AGE AT FIRST MARRIAGE OF ALGERIAN WOMEN: SOCIO-ECONOMIC DETERMINANTS

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ABSTRACT

This article examines the effect of socio-economic factors (education, place of residence, region of woman and woman cohort) on age at first marriage among Algerian women and the relative effects between generations of women. The data used are drawn from the MICS-4 multiple indicator cluster survey in Algeria from 2012-2013. Survival models, especially Cox's proportional hazard model in addition to the multiple linear regression model, are used to analyze the data. The results show that education has a positive effect remains robust for almost all generations of women. Significant disparities are found in the place of residence and the woman's region, where urban women are found to be associated with a lower luck of marriage than rural women. In addition, early marriage is more marked among southern women, then women in the High Plateau and in the end, women of the North with some differences in terms of coefficient.

KEY WORDS

Age at first marriage, fertility, educational attainment, Cox model, linear regression

JEL CLASSIFICATION : J12

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السن عند الزواج الأول للمرأة الجزائرية: المحددات الاجتماعية والاقتصادية

ملخص

نتناول في هذا المقال تأثير العوامل الاجتماعية والاقتصادية (المستوى التعليمي، مكان الإقامة، المنطقة والجيل الذي تنتمي إليه المرأة) على السن عند الزواج الأول بين النساء الجزائريات والآثار النسبية بين أجيال النساء، البيانات المستخدمة في الدراسة مستمدّة من المسح العنقودي متعدد الأهداف MICS-4 في الجزائر من 2012–2013. تُستخدم نماذج البقاء على قيد الحياة وخاصة نموذج الخطر النسبي لكوكس، بالإضافة إلى نموذج الانحدار الخطي المتعدد لتحليل البيانات. أظهرت النتائج أن المستوى التعليمي للمرأة له تأثير إيجابي لا يزال قوياً لجميع أجيال النساء تقريبًا ومرتبط ارتباطا عكسيا بعمر المرأة عند الزواج. بيّنت الدراسة وجود تباينات كبيرة في العمر عند الزواج من حيث مكان الإقامة والمنطقة التي تنتمي إليها المرأة حيث وجد أن المرأة الحضرية ترتبط بانخفاض حظوظ الزواج من النساء الريفيات. بالإضافة إلى ذلك يتضح الزواج المبكر بشكل أكبر بين النساء في الجنوب، ثم النساء في الهضاب العليا ثم النساء في الشمال.

كلمات مفتاحية:

الخصوبة، العمر عند الزواج، نموذج كوكس، الانحدار الخطي، المستوى التعليمي.

تصنيف جال: J12

ÂGE AU PREMIER MARIAGE DES FEMMES ALGÉRIENNES

RÉSUMÉ

Cet article étudie l'effet des facteurs socioéconomiques (niveau d'instruction, lieu de résidence, région de résidence et cohorte de la femme) sur l'âge au premier mariage chez les femmes Algériennes ainsi que, les effets relatifs entre générations de femmes. Les données utilisées sont tirées de l'enquête à indicateurs multiples MICS-4 en Algérie de 2012-2013. Les modèles de survie et notamment le modèle à risque proportionnel de Cox en plus du modèle de régression linéaire multiple sont utilisés pour analyser les données. Les résultats montrent que l'éducation a un effet positif reste robuste chez presque toutes les générations de femmes. Des disparités significatives sont marquées pour le lieu de résidence et la région de la femme. Nous avons constaté que les femmes citadines ont une moindre chance de se marier par rapport aux rurales. De plus, le mariage précoce est plus marqué chez les femmes du sud, puis les femmes des Hauts-Plateaux et enfin les femmes du Nord.

MOTS CLÉS

Âge au premier mariage, fécondité, niveau d'instruction, modèle de Cox, régression linéaire

JEL CLASSIFICATION : J12

INTRODUCTION

Marriage is one of the most important social systems serving the equilibrium, cohesion and stability of society, governing social relations and saving the individual and society from many social ravages that would destroy and disintegrate the structure of society. However, despite the importance of marriage for the individual and for the community, cultural, social, economic and even political transformations have led to significant changes in the matrimonial system in terms of age, style of selection, celebration, accommodation, etc. The society itself is a group of individuals belonging to different families, of different sizes, but who share a common unit of consumption, production and exchange of different goods and services and thus constitute a coherent social system sharing the same culture, customs and traditions, religion and perception of social relations. In addition, in most societies, particularly Muslim ones, of which Algeria is a part, marriage defines the beginning of the childbearing period and the effective and legitimate entry into it. However, this change in marital status has evolved considerably from early to late marriage in most countries, so that women will, on average, have a shorter period of exposure to the risk of pregnancy, and then, less chance of having many children compared to young mothers.

As a result, age variation at first marriage becomes a key element in explaining fertility differences between populations and also helps to explain fertility trends within populations over time, as early marriage is associated with early pregnancy and a longer period of exposure to pregnancy risk, and late marriage. On the other hand, directly affects final fertility by reducing the number of years available for childbearing (Ministry of Health, Population and Hospital Reform (MSPRH), 2015).

Given the status of marriage and its importance to individuals and communities, it is surprising to note the lack of empirical studies on the determinants and factors influencing marriage in Algeria. Indeed, several researchers have carried out a range of studies, but most of them do not go beyond the descriptive framework of the phenomenon or are the subject of survey reports, but even so, they have identified a number of factors that appear to influence the timing of marriage (Ouadah-Bedidi n.d.; Ouadah-Bedidi, 2005; Hammouda, 2009). Based on a comprehensive documentation of available survey data, Jejeebhoy (1995) in a study concludes that contextual factors such as the overall level of socio-economic development and the position of women in traditional kinship structures complicate general assumptions about the reciprocal relationships between education, fertility and women's autonomy (Jejeebhoy, 1995). These and other findings are almost universally found in studies conducted elsewhere using different data sources, such as Kaufman and Meekers (1998), Nasra M. Shah (2004), Caldwell et al (1983) etc.

The effect of different socio-economic factors on the timing of marriage has not been sufficiently and conclusively studied in Algeria. In particular, the relative effects of education through generations of women in the light of the continuous evolution of schooling rates and educational levels of girls that exceed those of boys, as well as the transition from a homogeneous situation characterised by a predominantly rural and illiterate population to a more heterogeneous one characterised by massive urbanisation with a range of educational levels (Hammouda, 2009), have not been well measured, notably by sophisticated mathematical models. Therefore, this study fills the gap in the studies conducted for the Algerian case by relying on different parametric and semi-

parametric models, in particular the COX survival model and of course descriptive statistics. The study aims at measuring and/or establishing the effects of some factors indicated in the literature on the age of women at first marriage, the potential factors being the level of education, the place of residence, the territorial programming area (TPA) and the cohort of the woman.

The purpose of this paper is to study the effects of socio-economic factors: TPA, education level, place of residence and the woman's cohort on the woman's age at first marriage. In order to better understand the different links between these factors and women's age at first marriage, we will devote the first part to illustrating the possible theoretical links between the different variables by referring to previous work carried out on heterogeneous cases, notably in African countries. In the second part of this paper we present the main data resources with a short presentation of the selected variables, followed by a description of the mathematical tools (Cox model and linear regression models) that help us to measure the target effects. The results are presented, analysed and interpreted in a third part, followed by a discussion, and finally a general conclusion.

1- THEORETICAL LINKS BETWEEN SOCIO-ECONOMIC FACTORS AND AGE AT FIRST MARRIAGE

Knowing the main determinants of fertility reminds us of the theoretical framework developed by Davis and Blake (Davis and Blake, 1956) where they retained eleven variables divided into three headings, age at first marriage being one of these headings. These socio-economic, environmental and cultural variables were then adopted in demographic studies and included in various specialised surveys, namely the MICS surveys. The nature of the subject of our study necessitates a filtering of these variables by limiting ourselves to the age-at-marriage rubric variables, and given the constraint of data

availability, we have retained three variables, which are the level of education, TPA and place of residence, in addition to constructing a fourth that describes the woman's cohort. The following is a theoretical development of the different possible links between these variables and the dependent variable 'age at first marriage'.

1.1- Educational level and age at first marriage

Education can affect the timing of marriage in various ways. First, much of the research on the subject attempts to analyse causal, selective, or other mechanisms that might link education and fertility (Steiner, 2005; Johnson-Hanks, 2003). Cognitive theories suggest that education leads to a change in individuals values and perceptions of the world, as well as a change in women's perspectives, ideas and ways of thinking due to educational processes that transform women's mental structures (Johnson-Hanks, 2003; Rocheleau, 2009). In contrast, instrumental theories of change emphasise that education changes the objective conditions of decision-making. Both cognitive and instrumental models of change emphasise that education encourages women to want fewer children, but for different reasons in both cases.

Many case studies show an inverse correlation between education and fertility. In this context, the methodological framework introduced by Davis and Blake (1995) has made it possible to distinguish between different determinants of fertility, namely direct determinants or so-called intermediate variables, through which any influence on fertility is necessarily exercised, and indirect determinants or so-called explanatory or independent variables which refer to sociology, economics, politics, etc. and which, through their effects on fertility, have a direct impact on fertility.

In Africa, debates on the relationship between education and fertility add to a very rich body of research on fertility determinants

(Caldwell and Caldwell, 1987; Ouadah-Bedidi, n.d.; Addai and Trovato, 1999; Jonson-Hanks, 2003; Ikamari, 2005; Hammouda, 2009). In fact, a large body of empirical research supports the almost universal negative correlation between women's educational level and age at first marriage, with educated women marrying later and having fewer children than their less educated counterparts. Moreover, this link can be explained in various ways. Indeed, in Algeria, highly educated women spend at least 21 years learning about education and knowledge to reach a first university degree, and when they are enrolled in school or college, it is undesirable for them to marry because it disrupts the educational process (Thornton et al, 1995 ; Blossfeld et Huinink, 1991 ; Blossfeld et Jaenichen, 1992). Thus, school attendance broadens girls from the domestic environment and allows them to learn and experience new ideas and value systems that can compete with traditional customs, beliefs and values that favor early marriage and that mention instrumental change and cognitive theories (Westoff, 1992 ; Johnson-Hanks, 2003; Ikamari, 2005).

Otherwise, the development of values and aspirations gives priority and advantage to personal and career developments over traditional roles or early marriage. Consequently, marriage is likely to be delayed or postponed when it is incompatible with the achievement of personal goals and ambitions.

1.2- Ethnicity, religion and age at first marriage

Numerous cross-sectional studies in developing countries have shown that ethnicity has a significant effect on fertility behaviour, including the timing of family formation, and that ethnic differences in age at first marriage and in childbearing age have been widely observed (Caldwell, Reddy, and Caldwell, 1983; Caldwell and Caldwell, 1987; Beaujot, 1976; Booth, 2010; Johnson-Hanks, 2003; Ikamari, 2005). Thus, previous demographic studies dealing with the relationship between ethnicity, religion and fertility differentials have particularly relied on four so-called 'theories' hypotheses. In short, the minority group hypothesis is based on insecurity and the fact of being marginal associated with the status of minority group, have an

influence on fertility. The norms hypothesis, sometimes referred to as the 'particularised idiology theory', argues that fertility is influenced by the values, cultural norms and religious doctrines specific to the ethnic group. The characteristics hypothesis would fully explain ethnic differences in terms of the demographic and socio-economic attributes that characterise these subgroups (Goldscheider, 1971; Beaujot, 1976; Booth, 2010), while the interaction hypothesis explains ethnic differences in terms of socio-economic level and cultural or religious norms (Chamie, 1981; Booth, 2010).

In Algeria, the Arabs, Berbers and Tuaregs are considered the indigenous and autochthonous peoples, while the Greeks, Marranos, Byzantines and Vandals, followed by the Andalusians and Ottomans, are not autochthonous but expatriates. In modern (post-independence) Algeria, there was a great mixture of these peoples due to the spread of Islam, which renounced nepotism and tribalism, as well as the consolidation of opinions and efforts to expel French colonialism. With the establishment of a unified constitution by the Algerian Republic after independence, guaranteeing the equality of all without distinction of race and origin, differences were dissolved and lineages were mixed between the different races thanks to the unified religious affiliation that contributed to the fusion of ethnic differences. Therefore, the ethnic analysis in our study will be a little different, as differences and disappearances often stem from religion and ethnicity and race, and this is negligible and rare in our case, the ethnic aspect in our case tends towards a geographical aspect and will be based mainly on the division of the National Scheme of Land Planning (SNAT) approved in 2010. The SNAT identifies nine (09) Territorial Programming Areas (TPA). Each area, identified as a key space for strategic territorial planning, re-groups a set of wilayas with common topics in order to improve the efficiency of the action of the State, local authorities and social and economic actors (MSPRH, 2015).

The survey design based on "SNAT" is defined in the survey report prepared by the MSPRH (2015) as follows "At the level of the Tell: The Territorial Programming Area "North Center" includes 10 wilayas: Algiers, Blida, Boumerdès, Tipaza, Bouira, Médéa, Tizi-

Ouzou, Béjaïa, Chlef and Ain Defla. The "North East" Territorial Programming Area comprises 8 wilayas: Annaba, Constantine, Skikda, Jijel, Mila, Souk Ahras, El Taref and Guelma. The "North-West" Territorial Programming Area comprises 7 wilayas: Oran, Tlemcen, Mostaganem, Ain Témouchent, Relizane, Sidi Bel Abbés and Mascara. At the level of the High Plateau: The "Central High Plateau" Territorial Programming Area comprises 3 wilayas: Djel-fa, Laghouat and M'Sila. The "Eastern High Plateau" Territorial Programming Area comprises 6 wilayas: Sétif, Batna, Khenchela, Bordj Bou Arréridj, Oum El Bouaghi and Tébessa. The "Western High Plateau" Territorial Programming Area comprises 5 wilayas: Tiaret, Saïda, Tissemsilt, Naâma and El Bayadh. And finally, in the South: The "South-West" Territorial Programming Area comprises 3 wilayas: Béchar, Tindouf and Adrar. The "South East" Territorial Programming Area comprises 4 wilayas: Ghardaïa, Biskra, El Oued and Ouargla. The 'Grand Sud' Territorial Programming Area comprises 2 wilayas: Tamanrasset and Illizi' (MSPRH, 2015). It should be noted that these last three TPAs are considered as a single space named Territorial Programming of south.

Given that TPA was adopted as a variable deemed important in the study and which takes seven modalities reflecting as a whole the geographical space to which the women belong, but at the national level. Accordingly, we will include another variable reflecting the geographical space to which the woman belongs but at the local level; that is the place of residence whether rural or urban, because of the fundamental disparities between different values, customs and social norms. As well as the living and economic standards of families in rural and urban areas.

Algeria is a united country - mainly - in terms of religion, with Islam encompassing the majority of the population. The partial influence of Christianity and Judaism was eliminated after the Islamic conquest and Islam spread to become the only religion. Therefore, the variable 'religion' in our study is meaningless and will be neglected.

An underlying variable was introduced to the study and named "Cohort", the purpose of this variable is to examine the dynamics of Algerian women's behaviour towards marriage, this variable assumed

that it addresses cultural, economic, social and other non-quantifiable conditions such as the role of parents in marriage, prevailing social norms, media development and information dissemination, nature of life etc. Four cohorts of all women according to their date of birth are defined as follows: the cohort [1962-1969], this cohort includes women who were born during independence until 1969, this period is characterised by difficult living conditions, the prevalence of poverty and the dominance of colonial cultural heritage. Cohorts [1970-1979] and [1980-1989], although similar in some respects, are characterised by two different political and governmental regimes. Finally, the cohort [1990-1998], this cohort covers women who were born during the black decade.

We hypothesize that education has a positive significative effect on age at first marriage and that its effect has increased over time. We also assume heterogeneity between the different territorial programming areas in terms of age at first marriage, as well as a difference in the chances of early marriage in favour of rural women compared to urban women. Furthermore, we hypothesise that younger generations of women are less likely to enter into early marriages than older generations.

2- DATA AND METHODS

The data for this study are mainly drawn from the MICS-4 Multi-indicator Cluster Survey in 2012/2013, the MICS is a specialised survey of demographic, health and marriage issues and contains six blocks of questions of which the block for women aged 15-49 is exploited. In this paper, the dependent variable is the age of the woman at first marriage, which is measured in terms of years completed during the MICS-4 survey, the selected women constitute a sample of over 49 thousand and are asked a series of questions about their marital status, women reporting a non-single marital status (married, widowed, divorced or separated) are asked to indicate their age at the time they started living with a man as a wife (assuming reliability of reporting). This measure is interpreted as the time in years spent in celibacy before the occurrence of an event, in this case

marriage. Each woman, during her lifetime, may or may not have married; women who are single during the survey are censored cases. Censored cases require special treatment to estimate the time of exposure to marriage and therefore ordinary regression procedures are limited and inappropriate for handling this type of dataset, but survival models and in particular the general Cox semi-parametric proportional hazard model seem most appropriate for assessing the effect of covariates on the timing of marriage (Lin, 1994; Machin, Cheung and Parmar, 2006; Elandt-Johnson and Johnson, 2014). The model is usually described as:

$$h(t, X_1, \dots, X_n) = h_0(\mathrm{t}).\exp(b_1 X_1, \dots, b_n X_n)$$

Where h(t ,,,) denotes the resulting risk, given the values of the n covariates for the respective case $(X_1, X_2, \dots, X_n)$ and the respective survival time (t). The term $h_0(t)$ is called the baseline risk; it is the risk for the respective individual when the values of all covariates are equal to zero. The use of Cox regression in the study of demographic processes such as marriage is quite common in the literature.

The use of the Cox model allows us not to specify the risk function, the relationship between the risk rate and the duration of exposure to risk, which is often difficult to specify at the outset. The proportional hazard model assumes that the hazard function for an individual depends on the values of the covariates and the value of the reference hazard. Therefore, given two individuals, say two women, with particular values for the covariates, the ratio of estimated risks over time will be constant. In this study, this proportionality assumption was examined statistically by plotting log minus log (LML) over time and it was not violated.

The hazard rate is the key concept in the proportional hazards model. The hazard rate measures the risk of moving from the absence to the presence of an event, for example from being

single to being married. The hazard rate is essentially a transition rate. The rate is measured by the ratio of the number of cases experiencing the event at time t to the total number of cases at risk of experiencing the event at time t. In this paper, a lower risk rate implies a longer waiting period for the event to occur, i.e. older ages at first marriage. Thus, the coefficients of the covariates will be exponentiated and interpreted as hazard ratios.

We present the results as hazard ratios, which represent the relative probability of a woman with a specific characteristic to marry compared to another who would be in the appropriate reference group. The risk ratio of the reference group or category is "one" (1.00). If the hazard ratio of a given category is greater than 1.00, it indicates a greater risk of marriage, and when the hazard ratio is less than 1.00, it indicates a lower risk of marriage compared to the reference group. In this analysis, a variable will be considered to have a significant effect if its effect on the timing of marriage is statistically significant at least at the 5% significance level.

In order to quantify the effects of the explanatory variables on the woman's age at first marriage, a separate analysis is carried out for already married women. In this analysis, a linear regression model is used, and the dependent variable is age at first marriage as reported by the already married women during the survey. The model is written as:

$$y = b_0 + b_1 X_1 + \cdots + b_k X_k + \varepsilon$$

With, y: the age of the woman at first marriage and the Xs are the recoded explanatory variables. The coefficients will be interpreted as the deviation of the conditional mean of the variable from the unweighted mean of the conditional means.

In addition, descriptive statistics allowed us to extract other information such as the probability of marrying, by detailed age

and/or age group, the mean age, and the median age at first marriage for each socio-economic subgroup.

All other explanatory variables used in this study (educational level, stratum background, cohort and TPA) are dummy variables, Table 1 summarizes the modalities of each variable by giving the percentage distribution in the population and according to the cohort variable.

Table 1: Percentage distributions of socio-economic subgroups, overall and by cohort (%).

Covariates	All sample	[1962,1969]	[1970,1979]	[1980,1989]	[1990,1998]
Women's education level					
No education	16,8	39,1	24,5	12,5	3,9
Primary	14,6	23,8	17,9	14,5	7,4
Middle	27,5	18,8	25,0	28,8	32,6
Secondary	26,1	14,6	24,2	20,7	40,3
Higher	15,0	3,8	8,4	23,6	15,9
Women's place of residence					
Urban	67,8	71,3	68,8	66,1	67,4
Rural	32,2	28,7	31,2	33,9	32,6
Women's cohort					
[1962,1969]	13,5	/	/	/	/
[1970,1979]	25,5	/	/	/	/
[1980,1989]	33,7	/	/	/	/
[1990,1998]	27,3	/	/	/	/
Women's territorial area					
North Center	12,9	15,2	14,9	12,3	10,7
North East	13,2	13,6	13,8	13,7	12,0
North West	14,0	14,9	14,1	13,7	13,6
High Plateau - Center	14,6	12,9	13,4	14,9	16,3
High Plateau - East	14,1	13,3	14,1	13,9	14,8
High Plateau - West	15,7	15,3	15,8	15,8	15,9
South	15,4	14,9	14,0	15,7	16,6

Source: MICS-4 data.

3- RESULTS AND DISCUSSION

3.1- Survival analysis

The descriptive statistical analysis (Table 2) revealed significant differences in both the mean and median age at first

marriage, and stratification of women in terms of their education levels showed a clear variation in behavior. As a result, the age of the woman during the formation of the family has a direct relationship with the educational level of the woman (The more educated she is, the later her marriage will be), we find that the median age among women with no education is 22 years, 24, 25 and 26 years for those with primary, medium and secondary education, respectively and over 30 years for those with at least a higher level of education with an age gap of almost 8 years between the most educated and the least educated.

Table 2: Mean age, median age at first marriage.

Covariates	Mean			Median		
	Estimation	95% confidence interval		Estimation	95% confidence interval	
Women's education level						
No education	25,6	25,4	25,9	22,0	21,8	22,2
Primary	28,0	27,6	28,3	24,0	23,7	24,3
Medium	28,4	28,2	28,7	25,0	24,8	25,2
Secondary	30,0	29,7	30,3	26,0	25,8	26,2
Higher	34,2	33,6	34,7	30,0	29,5	30,5
Women's place of residence						
Urban	29,5	29,3	29,7	26,0	25,8	26,2
Rural	28,5	28,2	28,7	25,0	24,8	25,2
Women's territorial area						
North Center	29,5	29,1	29,8	26,0	25,7	26,3
North East	31,9	31,5	32,3	28,0	27,6	28,4
North West	29,6	29,2	29,9	26,0	25,6	26,4
High Plateau - Center	27,7	27,3	28,1	24,0	23,7	24,3
High Plateau - East	28,5	28,1	28,9	25,0	24,7	25,3
High Plateau - West	29,1	28,7	29,4	25,0	24,7	25,3
South	28,4	28,0	28,8	24,0	23,7	24,3

Source: MICS-4 data.

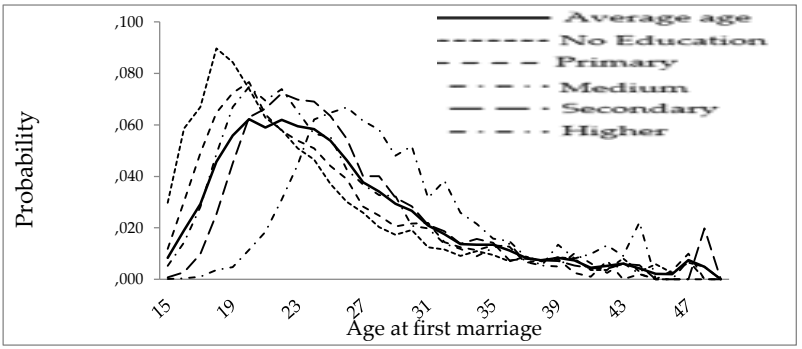
The difference in age at first marriage between urban and rural women is quite modest (Ouadah-Bedidi n.d.), in terms of

numbers, half of rural women marry at an age of less than 25 years compared to 26 years for urban women, in other words, rural women marry a little earlier than their urban counterparts. In addition to this, the behavior of Algerian women is quite different, as there are differences according to the place of residence, there are also obvious disparities between the different territorial programming areas. According to "Table 2", family formation in the Central High Plateau is earlier than in the North and the Eastern and Western High Plateau, and thus slightly earlier than in the South, while women in the North East are the most delayed in terms of age at first marriage, where it is estimated to be around 32 years; followed by women in the North Center, North West and Western High Plateau with an average age of over 29 years, with slight differences, while women in the Eastern High Plateau and the South follow them with an average age of 28. 5 and 28.4, respectively. In terms of numbers, half of the women in the Central and Southern High Plateau marry at an age of less than 24 years, compared to 25 years for women in the Eastern and Western High Plateau, 26 years for the North Center, North and West High Plateau and 28 years as the age at first marriage for half of the women in the North East.

Figures 1 to 3 give the probabilities of marrying by detailed age and socio-economic class of all women in the sample, the most important conclusion drawn from these figures is that ages between 20 and 25 are the most likely ages to marry (a probability of more than 0.5) with some exceptions. Figure 1 on the probability of marrying according to education level shows important differences in terms of probability, revealing that the modal age is 18 years for uneducated women, 20 years for primary and middle school students, 22 years for secondary school students and 26 years for the most educated. The

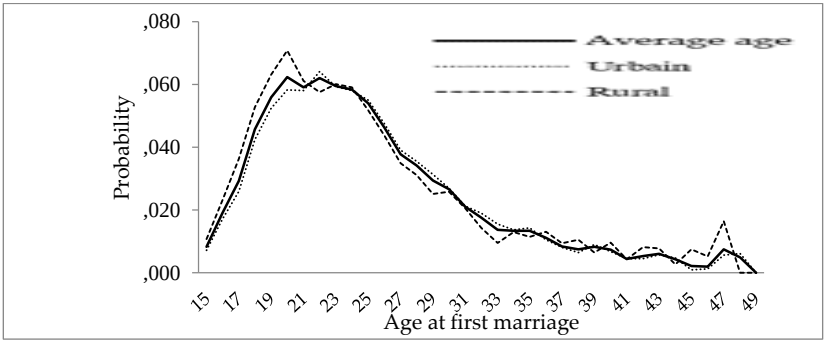
precociousness is thus remarkable among rural women compared to urban women, 20 years as the modal age in the company compared to 22 years in the city (Figure 2). Similarly (Figure 3), the most likely age of marriage is 20 years for women in the North West, High Plateau - West and High Plateau - Center; 19 years in the South; 22, 23 and 24 in the High Plateau - East, North Center and North East, respectively.

Figure 1: Probability of getting married by age according to the women's education level.



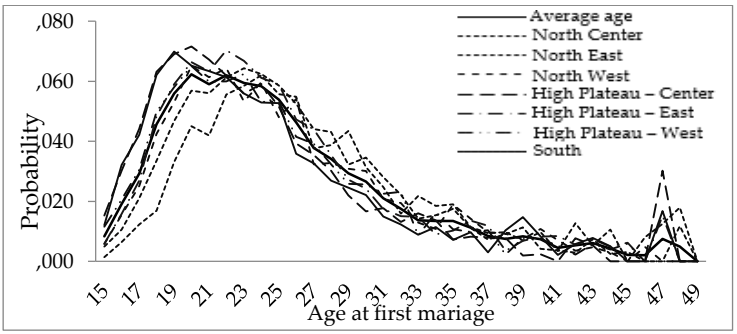
Source: MICS-4 data..

Figure 2: Probability of getting married by age according to the women's place of residence



Source: MICS-4 data..

Figure 3: Probability of getting married by age according to the women's territorial area.



Source: MICS-4 data.

Figures 4 to 7 represent the cumulative probabilities of women having experienced marriage according to different socio-economic factors. In Figure 4, it is amply found that the cumulative probability of reaching the first marriage was highest among women with no education, followed by women with primary and medium education, then women with secondary education and finally the most educated women. For example, at the exact ages of 25 and 49: 28% and 53%, respectively of uneducated women were already married; 45% and 74%, respectively of women with secondary education were already married; 52% and 82%, respectively of women with primary and medium education were in their first marriage, while 58% of uneducated women at the age of 25 were in their first marriage compared to 91% of uneducated women who had completed their fertile life. A similar trend is noted for all women in different territorial planning areas (Figure 5) but with modest variations according to the level of education; between 66% and 84% of women were married by the time of menopause. The same remarks (Figure 6) apply to the cohort variable where the

generation effect is significant. Figure 7 shows the residence variable where this variable is not significant.

Figure 4: Cumulative probability of age at first marriage by education level.

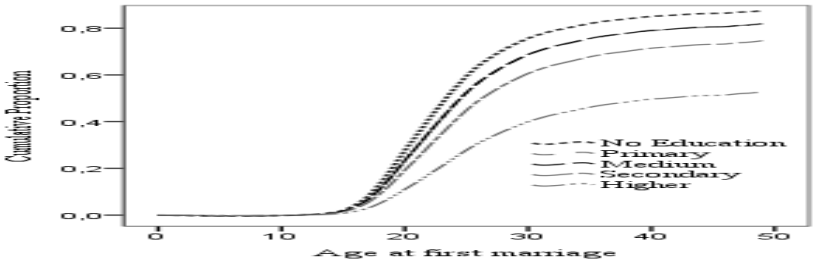
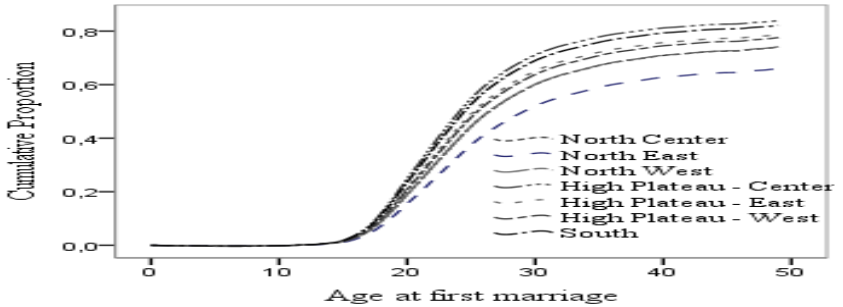
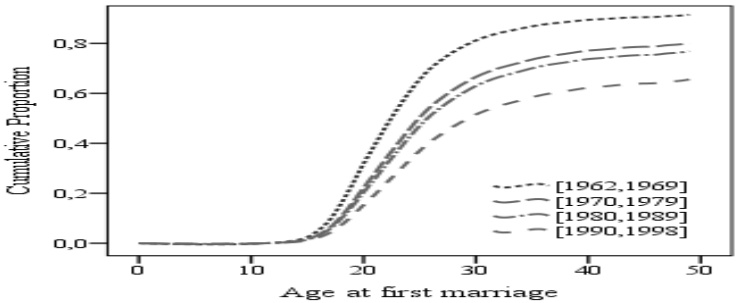


Figure 5: Cumulative probability of age at first marriage by territorial space



Source: Cox model estimation results, MICS-4 data.

Figure 6: Cumulative Probability of Age at First Marriage by Women's Cohort



Source: Cox model estimation results, MICS-4 data.

Figure 7: Cumulative probability of age at first marriage by place of residence.

Source: Cox model estimation results, MICS-4 data.

The results obtained by fitting the Cox models using the pooled sample are presented in Table 4. Four models are estimated with a full model including all variables, model 1 shows the results obtained when the woman's education level was the only explanatory variable, model 2 contains only the place of residence variable while model 3 and model 4 include the cohort and TPA variables, respectively. The last column of the table gives the estimation results of the full model. As indicated by the associated log-likelihood and chi-square (Table 03), all models are statistically significant. Therefore, all selected variables have a statistically significant effect on age at first marriage.

Table 3: Model's specification tests

Models	-2log-likeli-hood	Global (note)			Change from previous block		
		chi-square	df	Sig	chi-square	df	Sig
Model 1	390818,6	2209,7	4	,000	2386,5	4	,000
Model 2	393137,2	69,0	1	,000	67,9	1	,000
Model 3	391739,4	1593,0	3	,000	1465,7	3	,000
Model 4	392716,3	473,7	6	,000	488,8	6	,000
Full Model	389554,1	3576,8	14	,000	3651,1	14	,000

Source: Cox model estimation results, MICS-4 data.

In the full model (Table 4), there is a slight improvement in the effects of all variables on age at first marriage. According to the results, education is significantly associated with age at first marriage.

By setting the "higher" education level as the reference, the risk of marrying remains inversely proportional to the education level, i.e. each time the woman's education level improves the risk of marrying decreases. Compared to model 1, the full model brings a slight improvement in the effect of education on age at first marriage, the risk of first marriage was 18% lower for women with primary or medium education, 33% lower for women with secondary education compared to women who never attended school, the risk was 64% lower for those with higher education. This indicates that the effect of education is robust and significant in explaining age at first marriage.

Similarly, the territorial programming area is significantly associated with the risk of first marriage. Compared to women in the South, only women in the High Plateau - Center region have the same risk of marrying those in the South, while women in the two regions High Plateau - East and High Plateau - West have an almost similar behavior but run a lower risk of marrying than those in the South (-10.1 % and -13.2%). On the other hand, women in the North West, North Center and North East regions are respectively 11.5%, 11.7% and 37.3% less likely to marry than their southern counterparts. As a result, age at first marriage is lowest in the South, followed by the High plateau and the North. Model 2 shows that rural residence is associated with a slightly higher risk of first marriage, with rural women being 0.13 times more likely than urban women to enter into a first marriage, although this effect appears to be negligible in the overall model.

Table 4: Parameter estimation (Cox model)

	Model 1	Model 2	Model 3	Model 4	Full Model
Women's education level		/	/	/	
No education	1,00				1,00
Primary	,777***				,821***
Medium	,717***				,823***
Secondary	,577***				,660***
Higher	,296***				,361***
Women's place of residence			/	/	
Urban	/	1,00			1,00

Rural		1,133***			1,008*
Women's Cohort					
[1962-1969]			1,00		1,00
[1970,1979]	/	/	,628***	/	,656***
[1980,1989]			,519***		,595***
[1990,1998]			,355***		,433***
Women's territorial area		/	/		
North Center				1,00	1,00
North East				,770***	,801***
North West				1,018*	1,002*
High Plateau – Center	/			1,317***	1,354***
High Plateau – East				1,131***	1,148***
High Plateau – West				1,095***	1,108***
South				1,230***	1,277***

*Notes : signification : *** p<0.01, ** p<0.05, *p<0.1. na p>0.1.*

Source: Cox model estimation results, MICS-4 data.

As hypothesized earlier, year of birth is significantly associated with early marriage. Women from older generations were more likely to marry earlier than those born more recently, indicating that the probability of early marriage is decreasing. For example, women born between 1962 and 1969 were 2,308 times more likely than those born between 1990 and 1998 to marry early, and women born between 1970 and 1979 were 1.514 times more likely to marry early than women born between 1990 and 1998. At the same time, women in the [1980, 1989] cohort were 1,373 times more likely to marry early compared to women in the [1990, 1998] generation. These results indicate a downward trend in early marriage in Algeria.

Table 5 presents the estimation results of the Cox model on each of the four cohorts of women. According to these results, education is significantly associated with the time of marriage, maintaining the same inverse proportionality between education and age at first marriage. Moreover, women with higher education are associated with a lower probability of early marriage than their counterparts who have never attended school. However, this disparity is most noticeable in the youngest cohorts, where the risk of entering into a first marriage is about 95% lower for women with higher education than for women with no education. Otherwise, place of residence is

significant only for the oldest cohort, where the risk of early marriage is 10% higher for rural women than for urban women.

Table 5: Estimation of the Cox Cohort Model.

	[1962-1969]	[1970-1979]	[1980-1989]	[1990-1998]	Full Model
Women's education level					
No education	1,00	1,00	1,00	1,00	1,00
Primary	,769***	,810***	,932**	,869	,821***
Medium	,713***	,836***	,969	,560***	,823***
Secondary	,571***	,694***	,854***	,245***	,660***
Higher	,475***	,499***	,380***	,052***	,361***
Women's place of residence					
Urban	1,00	1,00	1,00	1,00	1,00
Rural	1,107***	,953*	1,012	,930	1,008*
Women's territorial area					
North Center	1,00	1,00	1,00	1,00	1,00
North East	,873**	,803***	,780***	,454	,801***
North Western	1,039	,919*	1,020	1,236*	1,002*
High Plateau – Center	1,747***	1,341***	1,200***	,978	1,354***
High Plateau – East	1,164***	1,086*	1,163***	1,229	1,148***
High Plateau – West	1,258***	1,061	1,020	1,209	1,108***
South	1,470***	1,170***	1,215***	1,298**	1,277***

*Notes : signification : *** p<0.01, ** p<0.05, *p<0.1. na p>0.1.*

Source: Cox cohort estimation results, MICS-4 data.

3.2- Multivariate analysis based on previously married women

Table 6 presents the results of a multiple link regression analysis of 20152 previously married women covered in the survey. Four models are estimated, each of which represents a cohort with a full model on the whole data set. These results clearly show that education has a significant positive effect on age at first marriage, with the results of the full model implying that, compared to women with no education, primary education delays marriage by about two-thirds of a year, while middle school delays a woman's first marriage by 0.91 years, while secondary and tertiary education delays marriage by 2 and 3.76 years, respectively. The effects of education are more pronounced for the older cohorts than for the younger cohorts.

Table 6. Estimation of the multiple linear regression model

Variables	Linear regression models				
	[1962-1969]	[1970-1979]	[1980-1989]	[1990-1998]	Full Model
Constant	21,695***	22,915***	22,602***	18,779***	22,366***
Women's education level					
Primary	1,173***	1,010***	,021	-,138	,668***
Medium	1,847***	1,640***	,160	,303*	,909***
Secondary	3,445***	2,742***	,889***	,926***	2,080***
Higher	5,673***	5,011***	2,586***	1,695***	3,760***
Women's place of residence					
Urban	,265	-,094	-,047	-,126	,213***
Women's territorial area					
North Center					
North East	1,114***	,236	-,009	,154	,406***
North Western	-,181	-,253	-,536***	-,308	-,572***
High Plateau – Center	-1,470***	-,880***	-,418***	-,201	-1,042***
High Plateau – East	-,273	-1,091***	-,801***	-,190	-1,004***
High Plateau – West	-2,861***	-2,039***	-1,357***	-,270	-2,142***
South	-2,273***	-2,008***	-1,499***	-,988***	-2,126***

Notes : signification : *** p<0.01, ** p<0.05, *p<0.1, na p>0.1.

Source: Primary analysis of MICS-4 data.

Similarly, the territorial area of the woman has a significant effect on the age at first marriage, hence, its effect becomes more and more significant as we move from north to south, the results suggest that, compared to women in North Center only women in North East have a significant positive effect on the timing of family formation, i.e. a woman in North East is associated with a delay of 0.4 years compared to one in North Center , while a woman in North West is about 0.57 years earlier to contract a first marriage than one in North Center . i.e. a woman from the North East is associated with a delay of 0.4 years compared to a woman from the North Center, while a woman from the North West is about 0.57 years earlier to contract a first marriage. Thus, in the High Plateau, the East and West are associated with an early marriage of about one year, while the Center is 2.14 years earlier than the North Center. Finally, the South is identical to the High Plateau - Center and associated with an earlier marriage age of 2.12 years compared to the North Center. Moreover, the effects are thus more

pronounced for the first three cohorts than for the last cohort. Residence is only significant in the aggregate model where urban women are about 0.21 years later at first marriage compared to rural women.

3.3- Discussion of the results

The mathematical analysis of the data led us to important results on the relationships between the different variables selected and the age of the woman at first marriage, where most of the results were in line with the theoretical analysis in the first part of the paper. This confirms the results obtained in previous studies on some African countries and in other countries (Caldwell and Caldwell, 1987; Addai and Trovato, 1999; Ikamari, 2005; Johnson-Hanks, 2003; Oppenheimer, 1988). Educated women are the latest to marry compared to less educated women, which corroborates what was discussed in the first part of the paper. In addition, the distribution of age at first marriage by level of education corresponds to that of fertility rates by level of education (MSPRH, 2015; Hammouda, 2009; Ouadah-Bedidi, nd). Thus, the proportionality relationships between the different levels of education are found to be constant over the four cohorts, which means that the effect of the level of education and age at first marriage is persistently significant.

TPA also yielded significant results in terms of explaining the variation in age at first marriage, with women from the south being the prime married women with women from the High Plateau - center, followed by women from the eastern and western High Plateau with a slight difference, then the North, West, and center High Plateau with also a slight difference in favor of the northwest. Finally, women in the North East are later to marry. These results confirm the periodic reports issued by the specialized institutions following the MICS surveys and censuses. On the other hand, they explain variations in fertility rates by territorial area, from which we find the same pattern between fertility rates and age at first marriage (MSPRH, 2015; Hammouda, 2009; Ouadah-Bedidi, n.d.).

According to the results, place of residence is found to be weakly associated with the time of first marriage, but its relative effect varies

between the four cohorts, suggesting that the effect is only significant for the older cohorts, which means that the variations in terms of age at first marriage narrow over time. Although these results are not entirely consistent with previous studies, this may be explained by the cultural and societal rapprochement between rural and urban areas in Algeria and the effectiveness of the rural promotion policies implemented by successive governments since independence. Finally, the results indicate that younger women are less likely to marry early than older women, indicating a downward trend in early marriage in the country.

CONCLUSION

This paper investigates the effect of socio-economic variables on age at first marriage among Algerian women and the relative effects between generations of women. The article is based on the use of Cox and multiple linear regression models applied to data from the 2012-2013 Algerian MICS-4 multi objective cluster survey. The results obtained clearly showed that education has a statistically significant lag effect on the timing of family formation. The risk of contracting a first marriage is very high for uneducated women and decreases as the level of education increases, compared to illiterate women, the risk of first marriage was 18% lower for women with primary or medium education, 34% and 64% lower for secondary and higher education, respectively. In all four female cohorts, educated women are more likely to delay marriage, so significant differences between education levels across generations are evident. The effects are more significant for older cohorts while the disparities are more pronounced for younger women, indicating an increase in delayed marriage. Results from a multiple linear regression model based on already married women also indicated that education has a significant positive effect on age at first marriage. It was found that, compared to the no education level, primary and middle school delayed marriage by 0.66 and 0.9 years, respectively while secondary and higher education delayed marriage by 2 and 3.76 years, respectively. In addition, women's place of residence is weakly associated with the timing of

first marriage, hence, the median age at first marriage for rural women is slightly lower than for urban women (25 years vs. 26 years), this difference only appears in a Cox model when place of residence was the only variable found that urban women are 13% less likely to marry for the first time compared to their rural counterparts, on the other hand, urban residence postpones marriage by at least 0. 2 years compared to rural residence according to the results of the linear regression model. These results confirm those reported earlier in the literature that the woman's level of education and her environment are important determinants of age at first marriage in Algeria.

The territorial area to which the woman belongs is also significant and associated with the time of first marriage. It should be recalled that, on the one hand, Algeria is globally mono-ethnic and there are races but with low representation such as the Kabyle and the Tuareg people. On the other hand, it is forbidden by law to ask citizens about their race, therefore the territorial area has just been proxy for the 'ethnicity' variable as it reflects the geographical space to which the woman belongs as discussed earlier in the literature. The results in 'Table 2' indicate clear differences in terms of age at first marriage. It was found that the median age at first marriage is lowest in the South and Center High Plateau (24 years), followed by the East and West (25 years), then the North Center and North West (26 years), and finally the North East at 28 years.

Furthermore, the Cox model results show that, compared to the North Center TPA, women in the North East are 20% less likely to marry for the first time, while the Center High Plateau, East and West are 35%, 14% and 10% more likely to marry early, and finally, women in the South are 27% more likely to marry early. However, the effect of TPA is found to be relatively significant, especially for the older cohorts with small variations in the proportions.

Moreover, the linear regression model suggests that, compared to North Center region, only women from the North East are more likely to delay marriage by 0.4 years while a woman from the North West is 0.57 years earlier to contract a first marriage, one year earlier in favor of women from the Eastern and Western High Plateau, more than two

years earlier in favor of women from the South and Central High Plateau.

Overall, this study of the Algerian case has shown that the variables: territorial programming area, level of education and place of residence are determinants of a woman's age at first marriage, but it is important to note that the Algerian case is only a simple model of the various models that have appeared in the literature on the subject. This is reflected in the fact that there are variables that have not been taken into account due to the specificity of Algerian society, such as religion, race and premarital sexuality etc., which cannot be included in the Algerian model of unity of religion and non-propagation of premarital sexual practices on the one hand, as well as the impossibility of obtaining information on this subject, such as race and ethnicity.

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