set of variables of educations.

Then we create variable id (match type) which is a way of referring to the observation number in our data and we name it match type. We use reshape wide command of Stata to reshape i (region ethnicity year place of residence religion age first marriage) and j(group) from long to wide. we can correspond each marrieds male and female, single male and female, ethnicity male and female, religion male and female to their different number of match type.

References:

Abramitzky, Ran; Delavande, Adeline; Vasconcelos, Luis (2011). "Marrying Up: The Role of Sex Ratio in Assortative Matching", *American Economic Journal: Applied Economics*, Volume 3, Number 3, July 2011, pp. 124-157(34).

Angrist, Josh. "How Do Sex Ratios Affect Marriage and Labor Markets? Evidence from America's Second Generation." *Quarterly Journal of Economics* CXVII, no. 3 (2002): 997-1038.

Bergstrom, T. and Bagnoli, M. (1993) Courtship as a Waiting Game. *Journal of Political Economy*, 101.

Becker, Gary S. "A Theory of Marriage: Part I." *Journal of Political Economy* 81, no. 4 (1973): 813-46.

Becker, Gary S. "A Theory of Marriage: Part II." *Journal of Political Economy* 82, no. 2, Part II (1974): S11-S26.

Blundell, Richard, Pierre-Andre Chiappori, and Costas Meghir (2005) 'Collective labor supply with children,' *Journal of Political Economy* 113, 1277–306.

Chiappori, P.-A., B. Salanie, and Y. Weiss (2017): 'Partner Choice, Investment in Children, and the Marital College Premium,' *American Economic Review*, 107, 2109-67.

Choo, E. and A. Siow (2006): 'Who Marries Whom and Why,' *Journal of political Economy*, 114, 175-201.

Dessy, Diarra, Pongou (2018), who takes a child bride and why? A "Set-Identification" Approach.

Ismael Mourifie & Aloysius Siow, 2015. "Cohabitation versus marriage: Marriage matching with peer effects," Working Papers tecipa-531, University of Toronto, Department of Economics.

Jain et Kurz (2007): *New Insights on Preventing Child Marriage: A Global Analysis of Factors and Programs*.

Kirsten Cornelson & Aloysius Siow, 2016. "A Quantitative Review of Marriage Markets: How Inequality Is Remaking the American Family by Carbone and Cahn," *Journal of Economic Literature*, American Economic Association, vol. 54(1), pages 193-207, March.

Loren Brandt & Aloysius Siow & Carl Vogel, 2009. "Large Demographic Shocks and Small Changes in the Marriage Market," CEPR Discussion Papers 615, Centre for Economic Policy Research, Research School of Economics, Australian National University.

Loren Brandt & Hongbin Li & Laura Turner & Jiaqi Zou, 2018. "Are China's "Leftover Women" really leftover? An investigation of marriage market penalties in modern-day China," Working Paper series 18-33, Rimini Centre for Economic Analysis.

UNICEF (2014): "Ending Child Marriage: Progress and Prospects," New York: UNICEF.

U.S. Agency for International Development (USAID) (2009), ADDRESSING EARLY MARRIAGE IN UGANDA, 2-32.

White, S. (1992). *Arguing with the Crocodile: Gender and Class in Bangladesh*, Zed Books.

Walker (2012) Early Marriage in Africa – Trends, Harmful Effects and Interventions, *African Journal of Reproductive Health* June 2012 (Special Edition); 16(2): 231

"Male, Chata; Wodon, Quentin. 2016. Basic Profile of Child Marriage in Uganda. Health, Nutrition and Population Knowledge Brief;. World Bank, Washington, DC. © World Bank. <https://openknowledge.worldbank.org/handle/10986/24763> License: CC BY 3.0 IGO."

Pollak, Robert. "Two-Sex Demographic Models." *Journal of Political Economy* 98, no. 2 (1990a): 399-420.

Zaki Wahhaj, 2015. "A Theory of Child Marriage," Studies in Economics 1520, School of Economics, University of Kent.

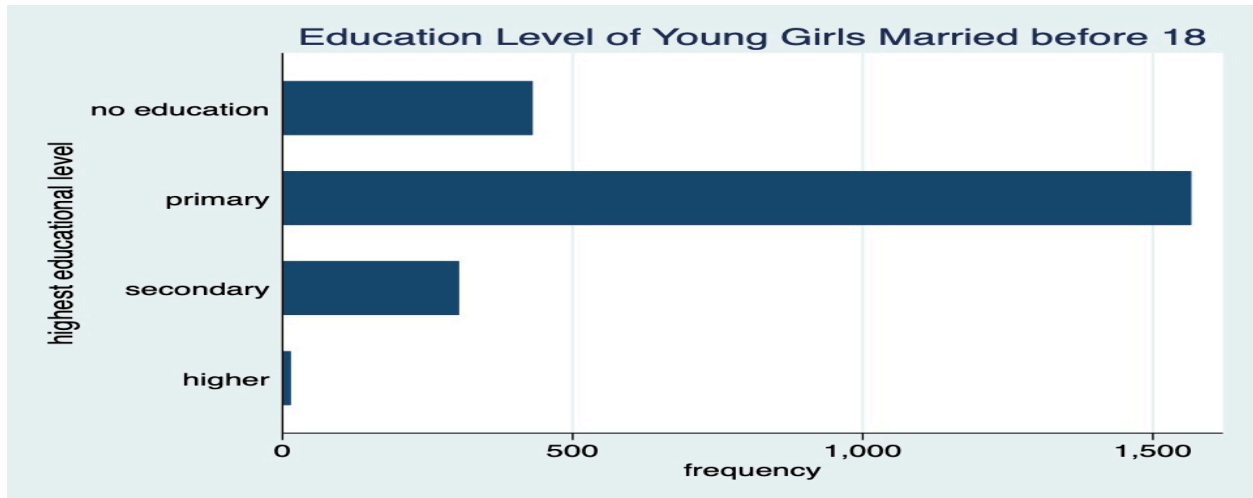
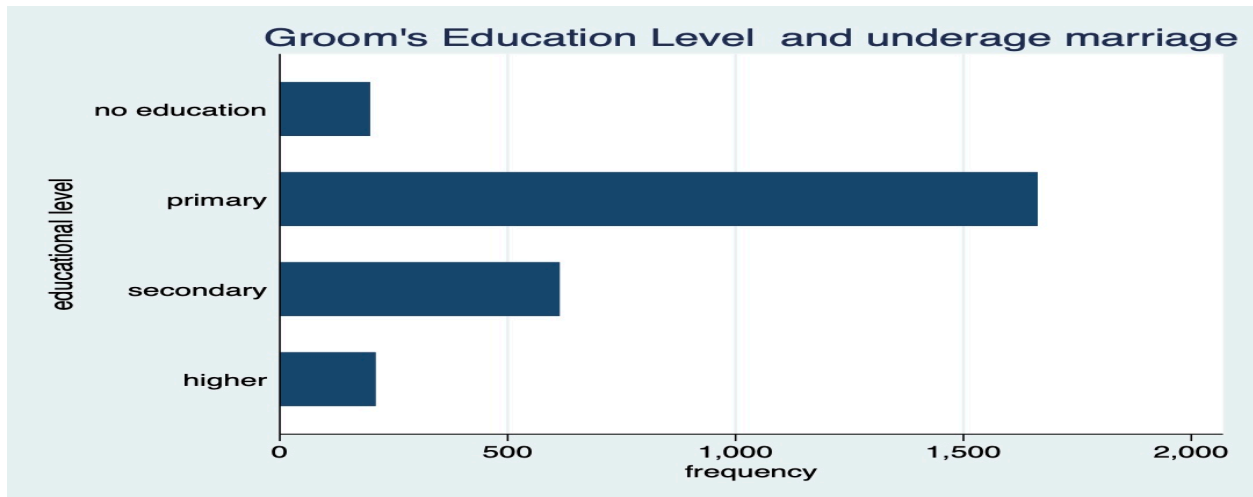


Figure 6: An underage girl married by educational level in Uganda 1995/2016



Source: data collected from DHS

Figure 7: An underage girl by education for men whose age at marriage was 25 or higher in Uganda 1995/2016

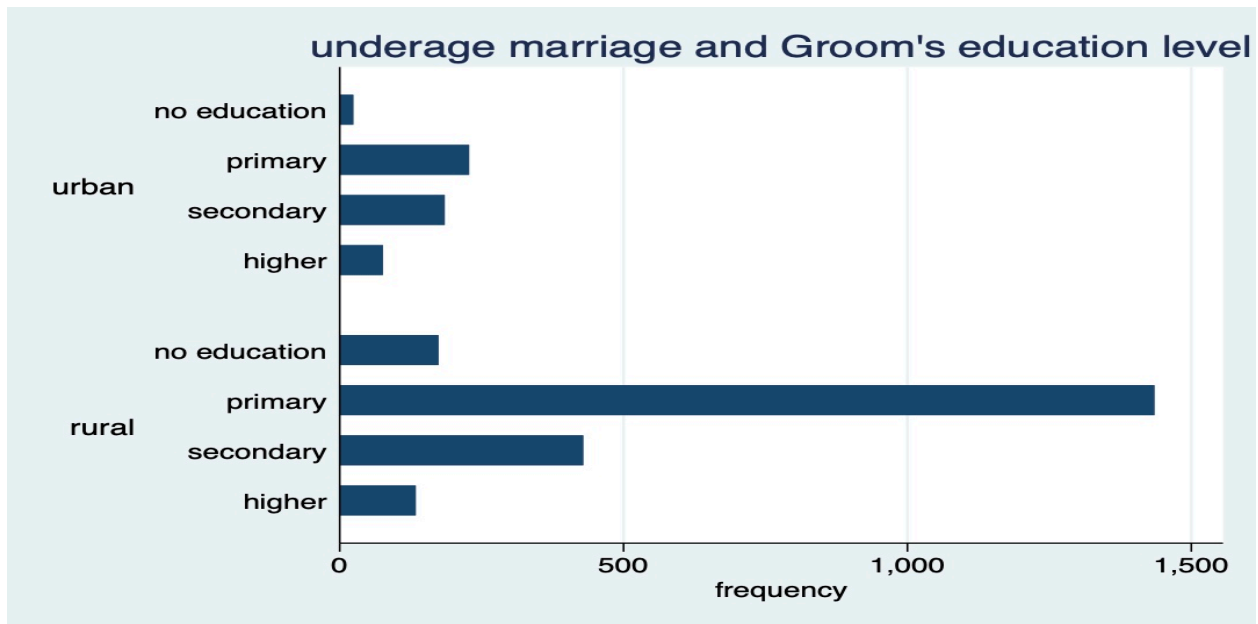


Figure 8: An underage girl by education and by rural/urban place of residence in Uganda 1995/2016 Source: data collected from DHS

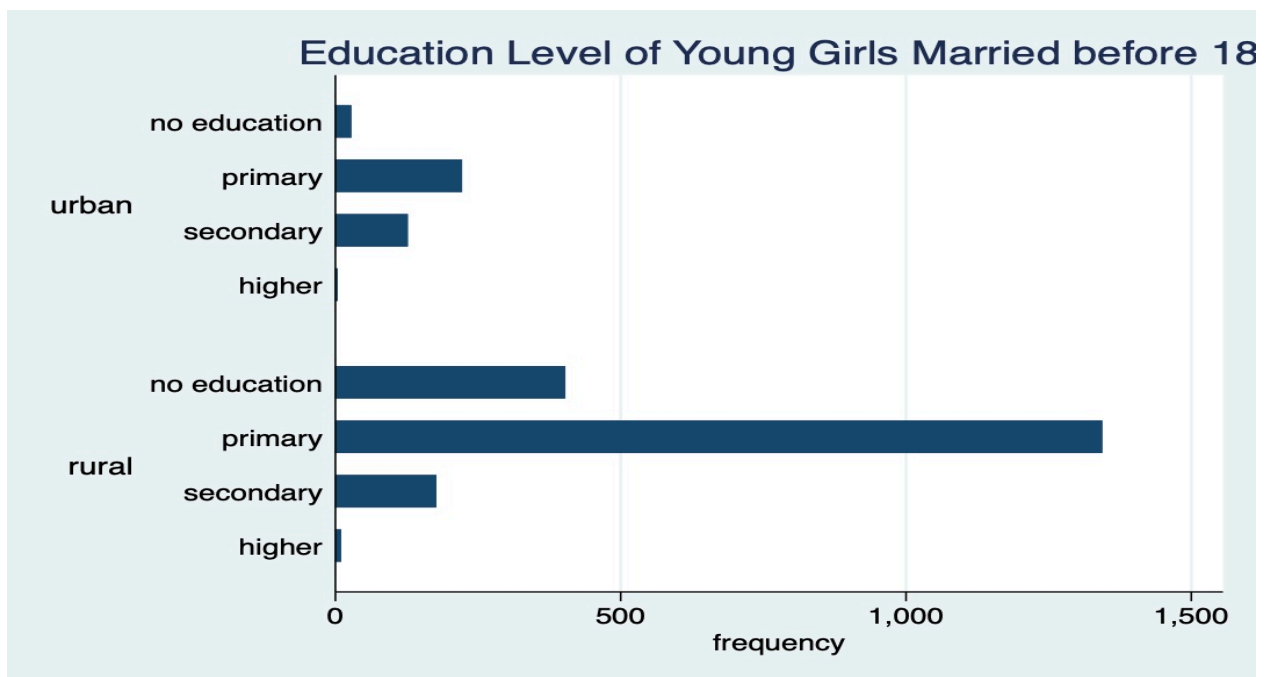


Figure 9: An underage girl Married by education and by rural/urban place of residence in Uganda 1995/2016 Source: data collected from DHS

Place of Residence			
Variables	Urban Col %	Rural Col %	Total Col %
Location			
Live in the Central	71,7	28,0	36,3
Live in the eastern	7,1	22,4	19,5
Live in the northern	5,2	33,1	27,8
Live in the western	16,0	16,5	16,4
Total	100,0	100,0	100,0
Religion			
Catholic	42,9	39,8	40,4
Protestant	43,4	36,8	38,0
Muslim	12,3	21,4	19,7
Other	1,4	2,0	1,9
Total	100,0	100,0	100,0
Ethnicity			
Baganda	54,7	7,6	16,6
Bagwere	18,4	22,2	21,5
Bakiga	5,2	4,2	4,4
Banyankole	12,3	6,6	7,7
Basoga	2,4	5,7	5,1
Iteso	0,9	5,1	4,3
Male Education Level depending on the match type			
No education	16,5	11,4	12,4
Primary	43,4	58,8	55,9
Secondary	40,1	25,4	28,2
Higher	0,0	4,4	3,6
Total	100,0	100,0	100,0
Female Education Level depending on the match type			
No education	7,5	25,0	21,7
Primary	39,6	46,5	45,2
Secondary	46,7	19,8	24,9
Higher	6,1	8,7	8,2
Total	100,0	100,0	100,0

Source: data collected from DHS

Table 1: Summary Statistics 1995/2016

OLS Estimation of the Effect of Male and Female Education on the Underage marriage
Dependent variable:

$$\ln \frac{\mu_{ij}^{rt}}{\sqrt{\mu_{0j}^{rt} \mu_{0i}^{rt}}} = \pi_{ij}^{rt}; i = 1, 2, \dots, I; j = 1, 2, \dots, J$$

VARIABLES	OLS (1)	OLS (2)	OLS (3)	OLS (4)
Ln male education	-2.958*** (0.106)	-2.752*** (0.192)	-0.415*** (0.107)	-0.415*** (0.107)
Ln female education	-0.847*** (0.0837)	-0.629*** (0.141)	-1.494*** (0.125)	-0.524*** (0.0506)
Age first marriage=13	-0.612* (0.367)	-0.621* (0.367)	-0.404* (0.228)	-0.404* (0.228)
Age first marriage=14	-0.684*** (0.141)	-0.623*** (0.147)	-0.0434 (0.146)	-0.0434 (0.146)
Age first marriage=15	0.226 (0.182)	0.216 (0.182)	0.157 (0.150)	0.157 (0.150)
Age first marriage=16	0.179 (0.155)	0.161 (0.151)	0.117 (0.118)	0.117 (0.118)
Age first marriage=17	0.0796 (0.153)	0.0764 (0.153)	0.214* (0.114)	0.214* (0.114)
Age first marriage=18	0.00264 (0.0975)	0.00935 (0.0975)	-0.0916 (0.0845)	-0.0916 (0.0845)
Urban			0.318*** (0.108)	0.318*** (0.108)
Region=central			-0.528*** (0.121)	-0.528*** (0.121)
Region=northern			-0.658*** (0.116)	-0.658*** (0.116)
Region=western			0.115 (0.142)	0.115 (0.142)
Ethnic=Baganda			-0.825*** (0.152)	-0.825*** (0.152)
Ethnic=Bagwere			0.594** (0.279)	0.594** (0.279)
Ethnic=Bakiga			-1.023*** (0.172)	-1.023*** (0.172)
Ethnic=Banyankole			-0.169 (0.173)	-0.169 (0.173)
Ethnic=Basoga			0.138 (0.171)	0.138 (0.171)
Ethnic=Iteso			-0.614*** (0.161)	-0.614*** (0.161)
Catholic			-1.034*** (0.185)	-1.034*** (0.185)

protestant			-1.285***	-1.285***
			(0.192)	(0.192)
Muslim			-0.816***	-0.816***
			(0.189)	(0.189)
Ln education interaction		-0.316		-0.883***
		(0.241)		(0.119)
Constant	2.599***	2.466***	3.588***	3.588***
	(0.0825)	(0.110)	(0.222)	(0.222)
Observations	1,117	1,117	1,117	1,117
R-squared	0.492	0.493	0.757	0.757

Robust standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

Table 2: Estimation of Marriage Matching Model

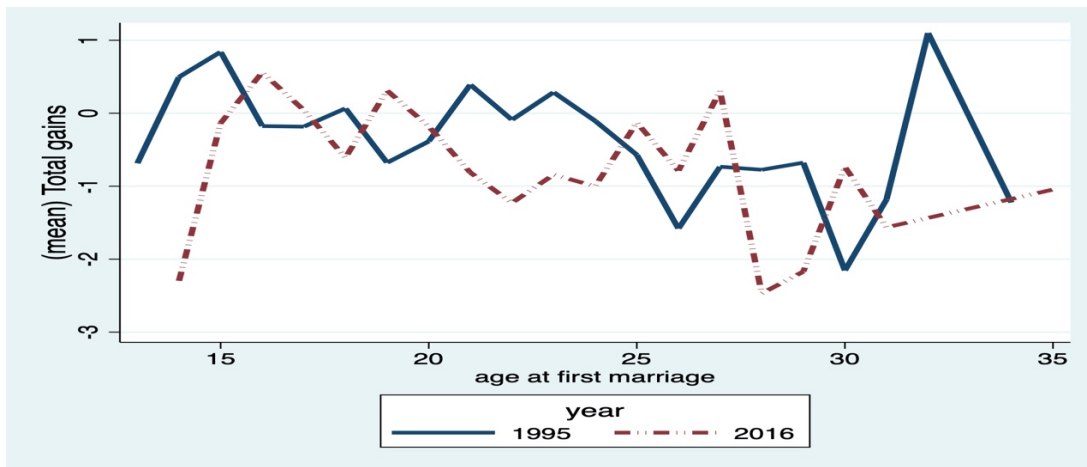


Figure 10: total gains by female and male's age at first marriage, 1995 and 2016

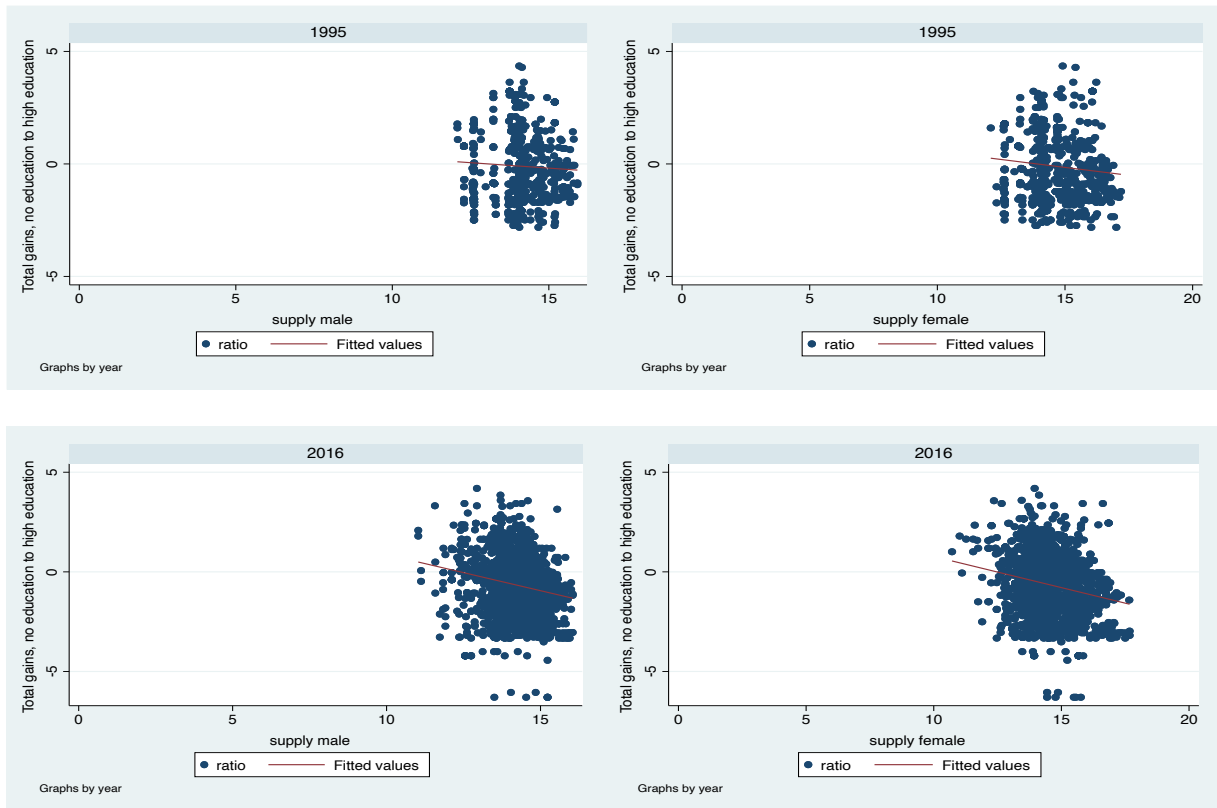
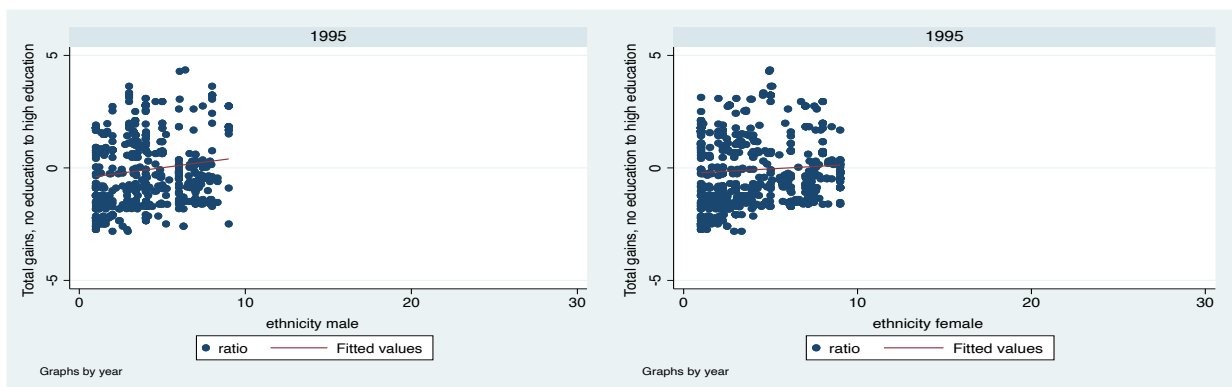


Figure 11: total gains by male and female’s supply, 1995 and 2016

Source: data collected from DHS



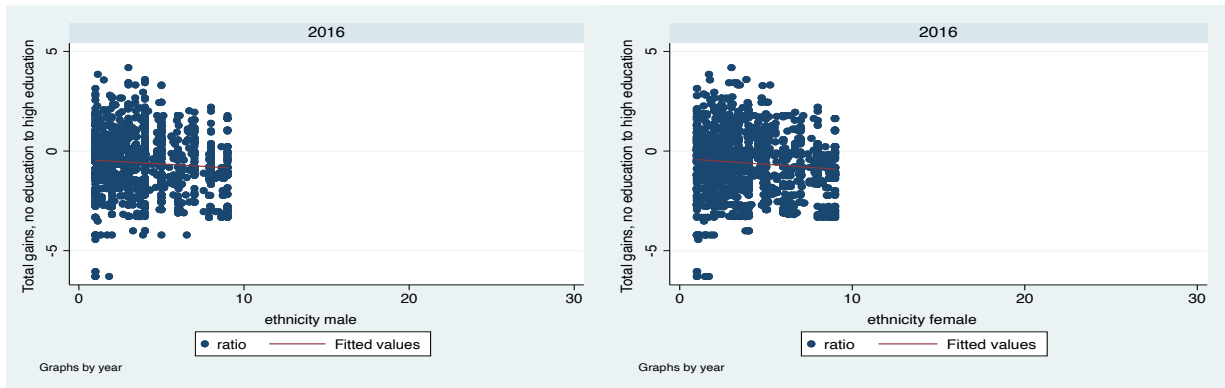


Figure 12: total gains by male and female’s ethnicity group, 1995 and 2016

Source: data collected from DHS

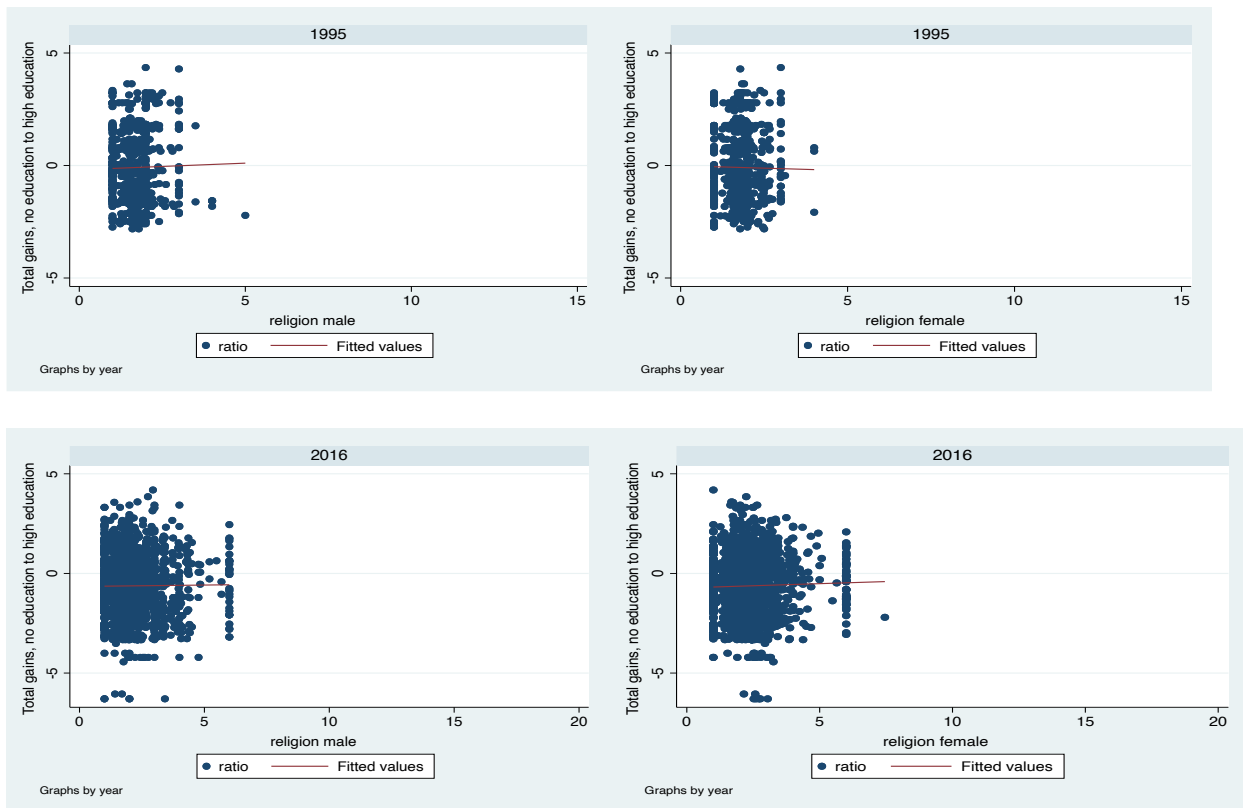


Figure 13: total gains by male and female’s religion group, 1995 and 2016

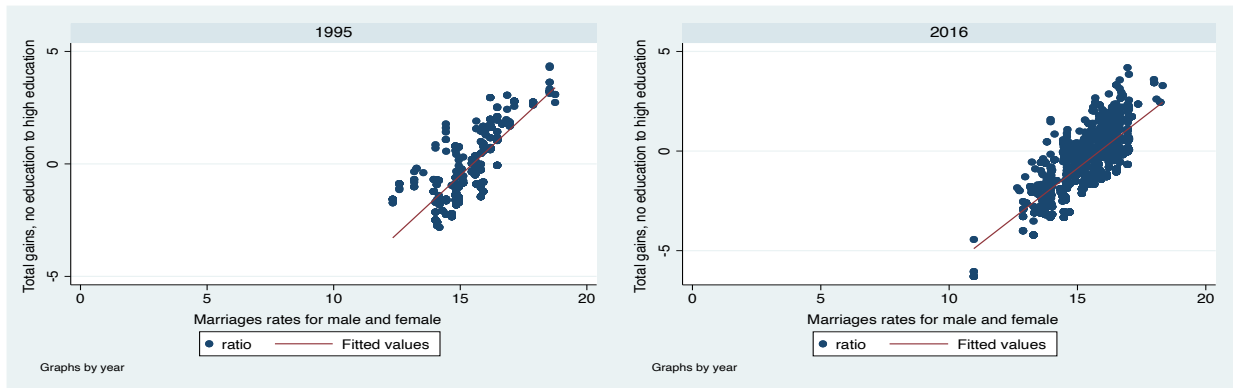


Figure 14: total gains female and male by age at first marriage, 1995 and 2016

Source: data collected from DHS