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AFRICAN ECONOMIC RESEARCH CONSORTIUM  
*Consortium pour la Recherche Économique en Afrique*

## EDUCATION, FAMILY FORMATION, AND FEMALE LABOUR MARKET PARTICIPATION IN CAMEROON

*Thesis submitted to the Faculty of Economics and Management in partial  
fulfillment of the requirements for the award of the Doctor of Philosophy (PhD)  
degree in Economics*

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January 2021

# Vindication

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*Neither The University of Yaoundé II-Soa, nor The African Economic Research Consortium (AERC) - Nairobi, is responsible for opinions in this dissertation.*

*They are to be considered as coming from the author.*

*I thereby*

*Confirm that this thesis is my original work, which has not been presented for a degree in any University. Also, information cited in this thesis has been properly acknowledged.*

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*This PhD thesis has been submitted for examination with my approval as  
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Date: 20/01/2021

**Glory belongs to God Almighty and to His Holy Spirit who accompanied me throughout the writing of this dissertation!**

Indeed,

*“I can do everything through Christ who strengthens me. Because without Him, I cannot do anything”*

(Taken from the Bible, Philippians 3/13; John 15/5b)

# Dedication

---

To:

*Louis KENGNE,*  
My God-given gift of a husband and best friend,

*Danielle KENGNE and Godson KENGNE,*  
My two blessings,

And  
*NEMBOT and Natassia KUIGUI,*

*Mr. and Mrs. FOTSING,*  
My lovely parents.

You all dared me to dream big and placed the foundational blocks to make this  
dream happen.

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# Abstract

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*The aim of this thesis is to investigate the effect of education on family formation and the ensuing effects on female employment in Cameroon, using individual and household records of the 2011 Cameroon Demographic and Health Survey (DHS). Specifically, the thesis seeks: to examine the influence of education on the timing of first marriage, to assess the effect of education on the timing of first birth, and to explore how transition into marriage and birth modulate the effect of education on female full-time employment in Cameroon. To achieve these objectives, we appeal to theoretical and empirical tools. Becker's model of time allocation provides the theoretical underpinnings on how with respect to education, a woman chooses between forming a family, working or both. Empirically, use is made of the survival analysis, the two-stage residual inclusion (2SRI) approach, the Heckman two-step correction for selection bias, the simple and ordered Probit models, and the control function modeling strategy. Results reveal that education delays women's age at first marriage. Education also induces women to postpone their age at first birth; and these delays increase monotonically with level of education. Yet, only wives with post-primary education postponed their age at first birth compared to their counterparts with no education. In addition, while delaying age at first marriage and age at first birth by a year encourages women to reduce their likelihood of participating in full-time employment, education induces women to increase their probability of participating in full-time work. Yet, transition into first marriage and first birth reduces the marginal efficiency of education on women's full-time employment, except if they choose to postpone their age at first marriage and age at first birth by up to 11 and 12 years, respectively. These findings have public policy implications. For instance, besides public interventions that encourage the girl child to stay longer in school, policy interventions could equality create an enabling environment that reconciles work and family formation. Such interventions may include the popularization of daycare centers and universal paid maternity leave.*

**Keywords:** education, age at first marriage, age at first birth, female employment, DHS survey, Cameroon

*L'objectif de cette étude est d'investiguer l'effet de l'éducation sur la constitution de la famille et de leur effet résultant sur l'emploi des femmes au Cameroun, en utilisant les données récoltées en 2011 auprès des individus et ménages lors de l'Enquête Démographique et de la Santé. En particulier, il s'agit d'examiner l'influence de l'éducation sur le timing du premier mariage, de l'effet de l'éducation sur le timing du premier accouchement, et enfin, comment la transition au mariage et l'accouchement affectent l'effet de l'éducation sur le travail des femmes au Cameroun. Pour atteindre ces objectifs, nous avons utilisé une approche théorique et empirique. Le modèle d'allocation du temps de Becker fourni une fondation théorique sur comment une femme selon son niveau d'étude choisit de former une famille, de travailler ou de faire les deux. Empiriquement, des modèles et techniques d'estimation appropriés tels que le modèle de survie pour les événements transitoires, 2SRI pour le biais d'endogénéité dans les modèles non linéaire et de survie, la procédure en deux étapes de correction du biais de sélection de Heckman, les modèles Probit simple et ordonné et l'approche par la fonction de contrôle ont été utilisés. Les résultats révèlent que l'éducation retarde l'âge au premier mariage. L'éducation encourage également les femmes à repousser leur âge au premier accouchement ; et ces retards augmentent de façon monotone avec le niveau d'étude. Toutefois, seules les femmes mariées avec au moins un niveau secondaire repoussent leur âge au premier accouchement comparativement à celles qui n'ont aucune éducation. De plus, tandis que repousser l'âge au premier mariage et l'âge au premier accouchement d'une année induit les femmes à réduire leur probabilité de travail à temps plein, l'éducation les encourage à augmenter leur probabilité de travail à temps plein. Cependant, l'entrée au premier mariage et au premier accouchement réduit l'efficacité marginale de l'éducation sur le travail à temps plein des femmes, sauf si celles-ci décident de retarder leur âge au premier mariage et âge au premier accouchement d'au moins 11 et 12 ans respectivement. Ces résultats aboutissent à des implications de politiques publiques. Par exemple, outre les interventions publiques qui encouragent la fille à rester plus longtemps à l'école, les politiques d'interventions pourraient également créer un environnement convivial qui concilie travail et constitution de la famille. De telles interventions peuvent inclure la vulgarisation des centres agréés de garderies (crèches) et la rémunération universelle des congés de maternité.*

**Mots clés:** éducation, âge au premier mariage, âge au premier accouchement, travail des femmes, enquête DHS, Cameroun

# List of Abbreviations and Acronyms

---

|                  |   |
|------------------|---|
| <b>2SPS:</b>     | Two-Stage Predictor Substitution  |
| <b>2SRI:</b>     | Two-Stage Residual Inclusion  |
| <b>AERC:</b>     | African Economic Research Consortium                                    |
| <b>CFA:</b>      | Control Function Approach   |
| <b>CPS:</b>      | Current Population Surveys  |
| <b>CHCS:</b>     | Cameroon Household Consumption Survey                                   |
| <b>EFA:</b>      | Education for All   |
| <b>EPAM:</b>     | Enquête Permanente Auprès des Ménages                                   |
| <b>EESI :</b>    | Enquête sur l'Emploi et le Secteur Informel                             |
| <b>FCFA:</b>     | Franc de la Communauté Financière Africaine (Central African CFA Franc) |
| <b>FDT:</b>      | First Transition Theory   |
| <b>GGs:</b>      | Generations and Gender Survey   |
| <b>HDR:</b>      | Human Development Ratio   |
| <b>HIV:</b>      | Human Immune Virus  |
| <b>ICRW:</b>     | International Center for Research on Women                              |
| <b>IIA:</b>      | Independence of Irrelevant Alternatives                                 |
| <b>ILO:</b>      | International Labour Organization                                       |
| <b>IMF:</b>      | International Monetary Funds  |
| <b>IMR:</b>      | Inverse of Mills Ratio  |
| <b>ISCED:</b>    | International Standard Classification of Education                      |
| <b>IV:</b>       | Instrumental Variable   |
| <b>MDG:</b>      | Millennium Development Goals  |
| <b>MICS/DHS:</b> | Multiple Indicator Cluster Survey/Demographic and Health Survey         |
| <b>NFFF:</b>     | Micro Projet Productifs en Faveur des Femmes                            |
| <b>NHE:</b>      | New Home (Household) Economics  |

|                |  |
|----------------|--|
| <b>NIS:</b>    | National Institute of Statistics                                 |
| <b>OECD:</b>   | Organization for Economic Co-operative and Development           |
| <b>OLS:</b>    | Ordinary Least Squares   |
| <b>SDT:</b>    | Second Demographic Theory  |
| <b>SEIS2:</b>  | Second Survey on Employment and the Informal Sector              |
| <b>SSA:</b>    | Sub Saharan Africa   |
| <b>TVET:</b>   | Technical and Vocational Education and Training                  |
| <b>UN:</b>     | United Nations   |
| <b>UNDP:</b>   | United Nations Development Program                               |
| <b>UNPD:</b>   | United Nations for Population Development                        |
| <b>UNESCO:</b> | United Nations Educational, Scientific and Cultural Organization |
| <b>UNFPA:</b>  | United Nations Population Fund                                   |
| <b>UNICEF:</b> | United Nations Children's Funds                                  |
| <b>WB:</b>     | World Bank   |
| <b>WDR:</b>    | World Development Report   |
| <b>WIDER:</b>  | World Institute of Development Research                          |

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# General Introduction

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## I.1 Background of the thesis

Two important recent trends in almost all countries have been the increase in female education and their tendency to combine work outside home (labour market) and family responsibilities. Of course, it is the investment in education which determines women's engagement in economic activities and shapes their preferences toward family formation (Sikot, 2007; Chioda, 2011).

Women's education plays an important role in economic development. Female education yields several returns both in and outside the household (Chiappori et al., 2009). Viewed as the major investment in human assets (Machlup, 1982), education is the act of teaching, training and nourishing someone with useful qualities and potentials that influence future real income and provide a better life. Besides these, it also provides better employment opportunities, increases labour market participation, and improves earning potentials (Becker, 1964; Mincer, 1996; Schultz, 1990). It raises women's status and empowerment both at the family and societal levels.

Educationalists are of the opinion that women, especially mothers are the first educator of the child, hence the entire society. It is also known that *“if we educate a girl, we educate the whole family”* (Deneulin and shahani, 2009). Therefore, female education is of great importance in our societies. It is the task of policy-makers to provide facilities for the education of women. Moreover, relying on this assertion: *“Without education, people can be subject to abuses by the most powerful. ....Without education, people may be constrained to find menial jobs that do not fulfill them... Without education, those who are marginalized or oppressed may not have the resources to denounce the injustices they suffer from and to claim their rights”* (Deneulin and shahani, 2009, P. 208), education is definitely vital in one's life, especially women, since it lays the foundation stone for the future.

Nowadays compared to the past, girls are on average closing educational gaps with boys. Prior to 1960, more women were likely to complete the primary level and graduate from high school, but less likely to enter college. They were interested in subjects called *“Women's fields”* such as home economics, literature and foreign languages which could help them to

better manage their households (Becker, 1993). After the 1970s, this pattern sharply changed. More women graduate from colleges and shun from the traditional field to study more sophisticated subjects such as accounting, science, economics and engineering.

This improvement in education has also been felt in developing countries. Particularly, African education made remarkable efforts in recent decades. Almost all Sub Saharan African (SSA) countries have been engaged in the achievement of universal primary education, Free Education for All (EFA), and gender equity in enrolments. As far as Cameroon is concerned, its government has made of education one of its main priorities of economic policy. In order to improve its educational system, it has allocated nearly 15.5%<sup>1</sup> of its total budget to education (NIS, 2010). Also, a vocational education strategy for 2013-2020 called the “*Technical and Vocational Education and Training, (TVET)*” was also put in place to create a trained workforce for various employment sectors and improve the understanding of technology.

As a result, slight improvements have been noticed in the Cameroonian educational system. The Millennium Development Goal’s (MDG) national report progress indicates that between 2001 and 2009, the net primary schooling rate has slightly increased from 77% to 83%. The number of illiterates has not changed significantly during the period of 2001-2007 (passing from 82.3% to 83.1%). At the regional level, disparities still persist. The northern part of the country registers the lowest schooling rate, namely Far-North (46.7%), North (54.1%), and Adamawa (57.0%). This can be justified by the heaviness of a particular socio-cultural and ecological environment. Meanwhile the two main cities of the country (Yaoundé and Douala) record a schooling rate of more than 98%. Even though female education has clearly improved, precisely in primary education, the educational gender gap still exists, especially at the higher levels. On average, 95 girls aged 6-11 go to school compared to 100 boys.

Moreover, statistics from the National Institute of Statistics (NIS) points out that in 2018, the highest proportion of the population not attending school was found among women (20% compared to 37% in 2010) relative to men (10% compared to 30% in 2010). For those who attended school at the primary level, there is almost no gap between girls and boys. At the secondary level, proportions are 45% for women and 54% for men (compared to 32% for women and 34% for men in 2010). However, proportions of attendance in higher level still remain weak; 8% for women and 11% for men (compared to 3.5% for women and 5.7% for men in 2010) (NIS, 2019). These educational differentials are detailed in Table I\_1.

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<sup>1</sup> That is to say an amount of 357.609 billion of CFA. An increase of almost 1.4% compared to the school year 2007/2008 (fiscal year 2008).

**Table I 1:** The rate of educational level (15+) in percentage

| Education           | Men (%) | Women (%) |
|---------------------|---------|-----------|
| None                | 15.2    | 28.2      |
| Primary             | 30.8    | 29.9      |
| Secondary general   | 34.05   | 29.9      |
| Secondary technical | 9.4     | 5.8       |
| Higher              | 10.5    | 6.1       |

**Source:** Comblon et al., 2017 (Data from EESI, 2010)

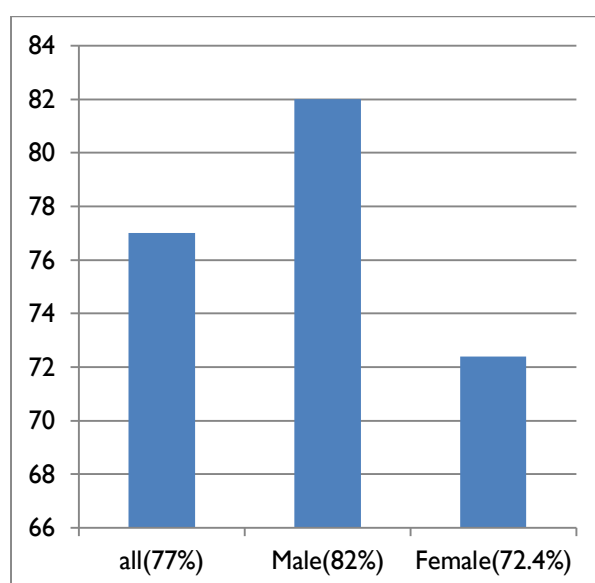
Human capital theorists argued that education increases workers' productivity and efficiency. Education and training are the most important investments in human capital which explains the net increase in women's participation in the labour market (Becker, 1993). As a result, the skills of women in the job market have increased substantially, to be equated and sometimes even above those of men. Most advanced countries like the United States of America, Great Britain, France, Scandinavia, Taiwan, Japan and Mexico experienced similar trends in women's education and labour market participation.

Female labour force participation rate is defined as the proportion of working-age female population in a country that is actively engaged in the labour market either by working or by actively looking for a job (ILO, 2016). In this study, we retain the restraint definition of labour force. Hence, female labour market participation in the Cameroonian context<sup>2</sup> will target occupied or active women at the time of survey, and exclude those who are discouraged or actively looking for a job.

Worldwide, 47% of the working-age women are employed against 72% of men (UNDP, 2015). Similar to developed countries, women in African countries have experienced increases in education and labour market outcomes. In fact, education may affect several labour market outcomes, such as employment/unemployment, workers' productivity and health, wages and earnings, hours worked, and sector of work (Ionescu, 2012). In SSA countries, this rate has always been very high. According to the recent report on global employment trends for women by the International Labour Organization (ILO), the employment-to-population ratio stood at almost 60% for the whole region, compared to 20% in North Africa, and 50% in Latin America and the Caribbean (ILO, 2012). As shown in Figure I\_1, this rate appears to be very high in Cameroon; 72.4% for women.

<sup>2</sup> The Cameroon 2011 DHS dataset used in this study does not define participation in the labour market as defined by the ILO, but in term of being active or not (either at home or outside home) at the time of the survey. In this perspective, individuals aged between 15 and 49 are asked if they have worked for the past 12 months.

**Figure I 1:** Labour force participation (LFP) rate in Cameroon (%)



*Sample: Individuals aged 15 years and older*

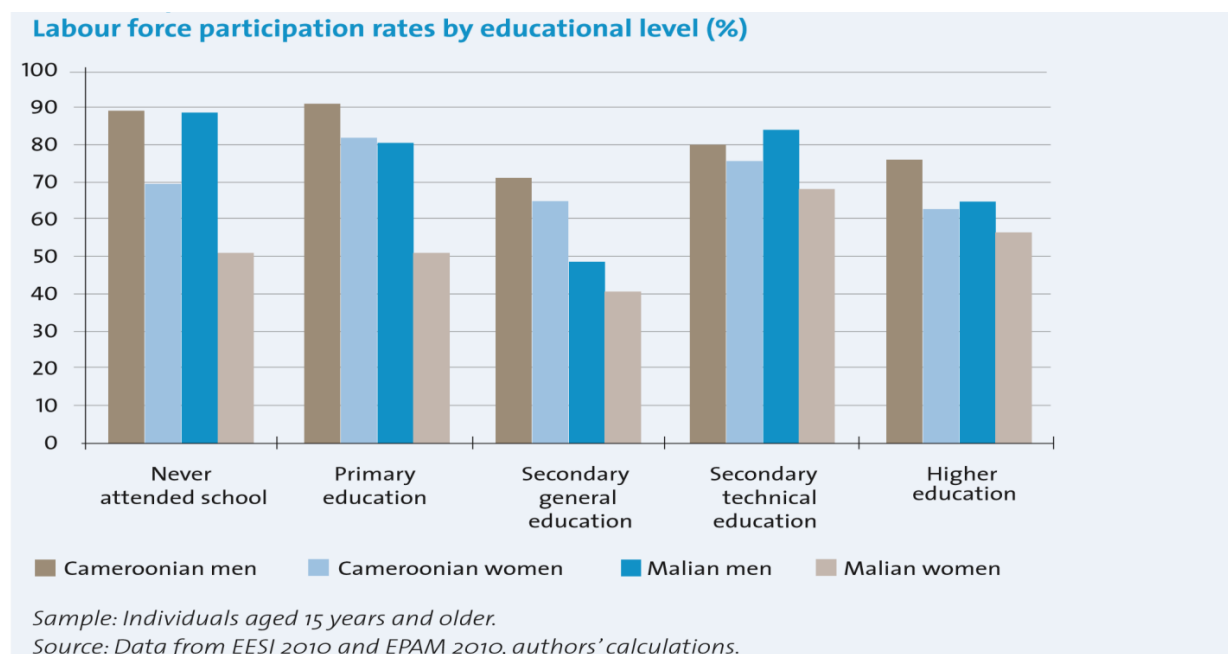
**Source:** Comblon et al., 2017 (Data from EESI 2010 calculations)

In order to attain these results in female education and their participation in the labour market, the government of Cameroon has equipped itself with an arsenal of instruments in order to guarantee gender equity and ensure the protection of women. For some years now, it is engaged in women empowerment through many actions, such as universal primary school attainment through free primary education for all, women in politics and the 30% women's participation in government imposed by some international institutions. Even though there are substantial progress in all levels of education in Cameroon, men still have advantage over women, and this gap tends to widen with the level of education. In 2014, the rate of literacy of women was 69% compared to 81% for men, 37% for women and 43% for men concerning secondary school, and 10% for women and 14% for men as higher education is concerned (CGGR, 2015). As a result, men are favored in the labour market compared to women. Also, they are not only highly represented in the labour market, but they occupy high employment positions, and earn higher wages compared to women. It is also reported that men earn twice as much as their female counterparts (Razavi, 2012).

The increased female education and opening up to labour market have greatly made them more and more independent from traditional forms of household formation and increased the opportunity costs associated with household chores, bearing and rearing of children (Becker, 1975). As women become better educated, their participation in the labour market is likely to increase. Yet many constraints keep them out of paid employment, lower returns from

the labour market being one of them. The weak engagement in women's economic activity, especially decent work, is a cause for concern, as women are valuable resources and as it implies a decline in their well-being.

**Figure I 2: Labour force participation by educational level (%)**



**Source:** Comblon et al., 2017, data from EESI 2010 and EPAM 2010.

Employing micro data from labour force surveys collected in Mali and Cameroon, Comblon et al. (2017) explored gender differentials in labour market outcomes. Their analysis reveals noticeable gender gaps in participation rate, earning, and hours of work, even when both men and women have the same level of education (see Figure I\_2 and Table I\_2)

Even though education is likely to improve chances to work in the labour market, it is also considered as an important driver in reducing the gender gap in participation (Comblon et al., 2017; Totouom et al., 2018). Yet, with the same level of education, men still earn more than women.

At this level, the standard neoclassical theory of labour supply fails to give clear justifications. This may be due to the observation that individuals are considered solely in their decision to work, while we know that human behaviors are inter-connected and dependent, especially in the situation of African women. Also, considering all individuals as identical may be a problem because women at a particular point in their life-course are called upon to give birth. Therefore, including other surrounding people like husbands and other family members

(children, elderly persons) may be determinant in explaining women's labour supply. This is particularly important to policy-makers who need to find evidence for the work-family balance.

**Table I 2: Earnings by educational level (in CFA)**

**Gender gaps by educational level**

|                  | Monthly earnings (FCFA) |        | Monthly hours |       | Hourly earnings (FCFA) |       |
|------------------|-------------------------|--------|---------------|-------|------------------------|-------|
|                  | Cameroon                | Mali   | Cameroon      | Mali  | Cameroon               | Mali  |
| <b>None</b>      |                         |        |               |       |                        |       |
| <b>Men</b>       | 35,431                  | 30,000 | 195.0         | 208.0 | 189.6                  | 188.4 |
| <b>Women</b>     | 22,026                  | 12,000 | 156.0         | 130.0 | 157.6                  | 103.0 |
| <b>Gap (%)</b>   | 37.8                    | 60.0   | 20.0          | 37.5  | 16.9                   | 45.3  |
| <b>Primary</b>   |                         |        |               |       |                        |       |
| <b>Men</b>       | 46,000                  | 32,000 | 208.0         | 208.0 | 238.8                  | 197.8 |
| <b>Women</b>     | 29,599                  | 20,000 | 156.0         | 130.0 | 201.6                  | 201.9 |
| <b>Gap (%)</b>   | 35.7                    | 37.5   | 25.0          | 37.5  | 15.6                   | -2.1  |
| <b>Secondary</b> |                         |        |               |       |                        |       |
| <b>Men</b>       | 67,419                  | 98,000 | 208.0         | 173.3 | 351.9                  | 721.2 |
| <b>Women</b>     | 41,000                  | 74,148 | 177.7         | 151.7 | 261.5                  | 480.8 |
| <b>Gap (%)</b>   | 39.2                    | 24.3   | 14.6          | 12.5  | 25.7                   | 33.3  |

*Sample: Employed individuals aged 15 years and older, excluding unpaid workers.*

*Source: Data from EESI 2010 and EPAM 2010, authors' calculations.*

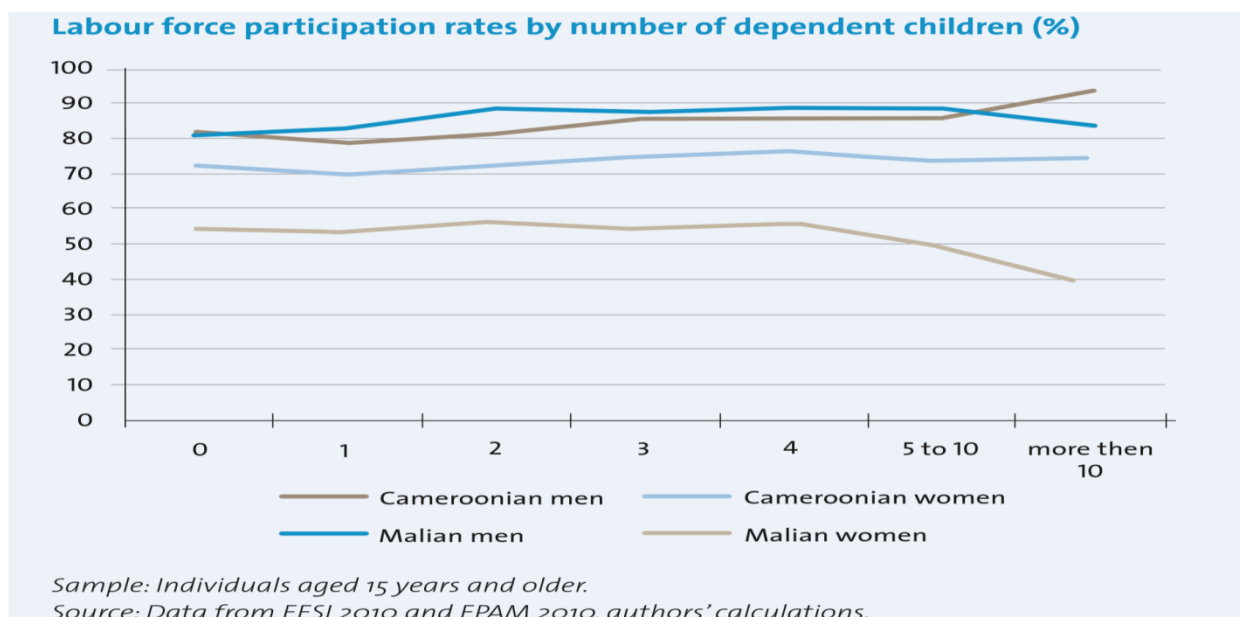
**Source:** Comblon et al., 2017, data from EESI 2010 and EPAM 2010.

From the above analyses, low female labour supply is not only an issue of education; there exist omitted factors that deserve to be studied thoroughly in order to understand the remaining differences in a context of evolving educational systems. At this juncture, one can suggest family formation responsibilities which reduce women's labour time, especially when they engage themselves in marriage and childbearing.

According to the 2012 World Development Report, unequal distribution of time use and household responsibilities between men and women is at the root of differences in labour supply (Razavi, 2012). In SSA countries, working women spend 5 hours in unpaid work (household chores and children/elderly care) compared to only 2 hours for men. This was confirmed by a study carried out by the International Monetary Fund in 2016, which supported the idea that

marital responsibilities were found to be importantly reducing women's labour time after they get married (Dieterich, 2016).

**Figure I 3: Labour force rates by number of dependent children in Cameroon and Mali (%)**



**Source:** Comblon et al., 2017, data from EESI 2010 and EPAM 2010.

Statistics from Cameroon and Mali show that in both countries women participate less than men when there are dependent children at home as shown in Figure I\_3.

Family formation is an important life-course event. Instead of remaining single, many people are likely to engage themselves in marriage and other relationships such as co-habitation and childbearing, despite the costs incurred in terms of limited freedom, financial charges, and closed activities. This is perhaps because of the great benefits attached to such relationships. As articulated by Becker (1973, 1974, 1985, and 1991), family formation brings with it several benefits, notably, specialization and exchange, the production of household public goods, economies of scale, and risk sharing (insurance). In addition, since spouses care about one another, their union reduces transaction costs in exchange (Pollak, 1985) and protects asymmetric investments between them (Jacobsen et al., 2004).

In most African societies, marriage is a central component in the process of family formation. It generally marks the beginning of socially acceptable sexual and reproduction activities, which constitute the two most important stages in the formation of new family cells (Fedd et al., 2015). Hence, social norms related to marriage, sexual relationships, maternity and parenthood determine family formation. Family formation as generally conceived, is a culturally and historically evolving process, which implies a recognized and approved form of



union between conjugal couples – the nucleus of the “family<sup>3</sup>”. To include the evolving process of family formation, we retain the definition given by most researchers which include marriage and birth-giving: “as *demographic markers of the transition to adulthood*” (Buchmann and Kriesi, 2011), including forming a co-residential union, getting married and transiting into parenthood (Bumpass and Westoff, 1970; Goldberg, 1960; Namboodiri, 1972, 1974). In this perspective, this study focuses on the broader context of the family formation process which views marriage and childbearing as important transitional events of family formation. This context governs in what way and when young women and men form families (Fedd et al., 2015).

Like in most traditional African societies, the issue of marriage and childbearing is very exciting in Cameroon. Marriage and childbearing are considered as means of gaining social identity and community respect (Calves, 2010; Wodon et al., 2018). Being characterized by both religious and ethnic diversity, Cameroon counts more than 250 ethnic groups, each having its own cultural practices, language and values concerning family formation. However, the general social structure of these societies is dominated by a patriarchal family model, whereby the man/husband is the head and main breadwinner of the household and the woman’s marital and reproductive rights lie in the hand of her parents, husband and lineage. This probably explains the high proportion (30%) of women married before the age of 18 (UNICEF, 2018) and a total fertility rate of 4.8 in 2015. Even though the Cameroon 2011 Demographic and Health Survey (DHS) suggests that the national median age at which females get married in Cameroon is 18.5 with an average age at first birth of 19.7, there exist great regional disparities. For example, the northern parts of Cameroon: the North, Far-North, and Adamawa regions record a median age at first marriage of 16 (Cislaghi et al., 2019). Beside marriage, children come as necessary outcomes of the union. Children in these regions are considered as wealth and a source of wealth<sup>4</sup> in most families. For this reason, women who are able to bear children are likely to be respected by their husbands, family-in-law and the society as a whole more than those who are not. Even though women carry the burden of childbearing, fertility timing and size of the family are controlled by men/husband. Yet, for some time now, many factors have been identified as being responsible to removing women from these traditional roles. These have resulted to postponement in formal marriage, increase in informal marriage or co-

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<sup>3</sup>The notion of family in this study follows the construct by Becker (1965), in which the man and the woman share the same household, including legalized and spontaneous unions, but excluding separated persons who are legally married.

<sup>4</sup> In the social structure of traditional African family, women were seen as wealth creator in terms of rearing children, providing labour services, as well as agricultural work (Calves, 2010)



habitation. Even as such, marriage and childbearing still remain prominent life-course events for young single adults.

Sociologists, demographers and economists are interested in families. This interest includes the definition, formation, functioning and structure of families. Becker (1985) considers the family to be the most important collective institution in the society. All decisions taken at the individual level of a family affect the whole village, region and nation. Viewed from an economic perspective, a family can be considered as a small industry in which time and market goods bought are combined to produce basic goods and services, such as meals, accommodations, children, and entertainment that yield utility to its members (Becker, 1991). As defined by Mattila-Wiro (1999), a family or household refers to a group of more than one person (even though a single individual can constitute a household), who share economic activities needed for the survival of the group and for the generation of well-being for its members.

Family formation has received much attention during these last decades because of its changing patterns. Modernization and technology have also changed the structure of family formation in most countries. Interestingly, most of these changes are directed towards the girl child and the empowerment of women. As a result, many socio-cultural norms are being enhanced or banished in replacement of modern habits. For instance, practices such as female genital mutilation, early marriages and female deprivation in terms of education and women's participation in the socio-economic and political activities of the nation are being challenged by both national and international opinions.

Of course, families have deeply changed in the course of recorded history (Becker, 1985). Progressively, both men and women desire to first acquire education before establishing themselves in the labour market and founding a family (Hegewisch and Gornick, 2011). Moreover, since women turn to invest more in the early years of marriage when they are most fertile, they typically will not want to engage themselves in marriage without some security (Jacobsen et al., 2004). Consequently, age at first marriage and age at first childbearing are occurring much more lately in people's lives. Meanwhile, fewer children are being born; more divorced and mono-parental households are forming. More recently, the prevalence of homosexual marriages is growing.

Developing counties are not exempted from this metamorphosis. Recent data show a decline in child marriages and early pregnancies, and a timid increase in the age at first marriage and birth which constitute the main indicators of demographic transition and change in family

formation in Sub Saharan African (SSA) countries. In fact, a 10% reduction in early marriages among girls between two MICS/DHS was recorded in Ghana, Liberia, Mauritius, and Sierra Leone, as well as in urban areas of Togo, Cameroon, Benin, and rural zones of Congo (UNFPA, 2012; Walker, 2012). More and more counties in Africa show demographic transition and changes in maternity and family formation during these last twenty years. An increase in the age at first marriage and in types of marriages, such as “Free Unions” in more than twelve countries in Africa (Shapiro and Gebreselassie, 2014), a decrease in the fertility rate (Shapiro, 2012; Gurmu and Mace, 2008; Westoff, 2003), and an increase in the proportion of unmarried women aged between 20 and 24 (Antoine and Marcoux, 2014). In the midst of this metamorphism, education plays a critical role.

The study of household economics is closely linked to gender matters, particularly the work and status of women within the family (Mattila-Wiro, 1999). In Cameroon like other SSA countries where the proportion of women (51%) is greater than that of men, the evolution of norms related to family formation is considered in a large proportion due to the improvement in the education of women (Marcoux and Antoine, 2014; Foley and Drame, 2013).

With respect to female education, it becomes challenging for them to juggle between a happy and stable family life and a prosperous career. This is mostly observed nowadays with societal pressures placed on individuals. It becomes tempting for women to pursue careers while forming family.

## **I.2 Statement of the problem**

Until the 50s, economists fundamentally ignored family issues in their analysis, maybe because family decisions were rather simple during the early centuries. Women were basically focused in marriage, household chores and did not work in the labour market (paid jobs). Meanwhile, husbands worked for income (Becker, 1985). This is called the sexual division of labour between husbands and wives. But nowadays, the increase in female education has made specialization in housekeeping less desirable to women in the modern-type of family (Oppenheimer, 1988). In this model, individual skills from both partners are combined, and the joined revenue from the labour market is higher and more desirable than a single source of income (Oppenheimer, 1994, 1995).

Prior to the 1960s, women were obliged by law to resign from the labour market after getting married; it is only recently that policy measures were introduced to facilitate the

combination of household production and labour market participation (Oppenheimer, 1988, 1994, 1995). As a result, more thorough studies report that more women now associate motherhood and paid work than in the past (Mertens et al., 1995), and that highly educated women tend to be more fully employed than less educated ones while the mean number of hours worked by men has not decreased (Camstra, 1993).

Unfortunately, highly educated women are more likely to invest their lifetime in the labour market, compared to less-educated ones (Bowen and Finegan, 2015), because education tends to increase the productivity of labour market time more than that of the time spent in home production. It follows that women's schooling induces them to spend a greater part of their lifetime in the labour market, and a smaller proportion of their time in home production (Leibowitz, 1974).

In the meantime we know that a woman through her lifetime experiences an exceptional pattern different from that of a man. If a well-educated woman gets married before entering the job market, the probability of working outside home becomes small, especially when children are still very young, and it is only when she is above forty years that she can fully enter the labour market (Leibowitz, 1974). Meanwhile, if she worked before forming a family, she will be more challenged by marketed jobs (earning) and career. Hence, she is likely to postpone her age at first marriage, reduces the number of children (Popkin and Solon, 1976; Edward and Grossman, 1978).

However, the recent literature has been concerned about the role and interaction of family formation in determining women's economic opportunities, such as the evolution of female labour participation (Goldin, 2006; Chioda, 2011). Of course, investment in education is necessary for women engaging in economic activities, but perhaps not sufficient because family formation also determines their participation in the labour market (Chioda, 2011). Thus, education and family formation determine women's professional aspirations and how they manage their time between market and family.

Hence, the study of women's education in their mother and spouse responsibilities (home production) is not negligible for the stability and prosperity of the family, since the standard labour market participation paints only a partial picture of women's work. Evidence from developing (Popkin and Solon (1976) and developed (Edward and Grossman (1978) countries have shown that increasing women education positively influences the labour force participation of married women by raising their market productivity relative to non-marketed

productivity on one hand, but labour force participation by mothers may also reduce children's health and cause marriage instability and divorce (Oppenheimer, 1988) on the other hand.

This study enters into a new period of interest on the importance of family formation neglected by the traditional microeconomics, according to which, activities done outside a market place such as marriage and childbearing are not important, and called “*loss income*” by Becker (1965). Henceforth, paid work should not be the only final aim of educated women; family formation should also be considered.

### I.3 Research questions

The model of family in developing countries seems not to be clear; meanwhile countries like Cameroon are still growing as far as education and labour force participation are concerned. Since the general attitude towards combining motherhood and work is becoming more and more desirable, young adults, especially educated ones tend, to adjust the timing towards family formation and their career prospects.

This study addresses some of the issues raised above concerning the changing attitude of women as spouse/mother and worker with respect to their level of education by asking the main research question of this study: **what are the effect of education on the transition into marriage and birth-giving, and the ensuing effect on female labour market participation in Cameroon?**

Since education tends to push women in the labour market but marriage and childbearing tend to keep them away from it, the specific questions are:

- **What is the effect of education on the timing of first marriage in Cameroon?**
- **What is the effect of education on the timing of first birth in Cameroon?**
- **How does transition into marriage and birth influence the effect of education on female employment in Cameroon?**

### I.4 Objectives of the research

To answer this question, our main objective is to **examine the role of education in the transition into marriage and birth-giving, and the ensuing effect on women labour market participation in Cameroon.**

That is to:

**O<sub>1</sub>- Examine the effect of education on the timing of first marriage;**

**O<sub>2</sub>- Scrutinize the effect of education on the timing of first birth;**

**O<sub>3</sub>- Investigate how transition into marriage and birth influence the effect of education on female employment in Cameroon.**

## **I.5 Hypotheses of the research**

In accordance with the above specific questions and objectives, hypotheses argue that holding other things constant:

**H<sub>1</sub>- Education delays entry into first marriage;**

**H<sub>2</sub>- Education delays the beginning of childbearing;**

**H<sub>3</sub>- Transition into marriage and first birth lessens or cancels out the effect of education on female employment in Cameroon.**

## **I.6 Policy and scientific significance of the thesis**

### ***I.6.1 Policy relevance of the thesis***

To investigate this issue, our thesis will be carried on married women and women living in unofficial (or consensual) unions using the Cameroon's Demographic and Health Survey (NIS, 2011). As the level of instruction of women is increasing, studies on the investment in human capital seem to mostly focus on its material outcome derived from the labour market (i.e. wage). The more women are educated, the more they spend much time in the labour market and reduce that spent in home production. Meanwhile, women are called upon by nature to respond to their motherhood role. Studies in Cameroon focused mostly either on fertility and female labour force (Tsafack and Zamo, 2010) and not marriage, or on education and female labour force participation (Tingum, 2016; Che and Sundjo, 2018, Totouom et al., 2018; Zamo, 2018). No study to the best of our knowledge addresses these three concepts at once in Cameroon. That is why this thesis considers the role of female education both in the family formation (marriage and birth) and the labour market arenas.

One of the greatest characteristics of African countries, especially Cameroon (Africa in miniature), is family value attached to union formation and births. In this value is centered the primordial role of women in child bearing and rearing, food preparation, clothing, ironing, cleaning, etc. A study on Cameroonian women, no matter their level of education, their position in the labour market, cannot put aside marriage and birth-giving. Hence, this thesis benefits both the family, in responding to all its members' needs, while working to prevent social risks (Wood et al., 2016); and policy makers, in issuing policies which focus on the quality and quantity of human capital accumulation, on policies which do not only empower women, but also motivate them in family formation and home production.

### ***1.6.2 Scientific relevance of the thesis***

Beside the policy-wise relevance of this thesis, it also presents scientific importance. Theoretical literature on this issue constructed different family organizations as far as work in the labour market and family formation are concerned: the traditional family model proposed by Becker (1981) suggests that there is incompatibility between family formation (home production) and labour market works. He proposed that to increase the gain from family formation, men should be the ones working outside home while women focus on home work. Other collaborative family models suggest that husband and wife bargain on who does what and to which extent (cooperative and non-cooperative family models). This study will discuss the best theoretical axiom reflecting the context of Cameroon.

Empirically, most works focusing on the effect of education did not control for its endogeneity may be because of the difficulty to find valid instruments (Tingum, 2016, Che and Sundjo, 2018, Zamo-Akono, 2018). The empirical added value of this research relies on the attempt to detect and correct these problems, and use the appropriate estimation methods, like a two-stage econometrics estimation and the survival analysis to estimate marriage and birth timing. Also, this thesis, contrary to others, uses the merged data sets of individual women and households to extract very important information advantageous to our analysis.

Finally, another added value of this thesis is that it is the first to the best of our knowledge to explore how female education simultaneously influences the timing of family formation and labour market outcomes in Cameroon. The gap to be filled by this thesis will act as a reference point for future research in this domain in Cameroon and other developing countries.

## I.7 Brief outline of the methodology

Since we have targeted many objectives in the course of this thesis, we will use a variety of empirical approaches. This section will only highlight the methodological approach employed for each objective, as more details in each empirical chapter will be provided later on the theoretical and empirical framework.

To examine the effect of education on marriage timing (O1) and birth timing (O2), we used a two-stage econometrics estimation as Ferre (2009). By following Nguyen and Wodon (2014), Delprato et al. (2015), Totouom et al. (2018), and Baye et al. (2020) reasoning, use is made of an instrumental variable (IV) approach to account for measurement error in education, omission of pertinent variables, and the simultaneity between marriage/birth decision and educational attainment. We use one instrument measured at the community level without factoring-in that of the woman in regression: leave-out-mean or non-self-cluster mean of women's years of education (neighborhood mean years of schooling). We suggest that the average years of education of other women in a community should be strongly correlated with a woman's educational attainment living in that same community, but not her marriage/birth timing. Hence, employing a two-stage econometrics estimation (Two-Stage Residual Inclusion, 2SRI) method, the first stage consists of estimating the effect of educational attainment on the instrument and some exogenous variables using an ordered Probit approach. Then we derive the Inverse Mills Ratios at each education level to capture omitted variables (Baye, 2015). The second stage consists of including as additional variables all the Inverse Mills Ratios derived from the first stage in the structural equation of first marriage/birth, and estimate it using the Cox proportional hazard technics.

The last objective (O3) may potentially suffers from endogeneity, sample selection, and unobserved heterogeneity biases. To solve these, we employ the control function modelling approach. Instruments and selection indicators (captured at the community level) will be plugged in their respective reduced forms and selection equations in first stages. In the second stage, their respective control variables will be included as additional variables in the structural equation of female full-time employment and estimated with a Probit technics.

This thesis in the first and second objectives use the merged individual data set of women and households, while the third objective use the sole data base of women of the 2011

Cameroon Demographic and Health Survey carried out by the National Institute of Statistics. The 2011 Cameroon DHS is a world-wide survey which ran from January to August 2011, and covered 14, 214 successfully interviewed households in which 14, 426 women and 7, 191 men were successfully interviewed. This data set show that out of the women aged between 15 and 49, about 63% are living with a husband or partner.

## **I.8 Organization of the thesis**

This thesis starts with a general introduction which presents issues related to the context, objectives, and the scientific and policy relevance of the thesis.

Chapter one provides detailed presentation of the conceptualization of education, family formation, and female labour market participation.

Chapter two examines the effects of education on marriage timing among women in Cameroon using survival analysis, while controlling for endogeneity.

Chapter three explores the effects of education on the transition into motherhood in Cameroon in a survival and hazard function framework.

Chapter four investigates how transition into marriage and birth affect the effect of education on female employment in Cameroon.

We finish this thesis by a general conclusion. We provide the summary of findings, recommendations, and suggestions for future research.



# Chapter One:

## Education, Family Formation, and Female Labour Market Participation: A Theoretical Background

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### 1.1 Introduction

Since this study is not the first attempt in establishing relationships between education, family formation, and female labour market participation, a thorough investigation concerning the definitions and the theoretical evolution are discussed on each concept; the theoretical framework and nexuses among them.

The rest of this chapter is organized as follows. Sections 1.2, 1.3, and 1.4 dwell respectively on the concepts of education, family formation, and female labour market participation. Each of these concepts is treated by considering its definition, measurement, and historical and theoretical evolution. Section 1.5 sheds light on the theoretical discussion and framework linking education, family formation, and female labour market participation simultaneously. Finally, section 1.6 establishes the various links existing between education, family formation, and female labour market participation as examined in this thesis.

### 1.2 The concept of Education

Education is at a critical crossroads. Theorists and practitioners of education are involved in heated debates over which type of educational definition, approach, and theory is adequate for nowadays' sociocultural climate (Sarid, 2018). Authors even argue that “*Present-day challenges deliver heavy blows to the very essence of the idea of education*” (Bauman, 2010). In order to better apprehend the concept, we will dive deep into the definition/measurement of education before presenting its theoretical evolution.

## 1.2.1 Definition and measurement of the concept of Education

### 1.2.1.1 Definition of Education

The word “*Education*” comes from the Latin term “*Educatum*” or “*Educare*” which means the act of teaching or training; or to bring up or to raise. To educate means to nourish someone with useful potentials, develop innate and inner capacities of that person, and bring out the best of him. It is commonly considered as the major form of investment in human assets (Machlup, 1982).

While many fields contribute to the understanding of education, economic analysis offers key insights for policy-makers. In this context, education, just like the physical capital, is considered as an economic good because it is a scarce good which is not easily obtained. For this reason, education is regarded as both a capital and a consumer good. It is regarded as a capital good in the sense that it can serve as input in the production of other goods. While considered as a consumer good, it can directly provide satisfaction to its owner. In the human capital theory, education is the central element for two main reasons: because it is primarily viewed as the key way to acquire skills and knowledge; also, it is considered to be the best way to quantify the quality of work in the labour market (Crocker, 2006).

In the seminal book of Becker (1962), human capital (which includes education) is globally defined as all “*activities that influence future real income through the imbedding of resources in people.*” However, most economists view the conceptualization of education differently.

(i) ***The Becker view***: it is viewed as useful in the production process (capital good).

(ii) ***The Gardener view***: it should not be viewed as one-dimensional as Becker’s view. Rather, it should be thought of as multidimensional since there are many types of skills. Gardener contributed to the development of the “*multiple-intelligences theory*”.

(iii) ***The Schultz/Nelson-Phelps view***: it is viewed as the capacity for an individual to easily adapt.

(iv) ***The Bowles-Gintis view***: human capital is viewed as the capacity to work in an organization, obey orders, and adapt in a society with a hierarchical/capitalist lifestyle.

(v) *The Spence view*: observable measures of human capital are more a signal of ability compared to characteristics which are useful in the production process.

In recent years, economic analysis started to combine with other fields such as psychology and neuroscience (Cunha et al., 2006), behavioral and genetics (Benjamin et al., 2012), and sociology to come out with a more comprehensive view of education. However in this study, we retain the multidimensional view of education and work with the socio-economic definition of education at the individual/household level, since it provides more insights for policy-makers (Burgess, 2016). In fact, economists and social researchers are more interested in teaching/learning processes and their outcomes described in the lower layers of Figure 1 of Appendix 1. First, the teaching and learning processes help individuals to attain higher levels of education, and acquire knowledge and skills. Second, these capacities acquired in the second layer will be beneficial both in the social and economic arenas. In this perspective, education affects employability, earnings, and chances of succeeding in life. Hence,

*“Education is a continuous practice consisting of purposively structured learning processes aimed at the realization of ends that are consciously derived from a certain conception of the ‘good’”* (Sarid, 2018; P. 480).

#### **1.2.1.2 Measurement of Education**

There are two main routes that have been used to value education in the theoretical and empirical literature, namely the macroeconomic<sup>5</sup> and the microeconomic models. The microeconomic models of education examine data at the level of individuals and households in order to focus on the return to education, and the externalities-related issues. Also, it compares the productivity/earnings of highly educated individuals relative to those of less educated ones.

Since education is an intangible capital whose stock is not directly observable as that of physical capital, it can be measured using two major approaches, namely the cost-based (retrospective technique) and the income-based (prospective technique) approaches.

Introduced by Engel (1883), the cost-based approach is a method of evaluating education which relies in summing up all the educational expenditures. This method was used by researchers such as Kendrick (1976) and Eisner (1989). Even though this method is

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<sup>5</sup> The macroeconomic models, treated as endogenous in the production process, examine education at the aggregate national level and explore it in a cross country setting in order to look how education is related to the GDP growth rates (see Krueger and Lindahl, 2001; Psacharopoulos, 2006).

advantageous in cost-benefit analysis, it has become less renowned for the following reasons: (i) it ignores issues related to returns to education and productivity; (ii) since it merely does the summation of historical costs, it ignores the time value of money (Dagum and Slottje, 2000); (iii) there is a lag between current expenditure and the appearance of educational stock in a graduate (Jorgenson and Fraumeni, 1989).

On the other hand, the income-based approach of evaluating education relies in calculating the total income to be earned by an individual during his lifespan from the labour market. This technique fundamentally relies on the Human Capital Theories assumption<sup>6</sup>. Like the previous approach, the income-based technique has few shortcomings: (i) since this approach uses a prospective technique, data on the flow of future earnings are often not observable or reliable; (ii) measuring the outcome of education only in the labour market is biased, since education apart from yielding income, also influences the socio-cultural and political life of the individual who acquires it.

Due to these inconveniences attached to the retrospective and prospective approaches of evaluating education, researchers have looked for “*current-looking*” techniques such as educational attainment, school enrolment rates, years of schooling, adult literacy rates, and dropout rates.

Mincer (1974) in his human capital earnings function measured education in years of education in completed years. It supposes that knowledge and skills bestowed in a worker is proportional to the number of years spent in school. Even though this indicator has been widely accepted and used (Wolff, 2000; Krieger and Lindahl, 2001; Couralet, 2003), it neglects issues related to difference in quality of education over time and across countries; it also omits the fact that one may spend many years in school but be unable to use them to have a better life or improve productivity. For example a slow learner because of repeating classes could spend more than ten years in school, while he has not yet acquired knowledge and skills of the primary level. Moreover, linking it to females ignores whether they have repeated a (or several) class (es); or even if they have temporarily interrupted school due to teen pregnancies or other issues.

Yet, researches have been concerned with the actual skills and knowledge acquired through exposure to education. In this context, it indicates educational performance in terms of

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<sup>6</sup> Human Capital Theories assumption supports that difference observed in wages is explained by the differences in productivity

grades achieved or learning indicators (Crocker, 2006) and the outcomes generated on the economic and social lives (Figure A1\_1 of Appendix 1).

Stratifying education by grades such as no education, primary, secondary, and tertiary levels give us an idea of the type of knowledge and skills the individual has (with the deliverance of a diploma showing his aptitude). Compared to years of education, it captures better the skills and abilities embedded in a person. With respect to the definitions of level of education, we use the revised international standard classification (ISCED, 1997) provided by United Nations Educational, Scientific and Cultural Organization (UNESCO) in Table A1\_1 of Appendix 1.

## **1.2.2 Theoretical evolution of the concept of Education**

### ***1.2.2.1 Early literature on Human Capital and Education***

Any theoretical analysis of educational attainment is the Theory of Human Capital (Mincer, 1958; Becker, 1962). Even though it is through the work of great economists that the notion of human capital was brought forth, Human Capital Theory is not an entirely new field in economics beginning in the 50s or 60s as many young students think (Machlup, 1982).

Of course, Sir William Petty was the first to evaluate the stock of human capital of a nation around 1676 (Petty, 1690; in his “*Political Arithmetick*”). However, he did not come out with any substantive hypotheses or theoretical model. It is only exactly a hundred years later that Adam Smith would provide a clear explanation about the role of human capital (Smith, 1776; in his “*Inquiry into the Nature and Causes of the Wealth of Nations*”). In his discussion, he clarified the preconceived notion of capital stock that most people had as always being something tangible or physical like machines, tools, or factories; he notified an important part of capital stock embodied in human beings that raised productivity. Because of the counterproductive arrangements of teaching at the Oxford University of this time (against capital formation through education), Smith cited education as being one of the most effective ways to increase productivity of human resources.

Years later, a German statistician named Ernst Engel in his book on the “*Cost Value of Human Being*” considered the quantity of investment expenditure realized in a man as a productive factor (Engel, 1883). Few years later, an English economist by name Joseph Nicholson published an article in 1891 titled “*The Living Capital of the United Kingdom*”. Unlike Engel, Nicholson in this analysis looked at the cost of educating, not the cost of

investment realized in a person as the main factor increasing human productivity (Nicholson, 1891).

Alfred Marshall (1890) is also cited among the early intellectual history of human capital (Machlup, 1982). He distinguished the “*personal*” from the “*material*” capital. In his analysis, he defined personal capital as the one chiefly formed through investment by parents caring and paying for the education of their children. It is finally in 1897<sup>7</sup> that the term “*Human Capital*” would be formally used in economics by Irvig Fisher.

Diving into the twentieth century, we have John Raymond Walsh in his article entitled “*Capital Concept Applied to Man*” (Walsh, 1935) and Milton Friedman and Simon Kuznets in “*Income from Independent Professional Practice*” (Friedman and Kuznets, 1945).

This brief academic history reveals that the economic and statistical literature of the human capital theory (which later gives rise to the concept of education) were discussed since three hundred years before the outbreak opened by Mincer (1958), Shultz (1960; 1961) and Becker (1962; 1964) during the 50 and 60s. It is after Mincer’s (1958) article that the formal use of Human Capital became considerably more popular. Schultz focused on the human capital applied to education, whereas Becker used more technical research in mathematical and statistical economics to compute rates of return to the investment in schooling and training (Machlup, 1982).

#### ***1.2.2.2 Neoclassical Standard Human Capital Theories***

This part presents a review of theoretical contributions discussed in the literature of economics of education after the 1950s. The basic education models emerges in the sixties, with major pioneers from the Chicago School of thought and concerned Mincer (1958, 1962), Schultz (1960, 1961), and Becker (1962, 1964). All their models rely on the neoclassical framework to investigate how investment behavior at the individual and household level functions. Stanley Gary BECKER (Nobel Prize in Economics in 1991), in his book “*Human capital: A Theoretical and Empirical Analysis*” in 1962, gives the microeconomic bases to the analysis of human behaviors.

The literature suggests a set of three factors on which investment decisions relied: individual, household, and community. At the individual and household level: Individuals,

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<sup>7</sup> Fisher cites J.S. Nicholson, “The Living Capital of the United Kingdom,” for the term “living capital” as opposed to “dead capital.”

especially parents, make investments in schooling till the private marginal benefits of investment are equal to their private marginal costs (Becker, 1962, 1994; Behrman and Knowles, 1999; Becker and Tomes, 1986; Leibowitz, 1974). In this vein, they decide to send a child to school when the expected utility of the investment exceeds that of not taking the child to school. Assuming that the production or supply of education is constant and reliable, the decision to invest in schooling depends on the factors affecting the expected utility (Gertler and Glewwe, 1990). In this context, characteristics such as parent's social background including education, income and endowments, household composition, religion, culture, marriage stability are cited as factors affecting the schooling investment decision.

However, these researchers remain silent on externalities attached to education, which was later introduced by Lucas (1988), Romer (1990), Lochner and Moretti (2004). Apart from outcome yields on the labour market, education produces externalities such as the reduction in criminal behavior, which enables people to participate efficiently in economic and political process (Lochner and Moretti, 2004). Yet, these latter models were also criticized since they mostly rely on the neoclassical assumptions. This gave room to alternative models.

#### ***1.2.2.3 Signaling or Screening model***

Initiated by Spence (1973) and Stiglitz (1975), this model deviates from the standard human capital models in that it considers education as acting as a filter rather than a capital. In this perspective, screening theory suggests that education does not increase a worker's productivity but rather informs the employer about the quantity and quality of education endowed in an individual. Because of uncertainty and adverse selection present on the labour market, this theory considers education as solely acting as a signal in order to reduce these biases, and nothing else. Yet, both the basic human capital and filter models fail to integrate the fact that investment in education changes with the age profile. Hence, there occurs the life-cycle theory which integrates the age at which investment in education should be carried out.

#### ***1.2.2.4 Life-cycle earning theory***

This theory is interested in indicating the time when an individual should opt for investment in education or for work in the labour market. Based on the earnings maximizing models, this model suggests that investment in education and earnings vary with age at each stage with its return. Hence, it proposes three stages in the life of an individual as far as education accumulation is concerned. The first stage is characterized by no earning in which



the individual is a full-time student. The second stage is characterized by part time education. Third stage is characterized with no training. Yet the decision to accumulate education depends on the cost required to produce an additional unit of education and the opportunities offered on the labour market. Hence, if the marginal benefit is greater than the cost of accumulating an additional unit of education, then the individual should opt for work only. In summary, the life-cycle earning models unanimously arrive at a compromise where the age-earnings profile is concave (Mincer, 1970, 1974).

## 1.3 The concept of Female Labour Force Participation

### 1.3.1 Definition and measurement of Female Labour Force Participation

#### 1.3.1.1 Definition of Labour Force Participation

The International Labour Organization (ILO) defines the labour force participation as “*the proportion of a country’s working-age population that engages actively in the labour market, either by working or looking for work*” (ILO, 2016). Labour market statistics consider employed people as all persons above a specified age (usually 15) exercising a paid employment or self-employment in labour market.

This definition considers individuals who are working in recognized activities included in the system of national accounts. However, it excludes an important share of activities carried out in the society such as unpaid family and domestic labour, own work and work done for members of the household, which are not usually considered as labour market work (Psacharopoulos and Tzannatos, 1989).

#### *Three paradigms explaining female labour force participation*

In the literature, three paradigms attempt to explain the increase in women’s engagement in the labour market and the cross-sectional differences in female labour force participation between countries, namely: the structural, the cultural and the institutional approach.

– ***The Structural explanation:*** Proponents of this approach hold that increases in female labour force participation started in the 1960s with the shifts in costs and benefits of the labour market participation due to the expansion of education and technological changes that led to an increase in women’s wages (England and Farkas 1986; Goldin, 1990) as well as the decline in fertility.



In fact, technological changes reduce the value of time devoted to non-market work, such as household production. These facilities increase the number of time a woman could work outside home. Also, the invention of sophisticated contraceptives helps women to increase their engagement in economically productive activities. However, the main limit of this approach relies on the fact that it fails to explain what drive the factors that increase female labour participation, considered as exogenous (Blossfeld and Drobnic, 2001).

– ***The Institutional explanation:*** similar to the structural approach, the institutional approach relies on the assumption of the neoclassical model of labour supply.<sup>8</sup> To contribute in filling the gap lefts by the structural approach, it attempts to seek the reasons for the differences in the proportions of female labour force participation. To do this, proponents of this approach advanced two roles of the state as factors responsible for the increase in female labour force participation. First, the state as the issuer of institutions facilitate women to combine family (especially childcare) and work by doing things such as the provision of public childcare, giving regulations on parental leave (Del Boca et al., 2008), or making available part-time jobs. Second, the state as the employer and provider of typical women jobs in the public segment of the labour market. However, this approach was found hard to be applied in less developed countries where researches on policy effects are rather limited. Hence this approach partially explains country-differences in female labour force participation, because it omits cultural factors which are not negligible (Hakim, 2000; Pfau-Effinger, 2000), especially in African societies. Although Pfau-Effinger (2000) does not reject the importance of institutions, she claims that previous researchers have been too focused on the role of institutions, neglecting the role of customs and culture in explaining female labour force participation.

– ***The cultural explanation:*** It focuses on attitudes and social norms to explain changes and differences in female labour force participation (Inglebart and Norris. 2003; Seguino, 2011). Due to lacks in a clear theoretical foundation, the cultural approach is less systematized in explaining women's labour force participation. According to Pfau-Effinger (2000), the cultural heritage of a country has its own role in female labour force engagement, whereas Hachim (2000) considers a more specific view according to which individual preferences are important factors in explaining women's labour force participation.

### ***1.3.1.2 Measurement of Female Labour Force Participation***

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<sup>8</sup> According to this theory, labour force participation is a function of costs and benefits.

Before the industrial revolution, there was no distinction between work done at home and work done elsewhere because only few individuals worked for pay at that time. It is only in the course of industrialization that there was a clear distinction between work at home and work performed in the labour market because during this time families started to send some of their members to labour in the new industrial settings. This demarcation between paid work and family life (called separate spheres) resulted in women responsible for domestic tasks and men for work outside home (Padavic and Reskin, 2002). In this context, the sexual division of labour<sup>9</sup> between men and women began to be a typical feature in almost all societies (Becker, 1965).

As years passed by, the growing in female engagement time in market work relative to domestic work become so obvious. Yet, women still lag behind in terms of participation share relative to men. This is because their participation is strongly influenced by the social and cultural context (Psacharopoulos and Tzannatos, 1989). They are the ones still doing the large proportion of domestic tasks (Brines 1994; Treas and Drobnic, 2010), childbearing and rearing responsibilities. For these reasons, this thesis focuses solely on these women's<sup>10</sup> engagement in the labour market, especially as far as their marital and childbearing responsibilities with respect to their education level are concerned.

In this thesis, we are interested in the simple opposition between active and inactive individuals. Since we are using the DHS dataset, which is not focused on employment, we limit employment to those who are actually working<sup>11</sup> in the labour market for the past 12 months following the time of the survey, excluding those who are actively looking for a job.

Hence, we consider as participants on the labour market, all economic agents who can influence the structure of this market; that is active<sup>12</sup>. And inactive agents those who are not currently working and those who are looking for a job at the time of the survey. Because we

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<sup>9</sup> That is the assignment of different kind of tasks to men and women, which is different from the sexual division of tasks within the labour market which referred to labour market segregation.

<sup>10</sup> Nevertheless some additional empirical analyses have been performed by including men in the sample and testing whether education explains differences in female labour force participation relative to that of men in Cameroon (Zamo-Akono, 2018). This thesis focused on women because marital and birth responsibilities are mostly carried by women.

<sup>11</sup> During the Cameroon's 2011 interview for the DHS, men and women were asked if they have worked during the last 12 months preceding the interview. This view excludes those who were actively looking for job at that time or discouraged job seekers.

<sup>12</sup> Economic agents who are engaged in economically productive activities.

want to evaluate women's activities in and outside home, the active/inactive orientation of participation in the labour market is adequate in this context.

### **1.3.2 Theoretical Evolution of Female Labour Force Participation: From an individual to a collective decision**

#### ***1.3.2.1 Early view of the concept of labour supply: traditional neoclassical model of labour supply***

Today, labour economists often write about the value of women's time<sup>13</sup>, and how marital status enters economic analyses of consumption<sup>14</sup> (Mincer, 1962). Overall, the labour supply in the standard economic model is a decision between work and leisure.

Jacob Mincer and Garry S. Becker are the pioneers of the basic foundation of the neoclassical model of labour supply (Mincer, 1962; Becker, 1965; 1991). This model relies on a rational decision made between the utility of time spent in leisure and that spent in participating in the labour market. This approach assumes that an individual solely takes his/her decision which maximizes own utility. This utility is derived from consuming commodities either purchased using wages earned on the labour market or produced at the household level. Hence, the individual maximizes his/her utility at the point where the marginal rate of substitution between work time and time for leisure equals the wage. This wage is called the reservation wage.

Since the opposite of time at work is not leisure, an individual time cannot be divided into leisure and time at work, not even for men. For instance, the time allocated to household chores cannot be accounted for leisure. To remediate this issue, Miner (1962) was the first to point out that work at home and leisure should be separated (at least for the women). Hence, Becker (1965) in his seminar paper on household production distinguishes time spent at work, time spent at home and leisure time. Even though he was not able to capture home activities, he summarized these as “*non-market activities*” or “*home production*” and named it after “*loss income*”, since individual household tasks are not recognized, thus making household work undervalued. At this level, the individual no longer maximizes his utility subject to budget alone but subject to the budget and time constraints.

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<sup>13</sup> The derivation of value of time in the home, also called the shadow wage, followed the economic theory of allocation of time. For a review of the influence of this theory see Becker and Michael (1973).

<sup>14</sup> Marital status obviously counts in economic analyses of fertility (see Becker, 1960, for instance).

### ***1.3.2.2 The tripartite choice model of time allocation***

It is an improved version of the traditional conception of labour supply, called time allocation models, in which one can allocate his/her time in three ways: leisure time, time spent on the labour market and on the house work.

In these models, an increase in the wage gives rise to two substitution effects: one between home and market work, and the other between market work and leisure. The first substitution effect is generally easy. One can increase work time and reduce the time spent doing house work by buying a microwave, an electronic dishwasher or by simply hiring the service of a house help or babysitter, while the substitution effect between market work and leisure times are generally not easy.

#### ***Becker's view of women's labour supply***

According to Becker (1991), production of commodities will be maximized if family members (usually partners) specialize either in home production or market work at least to some extent. Using physiological differences in women and men, he determines which family member specializes in which sphere of work. Hence, because of the biological advantage of women in childbearing age, he supports that it is rational for women to specialize in household production. Even though some researchers disagree with the biological argument, it is maintained that women in almost all societies still have a comparative advantage as far as housework is concerned because girls and boys receive different education and training, and are raised with different expectations (Blau et al., 2014). Whatever way, the economic model relies on the assumption that females have a comparative advantage in home production and that it is a rational choice for men to specialize in paid work (work outside home), whereas women specialize in household production (Becker, 1991; Blau et al., 2014).

One important limit of the neoclassical model detailed above is the fact that it neglects the power of preferences within the household. It assumes that all members of the family act in an altruistic manner and have the same preference. To illustrate this, the neoclassical model uses only one utility function within the family and family members are not supposed to have different interests (England and Folbre, 2005). This is where bargaining approaches came in reaction to this limit.

### ***1.3.2.3 The Bargaining approaches of Female Labour Force Participation***

Contrary to the neoclassical model, bargaining approaches consider different interests of men and women within a household (Lundberg and Pollack, 1996). Relying on game-theoretic models, bargaining approaches provides important insights for the logic of female labour market participation decisions. They assume that spouses with higher earning power and access to resources are able to bargain to work less in home production and more in leisure time. However, the threat point in these models is defined when couples specialize incompletely in home and market work because this latter acts as an insurance (England and Folbre, 2005). These improvements in the division of labour within households allow bargaining models to be more realistic in accordance with most empirical findings, which could not be explained by the neoclassical model.

### ***1.3.2.4 The Relevance of preferences theories of Female Labour Participation***

Another approach explaining female labour force participation is the role of preferences. In this context, the preference theory by Hakim (2000) argues that women differ with respect to their preferences and have different priorities regarding the conflict between employment and family life. However, with the historical changes such as the contraceptive revolution, women face a real choice between employment and motherhood, allowing them to have stronger preferences toward modern lifestyle choices of working women with fewer children. In this sense, Hakim differentiates three groups of women with respect to their preferences: (i) Home-centered women: this refers to women who prefer to be full-time home makers after marriage. (ii) Work-centered women: this refers to those who prefer full-time work other than motherhood. (iii) Adaptive women: it refers to those who prefer to combine family and employment

## **1.4 The concept of Family Formation**

Sociologists, demographers and economists are interested in families. This includes their definition, formation, functioning and structure. During recent years, a tremendous amount of research has been interested to family and family-related issues (Weigel, 2008).

### **1.4.1 Definition and measurement of Family Formation**

#### ***1.4.1.1 Definition of Family Formation***

Family scholars offer various definition of family formation with little consensus because of the variety of characteristics and forms of family (Weigel, 2008). For this reason, family can be conceptualized in two ways, namely family confined to the household and family extending beyond the household. In this study, we retain the first view.

Five different disciplines in the literature attempt to explain how and why families are formed. It is important to note that the discussion of each discipline is by no means exhaustive.

– ***Family Formation according to Anthropology***<sup>15</sup>: According to this view, there is not a unified theory which explains how families are formed (Jacobson et al., 2004). Families are formed on kinships. Different cultures have diverse rules about who should live with whom. While some give all rights for parents to choose their children’s spouses, other cultures do not. In the African societies, family formation is very sacred. Women generally marry men who are substantially older than themselves. Also, pride is given to women’s reproductive potentials, since children are considered as prolongation of family life and in some way a fulfillment of immortality.

– ***Family Formation according to Sociology***<sup>16</sup>: The sociology of the family involves marriage, childbearing, experiences of mothering, experiences of teenagers, and all the like. For this reason, kin and parents exert enormous pressure on couples (Anderson, 1995). Recent trends in family formation are explained by the importance of romantic love (Giddens, 1997). As noted by Stone (1977), family formation has changed from a marriage resulting from parents’ interests, kin or community, to a union based on emotional bonds.

– ***Family Formation according to Psychology***: Unlike sociology which focuses on social behavior, psychology focuses on the individual and uses the ‘*object relation*’, attachment, and the personality theories to explain the nature and drivers of family formation. “*Object relations*”<sup>17</sup> theories claim that families are formed because of the innate motivations to form and maintain relationships (Jacobson, 2004), which generally take off from the earliest relationships individuals have in their infancies (usually the mother-infant ties). The attachment

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<sup>15</sup> Anthropology involves the study of mankind. Early anthropology paid attention to kinship, but it now receives less attention, partly because of an increased interest in modern societies where kinship does not dominate every sphere of activity.

<sup>16</sup> Sociology involves the study of social life, social change, and the social causes and consequences of human behavior

<sup>17</sup> Object relations refer to the emotional bonds between the self and another person or object. It was first developed by Freud, who defined “objects” as anything an infant directs drives towards in seeking satiation (Freud, 1914)

theories claim that the formation of families in adulthood correspond to the kinds<sup>18</sup> of attachments infants received in their childhood from their mothers (Jacobson, 2004). The theories of personality argue that the selection of marriage partners depends on the personal characteristics (Botwin et al., 1997). According to the theories of assortative mating, people will tend to seek for mates who are similar to themselves (Blackwell and Lichter, 2000).

– ***Family Formation according to Biology***<sup>19</sup>: This discipline relies on the evolutionary theories to suggest that men (with their genetic predispositions) tend to be more aggressive, persistent, status-seeking, dominance-seeking, risk-taking, achievement-oriented, goal-oriented, single-oriented and more competitive compared to women. On the other hand, women tend to be more empathetic, nurturing, co-operative and concerned in maintaining relationships as compared to men. These differences in men and women also induce them to have different values about children, hence profound consequences on how they make decisions and how they form families (Jacobson, 2004).

– ***Family Formation according to Economics***<sup>20</sup>: It is the one used in the course of this thesis, which closely linked with Becker's view and extends the applicability of economic theory to analyze relations among individuals outside of the market system (Becker, 1991). In this context, the economics of family involves not only decisions about the distribution of work and household allocation of time, but studies marriage, fertility and children, and divorce.

Hence, family formation is a culturally and historically evolving process, which implies a recognized and approved form of union between conjugal couples - the nucleus of the

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<sup>18</sup> Bowlby and Ainsworth (1991) outlined three kinds of attachments that infants had to their mothers: secure attachment, where children had a loving childhood, with mothers who were sensitive and responsive to their needs; avoidant attachments, characterizing children who were constantly denied physical contact by their mothers; and anxious/ambivalent attachment, resulting from mothers who were slow and inconsistent in responding to their infant's cries.

<sup>19</sup> The biological view is based on the evolutionary approaches which consider human (man and woman) behavior to be complementary and driven by genetic selection.

<sup>20</sup> The economic approach stresses the concept of scarcity and the need to consider the costs and benefits of alternatives, since choices must always be made.

<sup>20</sup> The notion of family in this study follows the construct by Becker (1965), in which the man and the woman share the same household, including legalized and spontaneous unions, but excluding separated persons who are legally married. Viewed from an economic perspective, it can be considered as a small industry, in which time and market goods bought in the market are combined to produce basic goods and services, such as meal, accommodation, children, child rearing, and entertainment that yield utility to its members (Becker, 1991).



“family<sup>21</sup>” (Fedd et al., 2015). As most researchers pointed out, family formation may be viewed as “an ongoing system in which fertility is in part a function of events and states defined at earlier stages and in part determined by events and reevaluations as the process unfolds through time” Bumpass and Westoff, 1970; Goldberg, 1960; Namboodiri, 1972, 1974). According to Mott (1972), this process of family formation also includes desired family size, spacing of the first birth, and the timing of first contraceptive use.

Throughout this study, we retain the definition advanced by Buchmann and Kriesi (2011; P. 5) of the term family formation as “a demographic marker of the transition to adulthood” including forming a co-residential union, getting married, and transiting into parenthood. Since recent trends in family formation have consistently indicated a postponement in marriage and parenthood, this study will focus on these two main aspects of demographic transition.

#### **1.4.1.2 Measurement of Family Formation**

Various approaches are used in the literature to assess family formation.

– ***The household head approach***: It is the traditional way to assess family formation by determining how each member of the household is related to the “head”. One family member responds to all questions about the whole family. This method was found to be limited because it does not fully capture and present the exact measurement of step-parents, sub-families, and half and step-siblings. Another important issue with this approach is to identify the primary respondent.

– ***The Marriage and co-habitation approach***: most national surveys include questions to identify current marital and co-habitation status.

– ***The Family histories approach***: It is broader than the marriage and co-habitation approach, since it combines the marital and co-habitation histories along with fertility histories prior to the interview. Hence, it includes the union status and captures full family transitions for children and adults. It also includes the fertility histories which measures not only the



relationships of respondents to father/mother of the child, but also the dates of birth and number of children.

– *The Fertility experiences approach*: in order to capture family formation, most surveys use fertility histories to establish the timing of entry into parenthood. It establishes the timing or the union context of births, and whether a birth was intended or not.

In this thesis, since most definitions of family formation view it as a process and/or transitional event, it will be insufficient to consider only marriage or fertility. Hence, we capture family formation not only by marriage and co-habitation or fertility experiences separately, but we include both the union and the fertility pointers. This is because in the African context, especially in Cameroon, marriage occupies a crucial role. Marriage is generally recognized as the onset of the socially acceptable exposure to regular sexual activity and childbearing (Ikamari, 2005). According to Mpilambo et al. (2017), marriage is the first stage in the process of family formation. And, marriage includes the study of the formation of couples (Grossbard, 1999). Hence, in this context, family formation consists of marriage/co-habitation and fertility experiences captured at the transitional stage (as given in the definition of family formation). Hence, marriage is captured by the age at which the woman enters into marriage/co-habitation for the first time (age at first marriage), while fertility is captured by the age at which the woman gave birth to her first child (age at first birth).

## **1.4.2 Theoretical evolution of the concept of Family Formation**

### ***1.4.2.1 Early view of the concept of Family formation: The theory of first and second demographic transition.***

Historically, the evolution of family formation patterns is not unilinear, but multilinear. Therefore, it is not easy to provide a universal description on the change in marriage and childbearing in countries after the 1960s. After the end of “Baby boom” period which ran from early 1950s through early 1960s, demographic phenomena in most countries changed to give rise to increased number of cohabiting couples with fall in marriage rates, decline in fertility rates with postponement in the timing of childbirth. Demographers often termed these changes as from the 1960s as the “*Second Demographic Transition (SDT)*” (Lesthaeghe, 1983; 1995; Van de Kaa, 1987; 1994), a concept not unanimously accepted by all researchers (Coleman, 2004; Caldwell, 2006; Bernhardt, 2004). Despite the conceptual invalidity of the SDT, marriage

and childbearing are considered as human actions conducted within a society, which determine its demographic pattern.

Prior to the conceptualization of the SDT before the 60s, several theories have been advanced in order to characterize the demographic change from a long historical view (Kreager, 2015). SDT was initially termed as the “First Demographic Transition, (FDT)”, or simply “demographic transition”. In this context, Notestein (1953), and Davis (1945) used this concept to examine the relationship between the decline in fertility and mortalities in developed countries.

Relying on a framework describing a process of moving from one state of equilibrium to another, the theory of FDT supposes that high level of fertility balanced with that of mortality. The primary focus of the FDT was centered on the influence of marriage behavior on marital fertility. This is because, before the 60s, most births were occurring within wedlock, and marriages were tightly attached to fertility.

However, due to the technological improvements and modernization, death rate started to reduce; the fertility rate also started to decline in response to the decline in mortality rate. At this level, the classical theory or orthodox demographic transition with stability in the demographic regime fails to be verified (Wilson, 2013). The anticipated equilibrium between the number of births and deaths instead yield below-replacement fertility (Demeny, 1997). This new situation drew research interest; hence was advanced the theory of the SDT to clarify this double decline of mortality and fertility rates.

In contrast to the FDT, the SDT does not assume stability in the human population (Van de Kaa, 1987, 1994; Lesthaeghe, 1995, 2001; Lesthaeghe and Willems, 1999). That is, with respect to the level of mortality, human population is always replaced with the level of fertility. Even if the FDT’s interest lies on the marital fertility, the SDT includes patterns of partnership formation in its analysis. For instance, after the 1960s, changes such as increases in the number of birth-giving out of wedlock, in the divorce rate, in the number of co-habitation among couples, and more recently homosexual unions occur. In this regard, the SDT is more viewed as inclusive of changes in partnership and family formation (Coleman, 2004).

The concept of “*Second Demographic Transition*” was proposed for the first time by Van de Kaa and Ron Lesthaeghe in order to describe demographic changes which occurred in developed countries after the 1960s. Moving from a small world of mortality-fertility

relationship in Demography, fifteen sequential indicators were proposed in order to clarify and universalize the theory of the SDT. These sequential stages cover changes from partnership to reproductive patterns. When a country experiences an increase in the number of cohabited couples and extra-marital births, it is considered to enter the stage of the SDT. Changes in partnership formation and childbearing patterns seem not to be universal among developed countries. For example, a high number of extra-marital birth is experienced in Australia, whereas, the number still remains extremely small in Japan (Carmichael, 2014). Also, a salient postponement in marriage and childbearing tend to occur in Western and Northern Europe, while East Asian countries, dominated with a patriarchal family system, experience slight increase in co-habitation; and Latin American countries experience a drastic increase in the number of co-habitations and a mild delay in the timing of birth (Esteve et al., 2012; Lesthaeghe, 2014).

Despite the celebrity of the SDT, it could not explain these geographical variations in partnership and birth patterns. Another limit of this theory is that it focuses only on demographic changes occurring in developed countries, while these patterns in developing countries are not explained. Hence, we can argue that the theory of the SDT is not too sophisticated to describe accurately and sufficiently demographic changes occurring in developed and developing countries.

Because the demographic theories lack sufficient breadth of scope and content to describe a universal demographic pattern after the 1960s, two fundamental theories attempt to explain these changes: the economic and the ideational theories of marriage and fertility.

#### ***1.4.2.2 Economic theory of marriage and fertility behavior***

The economic theory of Marriage and Birth behavior generally claims that, given fixed preferences, demographic patterns and trends depend on objective and materialistic resource like income and employment opportunities.

The theory of marriage argues that people prefer to enter marriage because the benefits attached to marriage are greater than remaining single. These benefits include the reduction in transaction costs (Pollak, 1985); the protection of specific assets of marriage such as investment in children (Cohen, 1987, 2002); the production of household public goods, and the economies of scale in this household production (Becker, 1991). For this effect, efficient marriage is

generally characterized by positive assortative mating, where individuals select partners who have almost a similar “value” as themselves.

Since children are the most important marital-specific assets of marriage, decisions about fertility are crucial to family behavior. Because of the economy of well-trained workers, couples choose to have fewer children in order to invest more in them. In this perspective, the cost of children significantly depends on the value of time of married women (Becker, 1991).

In this perspective, two alternative economic theories of Richard Easterlin and Gary Becker were put forward to describe marriage and fertility patterns (Lesthaeghe, 2010). Even though the New Home (Household) Economics (NHE) and Easterlin’s theories formulate different explanation in marriage and childbearing behavior, they are fundamentally based on the idea that people’s decisions to get married and to have children are taken under an economic and materialistic point of view. Both theories arrive at the conclusion that if getting married and having children is economically beneficial to each, they choose to marry.

#### *Becker’s economic theory of marriage and fertility*

Originally articulated by Becker, his theory has been progressively developed by his colleagues (Becker, 1986, 1991, 1996; Becker and Barro, 1988; Becker and Lewis, 1973; Butz and Ward, 1979; Folbre, 1996; Rosenzweig and Stark, 1997; Schultz, 1974; Werding, 2014; Willis, 1973). The theoretical framework is based on the consumption theory of fertility of Hicks-Allen (Androka, 1978), and considers marriage and fertility behavior as economic activities.

Assimilating human fertility behavior with human consumption behavior, this theory formulates two assumptions concerning childbearing behavior. The first assumes that in industrialized countries, children are considered purely as consumption goods (not productive or economic goods), bringing psychological utility (satisfaction) to their parents. Second, in a fixed and stable preference, a household (or a couple) consumes goods and services in order to maximize its utility under the monetary and time constraints. Hence, the extent to which children bring satisfaction will determine the couple’s (or household) behavior toward the number of children to have.

Based on these assumptions, this theory claims that a couple (or household) consumes goods and services in a way that maximizes their utility in a fixed preference ordering<sup>22</sup>. Hence, using the analogy of the consumption theory, this theory assumes that an increase in the couple's (or household) income will increase the number of children, *ceteris paribus*. Yet this theory recognizes at the same time that a rise in income does not necessarily lead to an increase in the number of children. To overcome this weakness, Becker and Lewis (1973) used the phenomenon of the switch from the quantity to quality of children based on the consumption behavior<sup>23</sup>. Hence, in the case of fertility behavior, a couple (household) with higher income may decide to spend more income on few children in order to improve the quality of children.

Like childbearing behavior, marriage is also regarded as an economic activity. Relying on the “*The principle of comparative advantages*” proposed by David Ricardo, partnership formation is described under two basic assumptions. The first suggests that men and women allocate their own time between domestic and market activities. When engaged in home activities, people produce “home commodities” such as cleaning, cooking, good health, child bearing and rearing, but earn no salary for that. While, those engaged in market activities earn money for their work. The second assumption suggests that men and women have different production capacities in these two activities.

Based on these two assumptions, Becker and his colleagues consider partnership formation to be a trading process between a man and a woman in order to maximize their mutual utility. Hence, marriage will be beneficial for both partners if the partner with a comparative advantage in household production devotes himself or herself to domestic work, meanwhile the other with comparative advantage in market production specializes in market work. In this context, the total utility is greater and each partner is better off by being married than by remaining single.

#### *Easterlin's economic model of marriage and fertility*

Also relying on an objective and materialistic point of view, Easterlin's theory supports the idea that it is the relative income which determines marriage and fertility patterns (Easterlin,

<sup>22</sup> Becker (1996) attempts to propose a utility function which allows preference to be more dynamic and changeable. Yet, the formation of human preference of human preference is, in reality, more complicated than Becker formalizes (for details, see Henrich et al., 2004).

<sup>23</sup> In consumption behavior, it is likely that, instead of increasing the demand for inferior good, a rise in income levels will create an increase in the demand for superior goods. For example, a rise in income may allow a consumer to shift from an economy car to a luxury car.

1961, 1973, 1967, 1978, 1987, 2004; Easterlin et al., 1980; Oppenheimer, 1988). Specifically, this theory uses the relative economic status <sup>24</sup> between generations to explain marriage and childbearing behavior. In this view, when a young adult lives in a relatively economic status, he feels less economic pressure, thus will get married earlier and have more children. Whereas, if the relative economic status is worse, a young adult will feel high economic stress, hence will delay marriage and have fewer children.

#### *Economic theories of assortative mating, marriage and birth timing*

Oppenheimer (1988) in a modified job-search theoretical framework developed a model to show that some factors determine marriage timing either by easing or impeding partnership formation. In order to explain decline in marriage rate, this theory suggests that if people delay marriage, it is because they do not wish to just marry anyone; the time spent to find a suitable mate will delay marriage. Because there are too many uncertainties, imperfect information, and random elements involved in searching a suitable partner, potential partners will gather reliable information about important attributes on their mates. However, among these characteristics, young people's economic independence plays a crucial role in marriage timing. Hence, a young person's current labour-market position determines his or her current ability to enter marriage since he or she has the ability to set up an independent household.

On the other hand, in a multi-period life-cycle framework theoretically, Happel et al. (1984) identify microeconomic variables affecting the timing of the birth of the first child. Since childbirth implicates wives, the timing of the first child will depend on wives' lifetime earnings.

Overall, economic theories of marriage and fertility behavior all attribute changes in their patterns to economic conditions, whereas beliefs and values are kept aside.

#### ***1.4.2.3 Ideational theory of marriage and fertility behavior***

Instead of seeing marriage and childbearing behavior as a consequence of economic conditions, the ideational theory relates these behaviors to subjective and psychological attributes. This theory claims that the family formation process is not entirely dominated by economic conditions (Murphy, 1992). For instance, Lesthaeghe (1977) examined the case of Belgium and found that under the same economic conditions and within two different linguistic

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<sup>24</sup> This status is an index of relative affluence which is defined as a ratio between the earning potential of young people and the level of their material aspirations shaped by their natal household. In many cases, the job opportunities or wage rates of young adults in the labour market are used as the numerator of this ratio, while its denominator is measured by their living standards as children in their parental home.

regions (French-speaking Wallonia and Flemish-speaking Flanders), Belgium experienced diverged movements in fertility. Hence, the ideational theory relies on the theoretical framework of human action being directed by beliefs and values, that is, one's decision is affected by his or her beliefs and values which the person himself or herself holds.

Criticizing the NHE's theory of marriage and fertility behavior, Blake (1968) pointed out that even in the contemporary society children have more functions than just bringing satisfaction to the parents. Having children may bring inherent values such as consolidating the feeling of solidarity among families, especially in the African context.

Factors of beliefs and values that affect marriage and childbearing behavior can be summarized in two points, namely, a strong commitment to individualism and weakness in conventional values and customs.

#### *Strong commitment to individualism*

It has been widely displayed in developed societies where people are more preoccupied with the pursuit of own objective and aspiration of self-fulfillment. This individualism tends to increase as a society becomes affluent, since individual priority of needs shift to personal self-fulfillment (Moors and Vermunt, 2007). This ideational theory considers this self-oriented and goal-pursuing attitude as a main driving force behind the changes occurring in marriage and fertility behavior in developed countries. It is found that within a social sphere, as more weight is placed on individual self-fulfillment, individuals prefer to pursue their own goals instead of entering marriage and becoming parents (Buchamann, 1989; Preston, 1986).

#### *Weakness in Conventional values and customs*

Because conventional values and customs regulating human behavior have reduced, people have allowed more diverse lifestyles, thereby giving way to the principle of individual free choice and the development of an environment that accepts pluralism and diversity. As a result of this weakness, many demographic behaviors such as voluntary childlessness, co-habitation, and same-sex marriage which were rarely seen in the past have been tolerated and accepted in modern societies (Lesthaeghe and Meekers, 1986).

Although there is still room for further investigation regarding the extent to which ideational theory explains actual patterns of marriage and childbearing, there is no reason to



deny that preferential factors play an important role in recent demographic phenomena (Hackim, 2003).

## **1.5 Education, Family Formation, and Female Labour Market Participation: theoretical foundation and framework**

### **1.5.1 The New Home Economics (NHE): microeconomics models of intra-household activity and time allocation**

This study enters into the new breeze of theories arising after the 1960s, the New Household Economics (Becker, 1992). The starting point of work on the family departs with the fact that when a man and a woman want to get married or have children, they try to maximize their utility by weighing between costs and benefits, which is rational from an economic perspective. Yet according to assumption made on the preference of family members, we will have collective or altruist model and game-theoretic bargaining models.

#### ***1.5.1.1 Unitary or traditional models of the family***

Gary Becker was the first to introduce a model of family or household collective choice called “altruist model” (Pollack, 2002). In this model, Becker views household as a harmonious unit with an altruistic patriarch who keeps the household functioning for the common good, i.e. the household taken to be one person. Also named as “common preference” models of the family, unitary models make no distinction among the different family members. These models conclude that specialization in family formation and home production (household chores and child rearing) or decision to participate in the labour market, are always welfare maximizing decisions. Using the physiological difference between a man and a woman, Becker attempted to distinguish who works at home or outside home.

#### ***Becker’s traditional gender role: Incompatibility of employment and family life for women***

Furthermore, the NHE theory considers the opportunity cost of bearing and rearing a child to also play a major role in fertility behavior (Butz and Ward 1979; Mincer 1963). Since, taking care of an infant is viewed as a time-intensive activity, it reduces the mother’s time in responding to other activities such as work in the labour market. And assuming the traditional gender role, Becker sees childbearing and work to be mutually exclusive alternatives for women. As a result, women are forced to abandon their earning-jobs that could be obtained in the absence of a husband or a child.



Unfortunately, many studies do not corroborate with Becker's theory. As the increase in technology and female education attainment are progressively observed, specialization in housework is less attractive to educated women. The unitary models assume that decisions taken at the family level are made jointly so that the household maximizes a single set of objectives for all its members (Ellis, 1988). This occurs when all its members have exactly the same preferences. But, all household members do not necessarily behave in accordance with preference maximization. For example, if there is violence in the household, then somebody (the dictator) is forcing other members to agree with him.

Since the attitude toward women have changed since more women accumulate human capital and labour force participation (Chioda, 2011), another failure with this model is that it expects marriage to become rare as women's education increases, since no educated woman would desire to enter such a household. Oppenheimer (1994, 1995) contradicts this view by pointing out that it is the structure of the family that has changed (fewer children) while marriage has become a collaborative effort in which both partners contribute in accordance with their individual skills. According to him, it is good for both partners to be employed because it reduces the dependence of the family on a single source of market income. It is in this range that work-family balance and game-theoretic bargaining models arise in response to accumulating empirical evidence.

#### ***1.5.1.2 Non-unitary models of family***

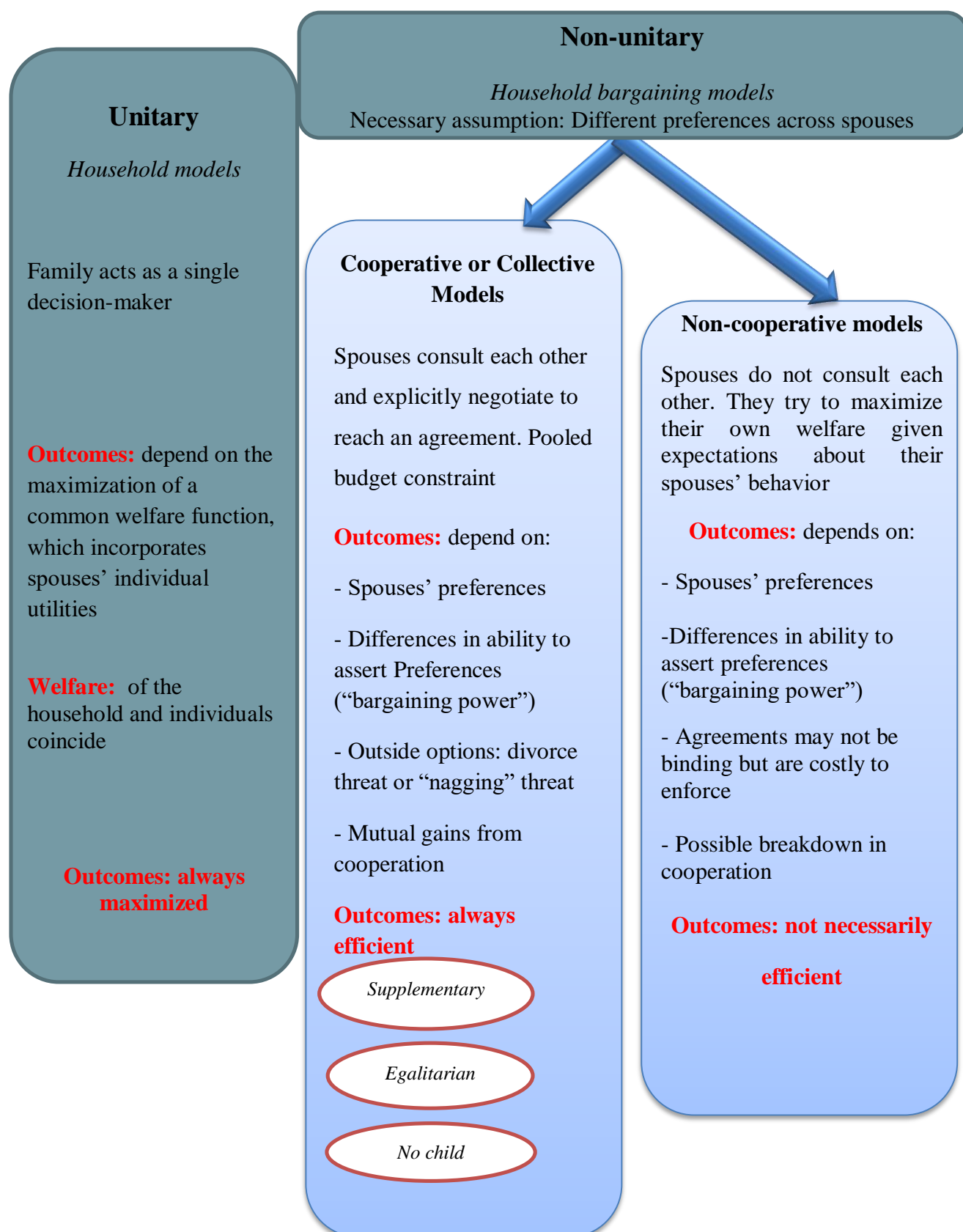
As an alternative to the unitary family model, the bargaining models of family were put forward in the early 1980s by McElroy and Horney (1981) and Manser and Brown (1980). These models consider a household as a group of more than one person, and that conflicts arise among its members due to different preferences and aims. Specifically, the cooperative bargaining model of marriage considers a married couple whereby each partner has a utility function that depends on his or her own consumption. When spouses reach an agreement, they easily find the work-family model that suits them. But if they fail to agree, they find a "threat point" or a "disagreement point" which can be interpreted as "divorce-threat" or non-cooperative equilibrium with marriage. This is illustrated in a nutshell as shown in Figure 1\_1.

The expression "Work-Family Balance" was first employed in UK in late 1970 to define individuals, particularly women's stability between work life and family or personal life. It does not mean an equal balance between responsibilities at home and at work, but a careful

synchronization of an individual's activities which include work, family, social obligations, leisure, spirituality, and so on.

Also called pluralistic decision-making models within the family (Bergstrom, 1997), collective models of household behavior aims at capturing the different preferences, conflicts and inequalities among household's members. These models focused on the individuality of household members rather than a joint decision-making (or only one utility function), i.e. they imply different decision-making rules than those apparent in the unitary model. A range of three alternative models on how to combine parenthood are as follows.

**Figure 1 1:** Unitary and non-unitary family models in a nutshell



**Source:** Author inspired from Chioda (2011)

A first strategy in collaborative models terms ‘*supplementary*’ model is a family model where wives in addition with their household chores and childbearing, can still earn from part-time jobs in order to supplement husbands’ income.

A second strategy is the ‘*egalitarian*’ model, where both partners share responsibility for childbearing and labour participation, depending on whether a partner prefers part-time or full-time work.

A final solution to the strategy of combining parenthood and work is the ‘*No-child*’ family model, where both partners completely specialize in paid work, without spending much of their time on childbearing and home activities. This framework is summarized in figure 2 of Appendix 1.

### 1.5.2 Theoretical framework

The rational choice analysis of entering family formation, or working in the labour market or doing both is built on the maximizing behavior. This rational choice is built using the new home economic framework, which is a model that combines education, marriage/birth choices and labour supply (Cigno, 1991). Based on Becker’s (1965, 1981) household production theory, the household total utility depends on the choices made by the household members (primarily the husband and the wife). These choices as elaborated above concern resolutions about who should focus on home production or work outside home; and if a partner works, how often should he or she do so. The optimal decisions about when to form a family, working in the labour market, or doing both is necessary.

In our theoretical framework, we consider two individuals, a man (M) and a woman (W) who must decide whether to form a family or remain single and childless. In this framework, we consider that “family” is composed of a woman and a man who share the same household as husband and wife. In this context, family formation occurs if and only if, both man and woman are made better off that is, they increase utility<sup>25</sup>.

Relying on the new household consumption theory and time allocation theory, a woman can devote her time into home activities, market work, and leisure. Hence, a typical two-person household maximizes its utility (U) as given by:

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<sup>25</sup> More precisely, if they expect to increase their utility, since the latter is not known with certainty.

$$U = U(X_m, X_h, l_M, l_W) \quad (1)$$

Where  $U$  is the household's utility function which is twice differentiable;  $X_m$ ,  $X_h$  are respectively vectors of market goods and home produced goods and services;  $l_M$  and  $l_W$  are respectively the man's and the woman's leisure.

In this construct, home-produced goods and services include union formation (meals, recreation, love, companionship, prestige) and childbearing (timing, quality and quantity of children). These home activities are produced partly with market goods and services and partly with each or both partner's time. We assume that these goods can be transferable among the man and woman of the same household, but neither marketable nor transferable among different household members. This implies that, depending on the relative comparative advantage of each household member, there could be either a complementary or a substitutionary effect in the production of home-produced goods and services, holding other things equal.

$$\text{Letting} \quad X_h = M + B \quad (2)$$

Where  $M$  is age at first marriage, proxy for union formation or marriage; and  $B$  is age at first birth, proxy for fertility. The production function of these two activities can respectively take the forms of:

$$M = M(I_m, E_W, E_M, X, \pi) \quad (3)$$

$$B = B(I_m, E_W, E_M, T_W, T_M, X, \pi) \quad (4)$$

Where,  $M$  and  $B$  are age at first marriage and age at first birth respectively;  $I_m, E_W, E_M, T_W, T_M, f, X, \pi$  are respectively economic prospects of the country, wife's education, partner's education, wife's time used to produce children, partner's time used to produce children, a vector of other exogenous individual, parental, household and community characteristics, and the woman's innate endowments.

Since the total available time  $T$  of each partner can be allocated to the labour market, family formation, and leisure, we have:

$$L_W + T_W + l_W = T^W \leq T \quad (5)$$

$$L_M + T_M + l_M = T^M \leq T \quad (6)$$

Where  $T^W, L_W, T_W, l_W$  is respectively the total time available to the wife, allocated to work, family formation, and leisure.  $T^M, L_M, T_M, l_M$  is respectively the total time available to the partner, allocated to work, family formation, and leisure.  $T$  is the total amount of time available to the household members. The composite time constraint of the household assumes that the total amount of time spent by both partners on work at home, work in the market, and leisure cannot exceed  $T$ . Hence, the total amount of time available for the household is:

$$L_M + T_M + l_M + L_W + T_W + l_W = T^W + T^M \leq T \quad (7)$$

The household is supposed to pool its pecuniary resources from both partners' earnings and exogenous non-labour incomes. Introducing a budget constraint that relates income and expenditures, we have:

$$P_M \cdot M + P_B \cdot B + P_I \cdot I_m = w_W \cdot L_W + w_M \cdot L_M + R = Y \quad (8)$$

Where,  $P_M \cdot M$ ,  $P_B \cdot B$ ,  $P_I \cdot I_m$ ,  $w_W \cdot L_W$ ,  $w_M \cdot L_M$ ,  $R$  and  $Y$  are respectively cost of getting married, cost of bearing a child, cost of market purchased goods, wife's labour income, partner's labour income, non-labour income, and the total income of the household.

To solve this structural model, we maximize the utility function given in equation (1), subject to marriage (3) and birth (4) production functions, time (7) and budget (8) constraints respectively. The solution of this maximization problem yields the woman's optimal timing in marriage, birth, and labour supply. Specifically, we obtain reduced forms of our endogenous variables with respect to exogenous variables. Thus, our decision variables such as marriage timing ( $M$ ), birth timing ( $B$ ), and the wife's labour supply ( $L_W$ ) can be expressed as a function of price of marriage, price of childbearing, female education, partner's education, non-labour income of the household, wife's expected wage rate, partner's expected wage rate, other exogenous individual, parental, household and community characteristics, and the woman's innate abilities and endowments.

Implicitly, these reduced forms can be expressed as:

$$M = M(P_M, P_B, E_W, E_M, R, w_W, w_M, X, \pi) \quad (9)$$

$$B = B(P_M, P_B, E_W, E_M, R, w_W, w_M, X, \pi) \quad (10)$$

$$L_W = L_W(P_M, P_B, E_W, E_M, R, w_W, w_M, X, \pi) \quad (11)$$

where  $P_M, P_B, E_W, E_M, R, w_W, w_M, X, \pi$  denote respectively price of marriage, price of childbearing, wife's education, partner's education, household non-labour income, wife's expected wage rate, partner's expected wage rate, a vector of other exogenous individual, household and community characteristics, and the woman's innate ability and endowments.

## **1.6 Linking Education, Family Formation, and Female Labour Market Participation**

### **1.6.1 Theoretical link and hypothesis derivation**

Human capital theories advocate that individuals decide to invest in education because of the benefits they expect to reap from this investment. These benefits include monetary and non-monetary aspects. However, most empirical evidences studying the effects of education limit themselves either on the monetary or non-monetary effect of education, especially when it concerns females. To this effect, our endeavor in this section is to theoretically establish the various links showing the effects of education both on family formation and labour market outcomes while deriving from our main hypothesis retained for this thesis.

#### ***1.6.1.1 Education and the timing of first marriage***

Female education is considered as an important input in marital outcomes. Hence, it may affect marriage timing in many ways.

School enrolment is an impediment to child marriage. It requires many years in school and college to receive knowledge and instruction (Ikamari, 2005). And once enrolled in school, it is neither easy nor desirable to combine marriage with education (Dixon, 1971; Oppenheimer, 1988; Goldscheider and Waite, 1991). Also, there are usually strong social norms which prevent people enrolling in school from marriage or any form of co-habitation (Blossfeld and Huinink, 1991; Thornton et al., 1995).

School enrolment withdraws girls from the domestic or traditional environment and inculcates in them new modern ideas which may compete with the traditional values and customs which promote early marriage (Westoff, 1992; Caldwell et al., 1983). For instance, estimates from the Kenyan DHS reveal that the median age at first marriage among ever-married women with at least secondary education was 22, while that of those with no education was 17 (NCPD et al., 1999). Hence, education develops values which give preference to career development and personal fulfillment at the detriment of traditional roles.

By exposing young girls to non-traditional or modern values, education affects marriage timing through the use of effective contraceptives. The appropriate use of these contraceptives enables them to avoid undesired pregnancies that may interrupt their education and compel them to enter early marriage (NCPD et al., 1999). Literature reveals that educated women are more likely to use effective contraceptives than uneducated ones.

Moreover, education may affect marriage timing through the way the society perceives educated people and how educated people perceive themselves (Caldwell et al., 1983). In the traditional society, early marriage and childbearing were highly valued (Caldwell and Caldwell, 1987), but with the advent of education, the modern society values educated women, whether married or not (Ikamari, 2005).

Since school enrollment and marriage seem to be incompatible, *education is likely to postpone the entry into first marriage (H1)*.

#### ***1.6.1.2 Education and the timing of first birth***

Education and birth timing are known to be strongly correlated. On the one hand, early birth often leads to the termination of education. Most studies concur that most girls drop out of school because of pregnancy (Gyepi-Carbrah, 1985). Policies in many developing countries, especially eight sub-Saharan countries (including Mali, Botswana, Tanzania, Kenya, Zambia, Liberia, Togo, and Nigeria), are much stricter: “they decree that pregnant schoolgirls be expelled permanently”. For instance in Kenya, schoolgirls who become pregnant are constrained to stop their education for at least a year (Ferre, 2009); in Cameroon too.

Education and birth-giving are usually time-incompatible. School enrollment needs all the attention of students so that a schoolgirl who becomes pregnant will have to interrupt her education at least for a while; meanwhile, the one who desires to attain a higher level of education, will have to postpone her first child birth-giving. This time incompatibility is more acute in SSA countries because of the legal incompatibility: schoolgirls who become pregnant or who enter marriage are asked to leave school as a matter of policy (Ferre, 2009).

Education improves women’s knowledge on contraceptive use and family planning. An educated woman is likely to better understand and use contraceptive methods and control her family size, compared to the one with low-education. Many studies show that education improves literacy skills, improves the ability to understand decontextualized language, and alters behavior (Ainsworth et al., 1998; Ferre, 2009).



Education increases women's autonomy. Education postpones marriage and childbirth by improving women's autonomy (Jejeebhoy, 1995), and increasing their decision-power in marriage through working prior to marriage.

Since school enrollment and childbirth seem to be incompatible, this study hypothesizes that *education is likely to postpone first birth timing (Hypothesis 2)*.

### ***1.6.1.3 How marriage and birth-giving modulate the nexus between education and female employment***

The literature indicates that highly educated women are more like to be employed in the labour market thanks to their higher human capital (Gaudet et al., 2011) compared to low-educated ones. This advantage induces educated women to attach greater importance to their work status as a means of self-realization (Friedman et al., 1994; Neels and Theunynck, 2012; Wood et al., 2016).

Yet, women's life course is different from that of men. Unlike men, women are called upon by nature to give birth and rear children. Many studies confirm that most family responsibilities and tasks are carried out by women, especially in SSA countries (Dieterich et al., 2016; Wood et al., 2016). Mothers who decide to work in the labour market have to combine their family roles and work. Hence a negative effect of marriage and childbearing on women's employment is expected.

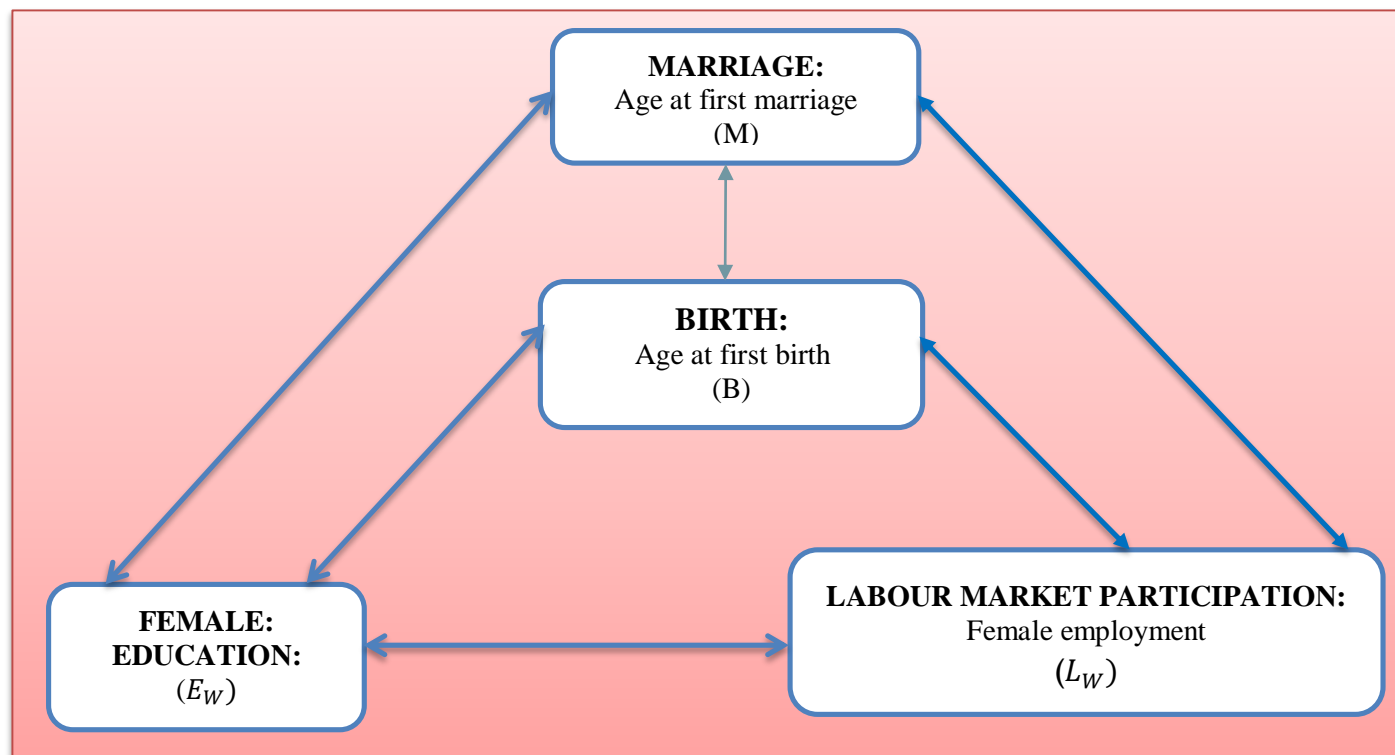
However, this effect will not necessarily have a strong negative effect on highly educated women's employment compared to less educated ones. Highly educated women are more likely to use formal childcare, to take shorter maternal leave, and are more favorable in combining work and family (Wood et al., 2016).

Therefore, there is a positive relationship between education and female employment before family formation, since highly educated women have more labour opportunities compared to low-educated ones.

Therefore, this thesis hypothesizes that *education offers greater opportunities for women to work in the labour market, yet these opportunities are reduced or cancelled out when they are engaged in marriage and birth (Hypothesis 3)*.

## 1.6.2 A triad of education, family formation, and female labour market participation

**Figure 1 2:** Channels transmitting Education to marriage and birth, and their ensuing effect on female Employment



**Source:** Realized by the author of the thesis

## 1.7 Conclusion

This chapter aimed to conceptually and theoretically link education, family formation, and female labour market participation. Each concept was respectively highlighted in terms of definition, measurement, and evolution in Section 1.2, 1.3, and 1.4. Section 1.5 establishes the main theoretical foundation and framework relating of our thesis. Finally, Section 1.6 explores the different linkages existing between our concepts, which guide us to construct a flow diagram.

# Chapter Two:

## Education and Transition into First Union Formation among Women in Cameroon

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### 2.1 Introduction

Marriage, which determines the transition to parenthood (Ikamari, 2005) is one of the most important and memorable event in a person's life-cycle. Since it is the onset of the socially acceptable exposure to regular sexual activity and childbearing, marriage is considered as the foundation in the process of family formation (Mpilambo et al., 2017). Actually, marriage has received more attention in recent decades because it shapes important future life events (Mensch et al., 2014) such as fertility and career prospects. Marriage is universally defines as a union between a male and a female who acquire a new social status as husband and wife (UN, 1988, 1990). In this union, apart from procreation, which is one of the main reasons for marriage, it also satisfies partners' biological desires, improves social ties among individuals of a society (Mibang and Behera, 2006), and meets with their mutual material, psychological and spiritual needs (Burgess and Locke, 1945; Dyer, 1983).

In this context, the timing of first marriage is a decisive dimension for women because it is linked with her procreative behavior and her labour market prospects (Singh and Samara, 1996). Marriage timing is the moment from which a woman is exposed to marriage until the time she actually gets married. Thus, age at first marriage (union) is likely to be an important determinant of fertility, since it determines the length of time a woman is exposed to the risk of pregnancies (Mpilambo et al., 2017).

Although patterns of age at first marriage across continents appear different and evolving over time, early marriages<sup>26</sup> (at age 15-19 years), were generally observed in traditional societies of Africa and Asia before the 50s, and is still currently going on in most societies of these continents. By the same token, late marriages (above age 25) appear to be

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<sup>26</sup> Defined by UNICEF (2001) as marriage below the age of 18.

common in modern western countries at the end of the 20<sup>th</sup> century (UN yearbook; Singh and Samara, 1996; Westoff et al., 1994, Althaus, 1991).

Singh and Samara's (1996) study using data from 40 demographic and health surveys reveals a tendency of early marriage in developing countries. Generally, 20 to 50% of women get married or enter a union before the age of 18, and 40 to 70% before 20 years of age. However, nowadays, highest rates of early marriage in the world are found in Sub Saharan Africa: Niger with the highest rate of 75%; followed by Chad, 72%; and Mali, 70.6% (Walker, 2012, Mpilambo et al., 2017). Within regions in SSA, early marriage is comparatively high in Central Africa (40%) and highest in West Africa (49%). While, it is lower in East (27%) and Northern (20%) Africa. Finally, within Central Africa, the highest rate of early marriage is found in the Democratic Republic of Congo - where 74% of all females are in unions before the age of 19, while Cameroon trails behind - where about 52% of females aged between 20 and 24 married by the age of 18 (Walker, 2012).

Many authors confirm that early marriage is generally related to early childbearing (Singh and Samara, 1996; Ikamari, 2005; Susuman, 2017; Mpilambo, 2017), which is usually subjected to high risks of morbidity and mortality (Ikamari, 1996). Women who get married early find in childbearing the unique attention of their lives (Singh and Samara, 1996), especially in the developing world where the main purpose of marriage is to have kids. For this reason they foreclose other life-course opportunities such as education, training for employment, work experience and personal development (Singh and Samara, 1996). Research has shown that early age at first marriage robs young girls from their childhood, results to early childbearing and repeated childbirth (less than 24 months), many unwanted pregnancies, higher rates of induced abortions, many children, and lack of contraceptive use (Raj et al., 2009; ICRW, 2012). High tendency of domestic violence and sexually transmitted diseases (Mpilambo et al., 2017), and higher chance of divorce and separation (Singh and Samara, 1996) are also observed among girls who married early.

Regarding early marriage as detrimental for both women, children and the society as a whole, some local governments, international organizations, women's and advocacy groups proposed programs to delay child marriage (Singh and Samara, 1996). This is because young girls who marry beyond their adolescence directly shorten the number of years available for childbirth, therefore limit family size, or widen the spacing of children (Amin, 1995; Jensen and Thornton, 2003), enhance their education, and develop their labour force abilities and career

prospects that compete with childbirth within marriage (Becker, 1993; Ikamari, 2005; Mpilambo, 2017).

In Cameroon, the centrality of marriage is well recognized. Even though the government initiated “*Free Collective Marriages*” in 2006 in order to legalize the marital status of couples who were still cohabiting, legal age of marriage (which is 15 for women and 18 for men) remains very low. And according to data from the 2011 Cameroon’s DHS, despite the timid increase in the median age at first marriage over years, it remains below 18 (early marriage according to UNICEF). The median age rose respectively from 16, 17 and 18 years during 1998, 2004 and 2011. In 2011, it occupied the 14<sup>th</sup> position in the ranking of countries in the world according to percentage of girls married before the age of 18 (Walker, 2012).

In general, some elements affect marriage timing by either easing or delaying family formation (Oppenheimer, 1988). In seeking for factors explaining marriage in developing countries, most findings confirm that age at marriage is related with main basic personality characteristics, cultural and religious beliefs, socio-structural arrangements, and socioeconomic background such as increases in educational level, urbanization, and the emergence of modern values (United Nations, 1987, 1988; Oppenheimer, 1988; Lesthaeghe et al., 1989; Singh and Samara 1996; Kaufman and Meekers, 1998). Among these factors, education appears to be the main factor that is strongly associated with the postponement of marriage (Jejeebhoy, 1995).

Measured as the signal for “ability” and quality, female education is considered as an input in improving marital outcomes. For many reasons, better educated women tend to have more advantages than less educated ones (Shafer and Qian, 2010). First, it affects individuals’ attractiveness in the marriage market by shaping their social status and economic potentials (Blackwell, 1998). That is, better educated women tend to be more efficient in household production (accommodation, cleaning, food, child’s health, etc.), have better career prospects, and better adaptive socialization. Secondly, since better educated women tend to marry highly educated men (Mare, 1991), similarly-educated partners in marriage enjoy a more stable marriage and increase their human capital (Oreopoulos and Salvanes, 2011). For instance, it was found that women additional year of schooling increases husbands’ earnings (Lefgren and McIntyre, 2006) and their probability of increasing some academic and professional qualifications (Anderberg and Zhu, 2014). Thirdly, similarly-educated partners also transmit their socioeconomic status to the next generation, where progenies can be helped thanks to the educational level of their parents (Fernandez and Rogerson, 2001; Kremer, 1997).

Developing countries have been more concerned with low school attainment and early marriages (Glick et al., 2015). The Cameroonian government has been involved in matters concerning education and marriage. On one hand, for some years now, a number of educational reforms have been introduced such as “*free primary education for all*” in order to enroll more children in schools, especially girls, who because of cultural and religious affiliation of their parents are kept at home. On the other hand, since 2006, the Government of Cameroon has also been involved in mass (and free) marriages in order to encourage legal marriage and family stability. However, notwithstanding this demonstrated commitment, the extent of the effects of educational improvements on marriage timing among women in Cameroon, to the best of our knowledge, is yet to be verified beyond the descriptive statistics compiled by the government’s statistics office. It may also be interesting to see how religious affiliation is likely to mediate these effects. In this connection, a key question driving this chapter arises: *To what extent does educational attainment influence the timing into first marriage by women in Cameroon?*

More specifically:

- *What is the relative dispersion of age of transition into first marriage among women by level of education and other selected correlates in Cameroon?*
- *What is the direct effect of educational attainment on timing into first marriage among women in Cameroon?*
- *How does religion mediate the influence of educational attainment on timing into first marriage among women in Cameroon?*

The corresponding key objective driving this chapter is *to investigate the extent to which educational attainment influences the timing into first marriage by women in Cameroon.*

More specifically:

- *To explore the relative dispersion of age of transition into first marriage among women by level of education and other selected correlates in Cameroon;*
- *To assess the direct effects of educational attainment on timing into first marriage among women in Cameroon;*
- *To evaluate how religion mediates the effects of educational attainment on timing into first marriage among women in Cameroon.*

This Chapter is guided other things being equal by the following hypothesis:

- *Transitional age into first marriage among women in Cameroon will have an increasing distribution with respect to educational level.*
- *Education will have a negative effect on the entry into a union formation in Cameroon.*
- *Religion will reduce the effect of education on first union among women in Cameroon.*

Although, many studies appear to have been recognized the delaying effect of education (at each level or in completed years) on age at first marriage (Brien and Lillard, 1994; Ikamari, 2005; Kidar et al., 2009; Ayiga and Rampagane, 2013; Gurmu and Etana, 2014; Duflo et al., 2015; Glick et al., 2015), this analysis aims at testing this effect in the case of Cameroon.

Since preceding studies have identify culture and poverty as leading causes of early marriage and hindrance in women's economic and social space in Sub-Saharan Africa, by denying them admission to school (Yabiky, 2005; Kaufman and Meeakers, 1998; Jejeebhoy, 1995; Ayiga and Ranpagane, 2013), this chapter is particularly interesting in the context of Cameroon, with more than 250 tribal groups, with religious affiliations believed to be playing a key role in shaping a range of life-course decisions, such as marriage. The inclusion of regions, parental background (household wealth status) and subsequently female religious affiliation as control variables in this study are expected to shed a new light in analyzing nuptial timing by women in the marriage market. The study also attempts to purge the results of potential endogeneity bias emanating from the possibility that schooling and marriage decisions are likely to be taken simultaneously; moreover, there are unobserved characteristics that correlate both education and marriage.

The rest of this chapter is structured as follows: Section 2 presents the literature review; Section 3 describes the methodology, data and defines variables; and finally, Sections 4 and 5 present the empirical results and conclusion, respectively.

## 2.2 Literature Review

### 2.2.1 Theoretical literature

Why do women marry late? Two main schools of thought have attempted to explain the demographic changes of the 20<sup>th</sup> century, especially the declining rate of marriages, namely the

normative and the rational choice theories (Fredman et al., 1994). Normative theories attribute the decline in marriage rates to changes in people's values, expectations and aspirations. While the rational choice theories assign this change to economic and structural factors, especially changes occurring in the labour market. However, behind these two theories, education plays a crucial role.

Even though normative theorists did not agree on the specific modern value that explained most demographic changes, they all consider educational achievement as responsible of the spread of these modern values (Hamplova, 2003). Because people with high level of education are characterized with important autonomy and independence (Liefbroer, 1991), and liberal values (Hamplova, 2003), they tend to put greater emphasis on self-fulfillment, freedom, individualism and independence. These influences therefore lead them to a decline in marriage rates.

Inglehart<sup>27</sup> (1990) viewed the declining in marriage rates as a result of a change from a 'materialist'<sup>28</sup> value to a 'post-materialist'<sup>29</sup> value. Giddens (1992) and Van de Kaa (1993) focused on the change in values due to modern technology, such modern contraception as responsible for the decline in marriage. According to Blossfeld and Huinink (1991), marriage postponement is caused by enrolment in school, which in turn is influenced by the existence of social customs. Among these social norms, reside the incompatibility between school enrolment and marriage (Blossfeld and Jaenichen, 1992; Blossfeld and Huinink, 1991; Thornton et al., 1995); the idea that unions (considered as an adult role) should take place after a youngster has finished with educational process (Marini, 1984), or after securing a stable economic position in the labour market (Oppenheimer, 1988). Therefore, a social context in which women are interested in human capital accumulation and labour market is likely to expect a postponement in partnership formation (Coppola, 2003). Education exposes women to non-traditional roles, opens them to new ideas and values that compete with traditional customs and beliefs of early marriage (Caldwell et al., 1983; Westoff, 1992), and orients their aspirations toward personal fulfillment (Ikamari, 2005).

The main limit of normative theories resides in the difficulty involved in specifying people's values derived from their behavior (unmeasured characteristics). Even though two

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<sup>27</sup> is the most influential normative theorist.

<sup>28</sup> The materialist values are related to physical well-being and craving for security

<sup>29</sup> The post-materialist values put emphasis on the quality of life. And Inglehart's conception of 'materialism' and 'post-materialism' differs from the common usage of these words.



different methods are used to specify values, both methods are problematic (Friedman et al., 1994). One method is simply to ask people what their values and preferences are. The problem with this method is that the declared values are often quite vague and inconsistent and do not conform to a given situation. The other method is to deduce the values from people's real behavior. This is also difficult because it is not possible to distinguish to what extent values can influence behavior.

Because of the difficulty in measuring values, this second group of theories assigns demographic changes and decline in marriage rates to a change in the price (earning potential on the labour market) and not in values or preferences (Hamplova, 2003).

With his New Home Economics, Becker has substantially influenced the rational choice theories (Hamplova, 2003). According to him, decline in marriage rate is explained by the increasing earning potential of women in the labour market, which in turn is determined by education. Because earning potential brings autonomy and empowerment, specialization and sexual division of labour within the household is no longer advantageous for women (Becker, 1996). Becker's conclusion is that women with higher earning potential and better education have lower marriage tendency. Also, the changing in gender roles was advanced as reason why women marry later (Hamplova, 2003). However, this view was highly criticized as being a theory explaining decline in marriage rates and not its postponement. Even though Oppenheimer (1988) assigned decrease in marriage rates to changes in the labour market, she proposed an alternative theory within the framework of rational choice, where it is the complicated situation of partner selection that induce individuals to marry later. Since individuals do not intend to just marry anyone, it takes them time to gather enough information in sorting mates. From the above arguments, education is viewed as a proxy of earning potential, human and cultural capital which delays union formation.

However theoretically, given these arguments, the effect of education level on marriage timing is ambiguous. On one side, more educated women may be more attractive in the marriage market and thus obtain better position. On the other side, women with higher education level are likely to earn higher income, which make them more economically independent, hence they may delay marriage timing or even stay without getting marriage. Even though, more educated women may be more attractive in the marriage market, other factors may hinder them from getting marriage. According to Oppenheimer (1988), because people usually need economic independence to proceed with marriage, the transitional timing into

work status is an important determinant in marriage timing. Also, since people do not intend to just marry anyone, the time spent in searching the adequate partner may delay marriage (Rogerson et al., 2005; Weiss (1997) and Oppenheimer, 1988)

Also, it is important to note that some studies have shown that entry into marriage induces women to terminate education (McLaughlin et al., 1986; Davis and Bumpass, 1976). That is, marriage and education are two processes that influence each other. It has been shown that while education delays union formation, union formation is likely to terminate education enrolment. Thus making the marriage and schooling decisions simultaneously determined.

### **2.2.2 Some results from empirical studies**

Empirically, the effect of education on marriage timing or probability of marriage is not clear. While some studies found that education significantly delay first marriage, others found that it has little or no effect on marriage timing.

On one hand, Lefgren and McIntyre (2006) used the 2000 Census data of United States to examine the effect of education on some marital outcomes while correcting for endogeneity. Choosing birth quarter as instrument for educational level, they found that education level has little effect on the probability of getting marriage, but positive and significant effect on the husband's earnings. But a same study carried out in United Kingdom on women aged 25 and above found that higher academic qualification does not affect these women's probability of getting married, but instead increases their husbands' probability of holding some qualification and being economically active.

On the other hand, Ikamari (2005) without controlling for endogeneity, investigated the effect of education on marriage timing among Kenyan women using Cox model and linear regression analysis. Both approaches arrive at the same conclusion that education is an important determinant of first union. Therefore, highly educated women tend to delay marriage compared to less educated ones. Also, this effect remains robust when controlling for other covariates. These same conclusions were found in almost all studies no matter the countries; Blossfeld and Huinink (1991) in Germany, Hamplova (2003) in the Czech Republic, Ayiga and Rampagane (2013) in Sub-Saharan Africa (Uganda and South Africa), Singh and Samara (1996) in developing countries, Ikamari (2005) and Nyamongo (2000) in Kenya, Mpilambo et al., 2017) in Congo.

However, Hoem (1986) in his study tried to distinguish between achieved level of education and being a student. Using descriptive statistics, he arrived at a different conclusion where there is no significant effect of educational attainment on first union formation; whereas, being a student strongly determine marriage behavior. Coppola (2003) doing the same study among Italian and Spanish women, insists that not controlling for individual unobserved characteristics that affect these two processes will yield biased estimates. The author used a simultaneous hazard modeling strategy to provide empirical evidence of simultaneous effect of education and union formation in Italy and Spain. She arrived at the conclusion that dropping out of the educational system increases a woman's risk of entering into first marriage.

Mpilambo et al., (2017) in their study among women in the Democratic Republic of Congo found that women with no education are at higher risk of early marriage compared to those with higher level of education using descriptive analysis and binary regression model.

Ntaganira (2010) studied the particular case of Rwanda characterized by high fertility. Based on the 2000 Rwanda DHS and using the survival analysis without correcting for endogeneity, he found that low educational level and residing in rural areas are more likely to induce women to get marry early.

To the best of our knowledge, the nature of the link between education and marriage timing has not been investigated in Cameroon, especially with a reference to religious affiliation. In a two-stage regression approach using proportional hazard model, this study will examine the effect of educational level on first marriage using survival analysis to correct for endogeneity.

## **2.3 Methodology, Modeling Framework, and Source of Data**

### **2.3.1 Methodology**

The literature has employed diverse methodological approaches in analyzing the effect of education on union formation. Some studies did not border to correct for endogeneity (McLaughlin et al., 1986; Ikamari, 2005; Hoem, 1986; Blossfeld and Huinink, 1991), while other did (Lillard et al., 1994; Sander, 1992, Boulier and Rosenzweig, 1984). This may be due to the idea that is not easy to find valid instruments. Also, most studies utilized the Cox proportional hazard model of survival analysis, while few used linear regressions and

descriptive statistics analysis. However, among these methods, the instrumental variable in Cox proportional hazard model will be used in this chapter in order to control for endogeneity arising from the simultaneity of education and marriage.

Social scientists are often interested in investigating whether the time until a specific event of interest occurs depends on explanatory variables. We are interested in examining what explains first marriage among women in Cameroon. Survival or time-to-event analysis or duration model is a set of statistical techniques designs to analyze the expected length of time until a particular event happens, such as death, first marriage, and first birth.

### ***2.3.1.1 Presentation of survival analysis***

Some studies (Hossain and Islam, 2013; Mpilambo, 2017) have employed approaches such as the Logit and Probit models to investigate the determinants of age at first marriage, where the dependent variable, age at first marriage, takes the value 1 if marriage occurred after a precise cut off age and 0 if not. But, age at first marriage (the observed outcome) is the time until an unmarried woman experiences first marriage. These approaches have been found inappropriate for three main reasons:

- Non-normally distributed outcome: age at first marriage is always positively valued and has a skewed distribution. This makes the symmetric distribution of the normal law a poor choice to fit data appropriately (Cleves et al., 2004; George et al., 2014).

- Censoring (or partial information): the outcome variable is not fully observed. Age at first marriage concerned only those who are in unions at the time of the survey, ignoring alternatives such as single, widow, etc. Such issues cannot be easily handled in linear regression models. The hazard model is best suited for marriage since age at first marriage captures the length of time (duration) till the incidence of the event (marriage). Hence, it accounts for women who are not yet married by the time of the interview (right censoring of the data), suggesting that even censored ones contributed in estimating the survival time to marriage (Ayiga and Rampagane, 2013).

- When dealing with time-to-event variables, we can sometimes have covariates which vary with time. Also, we may only have the point in time at which an event happens without any explanatory variable. As a result, without one or a set of explanatory variables, we cannot use conventional statistical methods such as linear and logistic regressions.

Since first marriage is a transitional event (from the status of never married to married), it has more complex form which are difficult to analyze statistically (George et al., 2014). And as such, linear regression methods are predisposed to produce biased estimates when employed in such a situation (Babalola, 2004).

One powerful characteristic of survival approaches is their ability to handle all types of censoring; right-censoring (where a subject did not experience the event before the end of the survey), left-censoring (where a subject has already experienced the event before the survey begins), and interval-censoring (where a subject experiences the event in a particular interval of time within the period of study) (Cleves et al., 2004; George et al., 2014). Unlike linear regression models which assume normal distribution of outcome variables, hazard models of survival analysis do not make any assumption on this distribution. Time to event analysis are considered as having more statistical information and power to identify significant exposure effects than whether an event occurs or not, such as binary outcomes (Georges et al., 2014). Hence, survival analysis or time to event outcome which study the time to the occurrence of an event of interest (Cleves et al., 2010) is appropriate to estimate age at first marriage and identify its risk factors or covariates (Ayiga and Rampagane, 2013).

To access how educational level is likely to affect marriage timing, we will proceed with the non-parametric and the semi-parametric methods of the survival analysis.

At the non-parametric level, using the univariate (Kaplan-Meier life table and curves) and the bivariate (Log Rank test) analysis, we aim at exploring the relative dispersion of age of transition into first marriage among women by level of education and other selected correlates in Cameroon.

At the bivariate level, the Kaplan-Meier<sup>30</sup> survival estimation and the Log Rank test<sup>31</sup>, which are two basic statistical non-parametric methods<sup>32</sup> (George et al., 2014), are used to evaluate the relationship between median age at first marriage and education level, and test if

<sup>30</sup> Kaplan EK, Meier P. Nonparametric estimation from incomplete observations. J Am Stat Assoc. 1958; 53(282):457–481.

<sup>31</sup> Savage I R. Contributions to the theory of rank order statistics: The two sample case. Ann Math Stat. 1956; 27(3):590–615.

<sup>32</sup> They are called non-parametric methods because their mathematical forms of survival distributions are not known.

this link is statistically significant. We present in this subsection differentials in the age at first marriage by level of education and other covariates respectively in Tables 4 and 5.

The Kaplan-Meier survival estimates at a bivariate level show the proportion of women surviving to first marriage at each level of education. The median age at first marriage for each category is found by looking at the intersection between the horizontal line related with the probability of survival equal to 0.5 and the particular survival curve (George et al., 2014), which corresponds to the age where half of women are expected to have experienced first marriage.

The log rank test is a popular test used to compared the survival curves of two or more independent groups (George and al., 2014), and to test the null hypothesis of no difference in survival between two or more independent groups, versus survival is different from one group to another (Mantes, 1966; Gehan, 1965). It is also taught to as a test of whether the survival curves are identical (overlapping) or not (Crawley, 2005). Using the Kaplan-Meier approach, survival curves are estimated for each group, and compared statistically using the log rank test. The log rank test is approximately distributed as a chi-square test statistic with the degree of freedom equal to  $(k-1)$ , where  $k$  is the number of groups in comparison. Results as shown in Table 5 reveal that differentials in age at first marriage in various groups are statistically significant at 1% percent. We reject  $H_0$  and conclude that we do not have enough evidence to state equality of survivor functions.

At the semi-parametric level, we aim at estimating the direct effects of educational attainment on timing into first marriage, and also, to evaluate how religion mediates this effects. A well-known method used in survival analysis to examine the relationship between an event time and covariates is the Cox proportional hazard model (Cox, 1972). Appropriate use of Kaplan-Meier approach rests on the assumption that censoring is independent of the likelihood of experiencing the event of interest and that survival probabilities are comparable for participants who entered early and later into the study (Cleves et al., 2010).

Cox Proportional Hazard model, the most popularly used survival regression model (George et al., 2014), will be employed here to estimate risks factors of first marriage using hazard rates. First developed by Sir David Cox (Cox, 1972), the basic idea behind the proportional hazard model was to identify the determinants of risk of occurrence of an event<sup>33</sup>. The fundamental assumptions of the Cox model is that the effect of predictors on the hazard is

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<sup>33</sup> Bleslow (1974) and others have modified the model to account for tied events.

constant over time (George et al., 2014); and at each duration<sup>34</sup> of occurrence of an event (for example marriage, birth, death, etc.), there is a risk or probability (Trussel and Bloom, 1983).

### 2.3.1.2 Cox proportional hazards model

To examine the effect of educational level and other covariates on the duration it takes a woman to get married, we assume a semi-parametric model for a woman at her first marriage (for those married before the beginning of the survey), or at the end of the survey (for unmarried ones), expressed in the form of a multiplicative relationship between the predictors and the hazard (as opposed to the linear regression as it is the case with multiple linear regression analysis). The Cox's conditional hazard function for marriage at time (or age)  $t$  is as follows:

$$h_{(t|\psi_{fm}, E)}^{FM} = h_0(t) \cdot \exp(u_1\psi_{fm} + E\phi_1) \quad (1)$$

Where:

$h^{FM}_t$  : Is the probability of experiencing first marriage given that the woman has survived i.e. has not gotten married up to a given point in time<sup>35</sup>,  $t$  (age at first union).

$h_0(t)$ : is an unspecified baseline hazard function. It is the risk of experiencing first marriage when the values of all other covariates are equal to zero. According to Cox (1972), there is no assumption about the shape of the baseline hazard function (Norusis, 2007; Gurm and Etana, 2014). It is also called the duration-dependent risk. While the exponential component  $\{\exp(u_1\psi_{fm} + E\phi_1)\}$  is the hazard rate component associated with the attributes of the woman. As Gowrisandaran and Town (1999) we followed time-independent covariates, suggesting that covariates have not changed radically from marriage till the time of the survey.

$\psi_{fm}$ : is a set of exogenous variables explaining entry into first marriage.  $E$  is a vector of educational attainment. And  $u_1$  and  $\phi_1$  are unknown parameters to be estimated.

The estimated regression coefficients  $\exp(u_1)$  and  $\exp(\phi_1)$  produce hazard ratios or risk ratios [similar to odds ratios in the multiple logistic regression setting, (Cleves et al., 2004)]. A

<sup>34</sup> Duration can also be given by age, if it is measured as time since birth

<sup>35</sup> The duration to marriage or survival time (age at first marriage) is measured as time since a woman is exposed to marriage, i.e. 15 years (legal marriage age for women in Cameroon) till the time the woman actually got married. Since marriage in the worldwide DHS program considered legal and consensual marriage, age at first marriage starts at 10. If the woman has not yet got married till the time of the survey (2011), she is not taken into consideration (censored). In this study, we will use age at first marriage in completed years as the dependent variable (Ayiga and Rampagane, 2013).



hazard rate or ratio is the relative risk of a woman with a specific characteristic of marrying in comparison to a woman in the reference category (Ikamari, 2005).

The term risk (instead of probability) is usually employed in survival analysis. And contrary to probability hypothesis (which range between 0 and 1), risk ratios (hazard ratio) can exceed 1. In the Cox model, the interpretation is done using the hazard ratio (George et al., 2014). Hence;

- When a hazard ratio is greater than a unit ( $HR > 1$ ), women are at higher risk of experiencing first union compared to those from the reference group. This corresponds to early marriage.
- When a hazard ratio is less than a unit ( $HR < 1$ ), women are at lower risk of marrying relative to those from the reference category. This is delayed marriage.
- A hazard ratio equal ( $HR = 1$ ) indicates the risk ratio of the reference category. The explanatory variable associated to this ration does not affect the probability of marrying.

However, before exploring the estimation procedure, we fix the ideas in the context of usual regression analysis, especially as the thesis also seeks to address the potential endogeneity problem emanating from two possible sources: the likely correlation of unobservable with educational attainment and the simultaneous nature of the decision to schooling and that of participating in the marriage market.

## **2.3.2 Estimation issue and estimating equation**

### ***2.3.2.1 Endogeneity bias and model identification***

A common problem occurring in applied economics is endogeneity. It is a situation where unobserved variables which affect the response variable also affect one or more explanatory variables used in the regression. Endogeneity bias arises from omitted variables, simultaneity between predictor and the response variables, and errors in covariates measurement (Terza et al., 2008).

However, most studies on the impact of education on marriage timing did not provide appropriate estimates in the sense that they did not consider endogeneity arising from reverse causality. Many studies have established that early marriage is a key determinant of educational attainment (Nguyen and Wodon, 2014; Delprato et al., 2015). Moreover, common factors such as ability and skills explained marriage timing. Girls who are weaker academically face more



chances to drop-out compared to those who are stronger, hence early marriage. Lloyd and Mensch (2008) explain that in most African countries, the main reason of school drop-outs among girls is related to early marriage. Also, poor families are less likely to send their child to school compared to rich ones, especially the girl child. And as such, early marriage comes as a solution in transferring child burden from the parents to the husband (Mathur et al., 2003). Empirical results similarly show that girls from poor background are three times more likely to marry before the age of 18, compared to girls from rich homes (UNFPA, 2012). Hence, marriage-education linkage is likely to be simultaneously determined (Nguyen and Wodon, 2014; Delprato et al., 2015).

Since education attainment and age at first marriage has a *ceteris paribus* impact on each other, their structural equations can be depicted as follows (Baye, 2010; Baye and Sitan, 2016):

$$FM = u_1\psi_{fm} + E\phi_1 + \varepsilon_1 \quad (2)$$

$$E = u_2\psi_e + \phi_2 FM + \varepsilon_2 \quad (3)$$

Where FM is first marriage – the potentially endogenous variable in the education level function – measured by age at first co-habitation in continuous years, with  $\phi_2$  the corresponding parameter.

E is a vector of educational attainment – the potentially endogenous variable in the first marriage equation – captured by complete years into primary, secondary and tertiary level of education, with  $\phi_1$  the corresponding vector of parameters.

$\psi_{fm}$  is a vector of variables explaining first marriage, with  $u_1$  the corresponding vector of parameters.

$\psi_e$  is a vector of variables explaining educational attainment, with  $u_2$  the corresponding vector of parameters. And  $\varepsilon_1$  and  $\varepsilon_2$  are error terms for first marriage and educational attainment equations respectively.

Since marriage timing and education attainment are jointly made, it means that the two structural error terms,  $\varepsilon_1$  and  $\varepsilon_2$  are correlated; hence, E is correlated with  $\varepsilon_1$  and FM is correlated with  $\varepsilon_1$ . In such case, using OLS estimation method will yield bias and inconsistent estimates (Baye and Sitan, 2016); also any linear regression model will be inconsistency because of the nature of the outcome variable. Like most studies, we account for endogeneity

by employing an instrumental variable-based approach called Two Stage Residual Inclusion (2SRI) method.

Since we are interested in estimating the effect of educational level on age at first marriage, equation (1) is included in equation (2), which is:

$$E = u_2\psi_e + \phi_2(u_1\psi_{fm} + E\phi_1 + \varepsilon_1) + \varepsilon_2 \quad (4)$$

$$= u_2\psi_e + \phi_2u_1\psi_{fm} + E\phi_1\phi_2 + \phi_2\varepsilon_1 + \varepsilon_2 \quad (5)$$

$$E(1 - \phi_1\phi_2) = u_2\psi_e + \phi_2u_1\psi_{fm} + \phi_2\varepsilon_1 + \varepsilon_2 \quad (6)$$

Assuming  $(1 - \phi_1\phi_2) \neq 0$ , that is  $\phi_1\phi_2 \neq 1$ , we solve for education level:

$$E = u_1Z_{fm} + u_2Z_e + \varepsilon_3 \quad (7)$$

Where:

$$Z_e = (\psi_e)/(1 - \phi_1\phi_2); Z_{fm} = (\phi_2\psi_{fm})/(1 - \phi_1\phi_2) \text{ and } \varepsilon_3 = (\phi_2\varepsilon_1 + \varepsilon_2)/(1 - \phi_1\phi_2).$$

Equation (7) is the reduced form equation of educational attainment, since it is expressed as a function of  $Z_e$  and  $Z_{fm}$  – which are vectors of exogenous variables of E and FM respectively; and the reduced form error term,  $\varepsilon_3$  – which is a linear function of  $\varepsilon_1$  and  $\varepsilon_2$ , structural error terms.

### 2.3.2.2 Estimating equation and procedure

The main idea is to use an additional variable called “instrument”, which extracts the exogenous component in the endogenous explanatory variable in order to assess consistent estimates (Terza et al., 2008). There is a large literature on IV approaches addressing endogeneity bias in linear models, but not in nonlinear and duration models. It is only recently that IV approaches are developed for these models, namely the Two-stage residual inclusion (2SRI) and the Two-stage predictor substitution (2SPS).

We fit our structural equation given by Cox Proportional hazard function in (1), with covariates assumed to be time-independent. The application of the 2SRI in this model is straightforward. Like Gowrisankaran and Town (1999), we treat our potentially endogenous variable, educational attainment, as a time-independent ordered variable.

Educational attainment is simulated using a standard normal distribution with probabilities determined as:

$$P(E_k = 1 | \psi_{fm}, IV) = \frac{\Phi\{(u_1 Z_{fm} + u_2 Z_e)_k\}}{1 + \sum_{k=0}^3 \Phi\{(u_1 Z_{fm} + u_2 Z_e)_k\}} \quad (8)$$

$$P(E_0 = 1 | \psi_{fm}, IV) = \frac{1}{1 + \sum_{k=0}^3 \Phi\{(u_1 Z_{fm} + u_2 Z_e)_k\}} \quad (\text{Base category}) \quad (9)$$

With  $k = 0, 1, 2, 3$

However, since we cannot predict residuals after an ordered estimation technic, we opt for the Heckman (1979) two-stage selection procedure to derive the IMRs.

### ***Hechman two-stage procedure***

*1<sup>st</sup> Stage:*

Using an ordered Probit, we fit each element of educational attainment derived from selection equation (7) with an instrument IV. This is given by:

$$E(e = j | Z, IV) = \Phi(\alpha_0 + \alpha_1 Z + \alpha_2 IV) \quad (10)$$

Where:

Educational attainment, E, is a categorical variable including Primary, Secondary, and Tertiary level of education, with no education as reference category.

We derive the IMRs =  $[IMR_P, IMR_S, IMR_T]$  which represent the IMR at each educational level, primary, secondary, and tertiary level respectively.

$Z = [Z_{fm}, Z_e]$  is a vector of exogenous variables with  $\alpha_1$  its corresponding vector of unknown coefficients. Z includes religion, parent's wealth status, parent's educational level, residence and regions.

IV is the instrumental variable with  $\alpha_2$  its corresponding coefficient to be estimated. In order to avoid weak instruments, similarly to Nguyen and Wodon (2014) and Delprato et al., (2015), we use an instrument, captured at the community level (Primary Sampling Unit, PSU), where

the girl lives. The instrument is the leave-out-mean<sup>36</sup> or non-self-cluster mean of years of education \_ it measures the mean value of the share of girls' education living around a girl without factoring in her own education. In this context, the decisions of other groups of individuals in the neighborhood or in the society may affect an individual's decision (De Grange, 2015). Hence, in a community, an additional year in other girls' education is likely to increase a girl's education level. This condition is verified if the F-statistics is statistically significant at a 1 percent level. Also, non-self-cluster mean of year of education should not be correlated with a girl's marriage timing. This exogenous condition is not easy to test.

However, since it is not econometrically possible to predict residuals after an ordered estimation, we opt for Inverse Mills Ratio to capture unobservable variables (Baye, 2015) at each education level. Heckman (1974) in his seminal paper considered sample selection bias as a sort of omitted variable bias.

### *Second stage*

According to Louviere et al. (2005), Guevara and Ben-Akiva (2009), and De Grange et al. (2015), the residual or any function of it (such as the IMR) can be included in the control function as an additional explanatory variable (Baye, 2015). Thus:

$$h_{(t|\psi_{fm}, E, \hat{\varepsilon})}^{FM} = h_0(t). \exp(u_1\psi_{fm} + \phi_1P + \phi_2S + \phi_3H + \beta_1IMR_P + \beta_2IMR_S + \beta_3IMR_H) \quad (11)$$

Where: P, S, and H are the primary, secondary and tertiary level of education.  $IMR_P$ ,  $IMR_S$ , and  $IMR_H$  are respectively the inverse Mills Ratios at the primary, secondary, and tertiary level education. Hence,  $u_1$  and  $\phi_1$ ,  $\phi_2$ , and  $\phi_3$  can now be unbiased and consistent (Terza et al., 2008; Baye and Sitan, 2016).

After defining our main explanatory variable, we also consider other potentially important covariates as used in the literature, namely type of place of residence, region of residence, religion (Ayiga and Rampagane (2013), Ikamari (2005). However, conversely to these studies, since familial background is very important in marriage decision in Africa, we add some specific information about the woman's family background such as her family or parental wealth status, her parent's educational level and if her mother or her father is still alive

<sup>36</sup> "Leave-out-mean" indicates that the community variable is computed for all girls living in the same community, except the one considered in the regression

or not. Also in our analysis, we replaced the variable ethnicity by region because we believe that the habits or culture acquired by someone is mostly influenced by the behavior of people living in that place. Moreover, in Cameroon all the ethnic groups are dispersed all over the national territory, applying a policy on a specific ethnic group will not be an easy task. Note that in this context, husband or partner's characteristics are not taken into consideration here, because the information collected on the girl in question are those when she was not yet married or not yet started living with a partner.

Note that in this context, husband or partner's characteristics are not taken into consideration here, because the information collected on the girl in question are those when she was not yet married or not yet started living with a partner.

### **2.3.4 Data and description of variables**

The data we use come from the 2011 round of the Cameroon Demographic and Health Survey which provides detailed information on marriage and sexual activity, fertility and fertility preferences, family planning, infant and child mortality, reproductive health, child health, nutrition of children and women, malaria, HIV/AIDS related knowledge, attitude, and behavior, adult and maternal mortality, domestic violence, and female genital cutting.

This chapter uses a merged dataset provided by information on members of a household and the individual women's questionnaires. For this effect, 15,050 households were covered and 72,622 members interviewed. The merged dataset provides characteristics of individual women and information on their respective family of origin (i.e. their parents) which finally give us a total number of 44,784 members in our study.

The outcome variable is age at first marriage or co-habitation measured in terms of completed years. During the survey, which was a face-to-face interview, all women aged between 15 and 49 were asked many questions regarding their marital status and whether they had ever lived with a man as husband. For those who affirmed to have ever lived with a partner were asked to indicate their age at that time; the answer to this question constitute the age at first union. Whereas, those who answered to have never been married or never-lived with a male partner were considered as single and the question on age at first marriage was not asked.

The starting event in the Cameroon 2011 DHS database is 10 years, which is below the legal marriage age for women in Cameroon. This is because the event of interest (marriage) includes legal and consensual unions, and in this country no timing has been given as far as age

of co-habitation is concerned. Hence, specifically for this study we retain as from 10 years the time from which a woman is exposed to marriage (starting event) and the terminating event (or failure), the age at first marriage (46 years). We want to find out how long a girl (with respect to her level of education) survives before she experiences first marriage/co-habitation.

Educational attainment, which is the main independent variable of this chapter, is measured in terms of no level of education, primary level of education, secondary level of education, and tertiary level of education. It is the achieved level of education at the time of the survey and not the one at the moment when she started staying with a man. Because of the hypothesis of the incompatibility between schooling and marriage, we assume like Ikamari (2005) that the level of education of a woman does not changed radically after marriage. Hence, we suggest that the level of education of a woman at the time of first union is still the same as that of the time of survey. This could be particularly true for Cameroon because it requires many years of schooling (about 6 years) to quit from primary to secondary, and from secondary to tertiary level of education.

Among other information asked to women were demographic, socio-economic and socio-cultural attributes. From previous works' findings, educational attainment, region of residence, type of place of residence, religion, parent's level of education, household wealth, the presence of the father, and the presence of a mother (Feng and Quanhe, 1996; Suwal, 2001; Hong, 2006; Islam, 2009; Ayiga and Rampagane, 2013; Mpilambo, 2017) were retained to estimate the effect of education on age at first marriage. In this same context, for simplification reasons, we also assume that other variables such as residence, region, religion etc. did not significantly change from marriage time till the moment of survey. Thus, all these covariates as educational level are considered to be time-invariant in order to facilitate estimation.

## 2.4 Empirical Results and Discussion

This section provides results from non-parametric and semi-parametric analysis.

### 24.1 Some descriptive statistics

In Table 2\_1 we provide summary statistics describing variables of interest used in this study. The average age at which women get married in Cameroun is around 17 years, age defined as early marriage according to UNICEF (2001). Most (i.e. 34%) of them have attained the secondary level of education, whereas only 3 percent reached the higher level of education.

On average, 40 percent of these females come from poor homes and 38 from rich ones. However, Moslem girls appear to attain lesser education. Thus, only 6 and 2 percent attained the primary and secondary level of education, whereas almost no one attained the tertiary level. Concerning the parent's education, most of them have attained only the primary (16 percent) followed by the secondary level of education (8 percent).

**Table 2 1:** Descriptive statistics of selected variables for empirical analysis

| <i>variable</i>                                  | <i>Obs.</i> | <i>Mean</i> | <i>Std.<br/>dev</i> | <i>Skewness</i> | <i>Kurtosis</i> | <i>Min</i> | <i>Max</i> |
|--|-------------|-------------|---------------------|-----------------|-----------------|------------|------------|
| <i>1. Dependent variable</i>                     |             |             |                     |                 |                 |            |            |
| First marriage(age in years)                     | 44,791      | 17.76       | 4.26                | 1.372           | 6.392           | 10         | 46         |
| <i>2. Endogenous explanatory variable</i>        |             |             |                     |                 |                 |            |            |
| Primary (=1 and 0, else)                         | 72,622      | 0.317       | 0.46                | 0.782           | 1.61            | 0          | 1          |
| Secondary (=1 and 0, else)                       | 72,622      | 0.339       | 0.47                | 0.676           | 1.457           | 0          | 1          |
| Higher (=1 and 0, else)                          | 72,622      | 0.028       | 0.16                | 5.645           | 32.876          | 0          | 1          |
| <i>3. Exogenous explanatory variables</i>        |             |             |                     |                 |                 |            |            |
| Moslem (=1 and 0, else)                          | 72,622      | 0.182       | 0.38                | 1.648           | 3.716           | 0          | 1          |
| Poor home (=1 and 0, else)                       | 72,622      | 0.402       | 0.49                | 0.4008          | 1.161           | 0          | 1          |
| Rich home (=1 and 0, else)                       | 72,622      | 0.384       | 0.48                | 0.473           | 1.224           | 0          | 1          |
| Parents with primary                             | 72,622      | 0.165       | 0.37                | 1.804           | 4.257           | 0          | 1          |
| Parents with secondary                           | 72,622      | 0.081       | 0.27                | 3.053           | 10.323          | 0          | 1          |
| Parents with higher                              | 72,622      | 0.006       | 0.07                | 12.571          | 159.03          | 0          | 1          |
| Moslem girl with prim.                           | 72,622      | 0.063       | 0.24                | 3.57            | 13.81           | 0          | 1          |
| Moslem girl with sec.                            | 72,622      | 0.026       | 0.16                | 5.91            | 35.93           | 0          | 1          |
| Moslem girl with high                            | 72,622      | 0.000       | 0.02                | 36.976          | 1368.22         | 0          | 1          |
| Mother alive                                     | 36,546      | 0.962       | 0.191               | -4.85           | 24.521          | 0          | 1          |
| Father alive                                     | 36,370      | 0.927       | 0.259               | -3.295          | 11.859          | 0          | 1          |
| Rural (=1 and 0, otherwise)                      | 72,622      | 0.47        | 0.499               | 0.119           | 1.014           | 0          | 1          |
| Great West (=1 and 0, else)                      | 72,622      | 0.331       | 0.47                | 0.718           | 1.516           | 0          | 1          |
| Great North (=1 and 0 else)                      | 72,622      | 0.277       | 0.447               | 0.992           | 1.984           | 0          | 1          |
| <i>4. Instruments for education level</i>        |             |             |                     |                 |                 |            |            |
| Non-self-cluster mean of<br>education (in years) | 62,115      | 5.864       | 3.077               | -0.311          | 2.023           | 0          | 12.98      |

**Source:** Author (Cameroon DHS, 2011)

Concerning the form of the distribution of variables, Table 2\_1 shows that no variables is symmetric, as no skewness coefficient tends to or equal to zero. Our outcome variable, age at first marriage has a dissymmetrical distribution, as the skewness coefficient is greater than 0 (Skewness is equal to 1.372), thus having a slightly sloping distribution on the left. Moreover, this variable has a flat distribution (the Kurtosis is equal to 6.392). This information on the distribution of age at first marriage show that it is far from being symmetric, thus suggesting

adequate estimation method for nonlinear model such as survival analysis. Hence, it poorly fits the normal law which recommends the mean to separate the distribution into two equal parts.

The distribution of age at first marriage is not common or known; hence we make use of Cox proportional hazard model, which does not assume a particular distribution of age at first marriage.

## 24.2 Relative dispersion of age of transition into first marriage by selected covariates: survival analysis

### 2.4.2.1 Kaplan-Meier table estimates: univariate level

At the Univariate level, we estimate the median age at first marriage, that is, the age at which at least half of women are married. To do this, we employ Kaplan Meier's life table approach. The main idea behind this analysis is to track females from a specified time until they experienced first marriage/co-habitation.

**Table 2 2: Median age at first marriage**

| <i>Variable</i>              | <i>No. of subjects</i> | <i>Percentile</i> | <i>Median</i> | <i>[95% conf.Interval]</i> |    |
|------------------------------|------------------------|-------------------|---------------|----------------------------|----|
| <i>Age at first marriage</i> | 44,791                 | 25                | 15            | 15                         | 15 |
|                              |                        | 50                | 17            | 17                         | 17 |
|                              |                        | 75                | 20            | 20                         | 20 |

**Source:** Demography and Health Survey, Cameroon, 2011

Table A2\_1 (Appendix 2) reports a total number of 44,791 females at risk (aged between 10 and 46 years) were detected at the beginning of the survey. The survival analysis reports that by this time, 8419 (i.e. about 18%) women cohabited with a partner before the legal age of marriage 15. Also, 201 women testified to have started living with a partner for the first time at the age of 10, while 27 censored for reasons not specified (may be death). This generates a survival percentage (i.e. the proportion of those who did not experienced first marriage at 10) of 99.5%. At 11 years, among the remaining women not married (i.e.  $44791 - 201 - 27 = 44563$ ), 515 got married, while 78 censored. Making survival percentage of 98.4 not married before 11.

Progressively, the number of women getting married increases with age to reach 18, where first marriage starts to decrease as age increases. This trajectory can be illustrated graphically using Kaplan-Meier survival curve (Figure A2\_1 of Appendix 2). These estimates suggest that median age at first marriage is between 16 and 17 years.

This is also confirmed in Table 2\_2. The above descriptive statistics revealed that among ever-married women, the median age at first marriage was 17 years in 2011. At this level, it is



important to explore substantial differences in the median age at first marriage by level of education and other covariates using bivariate analysis.

#### 2.4.2.2 The Log-rank test: bivariate level

##### *Kaplan Meier estimates*

Exploring Table 2\_3 at the bivariate level, we examine the cumulative percentages of women experiencing first marriage at specified ages.

**Table 2 3:** First marriage with respect to educational level in Cameroon, 2011

| <i>Education Level</i> | <i>No. of subjects<br/>at risk</i> | <i>-----Age at first marriage---<br/>(in years)</i> |           |            |
|------------------------|------------------------------------|---|-----------|------------|
|                        |                                    | <i>25%</i>  |           | <i>75%</i> |
| No education           | 11388                              | 14  | <b>15</b> | 18         |
| Primary education      | 18455                              | 15  | <b>17</b> | 20         |
| Secondary education    | 13730                              | 17  | <b>19</b> | 23         |
| Tertiary education     | 1218                               | 20  | <b>23</b> | 26         |
| <b>Total</b>           | <b>44791</b>                       | <b>15</b>   | <b>17</b> | <b>21</b>  |

##### *Log Rank Test*

*chi2(3)/Pr>chi2*

**5719.78\*\*\***

**Source:** Author (Cameroon DHS, 2011)

Generally, median age at first marriage increases as level of educational rises. The median age at first marriage among women with no education is 15, while those with primary and secondary have to wait at least 2 and 4 additional years respectively before getting married. Those with the tertiary level of education have a median age at first marriage of 23 years. We also observe that only women with no education marry below the legal marriage age. Therefore, by the age of 14, 25% of these women had already had their first co-habitation; meanwhile, this proportion of women with secondary and tertiary education marries respectively at 17 and 20 years. At the age of 18 years, 75% of women with no education were already married; meanwhile, 75% of women with secondary and tertiary level of education marry at 23 and 26 years respectively. Since there are differentials in age at first marriage with respect to level of educational, the next step will be to verify if these differentials are statistically significant.

##### *The Log-rank Test*

Our main explanatory variable of interest, the girl's level of education is associated with delay in initiating marriage/co-habitation. This result is in accordance with the findings of other

scholars (Ikamari, 2005; Mpilambo, 2017) who found that women with higher educational attainment also have higher median age at first marriage.

Even though these techniques are nice and simple, they cannot evaluate many covariates (more than two) simultaneously. That is, they cannot estimate the effect of education level and other covariates on the age at first marriage. Under such situations, it is advisable to use more comprehensive models in which factors affecting the probabilities of getting married are represented by unknown parameters. As discussed earlier, survival analysis is more adequate in time-to-event data such as age at first marriage because it does not follow a normal distribution.

### 2.4.3 Relative effects of education on first marriage using Cox proportional hazard analysis

Different from the non-parametric estimation, the semi parametric models allow the insertion of many independent variables simultaneously. We use in this study one of the most popular regression techniques for survival analysis: the Cox proportional hazard regression.

#### 2.4.3.1 First stage of Heckman procedure: estimates of the selection equation

Table 2\_4 presents the reduced form estimates of educational attainment using the ordered Probit. It reveals that almost all our covariates significantly explain a girl's educational attainment; also our instrument (average years of education of girls living around the girl) is relevant at 1%. An additional year of education among girls living around a girl is less likely to induce her completion at primary level education. Meanwhile, it is significantly likely to favor a girl at the secondary and tertiary level to complete these levels of education.

Additionally, Moslem girls are more likely to complete primary education, but less likely to attain secondary and tertiary education compared to their non-Moslem counterparts. This same situation is also observed for girls living in the northern part of the country, relative to those living in the center part.

**Table 2 4:** Ordered Probit model of the reduced form estimates of educational attainment

| <i>Variables</i>  | <i>(1)<br/>Primary</i>          | <i>(2)<br/>Secondary</i>       | <i>(3)<br/>Tertiary</i>        |
|---|---------------------------------|--------------------------------|--------------------------------|
| <b>Years of education (cluster level)</b>   | <b>-0.0232***</b><br>(0.000320) | <b>0.0546***</b><br>(0.000706) | <b>0.0172***</b><br>(0.000347) |
| Moslem (↓)  | 0.0363***<br>(0.00122)          | -0.0854***<br>(0.00277)        | -0.0269***<br>(0.000981)       |
| Poor home (↓)   | 0.0225***<br>(0.00115)          | -0.0529***<br>(0.00265)        | -0.0167***<br>(0.000887)       |
| Rich home (↓)   | -0.0270***                      | 0.0636***                      | 0.0201***                      |
| <i>Education, Family Formation, and Female Labour Market Participation in Cameroon Thesis</i> |                                 |                                |                                |
| <i>PhD</i>  |                                 |                                | <b>74</b>                      |

|                            |            |            |             |
|----------------------------|------------|------------|-------------|
|                            | (0.00111)  | (0.00273)  | (0.000950)  |
| Parents with primary (↓)   | 0.00156    | -0.00366   | -0.00115    |
|                            | (0.000992) | (0.00233)  | (0.000737)  |
| Parents with secondary (↓) | -0.0298*** | 0.0701***  | 0.0221***   |
|                            | (0.00135)  | (0.00322)  | (0.00101)   |
| Parents with higher (↓)    | -0.0689*** | 0.162***   | 0.0511***   |
|                            | (0.00573)  | (0.0136)   | (0.00425)   |
| Rural (↓)                  | -0.0140*** | 0.0328***  | 0.0104***   |
|                            | (0.00117)  | (0.00277)  | (0.000885)  |
| Great west (↓)             | 0.00762*** | -0.0179*** | -0.00566*** |
|                            | (0.000909) | (0.00214)  | (0.000677)  |
| Great north (↓)            | 0.00631*** | -0.0148*** | -0.00468*** |
|                            | (0.00153)  | (0.00358)  | (0.00113)   |
| Observations               | 62,115     | 62,115     | 62,115      |

*Standard errors in parentheses (.)*

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

(↓) *Marginal effect is for discrete change of dummy variable from 0 to 1*

**Source:** Computed by the author using the 2011 Cameroon's DHS and STATA14

#### 2.4.3.2 Second stage of Heckman procedure: Cox's estimates of first marriage

Table 2\_5 presents the results of the Cox models of the effect of education level on first marriage in Cameroon. The first two models (Model 1 and Model 2) evaluate the effect when education is the only explanatory variable, while the other ones (Model 3 and Model 4) consider few selected control variables. Models 1 and 2 facilitate the establishment of the net and relative effect of education on first union.

Moreover, the log likelihood and associated chi-squares indicate that these models are statistically significant. This table shows that the hazard ratio of omitted or unobserved variables significantly reduce the risk of first marriage. Thus, correcting for endogeneity was imperative in this study.

Consequently, we retain and interpret for this study model 2 and 4. In general, these two models show that as the level of education increase, females are more likely to postpone marriage in a monotonic manner. Moreover, controlling for other variables slightly reduce the effect of education on first marriage risk, however it still remain significant and monotonic.

**Table 2 5:** Hazard ratios of first marriage by education and other covariates using Cox approach

| <i>Variables</i> | <i>effect of education without control<br/>(Reference category: no education)</i> |                       | <i>Net effect of education<br/>(Reference category: no education )</i> |                       |
|------------------|---|-----------------------|--|-----------------------|
|                  | <i>Model 1<br/>HR</i>   | <i>Model 2<br/>HR</i> | <i>Model 3<br/>HR</i>  | <i>Model 4<br/>HR</i> |
| <b>Primary</b>   | <b>0.587***</b>   | <b>0.887***</b>       | <b>0.800***</b>  | <b>0.895***</b>       |

|   |            |            |                    |            |
|---|------------|------------|--------------------|------------|
|   | (0.0740)   | (0.0144)   | (0.0119)           | (0.0147)   |
| Secondary                                 | 0.430***   | 0.789***   | 0.659***           | 0.783***   |
|   | (0.0058)   | (0.0142)   | (0.0118)           | (0.0146)   |
| Higher                                    | 0.260.***  | 0.523***   | 0.413***           | 0.519***   |
|   | (0.0083)   | (0.0377)   | (0.0145)           | (0.0169)   |
| Mother alive                              |            |            | 0.831***           | 0.835***   |
|   |            |            | (0.0225)           | (0.0227)   |
| Father alive                              |            |            | 1.326***           | 1.308***   |
|   |            |            | (0.0358)           | (0.0354)   |
| Poor household                            |            |            | 1.037**            | 0.926***   |
|   |            |            | (0.0160)           | (0.0154)   |
| Rich household                            |            |            | 0.948***           | 0.971*     |
|   |            |            | (0.0148)           | (0.0152)   |
| Rural                                     |            |            | 1.057              | 1.023      |
|   |            |            | (0.0159)           | (0.0156)   |
| Great west                                |            |            | 0.939***           | 0.937***   |
|   |            |            | (0.0119)           | (0.0119)   |
| Great north                               |            |            | 1.153***           | 1.082***   |
|   |            |            | (0.0235)           | (0.0239)   |
|   |            |            | 0.14***            | 1.156***   |
| Moslem                                    |            |            | (0.0164)           | (0.019)    |
| IMR for primary                           | -          | 3.423***   | -                  | 2.695***   |
|   |            | (0.29707)  |                    | (0.2529)   |
| IMR for secondary                         | -          | 0.412***   | -                  | 7.448***   |
|   |            | (0.4719)   |                    | (0.6984)   |
| IMR for higher                            | -          | 7.772***   | -                  | 8.5694***  |
|   |            | (2.128)    |                    | (2.434)    |
| Estimation statistics                     |            |            |                    |            |
| Observations                              | 44,791     | 44,784     | 44,791             | 44,784     |
| LR Chi2(6/13)                             | 4517.99*** | 6115.44*** | 6091.21***         | 6457.16*** |
| Log likelihood                            | -393946.96 | -393072.46 | -393160.35         | -392901.6  |
| Robust standard errors in parentheses (.) |            |            | HR is hazard ratio |            |
| *** $p<0.01$ , ** $p<0.05$ , * $p<0.1$    |            |            |                    |            |

**Source:** Computed by the author using the 2011 Cameroon's DHS and STATA14

Results from model 4 show that the risk of first marriage is respectively 10, 22 and 48 percent lower for females with primary, secondary, and tertiary education respectively, compared to those with no education. These results imply that the higher the level of education completed by a woman, the more she is likely to postpone her entry into first marriage. These findings corroborate those of other scholars (Ikamari, 2005; Palamuleni, 2011; Kamal, 2011; Ayiga and Rampagane, 2013).

Additionally, Table 2\_5 also indicates that a girl whose mother is still alive is likely to postpone marriage compared to the one whose mother is dead; meanwhile the one whose father is still alive is likely to get married earlier compared to the one with a father. A girl living in

the rural area is more likely to marry earlier relative to the one living in the urban area. A girl living in the western part of the country is more likely to postpone first marriage, while the one from the northern part marry earlier compared to the one living in the center part. These results may be due to the enclaves found in this part of the country.

#### ***2.4.3.3 Second stage of Heckman procedure: How religion modulates the effect of education on first marriage***

Model 1, 2 of Table 2\_6 present hazard ratios of the relative effect of education without correcting and correcting for endogeneity respectively. Model 3 and 4 presents hazard ratios of the net effect of education without correction and correcting for endogeneity respectively.

Table 2\_6 reveals that taken individually religion and education has opposite effect on first marriage. Whereas education postpones women's first marriage, Moslem religion induces them to enter first marriage early. This finding suggests that education develops modern values such as self-esteem, independence and high aspirations in girls, which could be accounted as reasons why young girls delay their first marriage.

Also, great opportunities that offer education such as good jobs, high salaries and comfortable lives may induce young girls to postpone marriage in order to build more capacities, whereas Islam develops traditional values in girls and women such as virginity, submission and dependence to their husbands. Hence, depending on the strength of one or the other, model 4 reveals that only Moslem women with secondary and tertiary level of education are likely to significantly postpone first marriage respectively by 15 and 45% relative to Moslem women with no education. Yet, slightly lower than those who are not (19% for secondary and 47% for higher education).

**Table 2 6:** Hazard ratios of the combined effect of education and religion on first marriage

| <i>Variables</i>  | <i>effect of education level without control (Reference category: no education)</i> |                             | <i>Net effect of education level (Reference category: no education)</i> |                              |
|---|---|-----------------------------|---|------------------------------|
|   | <i>Model 1<br/>HR</i>   | <i>Model 2<br/>HR</i>       | <i>Model 3<br/>HR</i>   | <i>Model 4<br/>HR</i>        |
| <b>Primary</b>  | <b>0.626***</b><br>(0.0105)   | <b>0.894***</b><br>(0.0178) | <b>0.84***</b><br>(0.0162)  | <b>0.9132***</b><br>(0.0184) |
| <b>Secondary</b>  | <b>0.485***</b><br>(0.0084)   | <b>0.806***</b><br>(0.0183) | <b>0.719***</b><br>(0.0154)   | <b>0.811***</b><br>(0.0186)  |
| <b>High</b>   | <b>0.299***</b><br>(0.0102)   | <b>0.537***</b><br>(0.0209) | <b>0.464***</b><br>(0.0172)   | <b>0.539***</b><br>(0.0209)  |
| <b>Muslim</b>   | <b>1.327***</b>   | <b>1.188***</b>             | <b>1.329***</b>   | <b>1.2***</b>                |
| <i>Education, Family Formation, and Female Labour Market Participation in Cameroon Thesis</i> |   |                             | <i>PhD</i>  | <b>77</b>                    |

|                              |                 |                 |                  |                  |
|------------------------------|-----------------|-----------------|------------------|------------------|
|                              | (0.026)         | (0.0244)        | (0.0264)         | (0.0262)         |
| <b>Moslem with primary</b>   | <b>1.178***</b> | <b>0.988</b>    | <b>1.026</b>     | <b>0.964</b>     |
|                              | (0.0326)        | (0.0283)        | 0.029            | (0.0281)         |
| <b>Moslem with secondary</b> | <b>0.993</b>    | <b>0.869***</b> | <b>0.9106**</b>  | <b>0.8531***</b> |
|                              | (0.0391)        | (0.0354)        | (0.0361)         | (0.0351)         |
| <b>Moslem with high</b>      | <b>0.551**</b>  | <b>0.576**</b>  | <b>0.5361***</b> | <b>0.554**</b>   |
|                              | (0.1313)        | (0.1376)        | (0.1278)         | (0.1324)         |
| Mother alive                 |                 |                 | 0.8369***        | 0.837***         |
|                              |                 |                 | (0.0225)         | (0.0225)         |
| Father alive                 |                 |                 | 1.317***         | 1.308***         |
|                              |                 |                 | (0.0354)         | (0.0352)         |
| Poor household               |                 |                 | 1.083***         | 0.977            |
|                              |                 |                 | (0.0168)         | (0.017)          |
| Rich household               |                 |                 | 0.948***         | 1.052***         |
|                              |                 |                 | (0.0148)         | (0.0186)         |
| Rural                        |                 |                 | 1.066***         | 1.036**          |
|                              |                 |                 | 0.0161           | (0.0159)         |
| Great west                   |                 |                 | 0.9315***        | 0.9348***        |
|                              |                 |                 | (0.0118)         | (0.0119)         |
| Great north                  |                 |                 | 1.391***         | 1.13***          |
|                              |                 |                 | (0.0227)         | (0.0247)         |
| <b>IMR for Primary</b>       | <b>-</b>        | <b>2.536***</b> | <b>-</b>         | <b>1.833***</b>  |
|                              |                 | (0.2297)        |                  | (0.1853)         |
| <b>IMR for secondary</b>     | <b>-</b>        | <b>6.693***</b> | <b>-</b>         | <b>4.508***</b>  |
|                              |                 | (0.0413)        |                  | (0.05032)        |
| <b>IMR for higher</b>        | <b>-</b>        | <b>5.437***</b> | <b>-</b>         | <b>4.914***</b>  |
|                              |                 | (0.015)         |                  | (0.01425)        |
| <b>Estimation statistics</b> |                 |                 |                  |                  |
| Observations                 | 44,791          | 44,784          | 44,791           | 44,784           |
| LR Chi2                      | 5261.28***      | 6471.16***      | 6516.17***       | 6739.11***       |
| Log likelihood               | -393575.32      | -392894.6       | -392947.87       | -392760.63       |

Standard errors in parentheses (.)

HR is hazard ratio

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

**Source:** Computed by the author using the 2011 Cameroon's DHS and STATA14

Hence, Islamic religion slightly reduces the effect of secondary and tertiary level of education on first marriage, while Moslem women with primary education do not determine their age at first marriage.

This finding suggests that unlike education that develops modern values and possesses strongest influence in delaying first marriage; religion, especially Islam attaches great importance to traditional values of partnership formation and encourages girls in shortening their marriage timing. However, only higher education is able to induce Moslem girls to postpone first marriage.

## 2.5 Conclusion and policy implementation

This chapter investigated the effect of educational attainment on marriage timing, measured by age at first marriage. Data used were extracted from both the women and household datasets of the Cameroon DHS (2011). At the descriptive level, we employed non-parametric methods to access the evolution of age at first marriage and its relation with educational level, using Kaplan-Meier estimates and the Log-rank test. To access the quantitative effect, we employed the semi parametric model, after correcting for endogeneity.

Descriptive statistics reveals that median age at first marriage in Cameroon is still low (17 years), which indicates child or early marriage according to the definition given by UNICEF (2015). With respect to educational levels, median age at first marriage increases with education; 15 for those with no education, 17 for those with the primary level, 19 for those with the secondary level, and 23 for those who attained the tertiary level. While testing for the statistical significance of these differentials using the log-rank test, they were all found to be significant at 1% of significance.

Due to the simultaneity arising between education and marriage, we make use of the non-self-cluster mean of years of education as selection indicator of education, and proceed with Heckman two-stage procedure. Its results reveal that the more a girl increases with her education, the more she is also likely to postpone at an increasing rate her risk of getting marriage for the first time. However, Islam accords great importance to marriage and induces Moslem girls to marry earlier than girls from other religious denominations. Also, the Islam religion tends to reduce the effect of education on marriage timing only when she attains the secondary and higher level of education.

This finding simply shows that education could be considered as one of the most practical way of building women's capacity and rising marriage timing. However this enhancement is still timid in Cameroon because the legal age at first marriage remains very low (15), and girls as early as the age of 10 are already living with a partner, making a country of child or early marriage according to UNESCO (2010).

Hence, this study proposes to policy makers some policy implications both on marriage and education. Considering marriage, the legal age at first marriage in Cameroon is still very low for females (15 years). In this sense, the government could increase this age so as to permit girls to acquire more knowledge and maturity before deciding when to get married. It should continue to encourage legally unmarried couples to legalize their union, so as to eradicate co-

habitation, which has many risks when one of the partners (especially the man) dies. Hence, they could: (i) Increase the legal age at first marriage from 15 to 18 years; where a girl is entering maturity. In this perspective, it could also allow co-habitation if the woman is above 18. (ii) Continue to detect and take care of vulnerable girls, such as orphans.

Concerning education, authorities could: (i) Find attempts to keep young girls in school still a precise cut off age. This can be done by decreeing a compulsory school law where government could fix a minimum age at which a girl can leave school, for example 16 as in UK (Geruso and Royer, 2018). (ii) Continue to encourage parents to send their girl child to school or professional training, especially the northern part of the country; the positive effects of education favors young females to concentrate on schooling, while escaping the traditional upbringing of girls that mainly prepares them for marriage. This can be done through incentives like, free secondary education, financial assistance, scholarships or free trainings such as hair dressing, dressmaking, and other manual works, for girls living in these regions and rural areas. (iii) Reduce regional (geographic) differentials in first marriage by diffusing the risks and consequences of premature marriages through community leaders and mass media. (iv) Guarantee engagement of girls after school, easy women's insertion and participation in the economic, social and political live of the country; this also could motivate girls and parents to invest in education.

Furthermore, this research concludes that to address the issue of marriage timing and education in Cameroon, consideration needs to be given to both the legal age at first marriage and the quality of education that promotes modern and local (traditional) values and guarantees prosperity and wellbeing. One important value promoted in Africa and in Cameroon in particular is not only marriage between heterogeneous couples, but also childbearing in marriage. Hence, partnership formation is driven by the desire to bear children and the realization of a (planned) family formation (Bauer and Jacob, 2009). Considered as the next step of union formation, childbearing is generally approved as the most important outcome in marriage. Therefore, assessing how education is likely to influence birth timing will be the interest of the next chapter.



# Chapter Three:

## Education and Transition into Motherhood in Cameroon: A Couple Perspective

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### 3.1 Introduction

Although fertility has started to decline in most developing countries, it has not yet in most remote rural areas of African countries. According to the United Nations Population Division, the total fertility rate (TFR) in Sub-Saharan Africa (SSA) countries was rather smaller compared to other regions of the world; from 2005 to 2010, it declined from 6.53 to 5.39 (UNPD, 2012).

This decline in TFR was attributed to many causes such the rise in income per capita (or economic development), wider availability and use of modern contraception, better access to mass media, and higher level of education (Garenne, 2014). The level of education is generally found to be negatively correlated with fertility in cross-sectional. That is, women with more education are likely to have lower fertility.

Many studies have focused on the effect of education on fertility, yet less attention has been dedicated to the role of education in shaping people's decision as to when to enter into parenthood. Postponement of parenthood has mostly received attention from demographic research.

Childbearing is one of the most important couples' desires when deciding to live together. This is particularly true in the African context, where the coming of the first child engraved social marks in the family live, and more precisely in the wife's life (Fagbamigbe and Idemudia, 2016). For this reason, transition into parenthood brings joy in the household and extended families as a whole. SSA has some of the highest levels of fertility in the world. Since the 80s, most countries in this region began a transition toward lower fertility, accompanied by an upward trend in the age at first birth

Most studies on fertility focused on the number of children, yet only few dealt with fertility timing. However the time at which childbearing occurs in a woman's life affects her

socio economic wellbeing and the nation as a whole. It has been reported that birth timing has important consequences on the demographic behavior of the entire population (Rajaretnam, 1990). According to Happel et al. (2004), the timing of childbirth can be viewed as an economic choice because it affects a woman's lifetime earnings and household consumption. While early childbearing can be considered as hindrance to a woman's socio economic ambitions in later years, delayed entry into motherhood is seen as an opportunity to prolonged education and build a strong professional career, and be financially secure before family formation (Rindfuss et al., 1996; Happel et al., 2004; Kreyenfeld, 2005).

Researchers studying birth timing have been more interested in the postponement of childbearing. Because of the immense transformations in the reproductive expectations of young individuals in recent years, education contributes greatly in favor of changes in demographic outcomes in different ways (Ferre, 2009). First, because of the incompatibility between schooling and childbearing, the attendance in school reduces time a woman has to engage in childbirth, thus induces her to postpone the decision to commence childbearing: it is the “*incarceration*” effect of education on birth timing. Second, an educated woman has more knowledge on contraception and family planning, thus postponing her birth desire according to her aspirations: it is the “*knowledge*” effect of education on birth timing. Third, because of the high opportunity cost attached to more educated women, they strive over having few children of better quality, earning higher incomes, pairing with men almost sharing the same value like them, and having more bargaining power concerning their fertility decisions: it is the “*autonomy*” effect of education on birth timing (Jejeebhoy, 1995).

However, fertility decisions do not only involve one person (the wife). The desire to have a child is a household-related decision within existing partnerships. Yet, previous studies have so far not considered the consensual decision-making in the fertility timing. Thus, this research attempts to broaden the traditional (woman's) perspective of fertility, in which only the social characteristics of the wife were analyze, and not those of couple (Corijn et al., 1996). Hence, restricting fertility on one partner's view could be biased.

Because of the changing pattern in marriage, the dynamic relationship between union formation and fertility has become more complex in recent years (Garenne, 2014). In the SSA context, premarital fertility exists and is widespread, since more than half of women are concerned (Garenne and Zwang, 2004). It was found that when the rate of premarital fertility is widespread, the relation between marriage and birth becomes weaker, as births occur before

first marriage (Garenne, 2014). In Cameroon, marriage is considered to be the approved framework of sexual activity and procreation. While the legal age of marriage is set at 15 for female and 18 for men, the median age at first birth among women aged 25-29 is 19.7 years (NIS, 2017) with a total fertility rate of about 4 children born/woman in 2017.

By placing childbearing within an appropriated context of couples, it is reasonable to think that both wife and husband's education level potentially affect the timing of births. In partnership formations, individuals usually choose partners who share similar lifestyles and values (Oppenheimer, 1988; Corijn et al., 1996). This issue generally results in situations of educationally homogamous couples. Although couple homogamy as far as education is concerned are expected to prefer early first birth and many children, educationally heterogamous couples, who agree less among themselves about first childbirth, are expected to delay first birth compared to homogamous couples.

Because schooling rates are increasing for both women and men in Cameroon, it is interesting to examine how couples realize family formation timing. Hence the main question of this study is: *What is the effect of education on the timing of first birth within existing couples in Cameroon?*

Since birth decision involves both partners, the specific questions are:

- *What is the effect of the wife's education on the timing of first birth?*
- *What is the influence of the wife's education on the timing of first child when her husband's education is considered?*
- *What is the effect of the couple's education on the timing of first birth?*

In this study, we aim to examine *the influence of education on the timing of the first childbirth within couples in Cameroon.*

All things being equal, this study relies on the hypothesis according to which:

- *Highly educated wives are likely to delay the birth of their first child;*
- *The effect of a wife's education on the timing of the first child tends to reduce when incorporating her husband's education;*
- *Educationally homogamous couples are more likely to enter parenthood compared to other types of educationally heterogamous couples.*

Our study contributes to filling this gap by not only considering wives' education as done my most empirical works, but by including their partners' education which is very crucial

in the Cameroonian context, where husbands as main decision-makers play a crucial role in the family formation process; also by considering the couple's education to verify if there is some synergy in fertility decision among couples. This study uses birth timing to measure fertility instead of number of children ever born as used in most studies.

The rest of this chapter is structured as follows: Section 2 presents the literature review; Section 3 describes the methodology, data and defines variables; and finally, Sections 4 and 5 present the empirical results and conclusion, respectively

## 3.2 Literature Review

### 3.2.1 Theoretical Background

The economic analysis of fertility has shift from the quantity to the timing of fertility. The reason advanced to this shift is that most available micro-data on fertility concern families who have not yet finished with their reproductive cycle (Cigno and Ermisch, 1988). The theoretical view of this study shall be considered from the individual perspective of the woman and the couple perspective.

#### *Links between education and birth timing: An individualistic perspective of women*

There are two basic economic reasons why women postpone births, namely the consumption smoothing and career prospects motives (Hotz et al., 1997). However, Caldwell (1982), Cleland and Rodriguez (1988), and Jeffery and Basu (1996) confirmed that educational differentials play a crucial role in fertility transition among women. From the consumption smoothing point of view, couples engage in having a child when they feel that they have enough income which can afford to take care of the child without forgoing other consumptions. Whereas the career planning motives is about finding free time for child bearing and caring. This is because to expect higher earnings later in life, a young person has to spend many years to complete education and work experience that will make him/her more demanded on the labour market.

Many reasons justify why high educated women postpone birth the most. (i) High education requires longer years in school, thus more educated women tend to stay longer in education and will give birth later (ii) Schooling and childbearing are very incompatible because of insufficient income to pay for children and childcare costs. (iii) Another reason why

more educated women would postpone birth compared to less educated ones is the time conflict that exists between caring for career and caring for children. In this context, bearing a child relies on a cost and benefit evaluation, according to which people decide to form a family when benefits exceed costs (Becker, 1981).

Furthermore, it is also agreed that age at which a woman starts fertility is strongly associated with her educational deficit (Ferre, 2009). Because of the incompatibility between childbearing and schooling, the debates around birth timing an education have shown to have real consequences, especially in Sub-Saharan African countries. In most of these countries, national laws do not favor neither pregnant nor married women to attend school, precisely in primary and secondary levels (CBASSE, 1993).

Yet, most existing literature on the relationship between education and first birth focused only on women. Even though most of these studies confirmed that high educated women are more likely to postpone first childbirth than less educated ones (Ferre, 2009; Fagbamigbe and Idemudia, 2016), analyzing this relationship on the basis of an individualistic perspective could be problematic. Despite this, only few studies have applied a couple's perspective (Corijn et al., 1996; Kreyenfeld and Konietzka 2008; Bauer and Jacob 2009; Bauer and Kneip, 2013.)

Since most children are born and brought up within unions; restricting the timing of births to the sole characteristics of the woman will make the analysis insufficient. That is why the couple's perspective has to be examined theoretically and empirically.

#### *Links between education and birth timing: A couples' perspective*

Classical theories of household economics suggest that partners with different levels of education (heterogamous or asymmetric education) will be more expose to parenthood. This is because the partner who specializes in home tasks has lower opportunity costs than the other partner who specializes in marketed works. According to these assessments, specialization gains from such unions are high. Conversely, the situation is different when both partners have the same educational levels (homogemous education). For highly educated partners, the opportunity costs are high and therefore high risks of childlessness are expected.

During last years, models of fertility have paid attention to couples' characteristics in fertility behavior. Due to the idea that most children are born within co-residential unions (Perelli-Harris et al., 2012; Lichter et al., 2014), there is an important research gap on the issue

of how the partners' education interact to structure childbirth. The theoretical perspective of childbearing concern couples. A recent literature is interested on the interactive effect of partner's education on the fertility behavior (Corijn et al., 1996; Natalie et al., 2015; Thomson 1997; Bauer et Jacob, 2009).

For two main reasons, researchers have attempted to explain why it is important to consider the couple's education when studying fertility (Bauer and Jacob, 2009; Natalie et al., 2015). First using a household approach, the micro-economic theory considered childbearing as a family decision. According to this view, most children are engendered and grow up in a stable partner relationship (Corijn et al., 1996; Bauer and Jacob, 2010). Even in consensual and other forms of marriage-related relationships, both partners provide a social environment of parenthood.

Second, according to the traditional theory of household with specialization of partner's role, highly educated men choose less educated women in order to provide children with the ideal environment (Becker, 1993). However, with the increase in women economic contribution to household economics changes this pattern. Oppenheimer (1988) suggested a model of pooling of resources from both partners as a vital strategy to ensure the economic wellbeing of the family. This model implies that highly educated partners are expected to have fewer children compared to couples with dissimilar levels of education.

Third, the reduction and achievement (or even the reversal) of gender gap in education in many countries are bound to affect family formation decisions. At first, men tended to marry less educated women while women tended to marry men with at least their education level. But, nowadays with the increase in women education, this is no longer easy to be found. Individuals usually choose partners who share almost the same educational level as theirs (Oppenheimer, 1988; Corijn et al., 1996). Therefore, homogamous<sup>37</sup> educated couples imply change in fertility behavior. Educational sorting mates have switch from hypergamy<sup>38</sup> to hypogamy<sup>39</sup>, and are without no implications on the timing of fertility (Schawrtz and Han, 2014; Van Bavel, 2012).

#### *Educationally Homogamous/Heterogamous couples and timing of first childbirth*

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<sup>37</sup> Relationships where both partners have the same level of education

<sup>38</sup> Relationships where the level of education of the male partner is higher than that of the female partner

<sup>39</sup> Relationships where the level of education of the female partner is higher than that of the male partner

It is generally accepted that homogamous couples are more likely to share similar values than heterogamous couples (Krishnan, 1991). On one hand, while Thomson (1991) advocates that “homogamy is supposed to facilitate agreement and understanding between the partners and to results in share goals”, Kalmijn (1991) suggests that homogamous couples intend to develop a common lifestyle. On the other hand, educationally heterogamous couples have lower degree of value consensus among them; hence can exhibit different types of family formation models such as the patriarchal<sup>40</sup>, “*sphere-of-interest*”<sup>41</sup>, and “*power*”<sup>42</sup> decision rules. This implies different responses as far as fertility decision are concerned. Educationally homogamous couples may be expected to agree more among themselves compared to heterogamous couples (Corijn et al., 1996).

The above arguments explain how couples’ relative education may influence their childbearing decisions. Although it has been proven theoretically, most empirical studies view only one partner’s education.

In the partner’s view, two approaches are distinguished in empirical researches: the partner perspective and the couple perspective. In the partner perspective, some studies concentrated on one partner and examine how individual educational level changes when incorporating the other partner’s educational level. In this context, each partner’s educational level appears in the other partner’s model. Studies using the couple perspective consider couples as the unit of analyses and examine how couple’s education level affects each partner’s characteristics. This approach examines the interaction effects of both partners’ education.

Almost all empirical studies applied either the partner perspective (Kreyenfeld, 2009) or the couple perspective (Bauer and Jacob 2009, Corijn et al., 1996; Kreyenfeld, 2002; Wirth 2007). Only few applied both perspectives. In this study, these two approaches of education will be used to examine how the female spouse, the male spouse, and the couple’s educational attainment affect birth timing. Since fertility mostly concerned women, we will limit ourselves to the female spouse and incorporate the male and the couple’s education.

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<sup>40</sup> A patriarchal rule is a model where it is only the man who decides on the birth of a child, while the woman’s desire does not matter (Jansen and Liefbroer, 2006)

<sup>41</sup> A sphere-of-interest rule is a model where it is the woman who makes the ultimate decision of child birth in the family (Corijn et al., 1996)

<sup>42</sup> A power rule is a model where it is the partner with the highest bargaining power who decides on the family planning. This power variable can be measured by the earning capacities of the partner (Loving et al., 2004; Lyigun and Walsh, 2007).



### 3.2.1 Empirical evidence from previous studies

When analyzing the effect of education on first birth timing, some studies do not include the partner's characteristics. Almost all studies in this view arrive at the same result of the delaying effect of education on first birth timing. It is the case of Ferre (2009) who studied how education affects fertility timing in Kenya. To get rid of the endogeneity bias due to the unobserved variables and the simultaneity and between education and fertility decisions, she uses the instrumental variable approach in a binary model. Whereas, Fagbamigbe and Idemudia (2016) used a survival analysis model to examine first birth timing among Nigerian women. This study used the Nigerian representative DHS data of 2013. Descriptive results of Kaplan Meier survival function show that the median age at first birth was 20 (19 in the North and 22 in the South). Also, the Cox proportional hazard regression shows that first birth was mostly affected by women educational standing.

When incorporating the partner's education, most studies found that the effect of the wife's education on first birth timing reduces. Using vocational training as measure of education, Kreyenfeld (2002) found that wife's vocational training has a negative effect on first birth but a positive effect on second birth when considering only women. But these effects become irrelevant when including the husband's vocational training. This same results were obtained by Brose (2008) and Kreyenfeld and Konietzka (2008). They found that school enrolment of women reduces transition into first birth, but this effect is reduced up to a point of becoming insignificant when the male spouse's characteristics were included. Bauer and Jacob (2009) in their study considered both the effect of general education and vocational training on family formation. Considering only women, both types of education postpone first birth timing in Germany. Similar to other researches, they found that when including the male spouse's level of education this effect becomes unaffected. At this level, they concluded that the female spouse's education has a stronger effect on the couple's fertility decision compared to male spouse's education (Corijn et al., 1996)<sup>43</sup>.

As far as the couple perspective is concerned, Corijn's et al. (1996) empirical research on factor explaining fertility behavior in Netherlands and Flanders uses hazard models. They found that homogamous low educated partners are more likely to have early birth compared to

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<sup>43</sup> Corijn, Liefbroer, and de Jong Gierveld (1996) talk of '*sphere of interest*' to explain the stronger effect of female characteristics on fertility as women are more affected e.g. by pregnancy, (temporary) withdrawal from the labour market etc. (see Bauer and Jacob 2009). This means that for male spouses, the timing of first births do not depend neither on own resource nor own preferences, but on the female characteristics.



other types of couples. They found the strongest postponement in first childbearing in homogamous high educated couples. They also show that asymmetric educational (hyper and hypogamous educated) couples are at lower risk of early birth, but are likely to catch up later. This same conclusion was obtained by Sorenson (1989) who applied the diagonal reference models and Mascie-Taylor (1986). They arrived at the conclusion that educationally homogamous couples are at a higher rate of experiencing first birth than educationally heterogamous couples.

Empirically, most theses evoke the issue of simultaneity between education and fertility timing, but only few correct for this bias. This study corrects for endogeneity by following Ferre (2009) idea of instrumental variable approach in a continuous right-censored Cox Proportional Hazard model. But instead of considering only women's educational attainment, our chapter will include successively the male spouse's level of education, and the couple's educational constellation.

### **3.3 Methodology, Modeling Framework, and Data**

#### **3.3.1 Theoretical framework**

Cigno (1988) was the first to introduce time in the economic model of demand for children. From this view, the demand for a child at a point in time is an optimizing decision from both partners, whose aim is to maximize their common utility.

But because of the difficulty in estimating the structural parameters of the theoretical model (Cigno and Ermisch, 1988), more emphases were put on the econometrical analysis of fertility timing. For this reason, this chapter follows the econometric path taken by most empirical works with explanatory variables proposed by the theoretical analysis. Similar to Cigno and Ermisch (1988), we restrict our analysis to only married women with no premarital pregnancy. In their model as in many others, educational attainment plays a crucial role in determining birth timing. Yet unlike their studies, we will not use women's occupations as exogenous variable. This is because a married woman's career is more likely to vary over her lifetime because of childbearing and rearing. Also, her occupation is likely to be strongly correlated with her educational level which is our main explanatory variable.

#### **3.3.2 Methodology**

In order to examine how education influences family formation timing, some studies employed logistic regression models (Bauer and Kneip, 2012) whereas most studies applied

event history models. These latter are adequate in examining events, such as first birth (Bauer and Jacob, 2009).

First birth is a transitional event from a childlessness state to a parenthood state. In such studies it is usual for some participants not to experience first birth till the end of the survey, or for some participants to withdraw during the study. The most usually encountered form of censored observation is the one where some women have not yet experience first birth before the end time of survey (right censoring). In this framework, survival analysis which is the analysis of follow up situations has been proven to be adequate in such studies. Event history models or duration models have the strength to account and control for states transition and censored episodes.

Our analysis will be based on discrete hazard rate models. The hazard rate is the conditional probability that the birth of the first child will occur at a precise point in time to a particular woman given that this woman has not yet experienced first birth before (Allison, 1984).

In time to events analysis, two quantitative measures are important, namely the survival function and the hazard function denoted by  $S(t)$  and  $h(t)$  respectively. The cumulative distribution function of first birth,  $T$ , is the probability that a woman selected at random will experience a childlessness time less than or equal to a particular time,  $t$ . That is:

$$S(t) = P_r(T \leq t) \quad (1)$$

In the context of this study, the survival function yields the probability that a woman remains without a child till a specified time  $t$ . That is:

$$S(t) = P_r(T > t) \quad (2)$$

Since the sum of these two functions is equal to 1.0 at any value of  $t$ ,

$$S(t) = 1 - F(t) \quad (3)$$

Because it is routinely computed by most software packages, Kaplan-Meier estimate of survival function is the frequently used estimator (which integrates information from both censored and uncensored event times) will be employed to compute survival estimates (Hosmer et al., 2008). A general formulation of Kaplan-Meier survival function is given by:

$$S(t) = \prod_{i=1}^k \frac{(n_i - d_i)}{n_i} \quad (4)$$

Where  $n_i$  is the number of women at risk of experiencing first birth at time  $t_i$ ;  $d_i$  is the number of women actually experiencing first birth at that time.

After having an overall birth experience among women at risk, we will turn our attention in comparing birth experience in the key subgroup of educational attainment. These categories are defined as birth experiences in no education, primary, secondary and tertiary levels of education.

Conversely to survival function which describes the probability of not experiencing first birth before time  $t$ , hazard function concerns birth rate at time  $t$  among women who are at risk of experiencing first birth at time  $t$ .

The Kaplan Meier estimates of  $S(t)$  will be used to follow up first birth evolution at a univariate level, and with respect to educational levels at the bivariate level.

To explore how education and other selected covariates affect first birth timing, we will make use of the well-known Cox proportional hazard model. In the Cox model of first birth, the effect of a unit increase in covariates is multiplicative with respect to hazard rate and is given as:

$$H_{i(t|\psi_{fb, E})}^{FB} = \lambda_o \exp(\beta_1 Educ\_Level_i + \beta_2 X_{ifb}) \quad (5)$$

Where:

$t$  stands for age at which the female gave birth for the first time; this time is also interpreted as the survival time from a childless state to a parenthood state (Ferre, 2009)

$H_{i0}^{FB}(\cdot)$  denotes the hazard of first birth given that the woman has not given birth up to a precise point in time,  $t$  (age at first birth);

$\lambda_o$ : is an unspecified baseline hazard function;

$X_{ifb}$  stands for a set of covariates of first birth including husband's education, couples education, residence, region, religion, etc.);  $\beta_i$ , the corresponding coefficients attached to education and other covariates.

$Educ\_Level_i$  Educational levels categorized into 3 educational groups as primary, secondary, and tertiary level of education (with no education as base category)

Cox model assumes that proportions of hazards are constant over time; and the signs and the statistical significance of the coefficients of covariates indicate how significant they affect the hazard rate of first birth. A hazard ratio which is greater than one ( $>1$ ) implies a more exposure to first birth (teenage birth), whereas a hazard ration less than one ( $<1$ ) implies a low exposure to first birth (birth postponement). Moreover, to test whether our model satisfies the proportional-hazards assumption, we consider the significance of the hazards rations, the Wald chi square statistics and the log likelihood tests.

### 3.3.3 Estimation issue and model specification

#### 3.3.3.1 Endogeneity bias

Because of endogeneity bias, it is not easy to establish the causality between education and first birth timing (Ferre, 2009). Endogeneity arises from three main sources, namely unobserved heterogeneity, reverse causality, and measurement error.

Unobserved variables like personal ability and skills, personal motivation, and parental background may be significant factors explaining schooling and fertility decisions. For instance, a girl with high motivation may acquire more education and delay childbearing. Also, whereas early pregnancies may curtail women's formal education, education because of the incompatibility with fecundity, may delay childbearing. And finally, the error in the measurement of variable is common in surveyed data (Totouom et al., 2019).

Since education attainment and age at first birth has a *ceteris paribus* impact on each other, their structural equations can be depicted as follows):

$$fb = u_1\psi_{fb} + Educ\_Level.\phi_1 + \varepsilon_1 \quad (6)$$

$$Educ\_Level = u_2\psi_e + \phi_2fb + \varepsilon_2 \quad (7)$$

Where  $fb$  is first birth \_ the potentially endogenous variable in the education level function – measured by age at first birth in continuous years, with  $\phi_2$  the corresponding parameter.

$Educ\_Level$  is a vector of educational attainment \_ the potentially endogenous variable in the first birth equation \_ captured by complete years into primary, secondary and tertiary level of education, with  $\phi_1$  the corresponding vector of parameters.

$\psi_{fb}$  is a vector of variables explaining first birth, with  $u_1$  the corresponding vector of parameters.

$\psi_e$  is a vector of variables explaining educational attainment, with  $u_2$  the corresponding vector of parameters. And  $\varepsilon_1$  and  $\varepsilon_2$  are error terms for first birth and educational attainment equations respectively.

Since birth timing and education attainment are jointly made, it means that the two structural error terms,  $\varepsilon_1$  and  $\varepsilon_2$  are correlated; hence, *Educ\_Level* is correlated with  $\varepsilon_1$  and *fb* is correlated with  $\varepsilon_1$ . In such case, using OLS estimation method will yield bias and inconsistent estimates (Baye and Sitan, 2016); also any linear regression model will be inconsistency because of the nature of the outcome variable. Like most studies, we account for endogeneity by employing an instrumental variable-based approach called Two Stage Residual Inclusion (2SRI) method.

Since we are interested in estimating the effect of educational level on age at first birth, equation (6) is included in equation (7), which is:

$$Educ\_Level = u_2\psi_e + \phi_2(u_1\psi_{fb} + Educ\_Level.\phi_1 + \varepsilon_1) + \varepsilon_2 \quad (8)$$

$$= u_2\psi_e + \phi_2u_1\psi_{fb} + E\phi_1\phi_2 + \phi_2\varepsilon_1 + \varepsilon_2 \quad (9)$$

$$Educ\_Level.(1 - \phi_1\phi_2) = u_2\psi_e + \phi_2u_1\psi_{fb} + \phi_2\varepsilon_1 + \varepsilon_2 \quad (10)$$

Assuming  $(1 - \phi_1\phi_2) \neq 0$ , that is  $\phi_1\phi_2 \neq 1$ , we solve for education level:

$$Educ\_Level = u_1Z_{fb} + u_2Z_e + \varepsilon_3 \quad (11)$$

Where:

$$Z_e = (\psi_e)/(1 - \phi_1\phi_2) \quad Z_{fb} = (\phi_2\psi_{fb})/(1 - \phi_1\phi_2), \text{ and } \varepsilon_3 = (\phi_2\varepsilon_1 + \varepsilon_2)/(1 - \phi_1\phi_2).$$

Equation (11) is the reduced form equation of educational attainment, since it is expressed as a function of  $Z_e$  and  $Z_{fb}$  – which are vectors of exogenous variables of *Educ\_Level* and *fb* respectively; and the reduced form error term,  $\varepsilon_3$  – which is a linear function of  $\varepsilon_1$  and  $\varepsilon_2$ , structural error terms.

### 3.3.3.2 Estimating equation and procedure

The main idea is to use an additional variable called “instrument”, which extracts the exogenous component in the endogenous explanatory variable in order to assess consistent estimates (Terza et al., 2008). There is a large literature on IV approaches addressing

endogeneity bias in linear models, but not in nonlinear and duration models. It is only recently that IV approaches are developed for these models, namely the Two-stage residual inclusion (2SRI) and the Two-stage predictor substitution (2SPS). But in this case, use is made of the Heckman (1979) two-stage procedure to derive the IMRs at each level of education.

We fit our structural equation given by the hazard function in (5), with covariates assumed to be time-independent. Like Gowrisankaran and Town (1999), we treat our potentially endogenous variable, educational attainment, as a time-independent ordered variable.

Educational attainment is simulated using a standard normal distribution with probabilities determined as:

$$P(\text{Educ\_Level}_k = 1 | \psi_{fb}, IV) = \frac{\Phi\{(u_1 Z_{fb} + u_2 Z_e)_k\}}{1 + \sum_{k=1}^3 \Phi\{(u_1 Z_{fb} + u_2 Z_e)_k\}} \quad (12)$$

$$P(\text{Educ\_Level}_0 = 1 | \psi_{fb}, IV) = \frac{1}{1 + \sum_{k=1}^3 \Phi\{(u_1 Z_{fb} + u_2 Z_e)_k\}} \quad (\text{Base category}) \quad (13)$$

With  $k = 1, 2, 3$

#### *First stage*

Following Ferre's (2009) study in Kenya, we estimate an ordered Probit model of educational attainment as the reduced form equation: it is the first stage. This equation is given as:

$$\text{Educ\_Level}_i = \pi_0 + \pi_1 IV_i + \pi_2 G_i + \varepsilon_i \quad (14)$$

In a probability equation-type, we have:

$$\text{Educ\_Level}_i = \Phi(\pi_0 + \pi_1 IV_i + \pi_2 G_i) \quad \text{First stage} \quad (15)$$

Where:

IV is the instrumental variable captured at the community level (Wodon, 2014; Delprato et al., 2015). In this study, we retain as instrument, the non-self-cluster mean of years of education. This instrument captures the value of the share of girls' years of education living around the girl considered in our regression, without factoring her own education level. By this, we suggest that the average number of girls (captured at the cluster level) with more years of education

may induce a girl living in that same neighborhood to increase her own level of education. This in turn may induce her in postponing first birth decision. Thus, the non-self-cluster mean of years of education is strongly correlated with education level, but not directly correlated with age at first birth. That is, our instrument is correlated with first birth through education level.

$\Phi$  is the cumulative density function of the normal distribution.

Educational attainment, *Educ\_Level*, is a categorical variable including Primary, Secondary, and Tertiary level of education, with no education as reference category.

$\varepsilon = [\varepsilon_P, \varepsilon_S, \varepsilon_T]$  is the reduced form error term which is neither correlated with  $Z$  nor  $IV$ . Where  $\varepsilon_P$ ,  $\varepsilon_S$ , and  $\varepsilon_T$  are reduced form error terms of primary, secondary, and tertiary level of education respectively.

$G_i$ , is a vector of exogenous variables with  $\pi_i$  its corresponding vector of unknown coefficients.  $G$  includes religion, parent's wealth status, parent's educational level, residence and regions.

Yet, since it is not econometrically possible to predict residuals after an ordered approach, we opt for Inverse Mills Ratio to capture unobservable variables (Baye, 2015) at each education level. Heckman (1974) in his seminal paper considered sample selection bias as a sort of omitted variable bias.

### *Second stage*

According to Louviere et al. (2005), Guevara and Ben-Akiva (2009), and De Grange et al. (2015), the residual or any function of it (such as the IMR) can be included in the control function as an additional explanatory variable. Thus:

$$H_{i(t|\psi_{fb, E})}^{FB} = \lambda_o \exp \left( \sum_{k=0}^3 \psi_k Educ\_Level_i + \sum_{r=1}^m \delta_r X_{ifb} + \theta_3 IMR_p + \theta_4 IMR_s + \theta_5 IMR_h \right) \quad \text{second stage} \quad (16)$$

Where:

$IMR_p$ ,  $IMR_s$ ,  $IMR_h$  are respectively Inverse Mill's Ratios at primary, secondary, and higher levels derived from the reduced form of educational level. IMR captures unobserved variables affecting first birth.

$\psi_k$  and  $\psi_i$  : are parameters purged from potential endogeneity bias, which will yield unbiased and consistent estimates. With  $k = 0, 1, 2, 3$ .

$X_{ifb}$  : is the set of controlled variables explaining first birth. We consider the same variables selected in the previous chapter, added with the partner and the couple's education level (interaction between the wife and the partner's education).

We estimate equation (16) using Cox proportional hazard model because it does not assign any distribution in the occurrence of first birth.

When considering the husband educational level, equation (16) becomes:

$$H_{i(t|\psi_{fb,E})}^{FB} = \lambda_o \exp \left( \sum_{k=1}^3 \psi_k Educ\_Level_i + \sum_{k=4}^6 \psi_k H_{Educ\_Level_i} + \sum_{r=1}^m \delta_r X_{ifb} + \theta_1 IMR_p + \theta_2 IMR_s + \theta_3 IMR_h \right) \quad (17)$$

Where  $H_{Educ\_Level_i}$  is the education level of the husband.

When considering the couple's level of education, equation (17) becomes:

$$H_{i(t|\psi_{fb,E})}^{FB} = \lambda_o \exp \left( \sum_{k=1}^3 \psi_k Educ\_Level_i + \sum_{k=4}^6 \psi_k H_{Educ\_Level_i} + \sum_{k=7}^{16} \psi_k Educ\_Level_i * H_{Educ\_Level_i} + \sum_{r=1}^m \delta_r X_{ifb} + \theta_1 IMR_p + \theta_2 IMR_s + \theta_3 IMR_h \right) \quad (18)$$

In course of this analysis, we oppose homogamous versus heterogamous level of education. Hence, equation (18) becomes:

$$H_{i(t|\psi_{fb,E})}^{FB} = \lambda_o \exp \left( \sum_{k=1}^3 \psi_k Educ\_Level_i + \sum_{k=4}^6 \psi_k H_{Educ\_Level_i} + \psi_7 Heterog_i + \sum_{r=1}^m \delta_r X_{ifb} + \theta_1 IMR_p + \theta_2 IMR_s + \theta_3 IMR_h \right) \quad (19)$$

Where *Heterog* is heterogamous level of education.

### 3.3.4 Dataset, study design and setting

In this chapter, we use data from the 2011 Cameroon Demographic and Health Survey which is a cross- sectional national representative data. This survey was realized in Cameroon during the period of January to August 2011 by the National Institute of Statistics (NIS), in collaboration with the ministry of Public Health. Thus, DHS (2011) was conceived to provide



follow up data of the population on issues related to health such as the level of fecundity, fertility preferences, knowledge on methods and uses of contraceptives, family planning, knowledge on breastfeeding, child mortality, mother and child health. This survey also used clusters provided by the third General Census of the Population and Habitat (GCPH) of 2005. 580 clusters, 291 in urban areas and 289 in rural areas were numbered across the 10 regions of Cameroon. A total of 15, 050 households were selected and, among them, 15, 426 eligible women aged between 15 and 49 successfully answered the questionnaire.

This survey provides information on women's sexual and reproductive history and background characteristics. For those women who are staying with partners, the structure of this data also allow us to obtain little information about their partners such as age and educational level. This permits us to restrict our sample to existing partnerships at the time of the survey. Therefore, we excluded women who had a child before entering the current marriage. The beginning of marriage or partnership is considered as the moment the two spouses started living together as husband and wife. This is because in the DHS data base, are considered as married and eligible to be interviewed only those who share the same household. Therefore, for each respondent married woman we ask if she have a child (within marriage) at the time of survey. If the answer is yes we know at what age she had the child. Whereas, those who did not have a child at the moment of the survey time (January to August 2011) were censored. That is why event history models are appropriate for this study because they have the possibility to take into consideration and control not only for change state but also for censored episodes. This leaves us with 9,805 women in current existing partnerships and 8,870 with first births in 2011. We used within existing couples the age of the mother at the time of the first child's birth as our dependent variable.

Unlike some studies (Jacob and Bauer, 2009), we used only the woman's time axis because the fertility timing of a couple is mostly determined by the woman's fertile period (which on average is between 15 and 45). That's why we will focus at the female spouse's age at first birth as relevant in determining a couple's fertility.

Since we are interested in the effects of education, especially the formal education, we will use as main independent variables educational attainment of the female spouse, the male spouse, and of the couple's constellation. This variable is grouped into categories such as no education (reference category), primary, secondary, and tertiary education. When modeling interaction between both partners educational levels, we assume proportionality of educational

effects because the couple's educational levels are likely not to change significantly after marriage. We also include in these analyses exogenous variables such as religion, area of residence, wealth status, and region.

### 3.4 Empirical Results and Discussion

Empirical findings are presented as follows: first we provide some descriptive statistics of our variables, a univariate and bivariate description of data. Second, we present results of the effect of female spouse educational level on age at first birth. Third, we include the male spouse educational level to this latter analysis. And fourth, we include the couple's educational level to the above analysis.

#### 3.4.1 Some descriptive statistics of selected variables

Table 3\_1 provides detailed summary statistics of variables describing our sample population. Among the 9,805 married women totaled in our sample, 8,870 had experience first birth, with an average age of at least 18. The minimum age at which the youngest woman gave birth is 11 while the oldest one is 39 years. It is also important to note that this outcome variable displays a dissymmetrical and flat distribution (as the skewness coefficient is 0.98; and Kurtosis is 4.97). Thus justifying the use of the Cox Proportional hazard model, which does not assign any distribution pattern to the distribution of the outcome variable.

Concerning how couples are formed with respect to partners' educational level, Table 1 reveals that majority (56 percent) of husbands and wives in couples have the same education level. 34 percent of educationally homogamous couples have low education (no and primary education).

**Table 3 1: Descriptive statistics**

| variable                                  | Obs.  | Mean  | Std.<br>dev | Skewness | Kurtosis | Min | Max |
|---|-------|-------|-------------|----------|----------|-----|-----|
| <i>1. Dependent variable</i>              |       |       |             |          |          |     |     |
| First birth (age in years)                | 8,870 | 18.68 | 3.683       | 0.985    | 4.977    | 11  | 39  |
| <i>2. Endogenous explanatory variable</i> |       |       |             |          |          |     |     |
| Primary (=1 and 0, else)                  | 9,805 | 0.395 | 0.489       | 0.782    | 1.61     | 0   | 1   |
| Secondary (=1 and 0, else)                | 9,805 | 0.324 | 0.468       | 0.676    | 1.457    | 0   | 1   |
| Higher (=1 and 0, else)                   | 9,805 | 0.036 | 0.187       | 5.645    | 32.876   | 0   | 1   |

### 3. Exogenous explanatory variables:

|                              |       |       |       |        |         |   |   |
|------------------------------|-------|-------|-------|--------|---------|---|---|
| Moslem (=1 and 0, else)      | 9,805 | 0.23  | 0.421 | 1.648  | 3.716   | 0 | 1 |
| Poor home (=1 and 0, else)   | 9,805 | 0.397 | 0.489 | 0.4008 | 1.161   | 0 | 1 |
| Rich home (=1 and 0, else)   | 9,805 | 0.397 | 0.489 | 0.473  | 1.224   | 0 | 1 |
| Husband with primary         | 9,805 | 0.323 | 0.467 | 1.804  | 4.257   | 0 | 1 |
| Husband with secondary       | 9,805 | 0.358 | 0.479 | 3.053  | 10.323  | 0 | 1 |
| Husband with higher          | 9,805 | 0.088 | 0.283 | 12.571 | 159.03  | 0 | 1 |
| Homogamy couple              | 9,805 | 0.563 | 0.24  | 3.57   | 13.81   | 0 | 1 |
| Heterogamy couple            | 9,805 | 0.39  | 0.16  | 5.91   | 35.93   | 0 | 1 |
| Homogamy low couple          | 9,805 | 0.34  | 0.02  | 36.976 | 1368.22 | 0 | 1 |
| Homogamy high couple         | 9,805 | 0.024 | 0.191 | -4.85  | 24.521  | 0 | 1 |
| Hypogamy low couple          | 9,805 | 0.034 | 0.259 | -3.295 | 11.859  | 0 | 1 |
| Hypogamy high couple         | 9,805 | 0.002 | 0.02  | 36.976 | 1368.22 | 0 | 1 |
| Hypergamy low couple         | 9,805 | 0.063 | 0.191 | -4.85  | 24.521  | 0 | 1 |
| Hypergamy high couple        | 9,805 | 0.009 | 0.259 | -3.295 | 11.859  | 0 | 1 |
| Rural (=1 and 0, otherwise)  | 9,805 | 0.55  | 0.499 | 0.119  | 1.014   | 0 | 1 |
| Great Center (1 and 0, else) | 9,805 | 0.294 | 0.456 | 0.718  | 1.516   | 0 | 1 |
| Great West (=1 and 0, else)  | 9,805 | 0.359 | 0.479 | 0.718  | 1.516   | 0 | 1 |
| Great North (1 and 0 else)   | 9,805 | 0.346 | 0.476 | 0.992  | 1.984   | 0 | 1 |

#### 4. Instruments for education level

Non-self-cluster mean of

|                             |       |       |       |        |       |   |       |
|-----------------------------|-------|-------|-------|--------|-------|---|-------|
| yrs of education (in years) | 9,804 | 5.731 | 3.210 | -0.311 | 2.023 | 0 | 15.43 |
|-----------------------------|-------|-------|-------|--------|-------|---|-------|

**Source:** authors using the Cameroon's DHS (2011)

## 3.4.2 Descriptive analysis for survival data: Kaplan-Meier estimator and the Log rang test

### 3.4.2.1 Kaplan-Meier estimation: univariate level

**Table 3 2:** reports Kaplan-Meier estimates of first birth occurrence among married women.

| Age       | Number of married women | Occurrence of first birth | Proportion of childless married women | [95% Conf. Int.] |               |
|-----------|-------------------------|---------------------------|---------------------------------------|------------------|---------------|
| 11        | 8870                    | 1                         | 0.9999                                | 0.9992           | 1.0000        |
| 12        | 8869                    | 159                       | 0.982                                 | 0.9790           | 0.9845        |
| 13        | 8710                    | 250                       | 0.9538                                | 0.9492           | 0.9580        |
| 14        | 8460                    | 459                       | 0.902                                 | 0.8957           | 0.9080        |
| 15        | 8001                    | 705                       | 0.8225                                | 0.8144           | 0.8303        |
| 16        | 7296                    | 943                       | 0.7162                                | 0.7067           | 0.7255        |
| <b>17</b> | <b>6353</b>             | <b>1143</b>               | <b>0.5874</b>                         | <b>0.5770</b>    | <b>0.5975</b> |
| <b>18</b> | <b>5210</b>             | <b>1138</b>               | <b>0.4591</b>                         | <b>0.4487</b>    | <b>0.4694</b> |

|    |      |      |        |        |        |
|----|------|------|--------|--------|--------|
| 19 | 4072 | 1030 | 0.343  | 0.3331 | 0.3528 |
| 20 | 3042 | 795  | 0.2533 | 0.2443 | 0.2624 |
| 21 | 2247 | 564  | 0.1897 | 0.1817 | 0.1980 |
| 22 | 1683 | 464  | 0.1374 | 0.1304 | 0.1447 |
| 23 | 1219 | 344  | 0.0986 | 0.0926 | 0.1050 |
| 24 | 875  | 242  | 0.0714 | 0.0661 | 0.0768 |
| 25 | 633  | 180  | 0.0511 | 0.0466 | 0.0558 |
| 26 | 453  | 139  | 0.0354 | 0.0317 | 0.0394 |
| 27 | 314  | 94   | 0.0248 | 0.0217 | 0.0282 |
| 28 | 220  | 67   | 0.0172 | 0.0147 | 0.0201 |
| 29 | 153  | 47   | 0.012  | 0.0098 | 0.0144 |
| 30 | 106  | 31   | 0.0085 | 0.0067 | 0.0105 |
| 31 | 75   | 19   | 0.0063 | 0.0048 | 0.0081 |
| 32 | 56   | 13   | 0.0048 | 0.0036 | 0.0065 |
| 33 | 43   | 16   | 0.003  | 0.0021 | 0.0044 |
| 34 | 27   | 9    | 0.002  | 0.0013 | 0.0032 |
| 35 | 18   | 9    | 0.001  | 0.0005 | 0.0019 |
| 36 | 9    | 3    | 0.0007 | 0.0003 | 0.0014 |
| 37 | 6    | 2    | 0.0005 | 0.0002 | 0.0011 |
| 38 | 4    | 3    | 0.0001 | 0.0000 | 0.0007 |
| 39 | 1    | 1    | 0      | .      | .      |

**Source:** Demographic and Health Survey, Cameroon, 2011

A thorough univariate description of birth history in 2011 shows that among 9,805 women living with partners, almost all (8,870) already experienced first birth. This first birth starts as early as 11 years, while the eldest age at first birth is 39 years. The majority of these women give birth to their first child after 18 years. As reported in Table 1, out of the 8,870 respondents, only one girl of 11 years gave birth to her first child. This leaves 8,869 childless married women (that is a proportion of 99.99 %). At 12 years, out of the 8, 869 remaining childless married, 159 girls gave birth, leaving 8,710 childless married women. At 17 and 18 years, most women (1,143 + 1,138= 2,281) gave birth to their first child, leaving 4,072 childless married women above 19. At 39 years, only one woman was reported to have given birth for her first time.

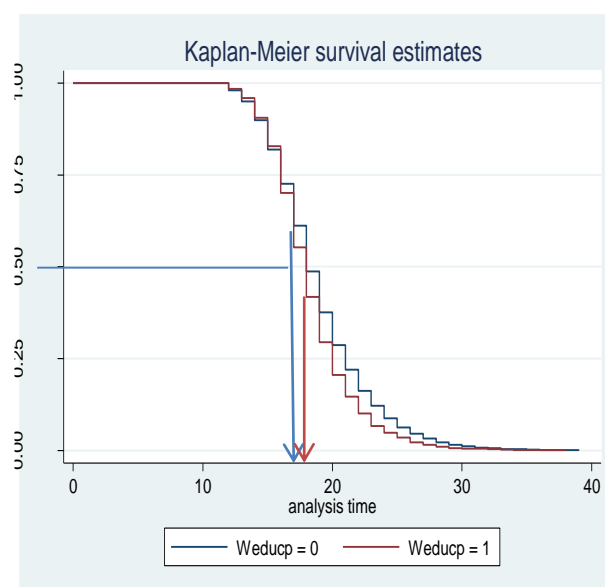
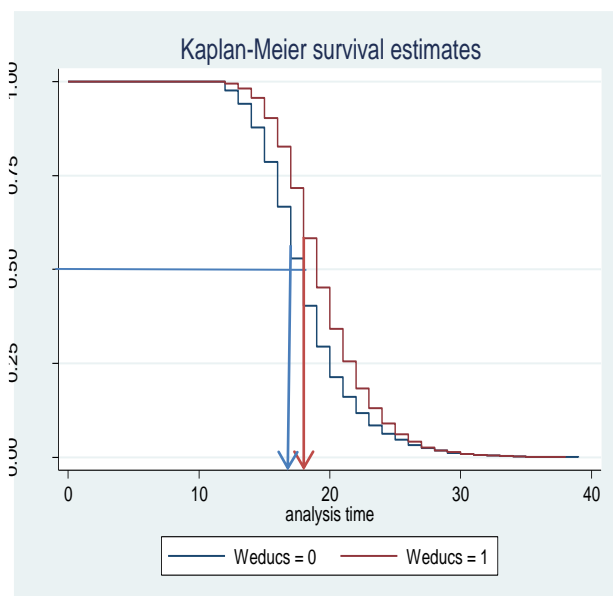
### 3.4.2.2 *Log-rank test: Bivariate level*

At the bivariate analysis, Figure 1 illustrates that age at first birth increases as the level of education goes high. This is also shown by the gaps between the other levels of education [primary (1.a), secondary (1.b), and tertiary (1.c)] and “no education”.

**Figure 3 1:** Survival plots of first birth by education level (with reference to “no education”)

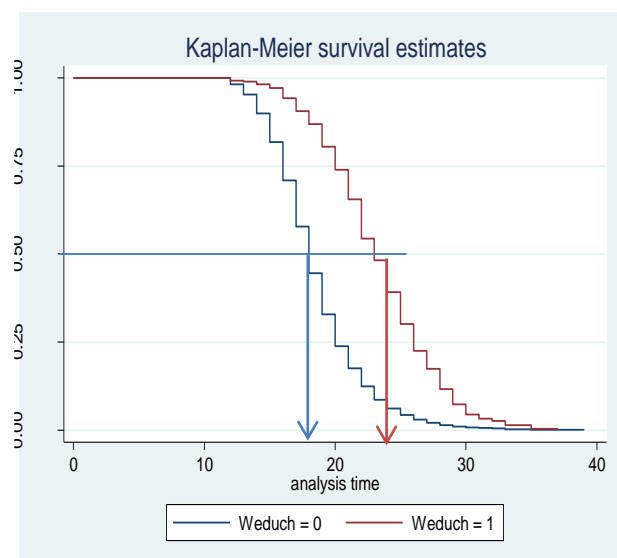
(a) Age at first birth at primary level

(b) Age at first birth at secondary level



(c) Age at first birth at tertiary level  
education

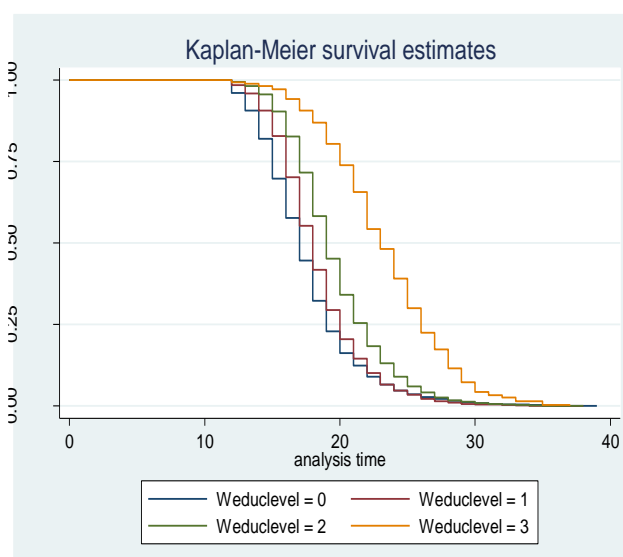
(d) Age at first birth at all levels of  
education



\_\_\_\_\_

*Source: Demographic and Health Survey, Cameroon, 2011*

As shown on the plots, married women with no educational, primary, and secondary levels married before the age of 20. Meanwhile, those with the tertiary level have their first birth after 20. This can be explicitly shown in Table 3\_3. On average, women living with partners with no education, primary, secondary, and tertiary levels give birth at 17, 18, 19 and 23 years respectively. The Log-Rang test also shows that this evidence is statistically significant at 1 percent.



**Table 3 3: First birth among married women with respect to educational level**

*Log Rank Test:*  
*Chi2 test: 590.48\*\*\**

|                        |                        | -----Age at first birth-----<br>(in years) |                             |           |
|------------------------|------------------------|--|-----------------------------|-----------|
| <i>Education Level</i> | <i>No. of subjects</i> |  | <i>[95% Conf. Interval]</i> |           |
| No education           | 2242                   | <b>17</b>                                  | 17                          | 17        |
| Primary education      | 3609                   | <b>18</b>                                  | 18                          | 18        |
| Secondary education    | 2743                   | <b>19</b>                                  | 19                          | 19        |
| Tertiary education     | 276                    | <b>23</b>                                  | 22                          | 24        |
| <b>Total</b>           | <b>8870</b>            | <b>18</b>                                  | <b>18</b>                   | <b>18</b> |

**Source:** Author (Cameroon DHS, 2011)

### 3.4.3 The effect of education on the timing of first birth: Cox Proportional Hazard Model

#### 3.4.3.1 First stage of Heckman procedure: estimates of the selection equation

Table 3\_4 reports that our instrument is relevant. It is statistically significant at 1%. An additional year of education of girls living around a girl is likely to disfavor her in completing primary level, whereas likely to favor her in completing the secondary and tertiary levels. Hence, a one year increase in the non-self-cluster mean of education is likely to reduce by 1% the probability for a girl to complete the primary; whereas an increase in a year in the non-self-cluster mean of education is likely to increase by around 4 and 1% the probability for a girl to

complete the secondary and tertiary education, respectively compared to a girl with no education.

**Table 3 4:** Ordered Probit model for the estimates of educational levels (Ref cat: no educ)

| <i>Variables</i>                         | <i>(1)<br/>Primary<br/>education</i> | <i>(2)<br/>Secondary<br/>education</i> | <i>(3)<br/>Tertiary<br/>education</i> |
|--|--------------------------------------|--|---------------------------------------|
| <b>Education (non self cluster mean)</b> | <b>-0.0124***</b>                    | <b>0.0381***</b>                       | <b>0.0141***</b>                      |
|  | (0.000593)                           | (0.00162)                              | (0.000802)                            |
| Muslim↓                                  | 0.0323***                            | -0.0991***                             | -0.0367***                            |
|  | (0.00238)                            | (0.00654)                              | (0.00282)                             |
| Poor↓                                    | 0.0191***                            | -0.0586***                             | -0.0217***                            |
|  | (0.00217)                            | (0.00639)                              | (0.00251)                             |
| Rich↓                                    | -0.0265***                           | 0.0811***                              | 0.0301***                             |
|  | (0.00191)                            | (0.00632)                              | (0.00277)                             |
| Rural↓                                   | -0.00919***                          | 0.0282***                              | 0.0104***                             |
|  | (0.00215)                            | (0.00661)                              | (0.00249)                             |
| Great west↓                              | 0.0103***                            | -0.0315***                             | -0.0117***                            |
|  | (0.00161)                            | (0.00498)                              | (0.00185)                             |
| Great north↓                             | 0.0265***                            | -0.0813***                             | -0.0301***                            |
|  | (0.00313)                            | (0.00874)                              | (0.00332)                             |
| Observations                             | 9,804                                | 9,804                                  | 9,804                                 |

*Standard errors in parentheses*

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

(↓) Marginal effect is for discrete change of dummy variable from 0 to 1

**Source:** Computed by the author using the 2011 Cameroon's DHS and STATA14

Moreover, Table 3\_4 shows that Moslem girls are more likely to complete the primary education but less likely to complete the secondary and tertiary level of education compared to girls from other religious denominations. Similarly to Moslem girls, girls from poor family, girls living in the western and northern parts of the country are less likely to complete the post-primary education.

### 3.4.3.2 Second stage of Heckman procedure: Estimates of first birth

Table 3\_5 presents estimates of first birth when the wife's and the partner's education are considered (Model 1); while Table 3-6, estimates of first birth when the couple's education is considered (Model 2) . The three models presented in these tables are statistically significantly specified at a 1 percent level.

Also, the parameters of the unobservable variables, captured by the inverse mills ratio, are statistically significant in all the models. This implies that our models are suffering from endogeneity bias. Hence, estimating them directly by the Cox proportional hazard, without controlling for unobservable would have yielded biased and inconsistent estimates.

### *Wife's education*

A married woman's educational attainment remains a crucial determinant of fertility onset. This is verified by the observation that wife's education remains statistically significant in all the models. Hence, as far as her educational level increases, the more she is likely to postpone first birth monotonically. A married woman who has attained the primary level is more likely to experience early childbirth at 6 percent, compared to the one with no education. Those who have attained the secondary and tertiary levels are at lower risk of experiencing first birth by 13 and 49 percent, relatively to those with no education. These findings corroborate with the findings of most studies.

### *Incorporating husband's education*

The economic intuition suggests that when considering the partner's education, the wife is likely not to considerably delay her first birth. Yet, incorporating husbands' educational attainment; only the effect of primary education of wives on first birth is reduced up to a point of becoming irrelevant. Whereas, the effects of secondary and tertiary education on first birth almost remain almost unchanged. This implies a reduced decision power of wives with primary education compared to wives with post primary education when it comes to the timing of their first birth.

**Table 3 5:** Cox proportional hazard model estimates of first birth with husband's education

| <i>Variables</i>  | <i>Wife's age at first birth</i>                        |                  |   |                   |
|---|---|------------------|---|-------------------|
|   | <i>Model 1</i><br><i>(considering wife's education)</i> |                  | <i>Model 2</i><br><i>(considering wife and husband's education)</i> |                   |
|   | coef.   | HR               | coef.   | HR                |
| Wife with no education (RC)   |   | 1.00             |   | 1.00              |
| <b>Wife with primary education</b>  | <b>0.0618*</b>  | <b>1.063*</b>    | <b>0.0241</b>   | <b>1.0243</b>     |
|   | (0.0367)  | (0.03902)        | (0.0390)  | (0.0399)          |
| <b>Wife with secondary education</b>  | <b>-0.134***</b>  | <b>0.8741***</b> | <b>-0.158***</b>  | <b>0.85353***</b> |
|   | (0.0413)  | (0.03612)        | (0.0448)  | (0.0382)          |
| <b>Wife with tertiary education</b>   | <b>-0.672***</b>  | <b>0.5103***</b> | <b>-0.611***</b>  | <b>0.5423***</b>  |
|   | (0.0554)  | (0.0282)         | (0.0607)  | (0.0329)          |
| Husband with no education (RC)  |   | 1.00             |   | 1.00              |
| Husband with primary education  |   |                  | 0.1227***   | 1.1305***         |
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|   |                  |                 |                  |                 |
|---|------------------|-----------------|------------------|-----------------|
| Husband with secondary education        |                  |                 | (0.0363)         | (0.041)         |
|   |                  |                 | 0.1216***        | 1.1292***       |
| Husband with tertiary education         |                  |                 | (0.0382)         | (0.0431)        |
|   |                  |                 | -0.0631          | 0.9388          |
|   |                  |                 | (0.0478)         | (0.0448)        |
| Other religion (RC)                     |                  | 1.00            |                  | 1.00            |
| Muslim                                  | 0.1575***        | 1.1705***       | 0.1661***        | 1.1807***       |
|   | (0.0400)         | (0.0468)        | (0.0400)         | (0.0471)        |
| Middle (RC)                             |                  | 1.00            |                  | 1.00            |
| Poor                                    | -0.0825**        | 0.9208**        | -0.0766**        | 0.9262**        |
|   | (0.0361)         | (0.0332)        | (0.0363)         | (0.0335)        |
| Rich                                    | -0.0336          | 0.9669          | -0.0299          | 0.97054         |
|   | (0.0377)         | 0.0364          | (0.0377)         | (0.0366)        |
| Urban (RC)                              |                  | 1.00            |                  | 1.00            |
| Rural                                   | 0.0507*          | 1.052*          | 0.0413           | 1.0421          |
|   | (0.0291)         | (0.0305)        | (0.0291)         | (0.0303)        |
| Great center                            |                  | 1.00            |                  | 1.00            |
| Great west                              | -0.172***        | 0.8416***       | -0.172***        | 0.8415***       |
|   | (0.0239)         | (0.02007)       | (0.0239)         | (0.0201)        |
| Great north                             | -0.0448          | 0.9562          | -0.0326          | 0.9679          |
|   | (0.0567)         | (0.0541)        | (0.0567)         | (0.0548)        |
| <b>Control for unobserved variables</b> |                  |                 |                  |                 |
| <b>IMR at the primary</b>               | <b>0.4194*</b>   | <b>1.5211*</b>  | <b>0.5476**</b>  | <b>1.729**</b>  |
|   | (0.2488)         | (0.3784)        | (0.2507)         | (0.4335)        |
| <b>IMR at the secondary</b>             | <b>0.4757</b>    | <b>1.6091</b>   | <b>0.5366*</b>   | <b>1.7102*</b>  |
|   | (0.2912)         | (0.4686)        | (0.2911)         | (0.4978)        |
| <b>IMR at the tertiary</b>              | <b>2.0887***</b> | <b>8.074***</b> | <b>2.0184***</b> | <b>7.526***</b> |
|   | (0.6219)         | (5.0214)        | (0.6198)         | (4.664)         |
| <b>Estimation statistics</b>            |                  |                 |                  |                 |
| Log pseudolikelihood                    | -72371.50        | -72371.50       | -72356.99        | -72356.99       |
| Wald chi2 (12/15)                       | 963.51           | 963.51          | 1030.02***       | 1030.02***      |
| Observations                            | 8,869            | 8,869           | 8,869            | 8,869           |

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$  H

HR Hazard Ratio

RC Reference Category

**Source:** Author (Cameroon's DHS, 2011)

This idea joins Jansen and Liefbroer's (2006) argument according to which men could have more bargaining power because they often have better access to resource compared to women. Yet, the desire of their counterparts with secondary and tertiary education still counts when considering their husbands' educational level. Thus suggesting that higher educational attainment post primary education) increases wives' decision-making power as far as fertility timing is concerned.

Also, Model 2 of Table 3\_5 reveals that unlike wives, only husbands with primary and secondary education are at higher risk of their wives' early childbearing compared to their uneducated counterparts.

This result implies that taken individually, the wife and husband's educational attainment has strong influence on fertility timing. However, one can advocate some determinacy of the husband's education in the wife's first birth timing, especially when the wife only has a primary education. At this level, it becomes interesting to know which of the wife and the husband desire dominates in the case of Cameroonian couples.

**Table 3 6:** Cox proportional hazard model estimates of first birth with couple's education

| <i>Variables</i>                        | <i>Wife's age at first birth</i> |                  |
|---|----------------------------------|------------------|
|   | <i>Coef.</i>                     | <i>HR</i>        |
| Wife with no education (RC)             |                                  | 1.00             |
| <b>Wife with primary education</b>      | <b>0.0236</b>                    | <b>1.0239</b>    |
|   | (0.0390)                         | (0.0399)         |
| <b>Wife with secondary education</b>    | <b>-0.1598***</b>                | <b>0.8522***</b> |
|   | (0.0450)                         | (0.0384)         |
| <b>Wife with tertiary education</b>     | <b>-0.6149***</b>                | <b>0.5407***</b> |
|   | (0.0621)                         | (0.0335)         |
| Husband with no education (RC)          |                                  | 1.00             |
| Husband with primary education          | 0.1243***                        | 1.1323***        |
|   | (0.0369)                         | (0.0418)         |
| Husband with secondary education        | 0.1241***                        | 1.1321***        |
|   | (0.0395)                         | (0.0446)         |
| Husband with tertiary education         | -0.0585                          | 0.9431           |
|   | (0.0515)                         | (0.0485)         |
| Homogamous education (RC)               |                                  | 1.00             |
| <b>Heterogamous education</b>           | <b>-0.0046</b>                   | <b>0.9953</b>    |
|   | (0.0216)                         | (0.0215)         |
| Other religion (RC)                     |                                  | 1.00             |
| Muslim                                  | 0.1661***                        | 1.1807***        |
|   | (0.0400)                         | (0.0471)         |
| Middle (RC)                             |                                  | 1.00             |
| Poor                                    | -0.0768**                        | 0.926**          |
|   | (0.0363)                         | (0.0335)         |
| Rich                                    | -0.0297                          | 0.9707           |
|   | (0.0377)                         | (0.0366)         |
| Urban (RC)                              |                                  | 1.00             |
| Rural                                   | 0.0413                           | 1.0421           |
|   | (0.0291)                         | (0.0303)         |
| Great center (RC)                       |                                  | 1.00             |
| Great west                              | -0.1724***                       | 0.8416***        |
|   | (0.0239)                         | (0.0201)         |
| Great north                             | -0.0325                          | 0.9679           |
|   | (0.0567)                         | (0.0548)         |
| <i>Control for unobserved variables</i> |                                  |                  |
| <b>IMR at primary</b>                   | <b>0.5477**</b>                  | <b>1.7292**</b>  |
|   | (0.2507)                         | (0.4335)         |
| <b>IMR at secondary</b>                 | <b>0.5385*</b>                   | <b>1.7133*</b>   |
|   | (0.2912)                         | (0.4989)         |
| <b>IMR at tertiary</b>                  | <b>2.0201***</b>                 | <b>7.5391***</b> |
|   | (0.6201)                         | (4.675)          |
| <i>Estimation statistics</i>            |                                  |                  |
| Log pseudolikelihood                    | -72356.971                       | -72356.971       |
| Wald chi2 (16)                          | 1030.19***                       | 1030.19***       |
| Observations                            | 8,869                            | 8,869            |

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$  H

HR Hazard Ratio

RC Reference Category

**Source:** Author (Cameroon's DHS, 2011)

### *Incorporating the couple's educational constellation*

As seen from the previous analysis, while wives' desire is to delay first childbirth and husband's desire is to curtail first birth, it is obvious that they do not commonly agree on their fertility planning. Hence, the insignificance of the couple's constellation variable of educational attainment suggests that there is no synergy or agreement in seeking for the timing of first childbirth (Table 3\_6). Hence, educationally heterogamous couples do not have any influence in the timing of their first childbirth. This finding contradicts the hypothesis according to which educationally hetegamous couples are more likely to have early birth compared to homogamous couples, who tend to postpone first birth.

## **3.5 Conclusion and policy implications**

In this chapter, we scrutinized the effect of education attainment (wife, husband, and partners' constellation) on the timing of the first childbirth. It makes use of the Cox proportional model in Heckman two-stage procedure to control for any potential endogeneity bias of education (Ferre, 2009). At the wife level, we found that the more a wife's education increases, the more she is at lower risk of first childbirth compared to the one with no education. When considering her husband's education, we found that a wife with the primary can no longer decide the timing of her first birth, while it is only wives with post primary education who still remain at lower rate of first birth compared to those with no education. Also, wives living with husbands who attained post primary education are all at lower risk of first birth compared to wives whose husbands have no education. Considering husbands' education is crucial in their wives' fertility decision. While husbands preferred early first birth, wives desire to postpone the birth of their first child. And it is only when the wife has attained at least the secondary education that she can maintain her postponement decision power. This finding suggests that wives' bargaining power over fertility timing is manifest only if she has post primary education.

Beyond that, we also found a negligible effect of the interaction between the wife and husband's education. When deciding on fertility timing, there is a symmetrical effect of both spouses' desires. This finding suggests that neither husbands nor wives dominate fertility timing when considering the couples' education. This result corroborates with some previous findings

(Thomson, 1997; Thomson and Hoem, 1998; Bauer and Kneip, 2013), but contradicts the patriarchal and matriarchal bargaining decision rules on fertility among couples.

The reason why husbands tend to desire early first birth while wives are more likely to delay first birth may be because childbearing and specially involvement in childcare affect women more than men. This situation is particularly strong in Cameroon as in many other African countries which are very much concerned with gender disparity issues. Childbearing and rearing as family formation loads come as a hindrance to women's career and professional prospects. Even when their decision-making power increases due to higher educational attainment, husbands and wives with divergent fertility preferences do not come up with a common consensus on their family planning. One possible explanation for this may be that during pre-natal and family campaigns, wives and mothers are the ones to participate, while male spouses do not, and consider it to be "*women issues*". Another economical reason could be that both partners do not know whether their household will benefit from the arrival of a child. The conflict between the traditional household rule (dominating husbands over submissive wives) and the modern household rule (women empowerment) could be advanced as a reason for the symmetrical desires.

In order to propose some policy implications for this thesis, we inspired ourselves from this idea according to which government could put in place policy to encore girls to complete at least the secondary level education: "*The expansion of female secondary education may be the best single policy lever of achieving substantial reductions in fertility*" Subbarao and Raney (1995). Level of education which also increases her probability of finding a relatively good job; hence improve her decision-making power within her household, since "*The increase in the education of women and girls contributes to greater empowerment of the women, to a postponement of the age of marriage, and to a reduction in the size of families.*"<sup>44</sup> Hence, policies in favor of improving educational expenditures towards girls should be prioritized. More access to day care centers may be improved in other to help mothers. By easing or relaxing labour market conditions for mothers. Also, the sensitization of male partners on fertility and family planning issues could be improved by constraining their presence during pre-natal and family planning counseling.

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<sup>44</sup> United Nations, 1994.

After examining the effect of education on the timing first marriage and the timing of first birth, we found that education plays a major role in delaying them. These delays could encourage wives to pursue with their career aspirations and be effective on the labour market with respect to their education level. This will be the subject of the next chapter, where we will explore the role of family formation in the education and female employment nexus.

# Chapter Four:

## Education and Female Labour Supply in Cameroon: The Role of Family Formation

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### 4.1 Introduction

In order to reap benefices of schooling, individuals generally face two important decisions: when to form a family and whether or not to enter the labour market and if they do, how often are they going to work in the labour market. This preoccupation is particularly crucial for women who are engaged in marriage and childbirth responsibilities, since it is reported that in SSA countries, working women spend five hours in unpaid work like household chores and children care, compared to only two hours for men (Blackden and Wodon, 2006).

Of course, improvements in female education have increased the proportion of working women and mothers in the labour market. Between 1980 and 2018, increases in women's labour force participation have been observed in almost all regions and countries of the world (Razavi, 2012). While female labour market participation in Africa is relatively high compared to other regions of the world (Comblon et al., 2017), the examples of SSA countries and Cameroon reveal specific patterns within the continent. In SSA countries, the female employment-to-population rate stood high at almost 60% as a whole for the region, compared to 50% in Latin America and the Caribbean and 20% in North Africa. As regards female education, Cameroon presents a noteworthy good level, even though this level remains low compared to male education. It is reported that about 28% of women have no education (compared to 15% for men); about one third of men and women reached the primary level; 35.7% of women have attainment the secondary general (29.9%) and technical (5.8%); while only 6.1% reached the tertiary education (compared to 10.5% for men) (Comblon et al., 2017). Yet, despite these improved economic opportunities in SSA, women, especially married ones seem not to find benefit from this trend, compared to their male/husband counterpart (Dieterich, 2016). Irrespective of their level of education, married women and mothers generally lag behind with regard to the labour market outcomes (Wodon, 2016). Men are advantageous in the labour market compared to women. Hence, the employment rate among men (78.5%) is higher than

that of female (66.4%); on average, men receive median monthly earnings of 51,000 CFA francs (86 US dollar), while women receive 31,000 FCA francs (52 US dollar) (Comblon et al., 2017). In Cameroon, with the unequal access to resources such as time, income and social status (Zamo-Akono, 2009), women are mostly engaged in informal or vulnerable sectors. More than 90% of women are working in the informal sector, and 58% employed in agriculture compared to 49% of men in 2010 (World Bank, 2015).

At this level, several theoretical and empirical studies suggest that the differential in education levels between male and female as the explanation for the gaps in labour market outcomes. Yet it was found that even with the same level of education, men and women are still treated differently in the labour market. In Cameroon for example, in terms of average monthly earnings, males with no education earn 35,431 CFA francs (relative to 22,026 CFA francs for women); males with primary education earn 46,000 CFA francs (relative to 29, 599 CFA francs for women); and males with secondary education earn 67,419 CFA francs (relative to 41,000 CFA franc). In Mali also, uneducated men earn more than twice as much as uneducated women (Comblon et al., 2017).

At this level, the standard neoclassical theory of labour supply fails to give clear justification. This may be due to the observation that individuals are considered solely in their decision to work, while we know that human behaviors are inter-connected and dependent. Also, considering all individuals as identical may be a problem because women at a particular point in their life-course are called upon to give birth. Therefore, including other surrounding people like family members may be determinant in explaining women's labour supply. This is particularly important for policy-makers to find evidence for the work-family balance.

In virtually every society, women are specialized in reproductive work while men in productive work; it is the division of labour based on gender norms (Wodon and La Briere, 2018). The 2012 World Development Report on gender (Razavi, 2012) advanced three reasons for these differences: (i) unequal distribution of time use and care responsibilities between men and women; (ii) unequal access to control over productive assets such as credit, land and key skills; (iii) institutional and market failures (legal and fiscal impediments, restrictive social norms, access to information and networks). An IMF research conducted in five SSA countries using household survey data (Zambia, Burkina Faso, Rwanda, Ghana and Mauritius) found that education is a crucial factor which gives opportunities to women to enter the labour market, however, these opportunities education offers to women to work in the wage sector tend to



diminish when she transit into marriage (Dieterich, 2016). Marital and motherhood responsibilities were found to importantly inducing females to massively drop out of labour market after they get married or give birth to children.

From the above analyses, differences in female-male labour supply is not only an issue of education, but one can suggest family responsibilities which reduced women's labour time, especially when they engaged themselves in family formation. According to the 2012 World Development Report, unequal distribution of time use and care responsibilities between men and women is at the root of differences in labour supply. This chapter aims to fill this gap in the context of Cameroon.

Since household chores and fertility are likely to be related to female labour force participation. Some socio demographic factors such as the size of the household, her husband's educational level and occupation, the presence of toddlers and school-age children in the household may affect maternal labour force participation. However, this effect is not conclusive. On one hand, they may be less willing to work outside the home in order to spend more time with their children; and on the other hand, more willing to be engaged in paid work in order to maintain family income, because children are expensive (Kahn and Kahn, 2009). In terms of marital status, it is found that in Cameroon, married women are more active and employed in the labour market compared to single ones. But in Mali, this is not the case since men are often considered as breadwinners of the family while women take care of the children and household chore (Slegh et al., 2013; Comblon et al., 2017). Hence, women's participation in the labour market is more constrained by social and cultural norms surrounding their marital status and births responsibilities.

Despite the abundant literature on female labour supply in Cameroon, important challenges still remain for development policy designers. Regardless of higher levels of female participation in the Cameroonian labour market, the structure of women employment differs greatly from that of men. Majority of women are found in the informal (more than 90%) and primary sector (57%), especially in the agricultural sector where they mostly farm food crops for family consumption. For this reason, more women allocate their time in seasonal temporary jobs.

This issue is much more interesting in the African and Cameroonian context as some cultural and social norms hinder women, especially married women and mothers to work out of their home. Indeed, information from the National Institute of Statistics reveals that since the

2006 policy of “Free Primary Education for All” to improve schooling rate in Cameroon, the proportion of working women has increased from 62 percent to 79 percent in 2010. Even though this rate has dropped, it remains high and ranges between 70 and 71 percent during the recent years. The female-male employment gap has reduced from 14 to 9 points from 1996 to 2010. Yet despite this, men are still favored in the labour market compared to women. They are not only highly represented in the labour market, but they occupy high employment positions, and earn higher wages compared to women. It is also reported that men earn twice as much as their female counterparts. As compared to men, females try harder than men to get a job. This may be often due to the fact that women find a new job again after leaving the labour market for a long time due to family responsibilities. Also, it was reported that individual who have higher family responsibility were found to be more unstable. In the particular case of married women, decision to participate in the labour market does not only fundamentally depend on factors affecting their reservation wage (Winkler, 2016), but most especially by family responsibilities.

There are various ways of measuring family responsibilities such as marital status, household size and number of children. In the course of this chapter, in addition to marital status as commonly used in most studies (Dieterich, 2016), we consider the childbearing dimension. We opt for these two measures for the following reasons: first, marriage is a significant jump into household domestic chores and responsibility. It is recognized that being a wife bears more home chores and responsibilities vis-à-vis the husband and family in-law compared to being a daughter in another home, especially in the African context. Second, childbearing is a necessity in most African societies which implies more motherly care compared to husbands. Hence, this suggest that a woman who is not married may be more involved in market job in terms of time compared to a married one or mother. Also, a married woman may be more involved in market work in terms of time relative to woman who is married and has a child. It therefore appears urgent to consider family responsibilities when analyzing female’s market work if the female-male employment gap needs to be resorbed.

Moreover, theoretical household models of time allocation suggest that higher levels of mothers’ labour market involvement before first childbirth are motivated by higher wage offers (Mincer, 1962; Becker, 1965; Willis, 1973; Michael, 1973; Liebowitz, 1974; Gronau, 1977; Angrist and Evans, 1998). When a working woman engages herself in marriage and childbearing (family formation), she start to reallocate some of her leisure and market time to the production of family-related responsibilities. For this reason majority of women with such

statuses work full-time before family formation (Troske and Voicu, 2009) and part time or no work when they engaged themselves.

Intrinsically, family formation and female labour supply have a very close relation to each other. Indeed, a woman engaged in marriage and childbearing has two potential fields of work, namely the work in unpaid home production and the work in paid labour. With her available time, she has to decide on how to allocate her time between these two options. In the Cameroonian context, most empirical studies focused either on the relationship between fertility and labour market participation (Zamo and Evou, 2006; Tsafack and Zamo, 2010; Eyene, 2012; Kuepie et al., 2014; Jah, 2014; Yeyouomo, 2016), or female schooling and their participation in the labour market (Ningaye and Talla, 2015; Tingum, 2016; Che and Sundjo, 2018; Totouom et al., 2018; Zamo, 2018). Yet, only Tsafack and Zamo (2010) attempted to empirically construct a unified framework that simultaneously analyzes fertility, health status, and female labour force participation in urban Cameroon using surveyed data. To the best of our knowledge, no study has tried to empirically test the combined effect of education and family formation on women's full-time employment in Cameroon using the 2011 Cameroon Demographic and Health Survey.

The main research question of this chapter is: *what is the effect of education on women's labour supply through family formation?*

More specifically:

- *What is the direct effect of education on women's full-time employment?*
- *What is the indirect effect of education on women's full-time through first marriage?*
- *What is the indirect effect of education on women's full-time employment through first birth?*

Since most family chores and childbearing tend to be mainly assumed by women, and at the same time they are willing to enter the labour market because of increases in education, their labour supply have not been fully examined. Indeed, it can be important for policymakers to know if the recent improvement in the Cameroonian educational system needs to be supported by measures which could allow women, especially married ones and mothers to be efficient both at the home and job sites.

Therefore, by addressing this question, this chapter attempts *to empirically explore the effect of education on female labour supply through family formation.*

Specifically, this study:

- *Examine the direct effect of education on women's full-time employment;*
- *Analyze the effect of education on women's full-time employment through first marriage;*
- *Assess the effect of education on married women's full-time employment through first childbearing.*

Other things being equal, this chapter suggests that:

- *Education increases women's probability of working full-time ;*
- *The effect of education on women's full-time employment is reduced or cancelled out when they are engaged in marriage;*
- *The effect of education on married women's full-time employment is reduced or cancelled out when they become mothers in Cameroon.*

It is important to understand the relation between education, family formation, and female labour market participation in informing policy-makers on the role of important role played by women both in the family and national frameworks.

The rest of this chapter is structured as follows: Section 2 presents the literature review; Section 3 describes the methodology, data and defines variables; and finally, Sections 4 and 5 present the empirical results and conclusion, respectively.

## 4.2 Literature review

Today, labour economists often write about the value of married women's time<sup>45</sup>, and how marital status enters economic analyses of consumption<sup>46</sup> (Mincer, 1975), because marital patterns can have important implications on female labour force participation and births decisions (Becker and Lewis, 1973) . This chapter's theoretical background is supported by the “*new Household Economics*”, in which Becker and Lewis (1973) and Becker (1974, 1991) elaborate fundamental models for the economic analysis of marriage and family. In order to go

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<sup>45</sup> The derivation of value of time in the home, also called the shadow wage, followed the economic theory of allocation of time. For a review of the influence of this theory see Becker and Michael (1973).

<sup>46</sup> Marital status obviously counts in economic analyses of fertility (see Becker, 1960, for instance).

through this vast literature, this section will be divided into two parts: the theoretical review and some empirical results.

#### 4.2.1 Theoretical Literature

The economic discussion of female labour market participation is founded on the neoclassical theory of labour supply which postulates that decision to work depends on the time allocation between work-leisure tradeoff (Abbott and Ashenfelter, 1976), and the theory of household production (Becker, 1965). This part progressively presents how labour market theories have evolved over time; from the basic neoclassical theory of labour supply to models incorporating family formation decisions.

##### *Female Labour Force Participation: The traditional neoclassical theory of labour supply*

Derived from the microeconomic model of consumer theory, the traditional model of labour supply examines the work-leisure choices. However, this model considers human time as divided into time allocated to work and that allocated to leisure. Hence, an individual faces two uses of her time, either spending it on leisure, or working for wage in the labour market. In this framework, the objective is to maximize utility by consuming time in leisure and goods purchased in the market place, subject to non-labour income, market wage and personal preferences. As a result to changes in market wage, this model predicts two outcomes namely the substitution<sup>47</sup> and the income<sup>48</sup> effects.

However, this time allocated to work and leisure is not true, even for adult males because the logical complement of leisure time includes both remunerative production and “non-paid” work. By allocating time not dedicated to wage labour to leisure, this basic model fails to analyze labour force behavior, especially that of married women. The consideration of the family context of leisure and work choices, and of the home-market dichotomy will later be studied by Jacob Mincer (1962), Gary Becker (1965), Lancaster (1966),

##### *Female Labour Force Participation: The household production Approach*

An extension of the above model of labour supply accounts for household characteristics. It is a more complicated household production model which involves three decision-makers (husband, wife and any older children able to work) who can allocate their

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<sup>47</sup> The substitution effect negatively affects the quantity of labour of the woman is willing to offer.

<sup>48</sup> The income effect positively affects labour supply.

time in three ways: leisure time, time spent on the labour market and on the house work. When there is an increase in the wage, two substitution effects are observed; one between household work and market work, and the other between market work and leisure. According to this model, the first substitution effect can easily be done. For example, one can reduce the time spent doing house work by buying a microwave, an electronic dishwasher or by simply hiring the service of a house help or babysitter. While the substitution effect between market work and leisure times are generally not easy

It was Miner<sup>49</sup> (1962) the first to point out that work at home and leisure should be separated (at least for the women). On the contrary, Becker (1965) in his seminar paper on household production did not come out with this distinction clearly, principally, due to difficulties in measuring these two activities empirically. But he rather summarized these activities and called them “non-market activities” or “home production”. Later on, Grossbard (1984) went further by considering the interdependence that exists between labour and marriage markets.

Using the sexual division of labour between men and women, Becker (1965) suggests an incompatibility of family life and labour force participation among women compared to men. In his observation, he assumes that it is more difficult for women to combine the roles of home worker/mother and paid worker. This is because women are more bestowed with natural ability of childbearing and rearing, thing which may enlarge their non-market time compared to men (Becker, 1985). However, since better educated women have higher opportunity costs of leaving the labour market either fully or partly, they tend to reduce their wage labour compared to less educated ones. As a result, this leads to the well-known expectation of a negative effect of family formation responsibilities on women’s labour supply.

#### *Female Labour Force Participation: Becker’s incompatibility hypothesis*

Becker’s “*incompatibility thesis*” was later attributed to a problem of ‘family system’<sup>50</sup> pre-dominating in a given society by Blossfeld (1995). Liefbroer and Corijn (1999) discussed this thesis according to cultural and structural contexts. Hence, cultural incompatibility relates women to their traditional role of wives and mothers in the society; whereas the structural incompatibility relates them to the actual opportunities and constraints offered by the actual

<sup>49</sup> In his pioneer work of Mincer (1962), he establishes a declining effect of husbands’ earnings on wives’ involvement in market work on determinants of labour force participation of married women.

<sup>50</sup> ‘Family system’ is a loosely defined concept, including a country’s dominant cultural values, family and religious traditions, and family policies (Blossfeld, 1995:11).

society. However, in some societies, women's relatively traditional cultural values may co-exist with their favorable opportunities of labour market (e.g. Italy, Belgium) (Liefbroer and Corijn, 1999). The literature on female labour supply provides several explanations concerning how women allocate their time. Mincer (1962) identified husband's wage, women's own market wage, and the number of offspring as crucial determinant of married women's labour supply.

### *Human capital theory*

Put forward by Becker (1957), the human capital theory is related to the allocation of time model of labour force participation. He argued that compared to men, women are less productive in the labour market because of child-care and maternity leaves. Yet, unanimously Human capital theorists suggest that higher educated women are more likely to work in the labour thanks to higher human capital (Wood et al., 2016) and crowding-out effects (Dolado et al., 2000; Olah and Fratzczak, 2004).

According to the standing three hypotheses, the relationship between education and female labour force participation can be summarized into three arguments:

**\_The opportunity cost argument:** Since education is an investment that is positively related with earnings, educated people's incentive to seek for employment is high. It therefore raises the opportunity cost of economic activity (Bowen and Finnegan, 1969).

**\_The relative employment opportunity argument:** Highly educated women, especially younger ones who are equipped with the latest sophisticated and actualized qualifications required by the changing labour market have greater opportunities in the labour market.

**\_ The aspiration argument:** Higher education attainment corresponds to higher income aspiration and expectations. Hence, more-educated women tend to be more active in the labour market compared to their less educated counterparts (Cain, 1966; Morgan et al., 1962).

In the developmental approach, it is generally asserted that women's employability<sup>51</sup> in the labour market depends on their attitudes towards work (Garcia-Manglano, 2014). Because of the privileges brought by education, highly educated women show positive behavior toward

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<sup>51</sup> This article defines employability as the "ability to gain employment or ability to move to a more suitable job" (McQuaid and Lindsay, 2005, p207).



employment and greater importance to their role as worker in the labour market as a means of self-realization (Alwin et al., 1992; Friedman et al., 1994; Neels and Theunynck, 2012). Also, for highly educated women, investment in a career them greater long-term advantages like wages and job status (Liefbroer and Corijn, 1999). These advantages offered by the labour market induced these women to put forward safety measures which will help them to keep their career prospects before entering marriage and motherhood (Matysiak and Vignoli, 2010; Liefbroer and Corijn, 1999); meanwhile due to the crowding-out effects, low educated women may opt for marriage and childbearing as an alternative (Friedman et al., 1994).

Additionally, concerning the type of employment, entering only temporary jobs at the early stage of the life course may jeopardize highly educated women's career prospects in terms of promotions, on-the-job training, job security and wages. Also, it might be considered as a signal of less commitment to a long-term career (Auriol, 2010; Liefbroer and Corijn, 1999).

#### *Women's labour supply with family formation*

Even though the Human Capital Theory advances the importance of schooling and training in women's participation decision in the labour market, women over their life cycle bear most of the marriage and childbearing responsibilities. Hence, these factors determine whether they will enter, stay on, or quit the labour market (Baah-Boateng et al., 2013). The relationship between family formation and female labour market participation has been formalized in the new household economics (Willis, 1973; Becker, 1981; Cigno, 1991). Women over their life course are called upon by nature to respond to their childbearing role. It creates falling-outs in work time of those who already engaged themselves in the labour market. Whereas men's labour markets work time and positions are relatively stable over their life course (Wood et al., 2016). Marital status and childbearing are the strongest factors determining female labour supply (Brewster and Rindfuss, 2000; Garcia-Manglano et al., 2014), and are considered to be very good proxies for women household responsibility for the following reasons: First, to enter marriage means a significant jump in women's domestic responsibility; on average, being a wife gives much housework than being a daughter (Dieterich, 2016). Second, the coming of a child still requires greater implications in household responsibilities. This is because children are endogenous to mother's employment work time. Hence, mothers who choose to work in market jobs have to combine family roles and work.



Even though Becker (1962) advanced the idea of work-family incompatibility may be because of the olden day's context, modern day's context progressively display work-family compatibility. Household-level factors (Hynes and Clarberg, 2005), women's individual attitudes (Wood et al., 2016), family policy are considered to be at the rood of work-family compatibility.

First, household characteristics affect the feasibility of combining family and work. Because household requires more spending, married women and mothers with no or low-income partners may be more likely to increase labour market work time (Gaudet et al., 2011). Also, egalitarian household (gender equality) model may encourage women's and maternal employment (Crompton, 2006; Smith, 1985).

Second, women's preferences influence their employment opportunities. Hence, because of high investments in schooling, highly educated women relative to less educated ones show more favorable behavior towards maternal employment (Nells and Theunynck, 2012a, 2012b; Scott, 1999). To combine work and family, some women may prefer part-time work which allow them to be both mother and earner (Booth and Van Ours, 2013; Laurijssen, 2012). However, part-time work is generally associated with lower monthly wages. Yet, depending on the country's policy in supporting the work-family balance, women's preferences to combine work and family will change.

Third, the literature indicates that family policy which encourages two-earner families may favor maternal employment (Guitierrez-Damenech, 2005). Hence, parental leave which allow parents to take care of childbearing tasks before returning to full-time work make it easier for mothers to keep a foothold in the work market (Gaudet et al., 2011; Wood et al., 2016). Studies also support that highly educated mothers tend to take short leave so as to return to work afterwards (Fitzenberger et al., 2010; Matysiak and Szalma, 2014). Moreover, it was also found that the availability, affordability, and cultural acceptance of formal childcare influence the feasibility of work-family balance (De Wachter et al., 2014; Fagnani, 2002).

## **4.2.2 Related empirical literature**

### *Effect of education on female labour force participation*

Findings of relationship between female education and labour market participation are diverse according to country-specific characteristics of women. Most empirical studies in

developed and developing countries found that education affect female labour market participation positively.

In Turkey, Tansel (1992, 2001) found that education has a positive effect on women's labour force participation; effect which greater at higher educational levels. Using data from the Ghana living standards surveys, Sackey (2005) studied the effects of education on female labour force participation in Ghana. In a Probit and multinomial Logit models, the results revealed that female schooling matters in both urban and rural localities, but has an opposite effect on fertility. He also found that the type of sector women find themselves tends to be related with their educational attainment, but majority are self-employed. Agriculture absorbs majority of female labour force. Using a labour force survey for Kenya, Atieno and Teal (2006) addressed a range of questions including whether education acts to increase women's labour force participation and how both education and experience impact on the choices across the formal and informal sectors. Results show that: first, increases in education act to increase women's participation. Second, it enables them greater access to formal sector jobs. Same results were found in many studies carry out in South Africa (Yakubu, 2010; Ntuli and Wittenberg, 2013).

In Cameroon, various empirical studies have been carried out. Tingum (2016) on his part constructed two models to analyze, on one part, the determinants of female labour force participation, and on the other part, determinants of female sectorial choices in the Cameroonian labour market, using respectively Probit and multinomial logistic models. Extracting data from the second Survey on Employment and the Informal Sector (EESI 2) conducted in 2010 in Cameroon. He found that education level (especially the secondary and tertiary levels) is likely to increase monotonically female labour force participation. This same result was found by Che and Sundjo (2018) using the 2011 Cameroon Demographic and Health Survey; yet, in an opposed J- shape.

However, though unexpected, some empirical studies found a negative impact of education on female labour force participation. This result was found in the United States of America (Smith and Ward, 1985), in Greece between 1971 and 1981, and in Cameroon (Ekamena et al., 2014; Totouom et al., 2018). In the Cameroonian context, these authors justified this result by the dominance of the informal and self-employed jobs. Also, Klasen et al. (2019) Explain that most countries-differences in the effect of women's education on their

participation rates depend on the country-specific characteristics; hence, not only education, but social, economic and institutional constraints govern women labour market participation.

Since most authors argue that the economic value of women's time associated with marriage and childbearing increases as their education increases (Becker, 1981), the present study advances the theory of family formation as the missing link significantly explaining the effect of education on female labour market participation in Cameroon.

### *Education, marriage, fertility, and female labour market participation*

Troske and Voicu (2009) employ panel data to examine the effects of the timing and spacing of birth on married women labour supply while controlling for endogeneity of fertility and labour market and unobserved heterogeneity of the effect of children on labour supply. They find that before the first childbirth, women experience higher labour market involvement.

Omori and Smith (2010) in their study analyze married women's hours of work with regards to their family responsibilities for three different ethnic/racial groups in the USA, namely African American, white and Hispanic women. Using the Ordinary Least Squares (OLS) regression analysis on the 2007 Current Population Surveys (CPS), they find that white women's work hours are greatly reduced by the presence of a young child. Whereas Hispanic and African American women work hours were not found to be influenced by the presence of a young child at home.

Working in the Ghanaian context, Baah-Boateng et al. (2013) explore the role played by education and fertility in the participation of female in the labour market in both rural and urban areas. They found that education (especially the basic and tertiary levels) increases women's propensity of working in the labour market, compared to non-educated ones; yet, being married and having more children instead increases women's likelihood of participation (especially in the urban area).

Measuring family responsibilities by the marital status (single or married), Dieterich et al. (2016) study examines the determinants of gender gap in the labour market on five SSA countries. Using the multinomial Logit regression and the propensity score matching it was found that education increases women's probability to move from the agricultural sector to the formal wage employment, yet these opportunities reduce as they enter marriage. As policy

implementation, it proposes that policies aimed at improving the educational could be supported by measures that motivate married women to keep their work on the labour market.

Using the first and second waves of the Generations and Gender Survey (GGS) longitudinal micro-data, Wood et al. (2016) examine the effect of family formation and women's employment in three European countries (French, Dutch, and Hungary). In order to control for time-constant unobserved heterogeneity, they employed the mixed effects Logit models. They found that of course the positive effect of education on maternal employment before first childbirth in all the three countries. Yet, childbearing has a strong negative effect on female employment with secondary and tertiary education, with much larger proportions in French and Hungary.

Related studies carry out in the Cameroonian context are those of Kuepie et al. (2013) and Yeyouomo et al. (2016). Focusing on three SSA countries with similar socioeconomic characteristics, namely Cameroon, Senegal, and Mali, Kuepie et al (2013) examine the effect of education and fertility burden on labour market inequalities between women and men using the DHS dataset of these countries. Their study provides in all three countries evidence of gender discrimination. Because women generally lag behind in terms of level of education relative to men, this automatically reduces their likelihood of accessing the top job segment. But even those who have the same level of education as men, they still not have the opportunity to get a top job as men, making education to be less efficient for women, compared to men. Apart from education, they also find that fertility burden (measured by the number of children ever born) is another obstacle that hinders women to access the most highly paid jobs segment. However, it is important to note that in the specific case of Cameroon, childbearing appears not to be a hindrance to women's career. These findings are confirmed by those obtained by Tsacfack and Zamo (2010), according to which fertility exerts a positive impact on the participation of mothers in the labour market.

Yeyouomo et al. (2016) examine how fertility affects women's insertion in the labour market of Cameroon. Using the 2011 DHS country data and infertility as an instrument of fertility, they find that the effect of fertility on females' insertion in the labour market depends on their educational attainment. Hence, regardless of the number of children under 5 a woman has the more her education give her chances to have a good insertion level in the labour market.

## 4.3 Empirical Strategy, Methodology, and Source of Data

### 4.3.1 Empirical strategy

The variables explaining a woman's decision to work part or full-time work can be examined in the household utility-maximization framework initiated by Mincer (1962), under Becker's (1965) '*Theory of the Allocation of Time*.' in this model, the husband's and wife's market productivity, the non-labour income of the family, and the non-market productivity of the family are identified as major factors explaining the amount of time the wife will provide to the labour market. Apart from being married, the wife's productivity is assumed to be correlated with her entry into motherhood. In this context, the wife work is negatively related to the family's non-labour income, her husband's earnings, and the presence of young children in the household. Meanwhile the wife work increases with her market earnings potential.

After controlling for the above factors, our basic theory can be extended in order to examine other characteristics of the wife that may influence her allocation of time (Long and Jones, 1981). Referring to the labour supply theory which suggests we retain for this study personal characteristics of the wife, partner's characteristics, and a number of exogenous factors.

The econometric model proposed to examine the way in which the timing of first marriage and birth influence the effect of education on female labour market work is given in a framework that simultaneously addresses three estimation issues, namely the endogeneity, self-selection, and unobserved heterogeneity. Inspired by Mincer's (1962) econometric model for cross sections, in which wives' hours of work are related to own and husbands characteristics, we follow Mroz's simple model of married women's labour supply. In this model, we consider husband's behavior to be exogenous (Mroz, 1987).

Supposing that  $H_i$  is the observed variable of female employment having 2 modalities ( $j = 0, 1$ ). This variable is related to a latent variable  $H_i^*$ , such that:

$$\begin{cases} H_{ij} = 1 & \text{if } H_{ij}^* > H_{ik}^*, j \neq k \\ H_{ij} = 0 & \text{if } \text{Otherwise} \end{cases} \quad (1)$$

Since  $H_i^*$  is a latent variable which is not observed, it can be represented as linear function given as:

$$H_i^* = a_0 + a_1 W_{fi} + a_2 W_{hi} + a_3 X_i + e_i \quad (2)$$

$H_i^*$  is the  $i^{\text{th}}$  woman's full-time employment measured by employment all year.  $W_{fi}$  and  $W_{hi}$  are respectively vectors of variables capturing the woman and the partner's characteristics.  $X_i$  is a set of exogenous variables affecting women's labour supply such as age, religion, region and area of residence;  $e_i$  is a stochastic disturbance which is independent and identically distributed;  $a_i$  are structural parameters of the labour supply function.

### 4.3.2 Methodology, estimation issues and identification strategies

#### 4.3.2.1 Methodology of the analysis

To analyze equation (1), use is made of discrete choice model of probability, which yields the chances that an even will occur. Hence, a binary approach is used given that employment takes the value 1 for a woman employed in full-time work and the value 0 for the one employed in partial time (seasonal and occasional) work. When summarizing the above explanatory variables into  $W$ , the probability that a woman  $i$  working in full and partial time is respectively given by:

$$\begin{cases} \text{Prob}(H = 1|W) = P, \text{ if } H^* > 0 \text{ (market wage is greater than reservation wage)} \\ \text{Prob}(H = 0|W) = 1 - P, \text{ if } H^* \leq 0 \text{ (market wage is less than reservation wage)} \end{cases} \quad (3)$$

Where  $0 \leq P \leq 1$

At this level, a Logit or Probit model can be used to estimate full-time employment. In this study, use is made of the Probit regression analysis. Equation (3) is estimated by maximizing the log likelihood function. Under certain conditions, the Maximum Likelihood method yields consistent and efficient estimates of the parameter  $a$  (Greene, 2003).

Since a working woman has the choice between working permanently<sup>52</sup> (full-time) or temporarily<sup>53</sup> (part-time), our outcome variable is a binary choice. Hence we estimate women's work using a Probit model.

Hence, our structural model of a woman's work becomes:

<sup>52</sup> Permanent workers are those whose main jobs are of unlimited duration, characterized by the continuity of the activity over the year without interruption

<sup>53</sup> Temporary workers are those whose main jobs are of limited duration or with interruptions over the year. It comprises occasional and seasonal workers.

$$Prob(H = 1/W, X) = \Phi(a_0 + a_1W_f + a_2W_h + a_3X) \quad (4)$$

Where, H is a dichotomous indicator taking the value 1 if the woman works through full-time, and 0 if otherwise (works occasionally/seasonally or part-time).  $\Phi$  is the cumulative distributive function of the normal distribution.

However, when analyzing the links between education, family formation and labour supply, potential endogeneity, sample selection, and unobserved heterogeneity are key issues. First, they could be generated by the decisions of working and forming a family which are jointly determined (Becker, 1991). Second, they could be due to endogeneity in education, marriage and birth, and unobserved heterogeneity (Kuepie et al., 2013).

#### **4.3.2.2 Estimation issues and identification strategies**

##### *Sample selection bias*

Additionally, one can suggest potential sample selection of female full-time employment, which concerns only women who are already in the labour market. Hence, ignoring other women such as full-time housewives and women who only go to school make our estimation sample non-random. The main challenge here is to find a valid selection indicator that determines the selection of women in all year work. For this instrument to be valid, it has to be strongly correlated with her participation decision, but not her all year work. Hence, we use a variable captured at the cluster level to reduce its dependence on individual female choices<sup>54</sup>. Specifically, considering a non-self-cluster mean as instrument is an elegant way of ensuring that it has no effect on the woman's all year work other than through her participation in the labour market.

##### *Endogeneity of education*

Another potential endogeneity is that of education in the employment equation caused by three sources, namely the reverse causality, unobserved heterogeneity, and measurement error. In this case, endogeneity could be caused by simultaneity between education and work decision. Hence, working in the labour market might give a woman the opportunity to increase her education level, by financing her studies with the earnings she get from working; also,

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<sup>54</sup> In general, acceptable instrument must be relevant: if their effect on the selection variable is statistically significant, strong: if the size of the effect is large enough; and valid: if uncorrelated with the structural error term, and the exclusion restrictions are correctly excluded from the estimating equation. Valid instruments are typically hard to come by (Baye et Sitan, 2016)



increasing her education level might increase her chance of working in the labour market. Endogeneity could be caused by unobserved factors that are strongly related with both education and type of employment. For instance, girls from well-connected social networks backgrounds may find it easier to be employed in the labour market, and she may also be likely to acquire more education (Riddell and Song, 2011). Also, endogeneity could be caused by measurement error in education. Error which is commonly found in surveyed data. Hence, not considering all these different causes of endogeneity of education in the labour market outcomes equations might yield biased estimates (Totouom et al., 2018).

The challenge at this level is to find a valid instrument which is strongly correlated with education, but uncorrelated with employment. Most studies (Kuepie et al., 2013; Tingum, 2016, Zamo-Akono, 2018; Che and Sundjo, 2018) in their analysis did not control for the endogeneity of education because of the difficulty in finding a valid instrument. Yet, for those who control for the endogeneity of education, various instruments such as the exogenous supply of education, parents' education, and the education of heads of households (Kuepie et al., 2013; Totouom et al., 2018). Duflo (2001) used large-scale government-sponsored program for the construction of 61,000 schools nationwide during the Vietnam War period; Riddell and Song (2011) in their study used changes in compulsory schooling laws; Totouom et al. (2018) in their study used heads of households' education because they suggest that the education of the households heads affects their children access to the labour market only through their children education.

In our case, just like the instrument of education used in the previous chapters, we use the non-self-cluster mean of years of education. By doing this we suggest that, other girls' years of education surrounding a girl might influence her own educational attainment, but indirectly the type of employment she works.

#### *Unobserved heterogeneity in education and female employment*

Female employment is potentially heterogeneous among women living in Cameroon. For example female full-time employment may be heterogeneous with respect to the strength of their labour market contacts (Sengupta, 2011). The strength of social capital or network effects (unobserved by the researcher) are very frequent in Cameroon in the sense that being related to a well-positioned and influential personality increases chances to work all year in the labour market. For instance, an educated person is likely to have a large network of people.



This well-connected social capital may in turn open up work opportunities in full-time employment. Hence, heterogeneity among female employment may be due to a non-linear interaction between education and social networks. To solve for this, we interact the inverse of Mill ratio at each educational level with the correspondent level of education.

#### *Endogeneity in the interaction term and identification strategy*

As explained above, education is potentially endogenous; hence, the interaction between education and family formation is likely to be endogenous. Since family formation is captured at the cluster level, it is likely to be exogenous. Thus, non-self-cluster mean of year of education times average age at first marriage/birth will be considered as instrument of the interaction term. For example, we suggest that women's education living in a community may affect a married woman living in that same community to increase her education, yet not directly her full-time employment.

### **4.3.3 Models specifications**

The modeling strategy adopts in this chapter is twofold. The first step consists of expressing the selection equation of employment and the reduced form equations for education, and the interaction between education and family formation variables. By carrying on these regressions, we assume that all the control variables used in these models are exogenous. This assumption supposes that there is no correlation between any of the explanatory variables and their respective error terms. It also presumes that none of the above equations suffer from any endogeneity, whether caused by measurement error, omitted variables or simultaneity bias.

The second step consists of explicitly expressing the structural equation for full-time employment which includes as additional variables control variables for the above mentioned estimation issues. Moreover, In order to obtain useful results for interpretation, use is made of marginal effects to estimate the probability that a female will be literate.

#### **4.3.3.1 Empirical selection and reduced form equations**

##### *Reduced form equation of education*

Measuring education by education and no education (literacy) make this variable a binary variable. Therefore, we model it in a latent regression framework given by:

it is simulated using a standard normal distribution with probabilities determined as:

$$E^* = \beta_0 + \beta_1 Other\_E + \sum_{k=2}^m \beta_k X_k + \varepsilon_1 \quad (5)$$

With  $E = 1$  if  $E^* > 0$  and  $E = 0$  if  $E^* \leq 0$

Where  $E^*$  is the net utility a woman derives from education.  $Other\_E$  is education captured as non-self-cluster proportion.  $X$  is a vector of exogenous variables including religion, distance to water source, residence, and regions.  $\varepsilon$  is the error term which is independently and identically distributed. In this study, we assume it to be normally distributed. In this case, equation (5) can be written as a Probit model in a probability format given by:

$$Prob(E = 1|Other\_E, X) = \Phi(\beta_0 + \beta_1 Other\_E + \sum_{k=2}^m \beta_k X_k) \quad (6)$$

With  $0 \leq Prob(E = 1|Other\_E, X) = \Phi(.) \leq 1$

Where  $\Phi$  is the cumulative density function (cdf).  $\beta$  are parameters to be estimated.

#### *Reduced form equations of education times marriage/birth (interaction term)*

Since education is potentially endogenous, it is still logic for its interaction with average age at first marriage/birth to be also potentially endogenous. Hence, the second reduced form is expressed as:

$$E * agefm = \delta_0 + \delta_1 Other\_E * agefm + \sum_{k=2}^m \delta_k X_k + \varepsilon_2 \quad (7) \text{ For age at first marriage}$$

$$E * agefb = \gamma_0 + \gamma_1 Other\_E * agefb + \sum_{k=2}^m \gamma_k X_k + \varepsilon_3 \quad (8) \text{ For age at first birth}$$

Where  $E * agefm$  and  $E * agefb$  are interaction terms between education and average age at first marriage and age at first birth captured at the cluster level respectively.  $agefm$  and  $agefb$  are respectively age the average marriage and age at first birth at the cluster level.  $\varepsilon_2$  and  $\varepsilon_3$  are respectively error terms for marriage and birth.  $\gamma$  and  $\delta$  are parameters to be estimated.

In addition, since the dependent variables in equations (7) and (8) are continuous, we will estimate those using OLS.

#### *Selection equation of participation in the labour market*

We appeal for Heckman's (1979) (Heckit) two-stage method to purge parameter estimates from sample selection bias. The first stage consists of estimating the selection equation using a Probit<sup>55</sup> method. This equation is given by:

<sup>55</sup> Heckman (1979) two-stage procedure relies on the univariate normality of the marginal distribution, condition which is no longer efficient in the presence of joint normality (Zamo-Akono, 2018).

$$Pr(w = 1/other\_work, X) = \Phi(\alpha_0 + \alpha_1 other\_work_i + \sum_{k=2}^m \alpha_k X_k) \quad (9)$$

With  $w=1$  when the market wage is greater than the reservation wage.

Where:  $w$  is the observed labour participation. *other\_work* is labour participation captured as the non-self-cluster proportion. This variable serves as the indicator selecting women in the labour market.  $\alpha$  are the parameters to be estimated. This stage includes the calculation of the Inverse Mill's Ratio (IMR), which capture the unobserved variable of the selection model. This variable is included as an additional variable in the structural equation of employment to control the selection bias.

#### 4.3.3.2 The structural equation of female full-time employment

The second step of our model specification consists of including control variables derived above in the structural equation of full-time employment. Written as a Probit model, this control function which simultaneously address these potential issues (Garen, 1984; Mwabu, 2008; Baye et Sitan, 2016):

##### *Direct effect*

In this analysis, we assume that education and family formation act separately, meaning that the return in education does not depend on the age at which the woman decides to form a family and vice-versa.

$$Prob(H = 1/W, X) = \Phi(a_0 + a_1 E + a_2 agefm + a_3 Age^2 + a_4 E^h + a_5 age^h + \sum_{k=6}^m a_k X_k + \partial_1 \widehat{\epsilon}_1 + \theta_1 \widehat{\epsilon}_1 \cdot E + \lambda imr_w) \quad (10) \quad \text{For the direct effect for first marriage}$$

$$Prob(H = 1/W, X) = \Phi(a_0 + a_1 E + a_2 \overline{agefb} + a_3 Age^2 + a_4 E^h + a_5 age^h + \sum_{k=6}^m a_k X_k + \partial_1 \widehat{\epsilon}_1 + \theta_1 \widehat{\epsilon}_1 \cdot E + \lambda imr_w) \quad (11) \quad \text{For the direct effect for first birth}$$

##### *Indirect effect or interaction between education and family formation*

Unlike the previous analysis, we assume that return in education depends on the age at which a woman chooses to form a family and vice-versa. Hence, we interact education and family formation.

$Prob(H = 1/W, X) = \Phi(a_0 + a_1 E + a_2 agefm + a_3 E * agefm + a_4 Age^2 + a_5 E^h + a_6 age^h + \sum_{k=7}^m a_k X_k + \partial_1 \widehat{\epsilon}_1 + \theta_1 \widehat{\epsilon}_1 \cdot E + \psi_1 \widehat{\epsilon}_2 + \lambda imr_w)$  (12) For the indirect effect for first marriage

$Prob(H = 1/W, X) = \Phi(a_0 + a_1 E + a_2 agefb + a_3 E * agefb + a_4 Age^2 + a_5 E^h + a_6 age^h + \sum_{k=7}^m a_k X_k + \partial_1 \widehat{\epsilon}_1 + \theta_1 \widehat{\epsilon}_1 \cdot E + \psi_1 \widehat{\epsilon}_3 + \lambda imr_w)$  For the indirect effect for first marriage (13)

Where, H is a dichotomous indicator taking the value 1 if the woman works full-time (all year), and 0 otherwise. *agefm*, and *agefb* are respectively the average age at first marriage and first birth at the cluster level.  $\widehat{\epsilon}_1$  is the fitted residual for education.  $\widehat{\epsilon}_2$  and  $\widehat{\epsilon}_3$  are respectively fitted residuals for the interaction of  $E * agefm$  and  $E * agefb$ .  $\widehat{\epsilon}_1 \cdot E$  the fitted residual of education times education controls for unobserved heterogeneity in education and employment. *imr<sub>w</sub>* is the inverse of Mills ratio.

#### *Total effect of education on female full-time employment*

The total effect of education on female full-time employment when she transit into first marriage is given by:

$$\frac{\partial H}{\partial E} = \widehat{a}_1 + \widehat{a}_3 agefm \quad (14)$$

The total effect of educational level on female full-time employment when she engages in first birth is given by:

$$\frac{\partial H}{\partial E} = \widehat{a}_1 + \widehat{a}_3 agefb \quad (15)$$

In this study, we consider individual and partner's characteristics to be exogenous and supposed to be time-invariant from the timing of first marriage/birth till the time of the survey (Mroz, 1987). Hence, we suppose that a woman's characteristics have not change significantly from the time of her first marriage/birth till 2011, time of the survey. This condition helps in doing a static analysis since characteristics at these different stages are not available.

Moreover, in order to check and control for the stability of our results, use is made of the bootstrap resampling technique which provides asymptotically consistent standard errors.

#### 4.3.4 Presentation of Cameroon's DHS data used in this chapter

This chapter requires information on education, marriage, childbearing and employment status simultaneously. The Demographic and Health Survey (DHS) is the only existing database that fulfills the above requirement (Kuepie et al., 2013). This database implemented in many developing countries obtained funding from the USAID with the technical assistance of the ICF international. We use the Cameroon 2011 DHS, which is the fourth survey of its kind collected by the National Institute of Statistics (INS). Cameroon DHS is the fourth survey of its kind to be implemented with the responsibility of collecting, collating, and analyzing demographic data. It is a national survey that provides up-to-date information on background characteristics of the respondents, which in this study is the woman. This target group of women age 15-49 is randomly selected from households across the national territory.

This survey collects information on the partner characteristics, fertility data and socio-economic and demographic variables (such as employment, education, age at first marriage and birth, etc.) of women. This is the most available and appropriate dataset which provides at once information on woman, wives, husband, and children (or family as a whole). This information is detailed into marriage activity, reproductive and fertility preferences, family planning, employment, occupations, and forms of earnings. Indeed, it is the only secondary data source in Cameroon which provides information on transition into adulthood and parenthood, useful in our analysis.

Concerning marriage we follow Becker's (1993) construct of marriage which includes legal and consensual unions. For those who were married or living with a partner, further information were asked on their age at the time they started living together, and also information on their husband/partner, such as age, education, work status. For those who were mothers, they were asked to give the age at which they had their first child.

**Table 4 1:** List of Variables

| <i>Variables</i>  | <i>Description of variables</i> |
|---|---------------------------------|
| <b>1. Dependent Variables</b>                           |                                 |
| <i><b>The woman's employment</b></i>                    |                                 |
| Full-time work (work all year)                          | 1=if full-time and 0 otherwise  |
| Part-time work (work seasonally and occasionally)       | 1=if part time and 0 otherwise  |
| <i><b>Labour participation (Selection equation)</b></i> |                                 |
| Working in the labour market                            | 1= if working and 0 otherwise   |
| Not working in the labour market                        | 1= if not working , 0 otherwise |
| <b>2. Explanatory Variables</b>                         |                                 |

|  |   |
|--|---|
| <b><i>Education level (Explanatory endogenous variable)</i></b><br>No education<br>education | 1= if yes and 0 otherwise<br>1= if yes and 0 otherwise  |
| <b><i>Average age at first marriage (at the cluster level)</i></b><br>Age at first marriage  | Age in continuous years   |
| <b><i>Average age at first birth (at the cluster level)</i></b><br>Age at first birth        | Age in continuous years   |
| <b><i>Education times average age at first marriage</i></b>                                  | Age in continuous years   |
| <b><i>Education times average age at first birth</i></b>                                     | Age in continuous years   |
| <b><i>The partner's current age</i></b>  | Age in continuous years   |
| <b><i>The partner's education</i></b><br>Number of years of education                        | Continuous years  |
| <b><i>The woman's religion:</i></b><br>Moslem<br>Other religions                             | 1= if Moslem and 0 otherwise<br>1=if Other religions and 0 otherwise  |
| <b><i>The woman's living region:</i></b><br>Great Center<br>Great West<br>Great North        | 1= if great center and 0 otherwise<br>1= if great west and 0 otherwise 1=<br>if great west and 0= otherwise |
| <b><i>The woman's area of residence:</i></b><br>Rural<br>Urban                               | 1=if rural and 0 otherwise<br>1= if urban and 0 otherwise   |
| <b>3. selection indicator and Instrument for education</b>                                   |   |
| Other working women (Cluster level mean)   | Number of women   |
| Other education (Cluster level mean)   | Number in continuous years  |

**Source:** Compiled by the author from the Cameroon DHS (2011)

Concerning the labour market, women were asked if they have worked during the last 12 months. For those who answered yes, they were asked about the frequency of their labour supply: all year and seasonally/occasionally.

## 4.4 Empirical Results

### 4.4.1 Descriptive statistics

Table 4\_2 presents descriptive statistics for the 2011 Demographic Health Survey.

**Table 4 2: Descriptive statistics**

| <b><i>Variable</i></b><br><b><i>Max</i></b> | <b><i>Obs.</i></b> | <b><i>Mean</i></b> | <b><i>Std. Dev.</i></b> | <b><i>Min</i></b> |   |
|---|--------------------|--------------------|-------------------------|-------------------|---|
| Employment                                  | 15,426             | 0.6819             | 0.465                   | 0                 | 1 |

|   |        |        |        |      |        |
|---|--------|--------|--------|------|--------|
| Full-time employment                    | 15,426 | 0.3675 | 0.4821 | 0    | 1      |
| Part time employment                    | 15,426 | 0.3123 | 0.463  | 0    | 1      |
| Women's education                       | 15,426 | 0.8187 | 0.3858 | 0    | 1      |
| Education times age at first marriage   | 9,805  | 14.006 | 8.1317 | 0    | 26.888 |
| Education times age at first birth      | 8,870  | 14.212 | 8.3613 | 0    | 26.5   |
| Partner's education                     | 10,451 | 6.9701 | 4.8792 | 0    | 17     |
| Partner's current age                   | 9,629  | 40.071 | 11.846 | 15   | 95     |
| Average age at first marriage (cluster) | 15,426 | 18.238 | 2.075  | 13.7 | 25     |
| Average age at first birth (cluster)    | 15,426 | 18.845 | 1.421  | 15.6 | 24.47  |
| Age square                              | 15,426 | 27.984 | 9.550  | 15   | 49     |
| Muslim                                  | 15,426 | 0.1942 | 0.3956 | 0    | 1      |
| Distance to water source                | 15,426 | 0.7642 | 0.4244 | 0    | 1      |
| Rural                                   | 15,426 | 0.496  | 0.500  | 0    | 1      |
| Great Center                            | 15,426 | 0.2916 | 0.454  | 0    | 1      |
| Great West                              | 15,426 | 0.4152 | 0.492  | 0    | 1      |
| Great North                             | 15,426 | 0.293  | 0.455  | 0    | 1      |
| Urban                                   | 15,426 | 0.5038 | 0.500  | 0    | 1      |
| Other education (Cluster mean)          | 15,417 | 6.2457 | 3.1273 | 0    | 15.42  |

**Source:** Compiled by author from the Cameroon DHS (2011)

On average, about 68% of women aged above 15 participate in the labour market. Among these women, 37% are engaged in all year work while 31% in part time (occasionally and seasonally) work. Concerning education, overall statistics on women reveals that majority (81%) of them are literate. And the average years of education attained by other girls living in a cluster is 6 years, while that of men approximates 7 years.

Table 4\_2 also reveals that the average age at which women enter first marriage in clusters is 18 and give birth to their first child at around 19 years. Yet, a literate woman on average enters first marriage and first birth earlier (14 years). And, a large proportion of girls (76%) do not have a water source at their premises.

#### 4.4.2 First stage estimates: selection and reduced-form equations

All results of reduced form and selection equations are provided in Table A4\_1, A4\_2 and A4\_3 of the Appendix. They show their respective coefficients and marginal effects. Hence, Table A4\_1 presents estimates of women's participation (1 if yes and 0 otherwise) in the labour market using a Probit model. Also using a Probit model, Table A4\_2 presents estimates of

education (1 if yes and 0 otherwise). And Table A4\_4 provides estimates of the interaction terms (education\*average age at first marriage and education\*average age at first birth). Moreover, the significance of our various instruments demonstrates their relevance.

#### ***4.4.2.1 Estimates from the selection equation***

Table 4A\_1 (in the Appendix) reveals that the non-self-cluster mean of work is significant at 1%, meaning that our instrument is relevant. The Wald tests carried out on our instrument yields significant results. Given these results, we reject the null hypothesis of weak instrument and it can be concluded that women's work captured at the cluster level is valid. Hence, other working women living around a woman increases her likelihood to work in the labour market. Hence, this non-self-cluster mean of working women increases by 56% a woman's probability of working in the labour market. This may be due to the various advantages offer by work outside home.

As expected, labour force participation has a quadratic relationship with age in the sense that participation decision increases with age and start to decline thereafter. Such results are confirmed by most empirical findings (Kuepie et al., 2013; Ekamena et al. 2014; Baye, 2015; Tingum (2016); Totouom et al. 2018). Although surprising, Ekamena et al. (2014) and Totouom et al., (2018) found this negative result in the context of Cameroon. They justify this result by the sector of activity occupied by women workers.

Moslem women are less likely to participate in the labour market relative to women from other religious denominations. Living in the rural area and living in the western part of the country increase women's probability to participate in the labour market.

#### ***4.4.2.2 Estimates from the reduced form equation of education***

These estimates are provided in Table 4A\_2 in the appendix. This table reveals that the non-self-cluster mean of years of education is significant at 1%, meaning that our instrument is relevant. The Wald tests carried out on our instrument yields significant results. Given these results, we reject the null hypothesis of weak instrument and it can be concluded that education captured at the cluster level is valid.

Holding other things being equal, women's education (captured at the cluster level) increases by 5% a woman's likelihood to go to school. Moreover, being a Moslem woman and



residing in the northern part of the country decrease the probability of going to school compared respectively to a non-Moslem woman and a woman residing in the center region.

#### ***4.4.2.3 Estimates from the reduced form equation of the interaction terms***

Table A4\_3 provides OLS estimates of the interaction terms, education times average age at first marriage (Model 1) and education times average age at first birth (Model 2). Also, the significance (at 1% level) of our instruments (non-self-cluster mean of education\*average age at first marriage/birth) and the significance of the F-statistics reveal that the selected instruments are relevant and our models well fitted.

##### *Education times average age at first marriage (Model 1)*

Model 1 of Table A4\_3 presents correlates of education\*average age at first marriage. Other educated women's age at first marriage (cluster level), our instrument, is negatively correlated with an educated woman's age at first marriage. This means that as other educated women increase their age at first marriage by a year, an educated woman (living in that same neighborhood) is likely to decrease hers by 8%.

Average age at first marriage is positively associated with an educated woman's age at first marriage at a 1% level of significance. Other women's education (cluster level) is significantly and positively related with an educated woman's age at first marriage. This implies that more education from other women induces an educated woman to delay her age at first marriage. In this vein, increasing the average age at first marriage by a year induces an educated woman to delay her age at first marriage by 1 year also.

However, being a Moslem and living in the northern part of Cameroon are negatively associated with educated women's age at first marriage.

##### *Education times average age at first birth (Model 2)*

Model 2 of Table A4\_3 (Appendix) presents estimates of education\*average age at first birth. Other educated women's age at first birth (cluster level), our instrument, is negatively correlated with an educated woman's age at first birth. This means that as other educated women increase their age at first birth by a year, an educated woman (living in that same neighborhood) is likely to decrease hers by 5%.

Average age at first birth is positively associated with an educated woman's age at first birth at a 1% level of significance. Other women's education (cluster level) is significantly and

positively related with an educated woman's age at first birth. This implies that more education from other women induces an educated woman to delay her age at first birth. In this vein, increasing the average age at first birth by a year induces an educated woman to delay her age at first birth by 0.77 year also.

However, being a Moslem and living in the northern part of Cameroon are negatively associated with educated women's age at first birth.

#### **4.4.3 Second stage estimates: the structural equation of female full-time employment**

The structural equation displays estimates of female full-time employment when she is married (Table 4\_3) and when she is mother (Table 4\_4), using a control function approach correcting simultaneously for endogeneity, sample selection and unobserved heterogeneity.

##### ***4.4.3.1 Estimates of married women's full-time employment: the role of age at first marriage***

Table 4\_3 presents estimates of married women's full-time employment in Cameroon. Columns (1) and (2) provide estimates of the coefficients and marginal effects of the direct effect, while (3) and (4) give those of the indirect effect of education on female full-time employment. In both the direct and indirect effect models, the coefficients of the IMR are statistically significant at 1% level. This result implies that correcting for selection bias in employment was imperative. The negative signs (-0.294 for the direct effect and -0.296 for the indirect effect) of this ratio implies that married women selected into the sample are less likely to be full-time employed compared to those who would have been randomly drawn from the whole population. The statistical significance (at 1% level) of the coefficient of the predicted residual of education implies that this input into female full-time employment is indeed endogenous. In this vein, there is an evidence of unobserved heterogeneity since the coefficient of the interaction of education\*its residual is statistically significant. Hence, including them in the structural equation of female full-time employment, as it is done in this thesis, is imperative for consistent estimation of our structural parameters. However, the coefficient of the predicted residual of education\*age at first marriage is not statistically significant, implying that this input into female full-time employment is not endogenous. Hence, including it in our structural equation is not necessary for consistent estimation of our structural parameters. In this perspective, we suggest that there is no evidence of unobserved heterogeneity.

Moreover, Pseudo R2 of 0.1241 for the direct effect and 0.1252 for the indirect effect is an evidence of significantly good fit of our models. This is approved by the 1% statistical significance of the Wald chi2, which suggest the joint significance of our selected regressors in explaining the probability of female full-time employment in Cameroon.

#### *The direct effect of education on female full-time employment*

Columns (1) and (2) of Table 4\_3 contains coefficients and marginal effect estimates of the structural equation of female full-time employment which integrates control function variables of the reduced form equation of education and the selection equation. These models do not consider interactions terms between education and age at first marriage.

Other things being the same, education increases the probability for a married woman to choose full-time employment. Hence, literate women are about 15% more likely to work all year round in the labour market compared to those with no education. This result corroborates with the Human Capital Theory and some empirical findings in the Cameroonian context (Kuepie et al., 2013; Tingum, 2016; Yeyouom et al., 2016; Che and Sundjo, 2018). This finding indicates the greater efficiency of human capital for women.

Concerning marriage decision, delaying age at first marriage by a year is likely to reduce female full-time employment by 2%. This reflects that unmarried women are less likely to be full-time workers. Several empirical findings found contrary results (Wambugu, 2002; Atieno, 2006; Kuepie et al., 2013; Zamo, 2018). The reason for this significantly negative effect may be twofold. First, since unmarried women may have no household or children responsibilities, they prefer to focus in acquiring more skills and knowledge (while doing part-time job) so as to increase chances to eventually enter high job segments (Kuepie et al., 2013). Also, one can advance the argument of labour market tightness, poor salaries, and an educational system not oriented towards self-employment. Because most educated persons in Cameroon aspire to be employed somewhere regarding the time and money spent in schooling, delaying marriage gives them the opportunities to gather more education to increase the probability of obtaining a well-positioned and paid job.

In this perspective having opposite direct effect of education and marriage on female employment, it will be interesting to measure how the negative effect of marriage affects the positive effect of female's education on their full-time employment. This will help in indicating

some sort of trade-off that may exists between delaying marriage and how often to work in the labour market.

*The indirect effect of education on female full-time employment through first marriage*

Column (3) and (4) of Table 4\_3 presents estimates of the indirect effect of education on female full-time employment through marriage. When including the interaction term, the effect of age at first marriage still remains statistically significant. While that of education changed drastically, revealing the relatively less strong impact of education on female employment relative to that of age at first marriage. Age at first marriage significantly reduces the probability for women to be fully employed, with higher amplitude, revealing the relatively strong impact of marriage on female employment compared to education. Considered solely, education now decreases the probability of female full-time employment by 43% compared to no education. At this level, one can predict an overwhelming effect of marriage on the education – female employment nexus, meaning that the effect of age at first marriage is stronger.

The interaction term of education times age at first marriage is statistically significant, revealing that education and age at first marriage depends on each other to explain female employment.

This indicates that there is an indirect effect of education to female employment through age at first marriage. That is, the effect of education on female full-time employment depends on the age at which she decides to get married.

**Table 4 3:** Direct and indirect effect of education on married women’s full-time employment

| Variables                              | Direct Effect                                   |                               | Indirect Effect                                 |                               |
|--|---|-------------------------------|---|-------------------------------|
|  | <i>Employment (1=full-time and 0 otherwise)</i> |                               | <i>Employment (1=full-time and 0 otherwise)</i> |                               |
|  | (1)<br>Observed<br>Coefficient                  | (2)<br>Marginal Effect        | (3) Observed<br>Coefficient                     | (4) Marginal<br>Effect        |
| <b>Education</b>                       | <b>0.4486***</b><br>(0.0938)                    | <b>0.1538***</b><br>(0.0317)  | <b>-1.2673**</b><br>(0.5417)                    | <b>-0.4339**</b><br>(0.1862)  |
| <b>Age at first marriage (Mean)</b>    | <b>-0.059***</b><br>(0.0114)                    | <b>-0.0205***</b><br>(0.0039) | <b>-0.1456***</b><br>(0.0382)                   | <b>-0.0498***</b><br>(0.0131) |
| <b>Education*age at first marriage</b> |   |                               | <b>0.1164***</b><br>(0.0354)                    | <b>0.0398***</b><br>(0.0122)  |
| Age                                    | 0.0785***<br>(0.0148)                           | 0.0269***<br>(0.0050)         | 0.0777***<br>(0.0149)                           | 0.0266***<br>(0.0050)         |

|   |                               |                               |                               |                               |
|---|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
| Age square                                      | -0.0009***<br>(0.0002)        | -0.0003***<br>(0.0001)        | -0.0009***<br>(0.0002)        | -0.0003***<br>(0.0001)        |
| Partner's education                             | 0.0131***<br>(0.0050)         | 0.0045***<br>(0.0017)         | 0.0130***<br>(0.0050)         | 0.0044**<br>(0.0017)          |
| Partner's age                                   | -0.0029<br>(0.0023)           | -0.0010<br>(0.0008)           | -0.0027<br>(0.0022)           | -0.0009<br>(0.0008)           |
| Muslim  | 0.4947***<br>(0.0399)         | 0.1696***<br>(0.0136)         | 0.4851***<br>(0.0475)         | 0.1661***<br>(0.0162)         |
| Distance to water source                        | 0.0068<br>(0.0433)            | 0.0023<br>(0.0149)            | 0.0066<br>(0.0439)            | 0.0022<br>(0.0150)            |
| Rural   | -0.2087***<br>(0.0437)        | -0.0716***<br>(0.0149)        | -0.2118***<br>(0.0438)        | -0.0725***<br>(0.0149)        |
| Great west                                      | 0.3351***<br>(0.0363)         | 0.1149***<br>(0.0121)         | 0.3352***<br>(0.0358)         | 0.1148***<br>(0.0119)         |
| Great north                                     | -0.1736**<br>(0.0867)         | -0.0595**<br>(0.0298)         | -0.2076**<br>(0.0951)         | -0.0711**<br>(0.0326)         |
| <b>Control function variables</b>               |                               |                               |                               |                               |
| <b>Education residual</b>                       | <b>1.0837***</b><br>(0.1765)  | <b>0.3715***</b><br>(0.0597)  | <b>1.6592***</b><br>(0.3366)  | <b>0.5681***</b><br>(0.1148)  |
| <b>Education*its residual</b>                   | <b>-0.3490***</b><br>(0.1297) | <b>-0.1196***</b><br>(0.0443) | <b>-0.7430***</b><br>(0.1683) | <b>-0.2544***</b><br>(0.0577) |
| <b>Education*age at first marriage residual</b> |                               |                               | <b>-0.0197</b><br>(0.0248)    | <b>-0.0068</b><br>(0.0085)    |
| <b>Inverse Mills Ratio</b>                      | <b>-0.8598***</b><br>(0.0968) | <b>-0.2948***</b><br>(0.0332) | <b>-0.8653***</b><br>(0.0974) | <b>-0.2963***</b><br>(0.0334) |
| Constant  | -1.2206***<br>(0.3984)        |                               | 0.1166<br>(0.6662)            |                               |
| <b>Estimation statistics</b>                    |                               |                               |                               |                               |
| Log pseudolikelihood                            | -4972.7279                    |                               | -4966.2735                    |                               |
| Replications                                    | 50                            |                               | 50                            |                               |
| Wald chi2 (14/16)                               | 2108.44***                    |                               | 2516.85***                    |                               |
| Pseudo R2                                       | 0.1241                        |                               | 0.1252                        |                               |
| Observations                                    | 8,275                         | 8,275                         | 8,275                         | 8,275                         |

*Bootstrap and Delta-method standard errors in parentheses \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$*

**Source:** Computed by author using Cameroon 2011 DHS

The concern at this level is to know whether age at first marriage acts as a mediator or a modulator. Our estimates indicate that in Cameroon, delaying marriage by a year increases the marginal efficiency of education on female full-time employment only by 4%, against 15% in the direct effect model. Hence, age at first marriage lessens the marginal efficiency of education on female full-time employment.

#### *The total effect of education*

As indicated above, the total effect ( $TE_M$ ) of education on female full-time employment through age at first marriage is given by:

$$TE_M = -43\% + 4\% (\text{age at first marriage}) \quad (16)$$

This can be illustrated as:

$$TE_M = -43\% + 4\% (1) = -39\% \quad (17)$$

We interpret equation (17) by saying that, delaying age at first marriage by a year is likely to reduce the marginal efficiency of education on female full-time employment by 39%.

Delaying age at first marriage by 10 years is likely to reduce the marginal efficiency of education on female full-time employment by 3%. That is:

$$TE_M = -43\% + 4\% (10) = -3\% \quad (18).$$

It is only when a woman delays her age at first marriage by more than 10 years that the marginal efficiency of education on female employment is positive.

These findings seem consistent with the Cameroonian context, especially in the rural and the northern parts of the country. Having the average age at first marriage in these areas around 15-16, revealing a low level of education. Delaying this age by 10 years may give them the opportunity to complete secondary level of education or acquire more skill, hence more efficiency in the labour market.

We conclude that early marriage lessens the effect of education on female full-time employment, but this marginal efficiency of education is greater when the woman delays her first marriage by 10 years at least.

#### 4.4.3.2 Estimates of mothers' full-time employment: the role of age at first birth

**Table 4 4:** Direct and indirect effect of education on mother's full-time employment

| Variables        | Direct Effect                                   |                              | Indirect Effect                                 |                              |
|------------------|---|------------------------------|---|------------------------------|
|                  | <i>Employment (1=full-time and 0 otherwise)</i> |                              | <i>Employment (1=full-time and 0 otherwise)</i> |                              |
|                  | (1)<br>Observed<br>Coefficient                  | (2)<br>Marginal Effect       | (3)<br>Observed<br>Coefficient                  | (4)<br>Marginal<br>Effect    |
| <b>Education</b> | <b>0.4783***</b><br>(0.0950)                    | <b>0.1640***</b><br>(0.0321) | <b>-1.3293**</b><br>(0.6328)                    | <b>-0.4555**</b><br>(0.2176) |

|                                     |                   |                   |                   |                   |
|-------------------------------------|-------------------|-------------------|-------------------|-------------------|
| <b>Age at first birth (Mean)</b>    | <b>-0.0650***</b> | <b>-0.0223***</b> | <b>-0.1460***</b> | <b>-0.0500***</b> |
|                                     | (0.0135)          | (0.0046)          | (0.0360)          | (0.0124)          |
| <b>Education*age at first birth</b> |                   |                   | <b>0.1067***</b>  | <b>0.0366***</b>  |
|                                     |                   |                   | (0.0361)          | (0.0124)          |
| Age                                 | 0.0799***         | 0.0274***         | 0.0779***         | 0.0267***         |
|                                     | (0.0148)          | (0.0050)          | (0.0149)          | (0.0050)          |
| Age square                          | -0.0010***        | -0.0003***        | -0.0009***        | -0.0003***        |
|                                     | (0.0002)          | (0.0001)          | (0.0002)          | (0.0001)          |
| Partner's education                 | 0.0133***         | 0.0046***         | 0.0131***         | 0.0045**          |
|                                     | (0.0050)          | (0.0017)          | (0.0051)          | (0.0017)          |
| Partner's age                       | -0.0028           | -0.0010           | -0.0027           | -0.0009           |
|                                     | (0.0023)          | (0.0008)          | (0.0023)          | (0.0008)          |
| Muslim                              | 0.4721***         | 0.1619***         | 0.4568***         | 0.1565***         |
|                                     | (0.0401)          | (0.0137)          | (0.0453)          | (0.0154)          |
| Distance to water source            | 0.0085            | 0.0029            | 0.0094            | 0.0032            |
|                                     | (0.0432)          | (0.0148)          | (0.0434)          | (0.0149)          |
| Rural                               | -0.2103***        | -0.0721***        | -0.2132***        | -0.0731***        |
|                                     | (0.0429)          | (0.0146)          | (0.0441)          | (0.0150)          |
| Great west                          | 0.3536***         | 0.1213***         | 0.3485***         | 0.1194***         |
|                                     | (0.0360)          | (0.0119)          | (0.0362)          | (0.0120)          |
| Great north                         | -0.1543*          | -0.0529*          | -0.1934*          | -0.0663*          |
|                                     | (0.0871)          | (0.0299)          | (0.0996)          | (0.0342)          |
| <b>Control function variables</b>   |                   |                   |                   |                   |
| <b>Education residual</b>           | <b>1.0097***</b>  | <b>0.3463***</b>  | <b>1.3447***</b>  | <b>0.4608***</b>  |
|                                     | (0.1745)          | (0.0591)          | (0.2507)          | (0.0855)          |
| <b>Education*its residual</b>       | <b>-0.4117***</b> | <b>-0.1412***</b> | <b>-0.6144***</b> | <b>-0.2105***</b> |
|                                     | (0.1316)          | (0.0450)          | (0.1467)          | (0.0503)          |
| <b>Education*age at first birth</b> |                   |                   | <b>-0.0137</b>    | <b>-0.0047</b>    |
|                                     |                   |                   | (0.0176)          | (0.0060)          |
| <b>Inverse Mills Ratio</b>          | <b>-0.8290***</b> | <b>-0.2843***</b> | <b>-0.8433***</b> | <b>-0.2890***</b> |
|                                     | (0.0958)          | (0.0329)          | (0.0970)          | (0.0333)          |
| Constant                            | -1.0534**         |                   | 0.4265            |                   |
|                                     | (0.4098)          |                   | (0.6579)          |                   |
| <b>Estimation statistics</b>        |                   |                   |                   |                   |
| Log pseudolikelihood                | -4975.5352        |                   | -4970.9623        |                   |
| Replications                        | 50                |                   | 50                |                   |
| Wald chi2 (14/16)                   | 2157.73***        |                   | 2421.6***         |                   |
| Pseudo R2                           | 0.1236            |                   | 0.1244            |                   |
| Observations                        | 8,275             | 8,275             | 8,275             | 8,275             |

*Bootstrap and Delta-method standard errors in parentheses \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$*

**Source:** Author using Cameroon 2011 DHS

Table 4\_4 presents the estimates of mothers' full-time employment in Cameroon. Columns (1) and (2) provide estimates of the coefficients and marginal effects of the direct effect, while (3) and (4) give those of the indirect effect of education on female full-time employment via age at first birth. In both the direct and indirect effect models, the IMR is statistically significant at 1% level. This result implies that correcting for selection bias in employment was imperative. The negative signs (-0.2843 for the direct effect and -0.2890 for the indirect effect) of this ratio implies that mothers selected into the sample are less likely to be full-time employed compared

to those who would have been randomly drawn from the whole population. The statistical significance (at 1% level) of the coefficient of the predicted residual of education implies that this input into female full-time employment is indeed endogenous. In this vein, there is an evidence of unobserved heterogeneity since the coefficient of the interaction of education\*its residual is statistically significant. Hence, including them in the structural equation of female full-time employment, as it is done in this thesis, is imperative for consistent estimation of our structural parameters. However, the coefficient of the predicted residual of education\*age at first birth is not statistically significant, implying that this input into female full-time employment is not endogenous. Hence, including it in our structural equation is not necessary for consistent estimation of our structural parameters. In this perspective, we suggest that there is no evidence of unobserved heterogeneity.

Moreover, Pseudo R2 of 0.1236 for the direct effect and 0.1244 for the indirect effect is an evidence of significantly good fit of our models. This is approved by the 1% statistical significance of the Wald chi2, which suggest the joint significance of our selected regressors in explaining the probability of female full-time employment in Cameroon.

*The direct effect of education:*

Columns (1) and (2) of Table 4\_4 contains coefficients and marginal effect estimates of the structural equation of female full-time employment. These models do not consider interactions terms between education and age at first birth.

Other things being equal, education increases the probability for a mother to choose full-time employment. Hence, literate mothers are about 16.5% more likely to work all year round in the labour market compared to those with no education. Just like in the case of married women and mothers, this finding indicates the greater efficiency of human capital for all women.

Concerning birth timing, delaying age at first birth by a year is likely to reduce female full-time employment by 2%. This portrays that childless women are less likely to be full-time workers. This may be explained by the observation that women without any family responsibility prefer to accumulate their human capital, so as to have the chance to enter higher job segments.

In this perspective having opposite direct effect of education and birth on female employment, it will be interesting to measure how the negative effect of birth affects the



positive effect of female's education on their full-time employment. This will help in indicating some sort of trade-off that may exist between delaying birth and how much time a woman spent in the labour market.

#### *The indirect effect of education on female full-time employment through first birth*

Column (3) and (4) of Table 4\_4 presents estimates of the indirect effect of education on female full-time employment through first birth. When including the interaction term, the effect of age at first birth still remained practically unchanged, while that of education changed drastically. Hence, age at first birth significantly reduced the probability for women to be fully employed, yet with higher amplitude. This finding contradicts the theoretical argument which postulates that birth compels women to allocate much time in home production while reducing their labour supply in the market (Becker, 1965).

However, considering education alone decreases the probability of female full-time employment by 46% compared to no education. At this level, one can predict an overwhelming effect of birth on the education – female employment nexus.

The interaction term of education times age at first birth is statistically significant, revealing that education and age at first birth depends on each other to explain female employment. This indicates that there is an indirect effect of education to female employment through age at first birth. That is, the effect of education on female full-time employment depends on the age at which she decides to give birth to her first child.

The concern now at this level is to know whether age at first birth acts as a mediator or a modulator. Our estimates indicate that in Cameroon, delaying childbearing by a year increases the marginal efficiency of education on female full-time employment by only 4%, against 16.5% in the direct effect model. Hence, age at first birth decreases the marginal efficiency of education on female full-time employment.

#### *The total effect of education*

As indicated above, the total effect ( $TE_B$ ) of education on female full-time employment through age at first birth is given by:

$$TE_B = -46\% + 4\% (age\ at\ first\ birth) \quad (19)$$

Hence, delaying age at first birth by a year is likely to reduce the marginal efficiency of education on female full-time employment by 42%. This can be illustrated as:

$$TE_B = -46\% + 4\% (1) = -42\% \quad (20)$$

Delaying age at first birth by 11 years is likely to reduce the marginal efficiency of education on female full-time employment by 2%. That is:

$$TE_B = -46\% + 4\% (11) = -2\% \quad (21).$$

It is only when a woman delays her age at first birth by more than 11 years that the marginal efficiency of education on female employment is positive.

We conclude that early childbearing lessens the effect of education on female full-time employment, but this marginal efficiency of education is increased only when the woman delays her first birth by 12 years at least.

#### ***4.4.3.3 Effect of other covariates on female full-time employment***

Results in Tables 4\_3 and 4\_4 on covariates are almost the same. All the exogenous variables determine the probability whether a woman will participate in full-time or part time employment. Therefore, the variables Age and Age-squared are statistically significant at 1% level of significance. The positive sign of the coefficient of Age implies that female full-time employment increases with age. This is because, as women grow older, they find the necessity to work so as to take care of their families and themselves. But the negative sign of Age-squared implies that as working women grow up to a certain age, her probability of full-time employment becomes to decrease. This finding conforms to most empirical evidence (Mincer, 1962; Tingum, 2016).

These Tables also reveal that an additional year of schooling of a partner increases his wife's probability of working all year round. Moslem women are likely to increase participation in full-time work compared to women from other religious denominations, whereas rural women and women residing in the northern part of the country are less likely to be full-time employed. This may be because, agriculture, which is their main activities are often seasonally.

## 4.5 Conclusion and policy implementations

This chapter sets out to examine the effect of education on women full-time employment through family formation. The economic literature advocates that education gives women the opportunity to fully engage themselves in the labour market, but this effect tends to be reduced or cancelled out when engaged in marriage and childbearing. To verify this hypothesis, we employ data from the Demographic and Health Survey (DHS) carried out in 2011, which simultaneously provides information on women's marriage, fertility, education, and employment. At the econometric level, in order to produce efficient estimators we adopt a control function approach which simultaneously takes into account the endogeneity of education and education\*family formation, the selectivity in employment, and unobserved heterogeneity.

We found that education increases the probability for married women and mothers to participate in full-time employment by 15 – 16% respectively, compared to uneducated women. This finding indicates a greater efficiency of education for women. But when considering life-course events such as marriage and childbearing, we notice that delaying first marriage and first birth by a year, induces women to reduce their participation in full-time employment. Although very surprising, this result contradicts the theoretical intuition and several empirical studies which support that marriage and children compel women to reduce the time they spent on the labour market. Our finding could be justified by the idea that due to a tied labour market and an educational system which do not adequately respond to employers' demand, delaying the forming of family appear as an opportunity for women to increase their education and skills so as to increase their chance to enter high job segments. Taken separately and without interaction, education and family formation exerts opposite effect on female employment. At this level, it becomes interesting to know how family formation influences the education – female employment nexus by observing the interaction term.

Interacting education with family formation brings about many changes in the models. This may be due to the significance of the interaction term which reveals that there is an indirect effect between education and female employment through family formation. Meaning that the total effect of education on female employment depends on the age at which a woman decides to form a family. First, Introducing the interaction terms of education and family formation makes the direct effect of education to change radically. Now education reduces the likelihood of female participation in full-time work, while the effect of family formation on female

employment still remains statistically significant. Second, the interaction between education and family formation increases the probability of female full-time employment, yet at reduced amplitude compared to the direct effect. Hence, an additional year in age at first marriage and age and first birth increases the marginal efficiency of education on female full-time employment just by almost 4% (against 15% and 16% respectively). Family formation acts as a modulator since it lessens the marginal efficiency of education on female full-time employment.

Additionally, the two effects of education and education\*family formation make the total effect of education to be negative. Meaning that, early family formation lowers the marginal efficiency of education on female employment. Yet, this total effect of education will be positive if and only if the woman delays her age at first marriage by at least 11 years, and her age at first birth by at least 12 years.

These findings imply that responsibilities attached to early marriage and childbearing sap the efficiency of education on female employment. Hence government could increase female legal age at first marriage which is considered as child marriage according to UNICEF (marriage under 18). It could also improve incentives to keep more girls in school, such as free secondary education for girls, especially in rural and remote areas of the country.

Given the key role played by education and family formation, both separately and jointly, government could ease female entering in full-time work and working conditions by: assisting the private sector in providing frameworks that are friendly for married women and mothers' employment; assisting financially and technically women in self-employment, and providing formal child care services.

# General Conclusion

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## C.1 Summary of the study

The main objective of this thesis was to examine how education affects transition into family formation, and the resultant effect on women's labour market participation in Cameroon. Due to the numerous benefits of education, it appears to separately affect family formation and female labour force participation. Indeed Cameroon has experienced improvement in its educational system, which according to the standard Human Capital Theories has resulted to increases in the participation rate of women in the labour market. Besides this effect, economists also noted that education plays a crucial role in determining when a woman decides to enter marriage and motherhood. Because of the important position occupied by marriage and children in Africa, especially in the Cameroonian context, this study appears to be exciting, and needs to be tackled in this sense.

Of course there is a large literature on female labour market participation in Cameroon, yet some either focused on factors explaining female labour force participation and sectorial choices (Tingum, 2016; Che and Sundjo, 2018; Totouom et al., 2018), on gendered wage-disparities (Kuepie et al., 2013; Ekamena et al., 2014; Ningaye et Talla, 2014; Baye et al., 2016; Zamo, 2018); or fertility and female labour participation (Zamo and Evou, 2006; Tsafack and Zamo, 2010; Kuepie et al., 2013). Yet, no study to the best of our knowledge simultaneously viewed the role of education from a marriage/birth timing and labour market perspective.

Hence, capturing transition into family formation by age at first marriage and age at first birth, we specifically examined: the effect of education on the timing of marriage; the effect of education on the transition into motherhood apprehended from a couple's view. Then, we explore how transition into family formation mediates or modulates the effect of education on female employment in Cameroon.

For this purpose, a theoretical model was developed in this thesis and from these analyses; several hypotheses were derived to be tested empirically using the Cameroon 2011 Demographic and Health Survey (DHS, 2011) and appropriate statistical tools. This was well detailed in chapter one of a conceptual framework.

To achieve the above objectives, they were tackled in three empirical chapters, namely: chapter 2, 3, and 4 respectively. Beside these, a general introduction and conclusion surrounding these chapters were also elaborated in this thesis.

## **C.2 Summary of main findings and policy implications**

### ***C.2.1 The effect of education on the timing of first marriage***

In chapter two, results from the non-parametric approach revealed that most marriages in Cameroon are considered as early marriages (below 18). Those from the semi-parametric method (Cox Proportional Hazard model) showed that as education level increases, the more a girl's risk of getting married decreases at increasing rate. Moreover, it was also found that unlike education, the Islamic religion induces women to enter early marriages compared to women from other religious denominations. Yet, interacting primary, secondary and tertiary levels of education with Moslem women, we found that only Moslem women with post primary education were likely to still postpone first marriage compared to those with no education, while those with primary education could not determine when to enter first marriage.

These findings imply that education tend to inculcate modern values in women which enable them to postpone first marriage whereas, the Islamic religion inculcates traditional values that encourage early marriage. Hence, policy makers could enlarge the schooling system from “*Free Primary for All*” to “*Free or compulsory Secondary for All or at least for girls*”, so as to permit girls to have a minimum decision power on their first marriage timing.

### ***C.2.2 The effect of education on the transition into motherhood***

In chapter three, we explore respectively how the education of the wife, of her partner, and of the couple determines the timing of the first child. Results revealed that when considering only wives' education, the more the level of education increases, the more they are likely to postpone first child birth compared to those with no education. When including their partners' education level, we noticed that only women with post primary education could still postpone first birth compared to those with no education, while those with primary could not. Additionally, unlike wives, husbands with primary and secondary level tend to shorten their wives' first birth timing. When verifying whether there is any coupled synergy in fertility timing, we found that there is a symmetrical effect of both spouses' desire, meaning that neither the wife nor the husband detain the absolute decision power on birth timing. This result

corroborates with some previous empirical findings, yet contradicts the patriarchal and the matriarchal decision rules on fertility among couples.

Like the previous chapter, we found that women's decision power over family formation (and with respect to religious affiliation) is achieved with the completion of at least the secondary level of education. This meets with this idea according to which:

*“The expansion of female secondary education may be the best single policy lever of achieving substantial reductions in fertility”* Subbarao and Raney's (1995, P. 36).

Hence, policies toward improving girls' secondary level attainment could be put in place such as scholarships. Furthermore, in order to create a synergy in fertility decision among couples, policy makers could improve sensitization concerning fertility toward men and encouraging their presence during their wives' pre-natal and family planning counseling.

### ***C.2.3 The effect of education on female employment through family formation***

Results from chapter four reveal that when considered separately without interaction, education and family formation acts contrariwise on female employment. While education opens up opportunities for women to increase their likelihood of participating in full-time employment, delaying family formation reduces their likelihood of participating in full-time work. Our finding could be justified by the idea that due to a tied labour market, delaying the forming of family may be an opportunity for women to increase their education so as to increase their chance to enter high job segments.

Introducing education times family formation brings about many changes. The direct effect of education on female employment changes radically while that of family formation remains practically unchanged, suggesting a stronger effect of family formation compared to that of education. As a result, transition into first marriage and first birth reduces the marginal efficiency of education on women's full-time employment, except if they choose to postpone their age at first marriage and age at first birth by up to 11 and 12 years, respectively. This finding implies that early marriages and childbearing hinder educated women to be fully-employed in the labour market.

Given the modulating effect of family formation on the education – female employment nexus, great concern should also be given to the timing of first marriage and child-giving. Hence, beside improvement in the educational system as proposed above, government could ease female entering in full-time work; improve working conditions, and facilitate family-work

balance. For example, decision-makers could increase female age at first marriage from 15 to 20 (above 18, threshold of early marriage); could increase employers' incentives to hire women; could enable parents, especially women to have flexible working schedule that suite better their family responsibilities; could improve the access to and availability of childcare services; and a universal paid maternity leave.

### **C.3 Constraints of the study**

The main constraint of this study has been that of using the DHS data because of the lack of an adequate Cameroonian database which captures information concerning reproductive, fertility and employment status. Even though the above analyses showed that most results are very robust, the use of the DHS dataset, reserved to health, reproductive, and fertility issues, is the not fully adequate to explore labour market outcomes. Because of this, this study had difficulty in finding adequate instruments as used in the empirical literature.

Since most household models in the theoretical literature were inspired from experiences from developing world, no typical model was developed for African economies whose experiences divert from those of the developed countries. Hence, another constraint encounter in this study has been to use inadequate (rich countries) models to explain household behavior in a developing country (Cameroon).

### **C.4 Suggestions for future research**

This study mostly focused on women, while studies concerning men are rare. A future research could enlarge the scope by considering men or carry out a gendered comparison analysis.

Concerning the theoretical framework, a future study could focus on constructing household models appropriate with the context of developing countries.



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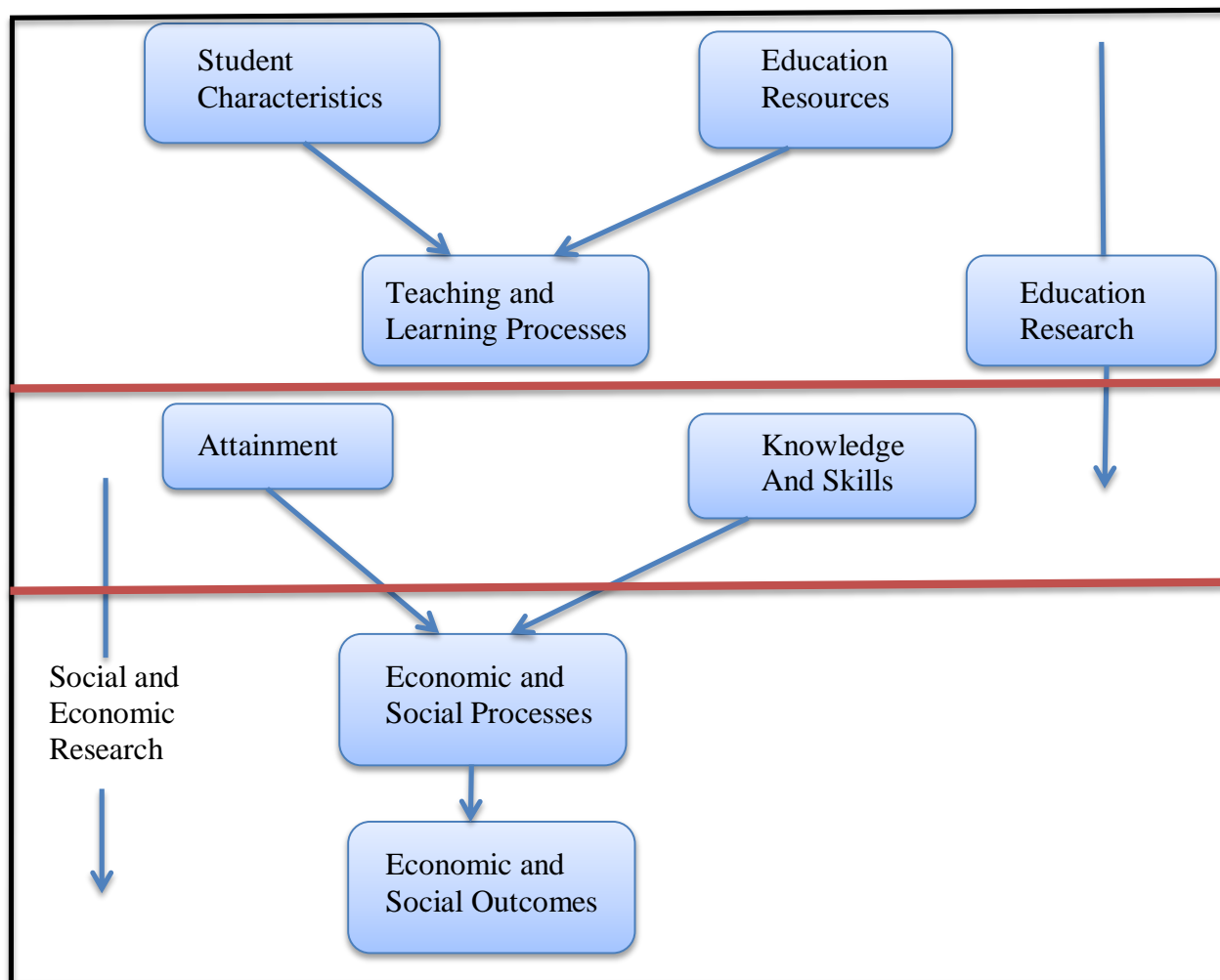
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## Appendix 1: Chapter One

**Figure A1 1: Conceptual Model of Education and Human Capital Development**



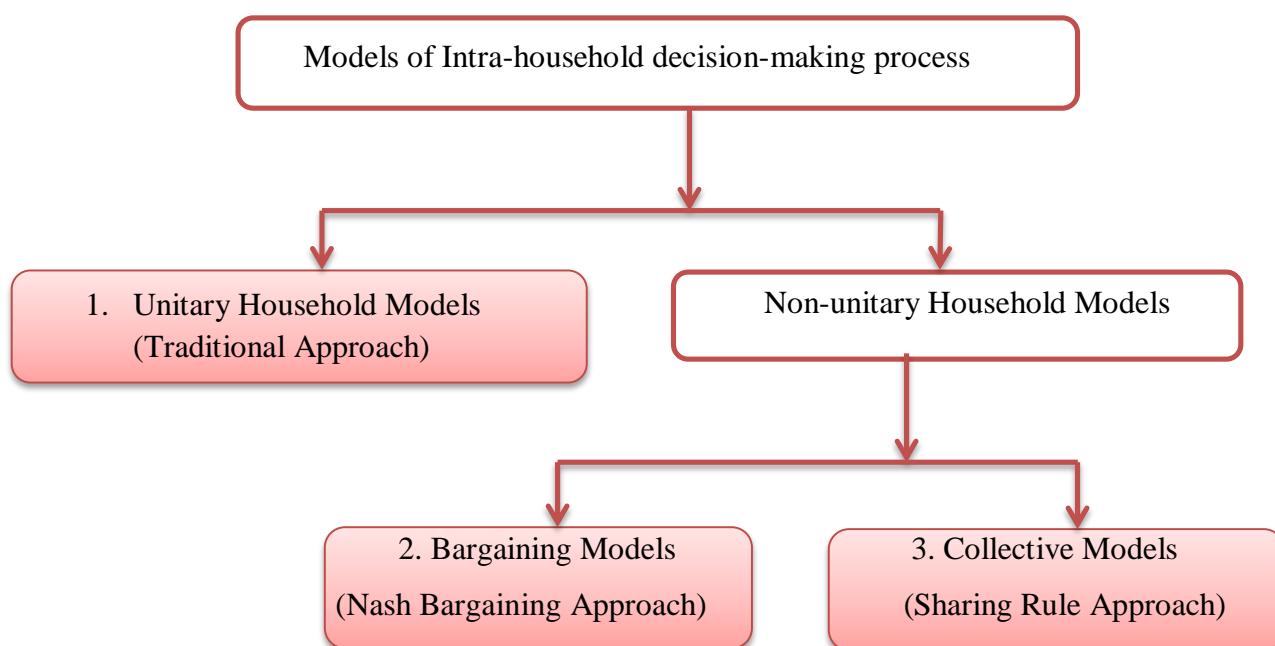
Source: Crocker (2006)

**Table A1 1: The International Standard Classification of Education (ISCED)**

| Education attainment              | Description  |
|-----------------------------------|--|
| <b>0=No Education/Pre-primary</b> | Initiation stage of organized instruction, designed primarily to introduce very young children to a school-type environment  |
| <b>1= Primary</b>                 | Normally designed to give students a sound basic education in reading, writing and mathematics.  |
| <b>2= Secondary</b>               | <ul style="list-style-type: none"> <li>- <b>Lower secondary:</b> The lower secondary education generally continues the basic programs of the primary level, although teaching is typically more subject-focused, often employing more specialized teachers who conduct classes in their field of specialization</li> <li>- <b>Upper secondary:</b> The final stage of secondary education in most countries. Instruction is often more organized along subject-matter lines than at Lower secondary and teachers typically need to have a higher level or more subject-specific qualification than at Lower secondary.</li> </ul>  |
| <b>3= Tertiary</b>                | <ul style="list-style-type: none"> <li>- <b>Post-secondary non tertiary:</b> These programs connect the boundary between upper secondary and post-secondary education. They are often not significantly more advanced than programs at Lower secondary but they serve to broaden the knowledge of participants who have already completed a program at secondary level. The students are typically older than those in Lower secondary programs.</li> <li>- ISCED 5A programs that are largely theoretically based and are intended to provide sufficient qualifications for gaining entry into advanced research programs and professions with high skills requirements.</li> </ul> |
| <b>3= Tertiary (ISCED 5)</b>      | <ul style="list-style-type: none"> <li>- <b>First stage of tertiary education:</b> Programs have an educational content more advanced than those offered at secondary levels and programs are generally more practical/technical/occupationally specific.</li> <li>- <b>Second stage of tertiary education:</b> The level is reserved for tertiary programs that lead to the award of an advanced research qualification. The programs are devoted to advanced study and original research (e.g. Ph.D. programs).</li> </ul>   |

Source: UNESCO/OECD (2001b, p. 206).

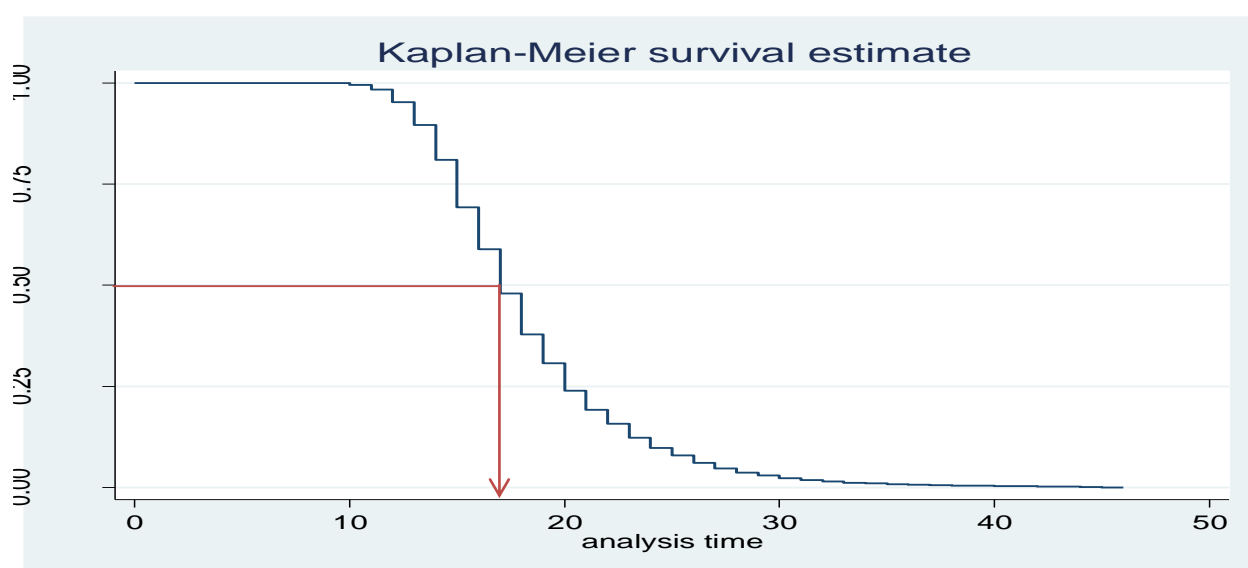
**Figure A1 2: Models of intra-household decision-making process**



**Source:** Author adopted from Nepal and Fukuda (2005)

## **Appendix 2: Chapter Two**

**Figure A2 1: Probability of transition into first marriage by age of women in Cameroon, 2011**



**Source:** Author, derived from Table 2

**Table A2 1:** Occurrence of first marriages for women by age in Cameroon

| <i>Age</i> | <i>Total number of women at the beginning</i> | <i>Occurrence of First Marriage</i> | <i>Censored</i> | <i>Proportion of never-married women</i> | <i>[95% Conf. Int.]</i> |               |
|------------|---|-------------------------------------|-----------------|--|-------------------------|---------------|
| 10         | 44791   | 201                                 | 27              | 0.9955                                   | 0.9948                  | 0.9961        |
| 11         | 44563   | 515                                 | 78              | 0.984                                    | 0.9828                  | 0.9851        |
| 12         | 43970   | 1377                                | 119             | 0.9532                                   | 0.9512                  | 0.9551        |
| 13         | 42474   | 2515                                | 241             | 0.8968                                   | 0.8939                  | 0.8995        |
| 14         | 39718   | 3811                                | 413             | 0.8107                                   | 0.807                   | 0.8143        |
| 15         | 35494   | 5168                                | 547             | 0.6927                                   | 0.6883                  | 0.6969        |
| <b>16</b>  | <b>29779</b>                                  | <b>4439</b>                         | <b>459</b>      | <b>0.5894</b>                            | <b>0.5848</b>           | <b>0.594</b>  |
| <b>17</b>  | <b>24881</b>                                  | <b>4618</b>                         | <b>391</b>      | <b>0.48</b>                              | <b>0.4753</b>           | <b>0.4847</b> |
| 18         | 19872   | 4184                                | 438             | 0.379                                    | 0.3743                  | 0.3836        |
| 19         | 15250   | 2868                                | 365             | 0.3077                                   | 0.3033                  | 0.3121        |
| 20         | 12017   | 2683                                | 221             | 0.239                                    | 0.2349                  | 0.2431        |
| 21         | 9113  | 1787                                | 217             | 0.1921                                   | 0.1883                  | 0.196         |
| 22         | 7109  | 1255                                | 216             | 0.1582                                   | 0.1546                  | 0.1618        |
| 23         | 5638  | 1235                                | 120             | 0.1236                                   | 0.1203                  | 0.1269        |
| 24         | 4283  | 894                                 | 120             | 0.0978                                   | 0.0948                  | 0.1008        |
| 25         | 3269  | 632                                 | 117             | 0.0789                                   | 0.0761                  | 0.0817        |
| 26         | 2520  | 585                                 | 103             | 0.0606                                   | 0.0581                  | 0.0631        |
| 27         | 1832  | 401                                 | 46              | 0.0473                                   | 0.0451                  | 0.0496        |
| 28         | 1385  | 320                                 | 69              | 0.0364                                   | 0.0344                  | 0.0384        |
| 29         | 996   | 167                                 | 27              | 0.0303                                   | 0.0284                  | 0.0322        |
| 30         | 802   | 195                                 | 32              | 0.0229                                   | 0.0213                  | 0.0246        |
| 31         | 575   | 111                                 | 17              | 0.0185                                   | 0.017                   | 0.0201        |
| 32         | 447   | 97                                  | 8               | 0.0145                                   | 0.0131                  | 0.0159        |
| 33         | 342   | 74                                  | 3               | 0.0113                                   | 0.0101                  | 0.0127        |
| 34         | 265   | 32                                  | 10              | 0.01                                     | 0.0088                  | 0.0112        |
| 35         | 223   | 32                                  | 1               | 0.0085                                   | 0.0075                  | 0.0097        |
| 36         | 190   | 41                                  | 7               | 0.0067                                   | 0.0057                  | 0.0078        |
| 37         | 142   | 20                                  | 11              | 0.0058                                   | 0.0049                  | 0.0068        |
| 38         | 111   | 19                                  | 7               | 0.0048                                   | 0.0039                  | 0.0057        |
| 39         | 85  | 14                                  | 2               | 0.004                                    | 0.0032                  | 0.0049        |
| 40         | 69  | 7                                   | 7               | 0.0036                                   | 0.0029                  | 0.0045        |
| 41         | 55  | 7                                   | 0               | 0.0031                                   | 0.0024                  | 0.004         |
| 42         | 48  | 8                                   | 1               | 0.0026                                   | 0.002                   | 0.0034        |
| 44         | 39  | 26                                  | 0               | 0.0009                                   | 0.0005                  | 0.0014        |
| 45         | 13  | 9                                   | 1               | 0.0003                                   | 0.0001                  | 0.0007        |
| 46         | 3   | 3                                   | 0               | 0  | .                       | .             |

**Source:** Demographic and Health Survey, Cameroon, 2011



## Appendix 4: Chapter Four

Table A4 1: Probit estimates of participation in the selection model

| <i>Variables</i>                                 | <i>Participation<br/>(1=work, 0 else)<br/>Coefficient</i> | <i>Participation<br/>(1=work, 0 else)<br/>Marginal effect</i> |
|--|---|---|
| Non-self-cluster mean of employment (instrument) | 2.3099***<br>(0.0990)                                     | 0.5659***<br>(0.0225)   |
| Age  | 0.1344***<br>(0.0147)                                     | 0.0329***<br>(0.0036)   |
| Age square                                       | -0.0015***<br>(0.0002)                                    | -0.0004***<br>(0.0001)  |
| Muslim   | -0.5091***<br>(0.0417)                                    | -0.1247***<br>(0.0100)  |
| Distance to water source                         | 0.0932**<br>(0.0399)                                      | 0.0228**<br>(0.0098)  |
| Rural  | 0.1467***<br>(0.0374)                                     | 0.0359***<br>(0.0092)   |
| Great west                                       | 0.1169***<br>(0.0413)                                     | 0.0286***<br>(0.0101)   |
| Great north                                      | 0.0261<br>(0.0461)  | 0.0064<br>(0.0113)  |
| Constant   | -3.4235***<br>(0.2409)                                    |   |
| Log likelihood                                   | -3894.9722  |   |
| Wald chi2  | 1436.3***   |   |
| Pseudo R2  | 0.1777  |   |
| Observations                                     | 8,870   | 8,870   |

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Source:** Author

Table A4 2: Probit estimates of determinants of education

| <i>Education (1 if education and 0 otherwise)</i> |                      |                        |
|---|----------------------|------------------------|
| <i>Variables</i>                                  | <i>Coefficient</i>   | <i>Marginal effect</i> |
| Non-self-cluster mean of education (instrument)   | 0.284***<br>(0.014)  | 0.050***<br>(0.002)    |
| Muslim  | -0.426***<br>(0.044) | -0.075***<br>(0.008)   |
| Distance to water source                          | -0.039<br>(0.057)    | -0.007<br>(0.010)      |
| Rural   | 0.096*<br>(0.053)    | 0.017*<br>(0.009)      |
| Great west  | 0.007<br>(0.061)     | 0.001<br>(0.011)       |
| Great north                                       | -0.533***<br>(0.068) | -0.093***<br>(0.012)   |
| Constant  | -0.251*<br>(0.129)   |                        |
| Estimation statistics                             |                      |                        |
| Log pseudolikelihood                              | -2791.535            |                        |
| Wald chi2(6)                                      | 2618.4***            |                        |
| Pseudo R2   | 0.4433               |                        |
| Observations                                      | 8,869                | 8,869                  |

Robust standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Source: Author

Table A4 3: Linear estimates of determinants of education\*family formation

| <i>Variables</i>   | <i>Education*average<br/>age at first marriage</i> | <i>Education*average<br/>age at first birth</i> |
|--|--|---|
| Non-self-cluster mean of education   | 2.4881***<br>(0.1970)                              | 2.1161***<br>(0.3030)                           |
| Non-self-cluster mean of education*average age<br>at first marriage (instrument) | -0.0872***<br>(0.0107)                             |   |
| Non-self-cluster mean of education*average age<br>at first birth (instrument)    |  | -0.0528***<br>(0.0158)                          |
| Average age at first marriage  | 1.3621***<br>(0.0982)                              |   |
| Average age at first birth   |  | 0.7719***<br>(0.1482)                           |
| Muslim   | -1.7449***<br>(0.2023)                             | -1.9795***<br>(0.2319)                          |
| Distance to water source   | -0.0685<br>(0.1242)                                | 0.0935<br>(0.1445)                              |
| Rural  | 0.3077**<br>(0.1399)                               | 0.2951*<br>(0.1608)                             |
| Great west   | 0.2754***<br>(0.0975)                              | 0.4660***<br>(0.1159)                           |
| Great north  | -2.9925***<br>(0.2790)                             | -3.6773***<br>(0.3098)                          |
| Constant   | -14.0388***<br>(1.7561)                            | -5.1210*<br>(2.7507)                            |
| Estimation statistics  |  |   |
| F (8, 8860)/ F (8, 9795)   | 1633.86***   | 1172.07***                                      |
| R-squared  | 0.5823   | 0.5299  |
| Root MSE   | 5.2577   | 5.7355  |
| Observations   | 9,804  | 8,869   |

Robust standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Source: Author

# Summary

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