Essays on Early Marriage Across Sub-Saharan Africa: An Economic Perspective

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Abstract

Rates of early marriage, here defined as any legal or customary union involving a male or female below the age of 18, have declined significantly over the last decade. However, progress has not been equitable, and rates of early marriage remain extraordinarily high in parts of Sub-Saharan Africa. There is widespread consensus that early marriage causes a significant disruption in a child's accumulation of human capital and has significantly negative intergenerational repercussions. Using a combination of secondary data from the Demographic and Health Surveys (DHS) and experimental data from the field, this thesis will empirically explore the phenomenon of early marriage across Sub-Saharan Africa.

Chapter 1 of this thesis explores associations between adolescent nuptiality and fertility patterns using the most recent Demographic and Health Survey datasets for thirty countries of Sub-Saharan Africa. Unlike previous studies examining marriage and fertility trends, we expand the adolescent period to more refined age categories to better capture age-specific variations in female sexual, marital and reproductive trajectories. Overall, results suggest that among middle adolescents (ages 15 to 17), marriage-specific fertility levels are 4% higher than the fertility levels of women marrying as adults. However, variations between countries are substantial, and some results significantly contradict the assumptions of the aggregate fertility model. We speculate that some differences between countries are due to inconsistencies in domestic marriage laws. In addition to examining fertility levels, we also investigate precise marriage-birth sequences and find that most adolescent births result from marital conception. However, we find some evidence of middle adolescent premarital sexual activity that led to birth within the first eight months of marriage. The chapter concludes with a case study on Ghana, examining whether a domestic law criminalising underage marriage effectively reduced its incidence, and whether this law had an overall demographic effect. Using a multi-stage regression discontinuity design, results indicate that early marriage reduced by approximately 6% due to Ghana's 1998 Children's Act. This reduction simultaneously increased the age of women at first birth by delaying marriage. Furthermore, our results found an overall welfare-improving effect, with reduced reports of emotional, sexual and physical domestic violence against women.

In Chapter 2, using lab-in-the-field experimental and comprehensive survey data, we examine whether age at first marriage affects the willingness of husbands and wives to cooperate to maximise household gains. Among the Bagisu of East Uganda, we find that women who marry older are more cooperative with their husbands. In a series of corresponding inter-household games, we conclude that

female behaviour is not driven by the selection of more cooperative women into progressively later union, but by the marriage institutions' effect. As an extension to the core analysis, we further examine the role of education and the cultural practice of Bridewealth on rates of cooperation. This chapter concludes by evaluating the linkages between the behaviour exhibited in our intrahousehold games and spousal behaviour in everyday lives. We find that pre-existing cooperative behaviours positively correlated to in-game contributions, particularly for husbands. Here, we add to the recent literature that focuses on correlates between behaviour in the lab and real-life behaviour.

In Chapter 3, using an original, multi-stage sampling strategy, we further investigate intrahousehold behaviour using a modified version of the Trust Game. Data gathered via an initial census allowed us to assign households to early and later marriage stratifications, based on the wife's age at marriage. As in previous studies, our results appear inconsistent with the assumption of Pareto efficiency in household decision-making. We reject the unitary and collective household models and identify early marriage as a channel through which trust and reciprocity can affect low household efficiency levels. Specifically, we find that women married as a 'child' exhibit less trust to their husbands than women who marry as adults. In a series of interactions with education, we observe that the negative effect of early marriage on female trust is the same, even with increased levels of education. By employing a within-subject design to our lab-in-the-field experiment, we directly compare intrahousehold behaviour with stranger counterfactuals. We find weak evidence suggesting that women married under 18 trust men from other households less. Similarly, men who married a bride under 18 exhibit significantly less trust to women from different households. We do not, however, observe any significant behaviour from men in our intrahousehold treatment. Throughout, our results are robust to a wide variety of control variables, and we find evidence suggesting that lab behaviour roughly mirrors analogous real-life household behaviour.

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Finally, I wish to dedicate this thesis to my mother, Angela:

You may have tangible wealth untold;
Caskets of jewels and coffers of gold.
Richer than I you can never be–
I had a Mother who read to me.

— Strickland Gillilan (1869-1954)

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Introduction

Statistics from UNICEF (2021) reveal that worldwide, an estimated 650 million women alive today entered their first marriage before they turned 18 years old. Rates of early marriage, here defined as any legal or customary union involving a male or female below the age of 18, have declined significantly over the last decade; however, it is now estimated that an additional 10 million women are expected to marry early due to the COVID-19 pandemic (UNICEF, 2021). Health, education, social networking, and livelihoods have been severely disrupted by the pandemic, creating an environment conducive to early marriage, particularly in Sub-Saharan Africa, where rates were already high for women.

Current research indicates that early marriage can infringe on economic development through its interactions with formative adolescent development, education, fertility behaviours, mental and physical health, labour force participation, and autonomy in household decision-making (Mathur et al., 2003; Field and Ambrus, 2008; Raj and Boehmer, 2013; Parsons et al., 2015; Hicks and Hicks, 2015; Wodon et al., 2016; John et al., 2019; Bengesai et al., 2021). These findings have raised researcher consciousness on the pervasiveness of early marriage and elevated concerns among policymakers about their role in its perpetuation. The latter is made evident by the intensity of legislative change in the last decade, ratifying international conventions such as the Convention on the Elimination of All Forms of Discrimination against Women (UN General Assembly, 1979). These laws seek to criminalise underage marriage and reform the minimum age to 18 in most countries of Sub-Saharan Africa. However, there is little evidence regarding the efficacy of standalone legal approaches to reducing early marriage, and inconsistency in legal prescription poses a significant challenge (Maswikwa et al., 2015; Santelli et al., 2019).

Structural poverty and inequitable gender norms are both a cause and a consequence of early marriage (Lee-Rife et al., 2012). Gender relations across the Sub-Saharan continent are mainly characterised by patriarchal socio-cultural values and norms, with a few notable exceptions[1]. Ascribed gender roles, decision making-patterns (affecting household hierarchies), customs and legislation regulating access ownership over resources constrain women's rights, privileges and autonomy. In addition to facing these gender-based inequalities, women that marry young also face age-based inequalities (Otoo-Oyortey and Pobi, 2003). Marriage leads to substantial changes in the lives of young women and requires transitioning abruptly into adult roles and responsibilities - often before she is developmentally ready to take on these responsibilities (Mathur et al., 2003). Consequently, brides under 18 begin as subordinates in a newly wedded household by virtue of their age, gender, and lack of education.

To shed further light on this dynamic, in this thesis we investigate a series of *ex-post* outcomes for women that married below age 18 in Sub-Saharan Africa. We specifically focus on fertility patterns, intrahousehold cooperation, and the extent

[1]We make specific reference to the "The matrilineal belt", which extends from western Congo through northern Zambia, central and southern Malawi, and northern Mozambique (Johnson, 2016).

to which husbands and wives are willing to trust one another to maximise household gains.

In Chapter 1, we examine precise fertility and nuptiality patterns using the most recent Demographic and Health Survey (DHS) datasets for 30 countries of Sub-Saharan Africa. Unlike previous studies, we expand early marriage to distinct adolescent age categories: early, middle, and late adolescence. This strategy allows us to examine age-specific variations in female sexual, marital and reproductive events trajectories. Overall, we find very mixed results for individual countries, but the aggregated data suggests that marriage-specific fertility among 15 to 18 years old is 3-to-4% higher than those women that marry as adults. In addition to examining fertility levels, we also examine precise marriage-birth sequences; here, we find that most adolescent births result from marital conception. However, we do find evidence suggesting premarital sexual activity of adolescents, leading to a birth within the first eight months of marriage.

The chapter concludes with a case study on Ghana, examining whether a domestic law criminalising underage marriage effectively reduced its incidence and whether this law had an overall demographic effect. Using a multi-stage regression discontinuity design, results indicate that early marriage reduced modestly among women by 6% due to Ghana's 1998 Children's Act. This reduction simultaneously increased the mean age at first marriage by 1.2 years. Furthermore, empirical results suggest that a one-year delay in marriage increased mean age at first birth by approximately 1.1 years.

This chapter makes three contributions to the literature. First, we examine age-specific variations in women's achieved fertility by decomposing early marriage into the adolescent age categories recommended by Dixon-Mueller (2008). In doing so, we found considerable differences between countries which previous studies have failed to identify. Second, we are the first study to use the DHS data to calculate probabilities of marriage-birth sequences for adolescent age categories. Third, this is the first study to exploit a change in marriage law to assess differences in women's nuptiality and fertility outcomes. We hope to have demonstrated that age discontinuities - brought about by the criminalisation of underage marriage - are a viable means to assess local, average treatments effects of delaying entry into marriage. The validity of our analysis is confirmed via robustness checks and placebo testing.

In Chapter 2, using lab-in-the-field experimental and survey data, we investigate whether age at first marriage affects the willingness of husbands and wives to cooperate to maximise household gains. Results from a public goods game reveal that, among the Bagisu of East Uganda, each additional year that marriage is delayed is associated with a 1% increase in female contributions to a common household pool. Behaviour in a corresponding series of interhousehold games indicates that cooperative behaviour is not driven by the selection of women into a progressively later marriage, based on their differential willingness to cooperate

with men. Instead, increased female cooperation, attributable to their increased age at marriage, is due to the marriage institution's effect rather than purposeful selection.

Specific to the context we are studying, we extend the core analysis to examine the role of education and the cultural practice of bridewealth on rates of cooperation. Here we find that, with some secondary education, an increase in women's age at first marriage by one year increases intrahousehold cooperation by approximately 4%. However, we also observe that secondary education interacted with a household's low wealth status, undermine the cooperative gains from increased age at marriage. For bridewealth payments, we observe a negligible effect on intrahousehold cooperation. However, due to data collection issues centred around non-responses from men, we do not place a significant emphasis on our results. Instead, we provide recommendations for improving this area of enquiry.

This chapter concludes by evaluating the linkages between the behaviour exhibited in our intrahousehold games and spousal behaviour in everyday lives. We find that pre-existing cooperative behaviours positively correlated to in-game contributions, particularly for husbands. Here, we add to the recent literature that focuses on correlates between behaviour in the lab and real-life behaviour.

Chapter 3 extends the analysis from Chapter 2 by isolating early marriage as a channel through which trust and reciprocity can affect household efficiency levels. Using an original, multi-stage stratified sampling methodology, we investigate intrahousehold behaviour using a modified version of Berg et al. (1995)'s Trust Game. Data gathered via an initial census allowed us to assign households to early and later marriage stratifications, based on the wife's age at marriage. As with previous intrahousehold studies, our results appear inconsistent with the assumption of Pareto efficiency in household decision making. We reject the unitary and collective household models and find that women married as a child exhibit less trust to their husbands than women who marry as adults. In a series of interactions with education, we observe that the negative effect of early marriage on female trust is the same, even with increased levels of education.

By employing a within-subject design to our lab-in-the-field experiment, we directly compare intrahousehold behaviour with stranger counterfactuals. We find weak evidence suggesting that women married under 18 trust men from other households less. Similarly, men who married a bride under 18 exhibit significantly less trust to women from different households; we do not, however, observe any significant behaviour from men in our intrahousehold treatment. Throughout, our results are robust to a wide variety of control variables, and we find evidence suggesting that lab behaviour roughly mirrors analogous real-life household behaviour.

Both Chapters 2 and 3 contribute to the literature in two ways. First, we contribute to the growing literature on cooperation between spouses in lab-type

experiments. Typically, studies in this area focus on monogamous households, augmenting inherent features of games to investigate specific mechanism such as bargaining, asymmetric information and communication features. We are the first study to use experimental methods to investigate the effect of bride's age at first marriage. Considering that more than half of young women marry before 18 (Koski et al., 2017; UNICEF, 2018), contravening international agreements and minimum-age-at marriage laws, understanding this phenomenon is highly relevant yet underexplored in current studies.

Second, we add to the literature on the socioeconomic repercussions of early female marriage. Specifically, we find that households where the bride married below age 18 are less efficient than those households where the bride married as an adult, insofar as they choose strategies that do not maximise aggregate pay-off. As a conjugal unit, differences in cooperation and trust can lead to severe efficiency losses for the household. Increasing age at marriage for women thus has a very clear macroeconomic benefit.

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Chapter 1

Early Marriage and Fertility Behaviour in Sub-Saharan Africa: A Multi-Country Study Using Demographic and Health Survey Data

ABSTRACT

Globally, the transition from high to low fertility is well underway, except for a few Sub-Saharan African countries. A closely linked aspect of the fertility transition is nuptiality patterns, where historically, lower age at first marriage has been associated with a higher Total Fertility Rate. This chapter explores associations between nuptiality and fertility patterns using the most recent Demographic and Health Survey datasets for thirty countries of Sub-Saharan Africa. We capture better age-specific variations in female sexual, marital and reproductive trajectories using expanded adolescent age categories. Overall, results suggest that among middle adolescents (ages 15 to 17), marriage-specific fertility levels are 4% higher than the levels of women marrying over 18 years. However, variations between countries are substantial, and we speculate that some differences are due to inconsistencies in domestic marriage laws. The chapter concludes with a case study on Ghana, examining whether a domestic law criminalising underage marriage reduced incidences of early marriage and whether this law had an overall demographic effect. Using a multi-stage regression discontinuity design, results indicate that early marriage reduced by approximately 6%. This reduction simultaneously increased age at first birth by delaying marriage.

Keywords: Early Marriage, Fertility, Demographic and Health Surveys, Sub-Saharan Africa

1.1 Introduction and Motivation

Globally, the transition from high to low fertility is well underway, with the exception of a few Sub-Saharan African (hereafter SSA) countries. Several factors have been attributed to this fertility transition, including macro-level structural and economic changes, and micro-level cultural value orientations. However, the recent pace of fertility decline in Africa is substantially slower than those transitions in Asia and Latin America during the 1970s (Bongaarts and Casterline, 2013). In fact, in some SSA countries, the fertility transition has stalled with a Total Fertility Rate of approximately five children per woman (Bongaarts and Casterline, 2013).

A closely linked aspect of the fertility transition is nuptiality patterns (Lesthaeghe, 1971); nuptiality is a direct determinant of fertility, and variations often precede a country's fertility transition. The precise interplay between nuptiality and fertility preferences (and the ability to act upon those preferences) are reflective of social and family structures (Beatty, 2016). Marriage is a structure that organises gender differences, and where "individual and conjugal autonomy are defined" (Beatty, 2016, p. 26). Women's agency and gender-based issues are thus important factors in reproductive behaviours.

Regarding nuptiality patterns, there are three notable differences between SSA and other developing regions. First, the mean age at first marriage is low at 18.3 years[1] in comparison to Latin America and the Caribbean, averaging 19.4 years, and Asia approximately 19 years based on most recent Demographic and Health Survey data (hereafter DHS). Second, the mean age difference between spouses is large at an average of 7.1 years across SSA (DHS), compared with 2.9 and 3.2 years older in Latin America and Asia, respectively (Beatty, 2016). Finally, and more broadly, the DHS consistently identifies a lack of accord between husband and wife on the desired number of children, with men - on average - desiring more. Patterns of ideal family size suggest distinctive pronatalist features of African societies (Bongaarts and Casterline, 2013), and men's strong fertility preferences (Mason and Taj, 1987). Fertility is, therefore, a central intrahousehold negotiation (Deschênes et al., 2020). Nuptialaity features such as universal marriage for both sexes, early marriage for women, prompt remarriage for widows and divorcees, and polygynous arrangements mean that women spend most of their reproductive life (ages 15 to 49) in a union.

This study explores associations between early marriage and fertility levels, using aggregated data from the most up to date DHS data for thirty SSA countries. We contribute to the literature by decomposing adolescence into more refined age categories to better capture age-specific variations in women's fertility. In doing so, we found considerable differences between adolescent women and between countries, which previous studies have failed to identify.

[1] Mean average calculated from thirty SSA countries.

Aggregated data suggests that marriage in middle adolescence (ages 15 to 17) is associated with a 4% higher fertility across the SSA region compared with the fertility levels of those women marrying over 18. These results are robust to the inclusions of a range of socioeconomic and household-level variables. Country-specific specifications, however, reveal that precise patterns of adolescent fertility and nuptiality differ significantly. In Gabon, for example, we find that women married in middle adolescence have 30% higher fertility than those married over 18. We primarily attribute this result to Gabon's age at marriage laws, which sets a minimum age of 15 for women.

Overall, we observe a positive and statistically significant association between marriage in middle adolescence and achieved fertility. However, in many countries, we cannot find any discernable associations between adolescent marriage and fertility levels. In some cases, we observe significantly lower fertility for those women married in early adolescence than women who married as adults. These results contradict core assumptions of the Aggregate Fertility Model proposed by Bongaarts et al. (1984).

In addition to examining fertility levels, we also use DHS data to examine precise marriage-birth sequences for adolescent categories. Our results suggest that most adolescent births result from marital conception. However, we do find evidence suggesting premarital sexual activity of middle adolescents, leading to a birth within the first eight months of marriage.

Studying the precise interplay between early marriage and the fertility behaviour of women is a challenging area of research due to the multiplicity of mechanisms that result in one marrying as a child and becoming a parent soon after. Like any decision faced by rational parties, marriage and childbearing are forward-looking decisions involving a myriad of preferences, expectations, and uncertainty. Furthermore, behavioural and psycho-social elements (such as self-control, self-efficacy, self-esteem and self-confidence) and sociocultural context (social norms, gender roles, and prevailing stereotypes) play a crucial role. The links between early marriage and specific outcomes, including fertility, may be driven by unobservable traits or by reverse causality. Statistical associations should not, therefore, be interpreted as the causal effects of early marriage. Similar to studies examining the predictors of risky sexual behaviours in adolescents (such as Favara and Sanchez (2017)), we do not seek to infer causality with our adolescent age categories. Instead, this study has identified the combination of early circumstances that induce a higher probability of achieved fertility.

To assess the causal effect of early marriage and overcome issues of endogeneity, some researchers have used age at menarche as an instrumental variable for age at marriage (pioneered by Field and Ambrus (2008)). This approach exploits quasi-random variation generated by women's age at menarche as a source of exogenous variation. However, we do not feel that this approach fully satisfies the exclusion restriction, as it underestimates the effects of environmental factors. In particular,

stress induced from extreme or traumatic events in childhood (which can have long-term effects on socioeconomic outcomes) has been linked to dramatic changes in normal menstruation (Wierson et al., 1993; Karapanou and Papadimitriou, 2010).

While the researcher cannot randomise early marriage for rigorous quantitative analysis, credible exogenous variation can be attained by exploiting a change in law that imposes a practical "cut-off" point. Over the last few decades, many countries with a high prevalence of early marriage practices have ratified different international accords, including Article 16 of the Convention of the Elimination of All Forms of Discrimination Against Women (CEDAW, 1979), Convention on Consent to Marriage, Minimum Age for Marriage, and Registration of Marriage (1964), and Article 21 of the African Charter on the Rights and Welfare of the Child (1999), which requires the effective prohibition of child marriage, and that the minimum age for marriage be set at 18 years. However, to date, there is little evidence regarding the efficacy of standalone legal approaches to reducing early marriage, and inconsistency in legal prescription poses a significant challenge (Maswikwa et al., 2015; Santelli et al., 2019).

Using the 1998 Ghana Children's Act, which criminalised marriage under 18 with a no exceptions clause, we use a Regression Discontinuity Design (RDD) to assess changes in women's nuptiality and fertility patterns. Our estimates suggest that criminalisation increased women's age at first marriage by 0.8 to 1.2 years, reducing the incidence of early marriage by approximately 6%. Furthermore, RDD estimates suggest that a one-year delay in marriage increases the age at first birth of women by 1.1 to 1.2 years, suggesting an overall improvement in adolescent sexual and reproductive health.

To the best of our knowledge, this is the first study to exploit a change in marriage law to assess women's nuptiality and reproductive outcomes. By moving away from the use of age at menarche as an instrumental variable, we hope to have demonstrated that age discontinuities brought about by criminalisation (while not perfect) are a viable means to assess socioeconomic and demographic outcomes of women marrying above and below the 18 year threshold.

This remainder of this chapter is structured as follows: Section 1.2 begins by reviewing the econometric modelling of marriage and fertility, assessing the historical evidence of legal age at marriage on fertility inhibition, and discussing the current empirical evidence in SSA that examine age at first marriage and fertility behaviours. Section 1.3 provides details on sample construction, and we discuss our key variables of interest with particular reference to our adolescent age categories. Section 1.4 presents our estimation strategy, and core analysis is conducted in Section 1.5. In Section 1.6 we discuss marriage sequence probabilities. In section 1.7 we present our case study of Ghana, using a Regression Discontinuity Design to assess the impact of legislative change on early marriage and fertility. Finally, in Section 1.8, we discuss our findings and conclude.

1.2 Related Literature

1.2.1 Modelling Marriage and Fertility

The precise factors affecting fertility can be classified into two groups: background variables and proximate variables. The former includes cultural, psychological, economic, social, and environmental factors. The proximate determinants are those factors that have a direct bearing on fertility, including contraceptive use and a person's age at marriage. Background factors operate through the proximate determinants to influence fertility; they do not influence fertility directly.

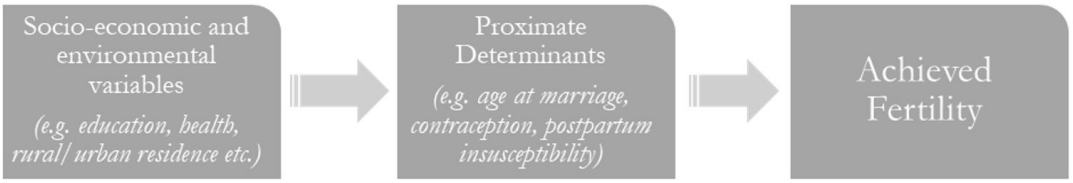

Figure 1.1: Aggregate Fertility Model

The aggregate fertility model proposed by Bongaarts et al. (1984) and summarised in Figure 1.1, identify biological, behavioural and cultural factors as the 'proximate' determinants of fertility. Such modelling implies that the onset of fertility decline does not strictly depend on a set level of development, nor is the transitional path predetermined by socioeconomic factors such as levels of education, female employment, nor urbanisation. Thus, the proximate determinants of fertility are more relevant in explaining changing fertility patterns and behaviour, given that they represent overt mechanisms through which the reduction of fertility has, and may well continue, to occur. The age at which a woman marries, therefore, is considered an important proximate determinant of fertility (Bongaarts, 1978), provided that conception occurs after (or around) the point of marriage. Without effective contraceptives, younger ages at first marriage indicate early exposure to regular sexual intercourse, translating into early childbearing (WHO, 2011; Solanke, 2015).

In more recent years, social scientists have given greater credence to elements of individual rationality in fertility determinants. In general terms, households in traditional societies (particularly in agrarian contexts) have many children because they believe it to be in their best interests. Consequently, a growing body of economic literature has emerged over the last two decades, examining the role of subjective expectations in observed martial and fertility behaviours. Carrasco (2012) found that, in the case of the Dominican Republic, high incidence of

teenage fertility were closely related to a lack of life goals and perceived lack of opportunities. This behaviour was particularly apparent among households classified in the lowest wealth quintile. Such negative perceptions regarding future prospects - or lack thereof - are corroborated by the testimonials of young women (see, for example, recent reports published by Human Rights Watch) and further exacerbated by the ongoing COVID-19 pandemic (UNICEF, 2021).

Similarly, empirical studies of the US and the UK suggest that teenagers' positive attitudes concerning future personal prospects negatively affect their likelihood of becoming parents in the interim (Plotnick (1992, 1993); Plotnick et al. (2007)). The argument put forward by Plotnick closely aligns itself to the "Marriage Market" model of Becker (1974), where adolescents with higher opportunity costs (indicated by better grades and higher aspirations post-compulsory-level schooling) condition their expectations accordingly; they then choose to marry and have children later in their lifespan.

Behavioural changes (accelerated via communication activities organised by heath facilities, community-based non-governmental organisations and mass media campaigns) have generally sought to change social norms and promote an enabling and supportive environment for delayed marriage. See, for example, Figure 1.2. Such communication programmes seek to educate communities on the risks and disadvantages of early marriage and childbearing whilst promoting egalitarian gender norms and socioeconomic opportunities for both men and women.

Figure 1.2: Example of poster campaigns to promote delayed marriage and childbearing among primary school children: Image taken by author in Sironko district, Uganda.

1.2.2 Legal Marriage Age: A Historical Means of Demographic Control

In conjunction with a decline in death rates (which have occurred at much lower per-capita income levels than in the now-developed countries), several SSA countries face population growth rates in excess of 3%. While plateauing since the 1970s, the average annual rate of population change remains extraordinarily high (see Figure 1.3). Figure 1.4 projects total population figures for SSA until 2100, based on the annual rates of population change. Such rapid population growth is leading to increased demand for social services, particularly health and education. This growth is also associated with a high dependency ratio, which can hinder the economic development of countries (Eastwood and Lipton, 2011; Cruz and Ahmed, 2018).

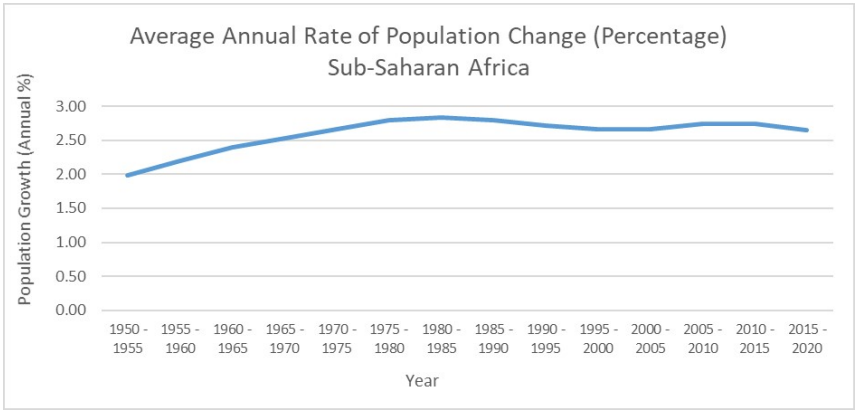

Figure 1.3: Rate of Population Change: United Nations, Department of Economic and Social Affairs, Population Division (2017).Custom data acquired online.

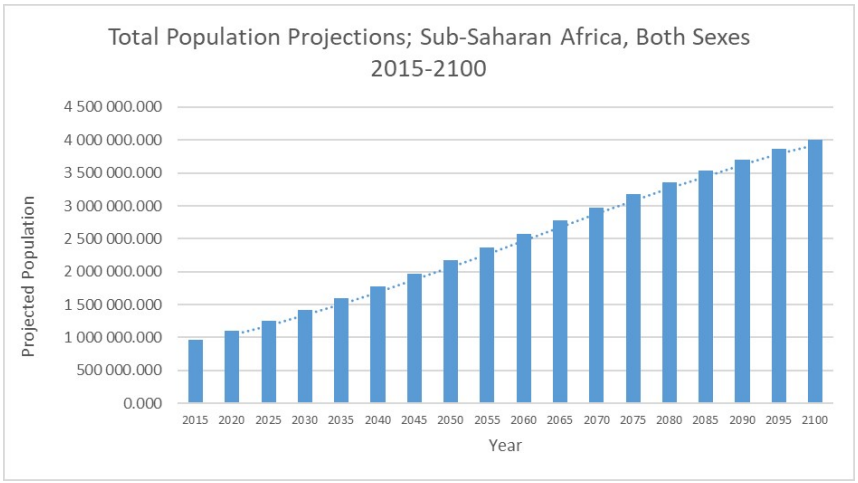

Figure 1.4: Population Projections: United Nations, Department of Economic and Social Affairs, Population Division (2017). Custom data acquired online.

Many proposals for delayed entry into marriage are based on the East and Western

European historical experience. Early entry into marriage was characteristics for both sexes and produced birth rates which - even at their highest recorded peak - were still lower than many of the crude birth rates currently experienced by African countries. Historically, marriage behaviour functioned as a means of demographic control in Europe: fertility was moderate at a later age at marriage; with early and universal marriage, fertility was markedly higher. This pattern, characteristic of the late eighteenth and nineteenth centuries, causally presumes that age-at-marriage-restrictions have a very rational, macro-economic goal: to avoid population pressures and so avert 'Malthusian' disasters. Until the widespread dissemination of contraception methods within marriage, the only so-called 'limit' on fertility was the number of years fecund women lived in matrimony. Consequently, early marriage increased women's period of exposure to unprotected sexual intercourse in a time where, biologically, she is at her most fertile (menarche to 30 years of age).

Responding to the challenge of overpopulation, a deliberate shift in Western European marriage patterns towards later age at marriage significantly diminished total fertility rates. This result was later corroborated by historians who confirmed that the later mean age of marriage for a woman (approaching her late twenties) resulted in European women averaging four to five births instead of six to seven had she married five years earlier. Given pre-industrialised Europe's typical short life expectancy and low levels of childbirth out of wedlock, restrained fertility levels due to a later mean age of marriage substantially diminished the resulting rate of population growth. Exceptions to this pattern occurred most frequently at the "frontiers of settlement" (Schultz, 2007, p.3) where labour was characteristically scarce, land abundant, and marriage early.

As amply illustrated by Eastern and Western Europe's demographic histories, a deliberate policy of delayed marriage would "most likely be an effective means of population control" (Sklar, 1974, p.246). The extent to which it is a viable means, however, remains questionable. In several historical case studies, particularly in Polish and Czech areas - institutional arrangements predisposed persons toward later marriage and had the foundations of an "anti-natalist" programme in structural arrangements (Sklar, 1974, p.246). For example, the migration of single women to urban areas in search of employment was common practice in Polish regions. This migration skewered sex ratios, leading to a shortage of men in urban areas and women in rural locations, making marriage difficult. Consequently, there was no real need to search for population control policies in these countries. In direct contrast, the Balkans had crude birth rates exceeding 40 per 1,000 from 1860 onwards[2]. A policy of delayed entry into marriage could have been successful in slowing population growth in this region. However, the combination of a worsening economic situation and spiralling population numbers was insufficient to motivate the Balkan government to take such a direct measure. Sklar (1974) comments that the institutions that favoured early marriage and high Balkan fertility were precisely those that, in any society, are most deeply entrench and

[2]A crude birth rate exceeding 30 per 1,000 is considered "high".

highly resistant to change. Given the powerful kinship and religious forces in the context of an economic system that provided few (if any) viable alternatives to marriage, "one could hardly have expected a different response" from the government (Sklar, 1974, p.246).

Moving to present day, a sceptic could question the demographic effectiveness of imposing legal sanctions seeking to restrict early marriage, quoting the argument that the interim between ages 18 and 49 (the upper limit of a reproductive age period) remains sufficiently long to give a fertile woman the same number of live births as if she were married at say 16. However, one must discriminate between a woman's physical reproductive capacities and *her desire* to bear children. If the desire to reproduce can be significantly influenced by the age at which a woman marries (particularly in cases where she is free to act of her own volition), then later marriage should yield a considerable impact on fertility. The sceptical view underestimates the behavioural implications of a change in marriage laws and patterns.

Of the thirty Sub-Saharan countries considered in this study, twenty six have legislated a minimum age of 18 years for women at marriage; almost half of these laws, however, contain provisions that allow children to marry in certain circumstances; please see Table 1.14 on page 1-57 for a comprehensive list of domestic laws. Progress towards eliminating early marriage has been remarkably slow in these countries, attributable to many reasons already discussed.

Nonetheless, the extent to which marriage laws can (or cannot) effectively reduce early marriage is the first step to understanding the full extent of the problem. Currently, and to the best of our knowledge, the only study quantifying the effect of marriage laws on incidences of early marriage is Hombrados (2017). This study examines Ethiopia's Revised Family Code that increased the legal marriage age from 15 to 18. Using a Regression Discontinuity Design, Hombrados (2017) found that the new law, while not perfectly enforced, reduced early marriage by approximately 20% in some Ethiopian regions.

1.2.3 Empirical Evidence from Sub-Sahara Africa

In a recent multi-country study, Melesse et al. (2021) found that early marriage and childbearing has gradually declined since 1990, but as of 2015, levels are still very high. Large and significant differences in marriage and childbearing were observed between adolescent women from rural versus urban areas and those from the poorest and wealthiest quintiles. These urban-rural and wealth-related inequalities remained stagnant and, in some cases, widened from 2000 to 2015.

Consistently, empirical studies have reported significant associations between age at

marriage and lifetime fertility, notably in Uganda and Rwanda. For Uganda, Ariho et al. (2018) found that the major contribution to the reduction in fertility between 2006 and 2011 was due to increased education and delayed marriage among women. Later, Ariho and Kabagenyi (2020) quantified age at marriages' contribution to the changes in fertility behaviour at 20.6%. The reduction in fertility was principally affected by changes in age at first sex (43.5%).

For Rwanda, women aged 25 years or older at first sex had less than half the fertility of women whose first sex was before age 19 in both married and never-married households (Ndahindwa et al., 2014). Rutayisire et al. (2014) further found evidence that a decrease in the proportion of women currently in unions contributed significantly to the lowering of Rwanda's fertility between 1992 and 2000. However, changing reproductive behaviour revealed that women's fertility in marriage was higher in 2000 compared to 1992. The decrease in the proportion of women in unions was more than offset by the shift in their reproductive behaviours, and thus, fertility remained high.

Many of the empirical observations discussed here complement the work of Hertrich (2017), who found that fertility decline is not possible where the age at first marriage is below 18. Using national surveys and census data, Hertrich (2017) observes that no country saw the onset of a fertility decline while adolescent marriage prevailed. She notes that, in most cases, fertility begins to decline after the median age at first marriage reaches 19 (Hertrich, 2017). Provided frequent sexual exposure and childbearing are restricted to within marriage, a rising age at first marriage is a necessary prerequisite for observed fertility declines. However, with an increasing number of women delaying marriage, researchers commonly assume pre-marital fertility will rise concurrently.

According to evidence from select African countries, unmarried women's pregnancies are generally unplanned (Gage, 1998), and thus women terminate these pregnancies at disproportionately high rates (Sedgh et al., 2012). Despite the high levels of premarital sex (Mensch et al., 2006), and limited contraceptive access, premarital births remain uncommon in several African countries (Clark et al., 2017). Several studies have shown that unmarried African mothers who do not experience a spontaneous miscarriage during pregnancy are likely to marry mid-pregnancy. Often, childbearing is a key feature of the lengthy and complex marital process in many SSA contexts (Meekers, 1992). Thus, a large proportion of premarital pregnancies result in marital births, and such unions are likely to be less stable relative to unions where pregnancy occurred after marriage (Smith-Greenaway and Clark, 2018; Smith-Greenaway et al., 2021).

In East Africa, premarital pregnancy is sometimes a driver of early marriage, rather than vice versa (Neal et al., 2015). In Uganda, early pregnancy is a positive incentive for early marriage; indeed, some young women are said to pierce condoms during sexual intercourse to get pregnant and thus compel their partners into marriage (Nalwadda et al., 2010). Their study found that young women remain

bound by cultural norms that equate marriage and motherhood with female status and value. Many women are thus eager to start their culturally set life course, and may feel pressure to prove their fertility as soon as possible (Nalwadda et al., 2010). Premarital sex thus creates a favourable ground for early marriage and early childbearing, which have known implications on fertility levels and adolescent sexual and reproductive health (ASRH). For example, compared with mothers aged 20–24 years, adolescent mothers aged 10–19 years had higher risks of pre-eclampsia, puerperal endometritis, systemic infections, low birth weight, preterm delivery, and severe adverse neonatal outcomes (Ganchimeg et al., 2014).

Understandably, ASRH is a serious public health concern in SSA. Given that, for many adolescent women, key life events such as marriage, first sexual intercourse, and childbearing remain intertwined in this transitional period, the lack of literature synthesizing these phenomena is an oversight detrimental to advancing ASRH understanding (Melesse et al., 2021). Furthermore, we have found that while precise marriage-birth sequences have become an increasingly explored area of research, decomposing these sequences by adolescent age categories is an underexplored area for modern-day SSA. Our research intends to address this gap, and so advance our understanding of ASRH.

1.3 Data and Methods

1.3.1 Sample Construction

For over three decades, the Demographic and Health Survey Program (DHS) has been implemented in over ninety low and middle-income countries worldwide and is renowned for being a nationally (and regionally) representative data source. The male and female modules of the DHS contain a wealth of information on health, demographics, fertility, contraceptive access and uptake, birth and mortality histories of children, and the date at which partners first cohabit (later used to calculate age at first marriage).

The data analysed in this Chapter is derived from the most recent DHS waves, available for thirty countries of Sub-Saharan Africa highlighted in Figure 1.5. Our self-constructed, aggregated data set contains observations for almost 96,000 heterosexual couples (hereafter referred to as 'households'). Precise questionnaires and the size and characteristics of our household sample vary across countries in the aggregated data set (please see Appendix A). Administered questionnaires all took place in the years spanning 2008 to 2018, with so-called 'Phases' varying between 6 and 7. From close examination of questionnaires and accompanying DHS documentation, the exact phrasing of questions - particularly those pertinent to our investigation of age at first marriage and achieved fertility - is verbatim in

Phases 6 and 7 of data collection.

Throughout, all estimates based on DHS data are weighted to restore the sample's representativeness and to adjust for any non-responses in the data; this is so the total sample distribution mirrors the actual population distribution for the thirty countries studied. Our research is primarily concerned with outcomes for women; therefore, we will be using the women's sampling weight throughout estimations.

1.3.2 Data Limitations

Within our refined sample, 85% of women declare their current relationship status to be "married" (versus "living with their partner", which we hereafter refer to as "cohabiting"[3]); for men, 83% self-identify as "married". The self-declared responses from individuals on their current relationship status reveal two salient points relevant to our discussion. First, in the dichotomy between marriage and cohabiting, the institution of marriage (customary or traditional) remains dominant across the Sub-Saharan continent. The so called "retreat from marriage" historically reported by social scientists (with particular study and reference to North America) is certainly slow-paced in this region, at least as a collective[4].

A second and closely interrelated point raised from these initial statistics is the slight discrepancy between male and female marital status reporting. Given that the (aggregated) dataset from the DHS contains *one record for each couple*[5], one would anticipate that there would be a consensus on whether a household is "married" or not; that is individually, men and women would have the same response to the identical question posed by a DHS surveyor. However, given our context, the slight difference in reporting by men and women is unsurprising.

Unlike Western marriages, which are often unambiguously dated by a ceremony or the signing of a license, marriage in Sub-Saharan Africa is often described as a 'process', consisting of multiple (sometimes lengthy) stages that can vary substantially between religions, ethnicities, and in domestic law. In the Democratic Republic of the Congo, for example, the near-ubiquitous practice of

[3]Cohabit: (verb) "*If two people, especially a man and woman who are not married, cohabit, they live together and have a sexual relationship*" Cambridge Advanced Learner's Dictionary Thesaurus.

[4]This is not to say that there should not be a refocused attention on the etiology of family change in Sub-Sahara, given that an increased number of women in the age bracket of 20-30 are cohabiting with their partner (and similarly for men aged 25-35). Angola in particular has a higher proportion of women cohabiting with their partner (79%).

[5]Couple's Data - Couple's Recode (CR):

"This dataset has one record for every couple. It contains data for married or living together men and woman who both declared to be married (living together) to each other and with completed individual interviews (questionnaires). Essentially the file is the result of linking the two files previously described based on whom they both declared as partners. The unit of analysis (case) in this file is the couple in which both partners were interviewed." (DHS, Dataset Types)

Figure 1.5: Countries of study with relevant and available DHS data sets coloured green.

brideprice has come to function as a "legal proof of marriage", and a couple are "not considered married until a brideprice is paid in full" (Lowes and Nunn, 2018, p. 4). With this in mind, there is a high probability that some individuals may not consider themselves as "married" if the agreed-upon brideprice has not been paid in full, pushing reported statistics down. Indeed, if several events are required to legitimise a union, it may be unclear precisely when a union was formalised, hence a lack of consensus in a household.

As Bledsoe and Cohen (1993) clearly state, the legal aspects of the marriage may be reasonably straightforward, and the "expectations and the appropriate behaviour of each part clearly defined" (p.43). However, the actual measurement problem lies in that there are multiple forms of marriage in Africa, and the processual nature of marriage makes it difficult for enumerators or even the respondents to categorise people [themselves] as being married or unmarried.

Conversely, there are several reasons why self-reported marriage statistics in the DHS could be inflated. One example could be the following: several countries in Sub-Saharan Africa practice 'Common-law' marriages (also known as "marriages by repute"), notably Angola and the Democratic Republic of the Congo (Department of State Country Reports on Human Rights Practices for 2015 via PEW Research Center). Within this particular domain of Family Law, a man and woman can be considered married in the legal sense, without the household formally registering their relation as a civil or religious union. Arguably, the term 'common-law marriage' has gained increased informal use, and its frequent colloquial use to refer to cohabiting couples (that are not legally registered as a common-law marriage) has led to widespread public misconception. Indeed, the act of a couple – organising their relation as if they were married in the conventional sense (living together and raising children) acts as the necessary evidence to their being "married" without any legal affiliation. Miscomprehension, self-delusion (or internalised stigma) all contribute to the possibility of incorrect self-reporting. Furthermore, we need to exercise caution when handling self-reported survey measures of perceived immoral behaviours (such as sexual relations outside of wedlock) and illegal activities (underage marriage and in select cases, defilement[6]), both of which result in inflated measures of marriage and certain key variables of interest (including age at first marriage and birth).

By acknowledging the potential for misreported measures of marriage (and associated variables), we are alluding to a more generalised point about the survey data collected by the DHS. All male and female respondents were asked to report their current marital status, and the month and year they were first married or began cohabiting with their partner. Where union formation consists of multiple stages, it is unclear which point in the process corresponds to the reported year of marriage (from which we calculate age at marriage). Without further questioning and clarification, we are left with imperfect data on age at marriage, as well as the exact nature of the household arrangement under discussion (traditional or

[6]The act of having sexual intercourse with a girl under 18, irrespective of consent.

customary marriage) and the legal status of individual unions.

After careful consideration, we have decided that all those who report that they are married or cohabiting with their partner are relevant for our study; this decision was driven by our primary focus on union formation, which we consider applicable to both classifications. Cohabiting is regarded as only one event among many in a long process of conjugal negotiations, that may last for several years. Irrespective of the exact nature – or status – of a households' dyad, we assume that the men and women in our "couple" sample, live together as if they were husband and wife, and follow similar trajectories (particularly when it comes to childbearing) to those of similar socio-economic status, but possess legal certification of their union (or similar ratification/ sanctification)[7].

Despite limitations, DHS data sets are the most widely available, nationally representative sources of quantitative information on marriage and fertility behaviours in SSA and the wider developing world. Given our intention to conduct a comparative analysis of age at first marriage, the DHS is undoubtedly the greatest (and most credible) source at our immediate disposal to achieve this end. Their focus on international comparability has facilitated multiple studies that cross-examine age at marriage in developing regions. Furthermore, the high quality and accuracy of the information collected in the DHS – particularly information concerning fertility behaviour – is demonstrated in Pullum (2008).

We consider our sample sufficiently adequate to conduct meaningful analyses and cross-country comparisons. This should prove helpful in identifying socioeconomic and regional foci that guide nuptiality and fertility patterns and contribute to the ongoing debate surrounding child and early marriage in public discourse.

1.3.3 Study Variables

In this section, we elaborate on the dependent and independent variables used in forthcoming analysis. Where relevant, we provide justification for the categories used and discuss their applicability to any study of early marriage.

First, to quantify the effect of age at first marriage on fertility behaviours, we consider early female marriage as an ***inciter*** of fertility (or a "proximate determinant" if one is to use Bongaarts' terminology). In other words, early entry into a first union is a factor that increases achieved fertility to levels above those that would prevail in the absence of this proximate variable (that is, if women were to marry over 18). Thus, the outcome variable of interest in our core analysis is

[7]The most obvious disadvantage to this strategy is the elimination of married couples who do not cohabit.

achieved fertility. Achieved fertility here refers to the total number of children alive at the time of survey who were given birth to women in the sample (Rutstein and Rojas, 2006).

Age at first marriage is calculated from the century month code of the date of the first marriage, and the century month code of the respondent's date of birth. For this study, early marriage is defined as first marriage when the female respondent was less than 18 years of age, commonly referred to as the 'adolescent period'. This period is characterised by an uneven progression in the development of brain structures and mental processes in the prefrontal cortex. Rapid physical, psychological and cognitive changes occur throughout adolescence, accelerating in varying degrees at intermittent stages. In addressing the question "How Young is Too Young?", Dixon-Mueller (2008), identifies three criteria for assessing the extent to which the timing of sexual, marital and reproductive transitions could be unequivocally deemed: "Too Young". First, she considers the physiological readiness and the maturation of the body; second, cognitive capacities for making safe, informed and entirely voluntary decisions; and finally, considers legal and international standards related to consent [8].

From reviewing the data, Dixon-Mueller (2008) concludes that boys and girls aged 14 and younger are universally too young to be making safe and consensual transitions. Depending on circumstances (particularly nutritional status), those aged 15 to 17 may or may not be too young, and 18-year-olds are generally "old enough" to be making these transitions. By 18, brain structures and cognitive processes are almost full articulated, and hormonal systems largely in balance, justifying the 18-year threshold for adulthood. The systematic review concludes with a recommendation for expanding adolescence to more refined, narrow age groupings to capture better age-specific variations in the trajectories of sexual, marital, and reproductive events. We have thus decided that our variable of age at first marriage should be split into four indicator variables: > 18 years of age (adult status, reference group), 18 years of age (late adolescence), 15-17 years (inclusive, to capture marriage in middle adolescence), and ≤ 14 years of age (to capture marriage in early adolescence or childhood).

To eliminate confounding factors, we restrict our sample to women $\leq$49 married only once; this is to ensure that we have captured (as far as we are able to) information about a women's first and only marriage. Widows, divorcees, and women in polyandrous arrangements were not included in the study. Households in polygynous arrangements are included in the study; we later control for this in our regressions with a dummy variable.

We are also interested in precise marriage-birth sequences, and their interactions with age at first marriage. Similar to Feng and Quanhe (1996), we identify three

[8] A comprehensive list of marriage laws for our thirty studied countries is provided in Appendix B.

possible sequences leading to first birth:

1. Pre-Marital Birth: conception-birth-marriage (CBM)

2. Pre-Marital Conception: conception-marriage-first birth (CMB)

3. Marital Conception: marriage-conception-first birth (MCB)

We define birth intervals of 0-8 months between the date of first marriage first birth as outcomes of pre-marital conceptions. Negative intervals are treated as pre-marital births[9]. Births that occurred nine months or later following marriage are treated as marriage-conceptions-birth sequences.

1.3.4 Descriptive Statistics

Table 1.1 displays the summary statistics for women across the thirty studies countries of SSA.

The average age at first marriage for women is approximately 18 years; however, there is tremendous variation regionally. Mean age at first marriage among women aged 15-49 at the time of each respective DHS survey ranges from 15.9 in Chad to 24 in Namibia. Households are overwhelmingly male-headed, with equal distribution across wealth indices (lowest to highest). While diverse religions are present across the sub-continent, Catholicism, Protestantism, and the Islamic faith dominate. Marriage length averages at 11.7 years, and 93.5% of women in our sample are married to older men. Approximately 18% of households are in a polygynous marriage arrangement. For fertility outcomes, most women give birth to a median of three children, with age at first birth averaging at 19 years.

There exist large disparities in the prevalence of early marriage across Sub-Saharan Africa, ranging from a high of 72.3% in Chad to a low of 11.7% in Rwanda. Prevalence of early marriage (<18 years) for our thirty studied countries are presented in Figure 1.6. Decomposing these statistics to our adolescent age categories (Table 1.13 and heat maps illustrate these figures on page 1-55 and 1-56), 32.3% of early adolescents - arguably the most vulnerable group of women given their young age - are married by 14 in Chad. Burkina Faso ranks first for marriage in middle adolescence (15-17 years) at 47.1%. Consistently, Rwanda and Namibia have low levels of marriage in the adolescent period, with 78% of women in these countries marrying instead as adults. It is worth noting that in many

[9]Pregnancies ended by induced abortion before marriage are not included in the study due to the high likelihood of underrerporting.

Table 1.1: Summary Statistics for Women from Thirty Countries

Variable	**N**	**Mean**	**Standard Deviation**
Age	81,887	30.01	7.97
Age at First Marriage	81,887	18.37	4.13
Early Marriage	81,887	0.47	0.50
Marriage Length (Years)	81,887	11.70	8.04
Rural	81,887	0.68	0.47
Male Household Head	81,887	0.95	0.21
Currently Employed	81,735	0.64	0.48
Education (Years)	81,870	4.45	4.75
Education (category):			
No Education	81,881	0.40	
Primary	81,881	0.33	
Secondary	81,881	0.23	
Higher	81,881	0.04	
Religion:			
Catholic	81,720	0.18	
Islamic	81,720	0.33	
Protestant	81,720	0.16	
Wealth Index (category):			
Lowest	81,887	0.20	
Low	81,887	0.21	
Middle	81,887	0.20	
High	81,887	0.20	
Highest	81,887	0.20	
Partner Characteristics (Male):			
Age at Marriage	81,887	24.10	5.18
Polygynous Arrangement	81,887	0.18	0.38
Age Difference (category):			
Wife Older	81,887	0.04	
Same Age	81,887	0.03	
Husband Older by 1 to 9 years	81,887	0.66	
Husband Older by 10 to 19 years	81,887	0.24	
Husband Older 20+ years	81,887	0.04	
Fertility Outcomes:			
Total Children Ever Born	81,887	3.61	2.53
Number of Living Children (Achieved Fertility)	81,887	3.19	2.18
Age at First Birth	76,166	19.23	3.71
Marriage to First Birth Interval (Months)*	64,800	20.49	20.60

Notes: Summary statistics generated using the female weighted sample. Full sample has been restricted to include women only married once, and aged ≤49. Given the diverse number of ethnicities represented in the DHS across the thirty studied countries, we have not included summary statistics for ethnicity here.

*Statistics reported for zero and positive intervals only. Currently, the DHS does not provide monthly data for negative birth intervals; instead, the DHS singularly codes birth before marriage as a "negative interval" (N=11,366).

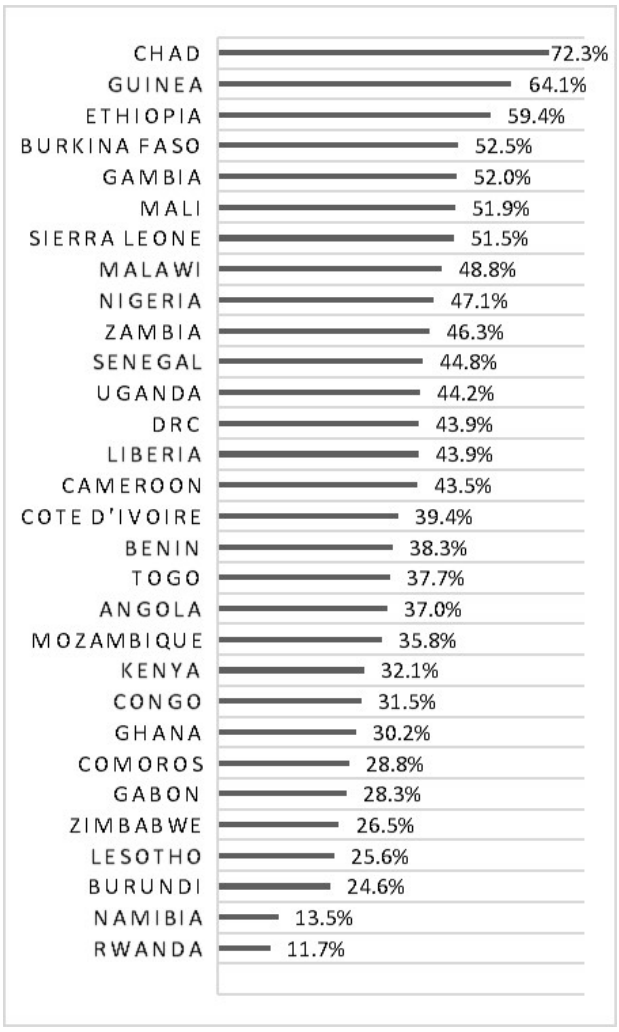

Figure 1.6: Prevalence of Early Marriage (< 18 years) Across SSA countries

countries, greater progress has been made toward reducing early marriage for those women in the middle adolescent category than for those women under 15 (see Koski et al. (2017)).

The DHS data has allowed us to generate an overall profile of women who marry early, confirming much of what the literature has already identified. To create this profile, we conduct standard means testing between women married as children (early) and those married as adults (later), the results of which are presented in Table 1.2. We find that most early marriages are localised to rural areas, and households are typically of lower wealth status than those where the woman married as an adult (Hotchkiss et al., 2016). Results from Field and Ambrus (2008), Wodon, Nguyen and Tsimpo (2016), and Bengesai, Amusa and Makonye (2021) demonstrate that early marriage is associated with low educational attainment for women. Our results similarly confirm this, with child brides averaging three years of education - almost half the average for women who marry later. Child brides are also more likely to have a considerable age difference with their husbands than women who marry after 18 (Erulkar, 2013). Again, our data confirms this, suggesting an age gap of approximately eight years between husbands and wives.

Finally, we find that those women in an early marriage arrangement are more likely to follow a marriage-conception-birth (MCB) sequence (79%); for later marriage, 59% of women follow MCB sequence and differences are highly statistically significant. Positive intervals between marriage and first birth are longer for women who marry early, averaging 23 months, compared to 17 months for later marriage. This result may be related to the sub-fecundity of young women at the time of their marriage, accounting for the low figures observed for conception-birth-marriage sequences (CBM). Expectations of sub-fecundity may inform and shape societal expectations of the timing of childbearing for women. Long first birth intervals are accepted as the norm, relieving pressure on women to establish fertility immediately after marriage at an early age. However, despite the larger interval between early marriage and first birth, age at first birth remains low at 17 years compared to 21 years for those marrying later. Overall, achieved fertility is higher for early brides, averaging four children compared to three for adult brides.

Table 1.2: Early Marriage Profile: A Comparison of Means

	Mean (Standard Deviation)				
Variable	**Total Sample (N = 81,887)**	**Early Marriage (N = 39,006)**	**Later Marriage (N = 42,881)**	**t-stat**	**p_value**
Age at Marriage	18.36 (4.13)	15.17 (1.63)	21.26 (3.53)	312.14	0.0000
Rural	0.68 (0.47)	0.76 (0.43)	0.61 (0.49)	-47.51	0.0000
Wealth*	2.91 (1.42)	2.61 (1.34)	3.17 (1.45)	57.36	0.0000
Education (Years)	4.45 (4.75)	2.96 (3.63)	5.62 (4.88)	87.66	0.0000
Age Difference with Partner	7.18 (5.68)	8.32 (5.68)	6.13 (5.47)	-56.06	0.0000
Marriage Length	11.70 (8.04)	13.46 (8.42)	10.10 (7.33)	-61.07	0.0000
Achieved Fertility	3.19 (2.18)	3.57 (2.31)	2.93 (2.05)	-42.03	0.0000
Age at First Birth	19.23 (3.71)	16.92 (2.24)	21.31 (3.50)	204.37	0.0000
Marriage to First Birth Interval (Months)$^{\Phi}$	20.49 (20.60)	23.31 (23.23)	17.09 (16.61)	-38.74	0.0000
Conception - Birth - Marriage Sequence (CBM)	0.15 (0.36)	0.06 (0.23)	0.24 (0.42)	71.88	0.0000
Conception - Marriage - Birth Sequence (CMB)	0.16 (0.37)	0.16 (0.36)	0.17 (0.38)	5.12	0.0000
Marriage - Conception - Birth Sequence (MCB)	0.69 (0.46)	0.79 (0.41)	0.59 (0.49)	-58.79	0.0000

*The wealth index is a composite measure of a household's cumulative living standard. The wealth index is calculated using data on a household's ownership of selected assets. Households are assigned a score, ranked 1 to 5 (low to high wealth).
$^{\Phi}$Statistics reported for zero and positive intervals only.

1.4 Estimation Strategy

Achieved Fertility, Y_i, is an event count variable, where Y_i $E\{0, 1, 2...\}$. Figure 1.7 shows the weighted frequency distributions (aggregate for thirty countries) of the achieved fertility DHS data for 4 sub-groups: A. Women married in early adolescence and childhood ($\leq$ 14), B. Women married in middle adolescence (15-17), C. Women married in late adolescence (=18), and D. Women married above the legally defined threshold of "adulthood" ($>$ 18). Fertility distributions for women throughout adolescence and into adulthood appear heavily skewered, with long right tails. Because of this, Poston Jr (2002) argues that the use of linear regression approaches (such as OLS) to model achieved fertility is statistically inappropriate, particularly if one is to analyse sub-groups of women[10].

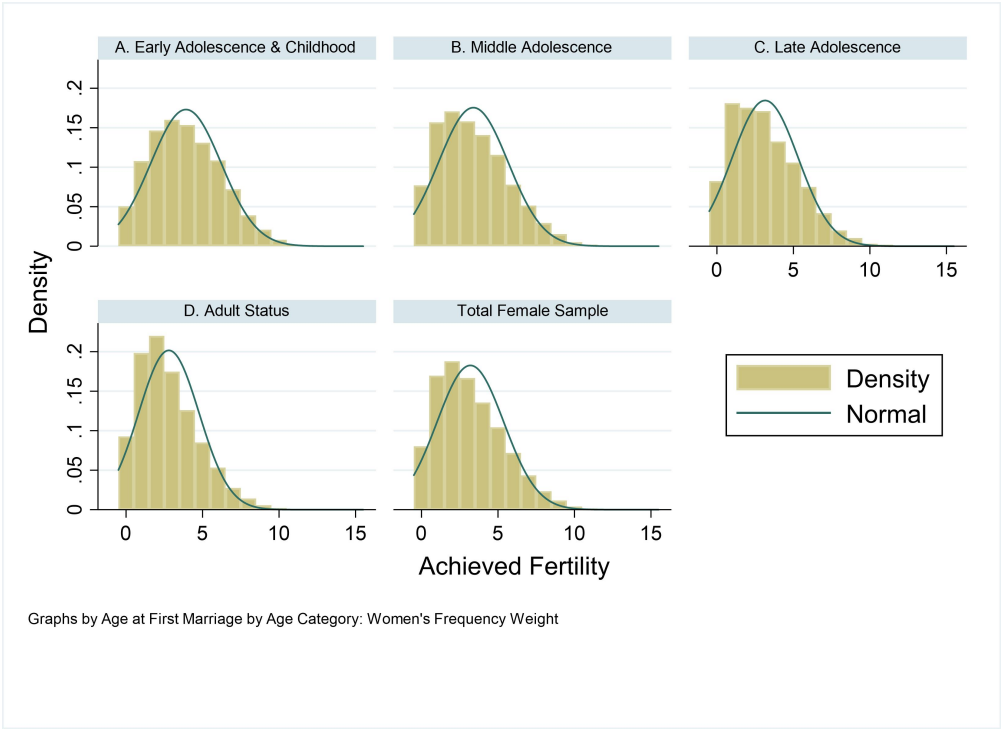

Figure 1.7: Achieved Fertility by Age Group

Birth outcomes do not follow an invariant, biological, stochastic process but are instead responsive to social norms, heterogeneity of individual preferences, economic constraints and incentives. Such factors individually and collectively affect fertility trends, as evident from the previously discussed literature. Therefore, Poisson modelling is not appropriate, as the Poisson distribution embodies strong assumptions that are easily violated (for example, being unimodal and the assumption of independent events). These features are often (at least

[10]Using OLS to predict count outcomes (such as number of living children) will often result in "inefficient, inconsistent and biased estimates" of the regression parameters (Long and Long, 1997, p.217).

partly) absent in observed data. Cameron and Trivedi (2013) further demonstrate that over-dispersion in fertility data from low-income developing countries is far greater than fertility data from developed nations. Preliminary summary statistics for our data confirm that the conditional variance of the (count) response variable is greater than the conditional means; this trend holds for our four age groups:

Age at first marriage (≤ 14); mean of 3.92 children with a standard deviation of 2.31 and a variance of 5.31, which is 1.35 times the sample mean.

Age at first marriage between 15 and 17; mean of 3.39 children, with a standard deviation of 2.27 and a variance of 5.17 (1.53 times the sample mean).

Age at first marriage = 18; mean of 3.15 children, with a standard deviation of 2.16 and a variance of 4.68 (1.49 times the sample mean).

Age at first marriage (> 18); mean of 2.80 children, standard deviation of 1.98 and a variance of 3.91 (1.40 times the sample mean).

It is clear from the distributional characteristics of births, decomposed by adolescent age category, that we have overdispersion in the data. We, therefore, look to an alternative modelling approach more appropriate for out count data, specifically, the negative binomial regression model[11]. Running the STATA command "nbvargr"[12] we graph observed proportions of our fertility count variables, along with the Poisson and negative binomial probabilities in Figure 1.8. The Poisson probabilities are computed using an estimate of the Poisson mean, and the negative binomial probabilities use the same mean and an estimate of the overdispersion parameter. We can see from the graph that the negative binomial probability curve fits the data better than the Poisson probability curve.

[11] Given a dataset with overdispersion, if one were to estimate both the Poisson and negative binomial regression models, both will return with the same mean structure. However, the Poisson model will tend to underestimate the dispersion in the dependent count variable. Consequently, the standard errors in the Poisson regression models will be biased downwards, resulting and spuriously small p-values and misleading inferences (Cameron and Trivedi, 2013).

[12] "nbvargr" is a user-written command by Philip B. Ender, UCLA Statistical Consulting.

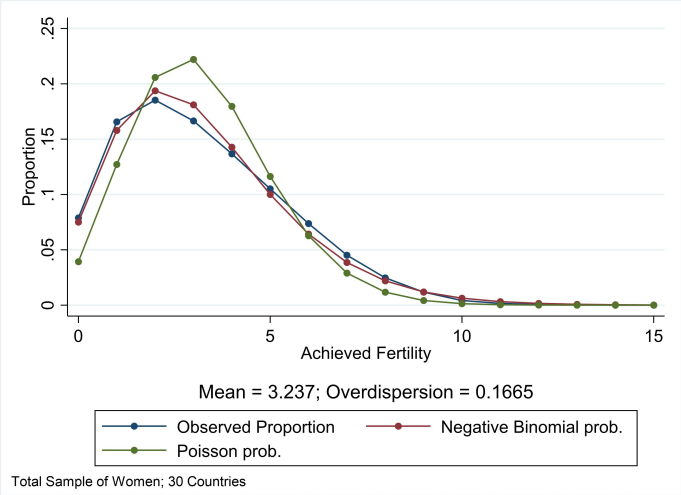

Figure 1.8: Variable, Poisson and Negative Binomial Probabilities for Achieved Fertility

The negative binomial (hereafter NB) distribution is a two-parameter distribution, combining the Poisson and Gamma distributions (Gamma–Poisson mixture). The NB relaxes the assumption of equality of mean and variance, thus accounting for unobserved heterogeneity in count data. Its probability mass function (PMF) is given by:

$$f(y_i;\theta;\delta) = \frac{\Gamma(y_i + 1/\theta)}{\Gamma(1/\theta)\Gamma(y_i+1)}\left(\frac{1}{1+\delta\theta}\right)^{1/\theta}\left(1-\frac{1}{1+\delta\theta}\right)^{y_i}, \quad y_i = 0,1,2,... \qquad (1.1)$$

with mean, $\mu_i = E(Y_i) = \delta$, variance, $Var(Y_i) = \mu(1+\mu\theta)$ and the dispersion $1+\mu\theta$. Regressors are introduced via δ, which $= exp(\boldsymbol{x}_i\beta)$, where $\boldsymbol{x}_i$ is a covariate vector, and β is a vector of the regression parameters to be estimated.

Heterogeneity is introduced into the NB model by drawing upon the observed characteristics of individual women and their households. We employ a wide selection of independent variables that reflect the socioeconomic and locational characteristics that have been shown in previous studies to interact with household fertility levels. These variables include age, education, residence, gender of the household head, wealth and employment status, religion, ethnicity and polygynous status of the household. Given the breadth of data from the DHS, we can include several independent variables related to the characteristics of the male spouse, including their age at marriage and the relative age difference between the couple. Some of the aforementioned variables are measured as dummy, and others as interval. Full descriptive statistics of all explanatory variables are displayed in Appendix C, page 1-66.

1.5 Analysis

1.5.1 Fertility by Adolescent Age Categories

In the first instance, the NB model is estimated for women's achieved fertility using data aggregated for our studied SSA countries. Coefficients, decomposed by adolescent age categories, are presented in Table 1.3.

Table 1.3: Negative Binomial Model for Achieved Fertility; Aggregated Data for Thirty SSA Countries

Age at First Marriage by Age Category	**Coefficient (Standard Error)**
a. Early Adolescence	0.01
	(0.01)
b. Middle Adolescence	0.04***
	(0.01)
c. Late Adolescence	0.03***
	(0.01)
Controls	Yes
Wald Tests (Post-estimation)	
a. Early Adolescence = b. Middle Adolescence	χ^2: 30.06 (p-value: 0.000)
a. Early Adolescence = c. Late Adolescence	χ^2: 6.19 (p-value: 0.0128)
b. Middle Adolescence = c. Late Adolescence	χ^2: 4.94 (p-value: 0.0262)

*** p<.01, ** p<.05, * p<.1
Notes: Reference Group for Adolescent Age Category is "Adult Status" (> 18).
Control variables include the following: current age, gender of the household head, marriage length, dummy for polygynous marriage arrangement, current employment status, religion, wealth, education, age difference with partner, and husbands age at first marriage.

Results from the NB model suggest that women marrying in early adolescence do not have significantly different fertility levels to those women married over 18 (or as an "adult"). However, if a women were to marry in middle adolescence, the difference in the logs of expected fertility would be 0.04 units higher for these women, whilst holding all other predictor variables constant in the model. Taking the exponent of this figure, we find statistically significant evidence that women marrying in middle adolescence increases their fertility by approximately 4% relative to marrying over 18. This figure decreases to approximately 3% for those marrying in late adolescence, and is again highly statistically significant. Post-estimation, we formally test the equality of coefficients between our adolescent age categories, using the standard Wald test. These statistics are presented at the bottom of Table 1.3. We can reject the null hypothesis for the aggregated data, indicating that the coefficients are not

equal to one another. Fertility levels between the adolescent age categories are individually distinct, and significantly different from one another.

Given the variation in patterns of early marriage across SSA, we decompose our results by country. These results are presented in Table 1.4. We similarly conduct post-estimation Wald tests to test for equality of coefficients. These results are located in Appendix C, Table 1.16 on page 1-68. Throughout specifications, we include the following control variables: current age, gender of the household head, marriage length, a dummy for polygyny, current employment status, religion, wealth, education, ethnicity, age difference with partner, husbands age at first marriage, and a dummy for CBM and CMB birth sequences.

It is immediately apparent that fertility patterns are markedly different between countries and across the adolescent age categories. The most significant result from our estimations is for the country of Gabon. Estimates suggest that women married in early adolescence have 25% higher fertility than women who marry over 18. This result is highly statistically significant; however, post estimation tests cannot distinguish early adolescence from the middle and later age categories. Estimates for middle and later adolescence suggest that fertility is 30% higher for both categories than women married over 18. Wald testing reveals that the fertility levels between these two categories are individually distinct and highly statistically significant. We believe that such significant results are due to Gabon's age at marriage laws, which grants permission for women to marry at 15 without any parental consent. In terms of ASRH, we feel that these results should be of great concern to policymakers.

Overall, we observe a positive and statistically significant association between marriage in middle adolescence and achieved fertility, particularly for Angola, Benin, Cote d'Ivoire, Guinea, Liberia, Mali, Namibia, Ugandan, and Zimbabwe. Estimates range from a low of 5% in Zimbabwe and Benin to a high of 14% in Namibia. In most countries, however, we cannot identify any discernable associations between adolescent marriage and fertility levels. This includes Burkina Faso, Burundi, DRC, Congo, Cameroon, Ethiopia, Gambia, Kenya, Comoros, Lesotho, Mozambique, Senegal, Chad and Togo.

For countries with the highest proportion of women married below 14, we observe a negligible association with fertility levels. In fact, in Nigeria, we have weak evidence suggesting that fertility is lower among those married in early adolescence compared with adult marriage. Similarly, in other countries, including Ghana, Malawi, Rwanda, Sierra Leone, and Zambia, we observe a negative coefficient for early adolescence on fertility levels. These results contradict the models of fertility (namely Bongaarts (1978)), where earlier marriage is considered an inciter of fertility, prolonging women's exposure to childbearing.

Table 1.4: By Country: Negative Binomial Model for Achieved Fertility

Country	Angola	Burkina Faso	Benin	Burundi	DRC	Congo	Cote d'Ivoire	Cameroon	Ethiopia	Gabon	Ghana	Gambia	Guinea	Kenya	Comoros
Age at First Marriage by Age Category															
a. Early Adolescence	0.07	-0.01	0.01	-0.07	0.00	-0.05	0.03	-0.07	-0.01	0.22**	-0.12**	0.06	0.05	-0.02	0.06
	(0.05)	(0.03)	(0.04)	(0.04)	(0.04)	(0.07)	(0.06)	(0.05)	(0.04)	(0.09)	(0.05)	(0.07)	(0.05)	(0.03)	(0.09)
b. Middle Adolescence	0.08**	-0.00	0.05**	-0.03	0.02	-0.02	0.07*	-0.02	0.03	0.26***	-0.01	0.05	0.10***	0.01	0.09
	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)	(0.04)	(0.04)	(0.03)	(0.03)	(0.06)	(0.03)	(0.05)	(0.04)	(0.02)	(0.06)
c. Late Adolescence	0.05	-0.00	0.04*	0.02	-0.03	-0.05	0.07	-0.04	0.01	0.26***	0.02	0.01	0.07*	-0.01	0.05
	(0.04)	(0.02)	(0.02)	(0.02)	(0.03)	(0.05)	(0.05)	(0.03)	(0.03)	(0.07)	(0.04)	(0.05)	(0.04)	(0.02)	(0.06)

Country (cont.)	Liberia	Lesotho	Mali	Malawi	Mozambique	Nigeria	Namibia	Rwanda	Sierra Leone	Senegal	Chad	Togo	Uganda	Zambia	Zimbabwe
a. Early Adolescence	0.12*	-0.02	0.07*	-0.10***	0.05	-0.05*	0.11	-0.31***	-0.10***	-0.03	0.03	-0.06	0.05	-0.07***	0.05
	(0.06)	(0.10)	(0.04)	(0.03)	(0.08)	(0.03)	(0.11)	(0.11)	(0.03)	(0.04)	(0.05)	(0.05)	(0.05)	(0.02)	(0.04)
b. Middle Adolescence	0.09**	-0.05	0.06**	-0.00	0.07	-0.01	0.14**	-0.06**	-0.09***	0.00	0.05	0.00	0.10***	-0.04**	0.05**
	(0.04)	(0.06)	(0.03)	(0.03)	(0.05)	(0.02)	(0.06)	(0.03)	(0.02)	(0.03)	(0.04)	(0.03)	(0.03)	(0.02)	(0.02)
c. Late Adolescence	0.03	0.09	0.03	0.00	0.01	0.02	0.02	0.01	-0.05	0.03	0.04	-0.00	0.06**	-0.02	0.02
	(0.05)	(0.06)	(0.04)	(0.03)	(0.05)	(0.02)	(0.07)	(0.02)	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.02)	(0.02)

*** p<.01, ** p<.05, * p<.1
Standard errors are reported underneath coefficients in parentheses.
Notes: Reference Group for Adolescent Age Category is "Adult Status" (> 18).
Control variables include the following: current age, gender of the household head, log of marriage length, dummy for polygynous marriage arrangement, current employment status, religion, ethnicity, wealth, education, age difference with partner, and husbands age at first marriage.

The NB models in Tables 1.3 and 1.4 include a series of alternative predictor variables for achieved fertility. Table 1.5 contain the coefficients for all our control variables for our aggregated data set, and here we will briefly discuss some of the key findings that largely corroborate the conclusions drawn from the literature. It is worth noting, that moving from Model (1), to Model (2), the dramatic change in coefficients for our adolescent age categories was primarily due to the inclusion of marriage length into the model. We note this, because several studies including Yaya et al. (2019), and Melesse et al. (2021) fail to include this variable as a control in their estimations. Without controlling for marriage length, figures for early marriage will be inflated and should be treated with caution.

Against the baseline of middle income, those women classified in the lowest and low wealth quintiles have 3% and 2% more children, respectively. Those in the high and highest wealth quintiles simultaneously decrease their fertility by 3% and 12.7%, respectively. Based on human capital theory and the quantity-quality trade-off of children, these wealth-related results were somewhat anticipated.

Consistent with the Beckerian theory of human capital, women with increased education have lower fertility at any point in time than those who have no education (the control group). Those women with primary education have fewer children (1%), and those with secondary education have even less (approximately 12%) than women with no education. Similarly, those with higher education (university or vocational training) have 23% fewer children than those with no education. Results for secondary and higher are highly statistically significant at the 1% level, while primary is significant at the 5% level.

Aspects of women's agency and household autonomy can also be inferred from the model; for example, male-headed households have higher fertility than those headed by women[13]. This positive correlation was somewhat expected given men's strong fertility preferences (discussed in the preceding literature review). Women's current employment status also appears to affect the number of children she has, albeit very modestly. We estimate that female employment reduces the number of children per woman by 1% compared to those not currently employed, and this result is significant at the 5% level. Age difference within the household also appears to have a mixed effect on fertility levels. For example, women older than their spouse have 5.8% fewer children than couples of similar age. Husbands older than their wives by up to and including 19 years have 7.3% more children than those of a similar age. An age gap upwards of 20 years does not appear to have a significant effect on fertility, possibly due to the shorter time horizon of the couple.

Interestingly, we found that women in polygynous marriage arrangements have 3% fewer children than those women in a monogamous arrangement. We find this result interesting because, in the absence of controls, the size and direction of the

[13]Arguably, female-headed households may no longer have a husband, hence this lower fertility; however, we reject this argument, as the data collected by the DHS is for **both living couples**, and we further restrict the sample to observe first and current relationships.

polygynous coefficient is 0.16 (p-value=0.000), indicating that women in a polygynous arrangement have 16.8% higher fertility than monogamous women. In patrilineal and pastoral societies, the central *raison d'être* of polygyny is to ensure a greater number of offspring to a man. Furthermore, polygynous wives are believed to behave strategically regarding their fertility to maintain bargaining power over resources controlled by their husbands (Rossi, 2019). In response to an increase in the fertility of their co-wives, she will subsequently raise her fertility (Rossi, 2019). Thus, the total number of children born to a polygynous family (by all wives together) exceeds the number of children born to monogamous families. Individually, however, women appear to have fewer children than only wives of monogamous husbands. A general conclusion drawn from Muhsam (1956) is that this lower fertility is partly due to the lower average duration of married life for subsequent wives and the sharing of her husband with other women; the latter affects the frequency of sexual intercourse. Our results appear to complement this conclusion.

Another interesting series of results is for our marriage sequences. Against the reference group of women following a traditional MCB sequence, women giving birth before marriage (CBM) have 22% higher fertility. Similarly, those women following a CMB sequence have 7.2% higher fertility than a traditional MCB birth. Both results are highly statistically significant.

Table 1.5: Full Negative Binomial Model for Achieved Fertility

Variables	(1) No Controls	(2) Controls
Early Adolescence	0.34***	0.01
	(0.01)	(0.01)
Middle Adolescence	0.19***	0.04***
	(0.01)	(0.01)
Late Adolescence	0.12***	0.03***
	(0.01)	(0.01)
Current Age (RG: 20-24):		
15-19		-0.37***
		(0.01)
25-29		0.29***
		(0.01)
30-34		0.40***
		(0.01)
35-39		0.40***
		(0.01)
40-44		0.29***
		(0.02)
45-49		0.11***
		(0.02)

Table 1.5 continued from previous page

Variables	(1) No Controls	(2) Controls
Male Household Head		0.04***
		(0.01)
Polygynous Marriage		-0.03***
		(0.00)
Marriage Sequence 1 (CBM)		0.20***
		(0.01)
Marriage Sequence 2 (CMB)		0.07***
		(0.00)
Marriage Length		0.05***
		(0.00)
Currently Working		-0.01**
		(0.00)
Religion (RG= Islam):		
Catholic		0.04***
		(0.01)
Methodist		-0.09**
		(0.04)
Protestant		0.09***
		(0.01)
No Religion		0.01
		(0.01)
Orthodox		-0.11***
		(0.01)
Anglican		0.11***
		(0.02)
Rural		0.05***
		(0.01)
Wealth Index (RG: Middle):		
Lowest		0.03***
		(0.01)
Low		0.02***
		(0.01)
High		-0.03***
		(0.01)
Highest		-0.12***
		(0.01)
Education (RG: No Education):		
Primary		-0.01**
		(0.00)
Secondary		-0.12***
		(0.01)
Higher		-0.23***
		(0.01)
Age Difference with Partner (RG: Same Age):		
Wife Older		-0.06***

Table 1.5 continued from previous page

Variables	(1) No Controls	(2) Controls
		(0.02)
Husband older by 1 to 9 years		0.07***
		(0.01)
Husband older by 10 to 19 years		0.03***
		(0.01)
Husband 20 years older +		0.02
		(0.02)
Husband Age at First Marriage (RG: Adult):		
Early Adolescence		0.03
		(0.03)
Middle Adolescence		0.04
		(0.01)
Late Adolescence		0.03
		(0.01)
Constant	1.03***	0.23***
	(0.00)	(0.02)
Observations	81,887	75,872

*** p<.01, ** p<.05, * p<.1

Notes: RG = Reference Group

1.6 Marriage-Birth Sequence Probabilities

Concern over rising pre-marital fertility in Sub-Saharan Africa has increased in the last decade (Neal et al., 2020). In our aggregated data set, we observe that women giving birth before marriage have 22% higher fertility that those following a traditional marriage-conception-birth sequence. It is possible that the changing patterns of marriage toward greater pre-marital sexual activity is stalling SSA's TFR at 5 children per women. This point, however remains speculative and highlights the need for further research. Nevertheless, the DHS data indicates that rates of pre-marital births vary dramatically between countries, from a high of 52.69% in Namibia to a low of 3.76% in Burkina Faso.

Contingent on the cultural view of pre-marital fertility, pre-marital births and pregnancies may precipitate premature marriage among adolescents, inflating rates of early marriage. To investigate precise marriage sequences and the timing of marriage, we decompose the first birth interval into three parts – births that occurred before marriage, births likely to have resulted from conception before marriage, and births that resulted from conception after marriage. We refer to these as Marriage Sequence 1 (CBM), Sequence 2 (CMB), and Sequence 3 (MCB),

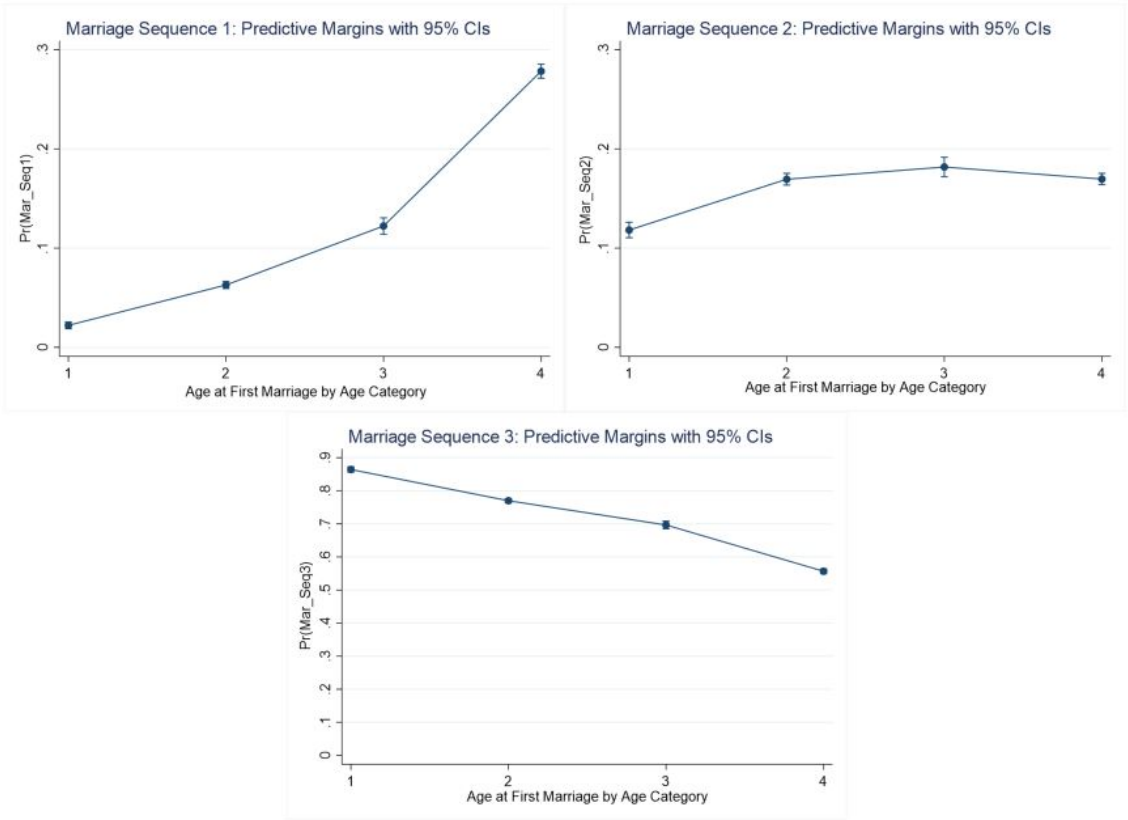

Figure 1.9: Marriage Sequences: Predictive Margins by Age Category
Notes: Marriage Sequence 1 (CBM): Conception-Birth-Marriage
Marriage Sequence 2 (CMB): Conception-Marriage-Birth
Marriage Sequence 3 (MCB): Marriage-Conception-Birth

respectively.

Figure 1.9 displays the calculated probabilities of the three marriage sequences by age category for woman, aged $\leq$49 and married only once. These probabilities were calculated from a series of probit regressions, the estimates of which are displayed in Tables 1.6, 1.7, and 1.8.

Our results suggest that first births for those women marrying in early adolescence occur primarily after the point of marriage. Similarly, first births most probably occur after marriage for those married in middle-to-late adolescence (0.7). Probabilities of giving birth before marriage increase as age increases, from 0.022-0.063 in early and middle adolescence to 0.122 - 0.278 for late adolescents and adults. We also find evidence of pre-marital sexual activity leading to birth within the first eight months of marriage for early and middle adolescents; 0.118 and 0.169, respectively. Inconsistency in marriage laws for several studied countries legally accommodate these marriages, without considering them a form of "child" marriage[14]. Marriage continues to be seen as the rightful approach to protecting young women from the consequences of unintended pregnancy.

[14]Such marriages are often omitted from country reported statistics on rates of child marriage.

Table 1.6: Probit Regression for Pre-Marital Birth by Adolescent Age Categories

Marriage Sequence 1: Conception-Birth-Marriage	Model (1)	Model (2)
Early Adolescence	-1.32***	-1.49***
	(0.033)	(0.038)
Middle Adolescence	-0.84***	-0.99***
	(0.018)	(0.021)
Late Adolescence	-0.50***	-0.60***
	(0.023)	(0.024)
≥18 (ref. group)		
Adjusted Predictions:		
Early Adolescence	0.024***	0.022***
	(0.002)	(0.002)
Middle Adolescence	0.068***	0.063***
	(0.002)	(0.002)
Late Adolescence	0.125***	0.122***
	(0.004)	(0.004)
Adult Status	0.258***	0.278***
	(0.003)	(0.004)
Controls	No	Yes
Observations	76,166	75,872
Pseudo R^2	0.0971	0.1365

*** p<.01, ** p<.05, * p<.1

Notes: Adjusted using female weighted probability. Controls include age, education, current work status, place of residence, and religion. Standard errors are robust and in parentheses.

Table 1.7: Probit Regression for Pre-Marital Conception by Adolescent Age Categories

Marriage Sequence 2: Conception-Marriage-Birth	Model (1)	Model (2)
Early Adolescence	-0.21***	-0.23***
	(0.021)	(0.025)
Middle Adolescence	0.03**	-0.000
	(0.016)	(0.018)
Late Adolescence	0.07***	0.05**
	(0.022)	(0.022)
≥18 (ref. group)		
Adjusted Predictions:		
Early Adolescence	0.119***	0.118***
	(0.004)	(0.004)
Middle Adolescence	0.173***	0.169***
	(0.003)	(0.003)
Late Adolescence	0.185***	0.182***
	(0.005)	(0.005)
Adult Status	0.166***	0.169***
	(0.003)	(0.003)
Controls	No	Yes
Observations	76,166	75,872
Pseudo R^2	0.0033	0.0162

*** p<.01, ** p<.05, * p<.1

Table 1.8: Probit Regression for Marital Conception by Adolescent Age Categories

Marriage Sequence 3: Marriage-Conception-Birth	Model (1)	Model (2)
Early Adolescence	0.87***	0.99***
	(0.020)	(0.024)
Middle Adolescence	0.51***	0.619***
	(0.014)	(0.016)
Late Adolescence	0.31***	0.387***
	(0.019)	(0.020)
≥18 (ref. group)		
Adjusted Predictions:		
Early Adolescence	0.857***	0.864***
	(0.004)	(0.004)
Middle Adolescence	0.759***	0.770***
	(0.003)	(0.003)
Late Adolescence	0.691***	0.697***
	(0.006)	(0.006)
Adult Status	0.576***	0.557***
	(0.004)	(0.004)
Controls	No	Yes
Observations	76,166	75,872
Pseudo R^2	0.0430	0.0761

*** p<.01, ** p<.05, * p<.1

Given the current attention toward the changing patterns of sexual and reproductive behaviours of adolescents across SSA, we explore some of the socio-economic determinants of pre-marital births for our sample of women. The results of the probit model are presented in Appendix C, Table 1.17. Our results confirm that increased age at first marriage does increase the probability of women following a birth-before-marriage sequence (Sequence 1). Furthermore, we find that the probability of pre-marital births decreases with increased levels of education. Women with lower levels of education (primary and secondary) are much more likely to give birth before marriage; however, with a higher education qualification, women are less likely to have a pre-marital birth (compared with those women who have no formal education).

For the majority of women, however, first births are a consequence of marital conception. Thus we hypothesise that in contexts that combine early marriage and the Marriage-Conception-Birth (MCB) sequence, a later marital age prescribed by government policy should precipitate childbearing by delaying the age at first birth. Consistency in marriage laws, however, is paramount to the success of such a legal instrument. As evident by the marriage laws outlined in this chapters Appendix, several countries contain provisions that allow children to marry in exceptional circumstances, including if they become pregnant. A recent study from Maswikwa et al. (2015) found that teenage childbearing was 25% lower in countries with consistent minimum marriage age laws than in countries with inconsistency in legal prescription. We thus propose Ghana as an interesting case study, where most first births follow an MCB sequence and Ghanaian law prohibits underage marriage unequivocally.

1.7 Case Study: Early Marriage in Ghana and the 1998 Children's Act

Thus far, we have addressed the key research question: *What are the associations between early marriage and achieved fertility in Sub-Saharan Africa?* This section will further examine whether domestic laws criminalising underage marriage effectively tackle the issue and whether these laws, in turn, have an overall demographic effect. To this end, we use Ghana as a case study, exploiting age discontinuities in exposure to a 1998 domestic law that introduced legal consequences for underage marriage.

In 1998 the government of Ghana harmonised its child care legislation to conform to the United Nations Convention on the Rights of the Child (UNCRC) by enacting the Children's Act 1998, Act 560 (The Parliament of the Republic of Ghana, 1998). The Act came into force in January 1999 and is currently the only legal instrument protecting children in Ghana. Broadly, the Children's Act ensures the interest of the child to adequate welfare and contains legal provisions that ensure some aspects

Figure 1.10: Ghana and Regional Boundaries (Correct for DHS 2008)

of the rights of the child to provision, protection and participation within the remits of the UNCRC (Manful, 2010).

The Act itself prohibits "any cultural practice which dehumanises or is injurious to the physical and mental well-being of a child" (Section 13(1)). Concerning marriage, the Act states that "No person shall force a child (a) to be betrothed; (b) to the be subject of a dowry transaction; or (c) to be married." Furthermore, "[t]he minimum age of marriage of whatever kind shall be eighteen years." (Section 14(1 and 2). Those who contravene these provisions are liable for a GH₵5 million fine[15] and/or a prison term of one year.

The 2008 Demographic and Health Survey (n=4,926) reveals that of those women legally defined as a child by the Children's Act (46.4% of the Ghana dataset), 18.9% married before the age of 18 after 1998. At the time of data collection (2008), Ghana had ten regional boundaries[16] (as depicted in Figure 1.10), which are diverse in their ethnicities. In terms of religion, the Islamic faith has a majority in the Northern and Upper West regions. The vast majority of regions are Christian with a range of denominations represented; for example, Catholicism has a strong presence in the Upper East and Upper West, and the Pentecostal faith is dominant in Greater Accra, Eastern, Ashanti and Brong-Ahafo.

Full descriptive statistics of the 2008 DHS sample are provided in Table 1.18 in Appendix D, page 1-70. To summarise, mean age at first marriage is approximately 19 years, with age at first birth averaging slightly later at 20 years. Marital conception remains the norm, with almost 66% of births occurring after the point of marriage (15% are pre-marital births, and almost 19% of births are the result of pre-marital conception)[17].

[15] Approximately US$ 810,000.

[16] A 2018 referendum increased this to 16 regions.

[17] It is important to note that RDD analysis, by its very nature, does not use all these women to estimate the parameters of interest - only those that fall within the bandwidth used for non-

Figures 1.11 and 1.12 on page 1-36 depict the evolutions of mean age at first marriage, and child marriage incidences over time in Ghana. While early marriage practices occur throughout Ghana, there is a clear urban-rural distinction. In Figure 1.11, the mean age at first marriage for women in urban areas is consistently higher than for those residing in rural areas, remaining above the 18-year adult threshold throughout.

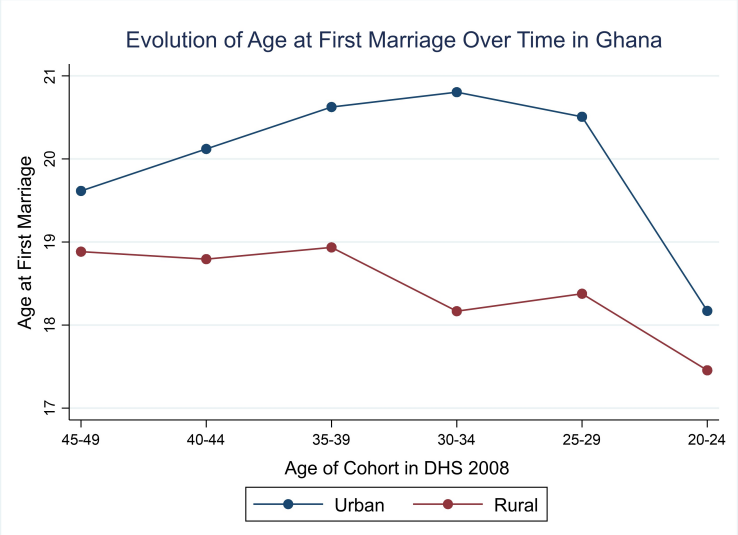

Figure 1.11: Mean Age at First Marriage Over Time Using Age Cohorts (Ghana DHS, 2008)

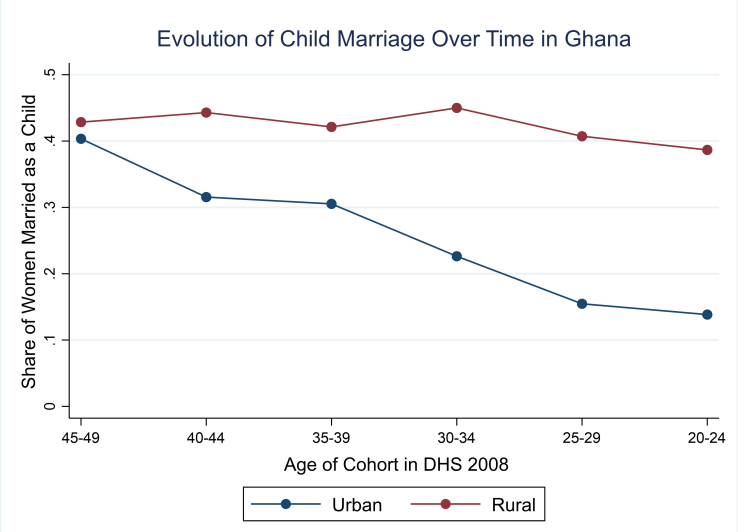

Figure 1.12: Proportion of Women Married as a Child Over Time Using Age Cohorts (Ghana DHS, 2008)

From Figure 1.12, it is evident that child marriage in urban areas has steadily declined; among those aged 45-49, 40% of women married as a child. This figure drops to an average of 30% for those aged 35-39, and finally to 13% among those

parametric analysis.

aged 20-24 at the time of data collection. The early marriage rate is primarily flat in rural areas, with figures ranging between 40 and 45% over female age cohorts.

To illustrate variations across regional boundaries, Figures 1.21 and 1.22 in Appendix D, page 1-71 similarly display the evolutions of the prevalence of early marriage and mean age at first marriage in Ghana. It is evident in some regions that early marriage has significantly declined; take, for example, the Upper West region, where rates of child marriage have historically been recorded as high (see Table 1.14 in Appendix B). Among those aged 45-49, 70% of women married as a child. This figure drops to 35% for those aged 20-24 at the time of data collection. In the adjacent Upper East region, however, rates of early marriage have primarily remained stable and, in fact, increased from 39% for those aged 45-49 years to 44% for those aged 20-24.

Figures 1.13 and 1.14 display the local linear density estimator (McCrary, 2008) of the age at first marriage for those women that were aged 12-14 (early adolescence), and for those women aged 15-17 (middle adolescence) at the time of the Children's Act implementation in Ghana (January 1st, 1999). For both early and middle adolescents, there appears a discontinuity in the density of women that first married with a partner at the age of 18; albeit, the discontinuity for the older cohort appears smaller. It is also worth noting that both Figures 1.13 and 1.14 confirm that the percentage of women that marry before reaching the minimum age of marriage is non-negligible among adolescent women.

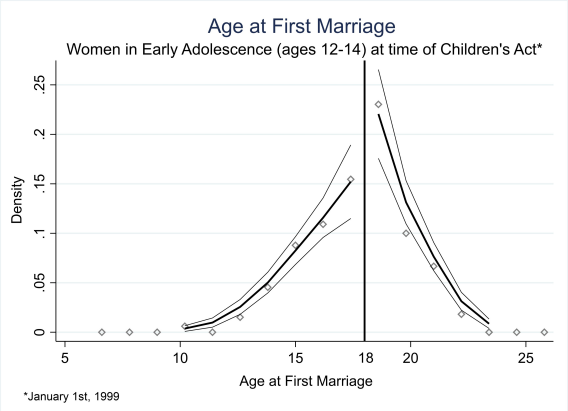

Figure 1.13: Age at First Marriage (Women in Early Adolescence at Children's Act): Discontinuity at 18 with standard error bands

Figure 1.14: Age at First Marriage (Women in Middle Adolescence at Children's Act): Discontinuity at 18 with standard error bands

Figure 1.15 demonstrates that the prevalence of early marriage is marginally lower among younger cohorts of women and seemingly changed at the 18-year cut-off. A possible reason why we only observe a modest reduction in early marriage can be attributed to the sample selection process of the DHS. Sampling includes women aged 18-49 at the time of data collection that have ever cohabited. Therefore, it is very likely that some of the youngest women (those aged 18 or 19) cohabited with their partner before they were 18.

Due to clear urban/rural differences (as evident from Figure 1.12), we decompose the regression discontinuity plot by urban/rural residence; these graphs are depicted in Figure 1.16. For women residing in urban areas, while proportions of early marriage are lower compared to rural areas, we observe that early marriage is lower among those women under 18 at the time of the Children's Act. However, we do not observe the same discontinuity for women in rural areas, as proportions of early marriage remain somewhat unchanged.

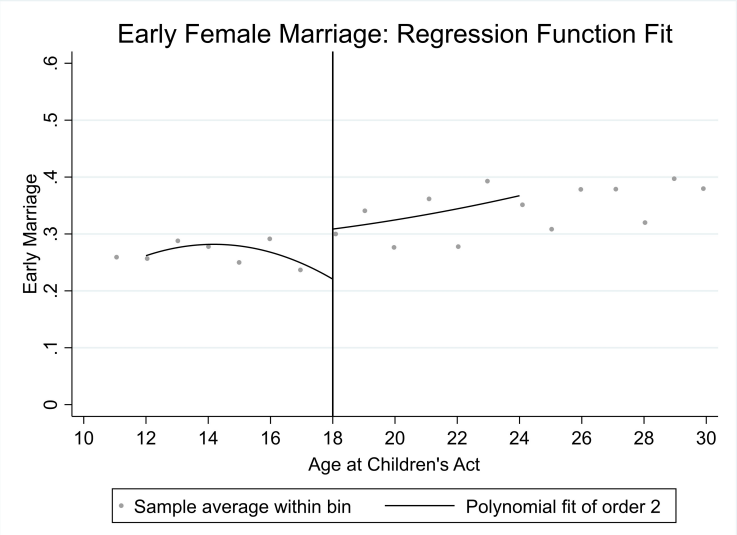

Figure 1.15: The Children's Act and Early Marriage

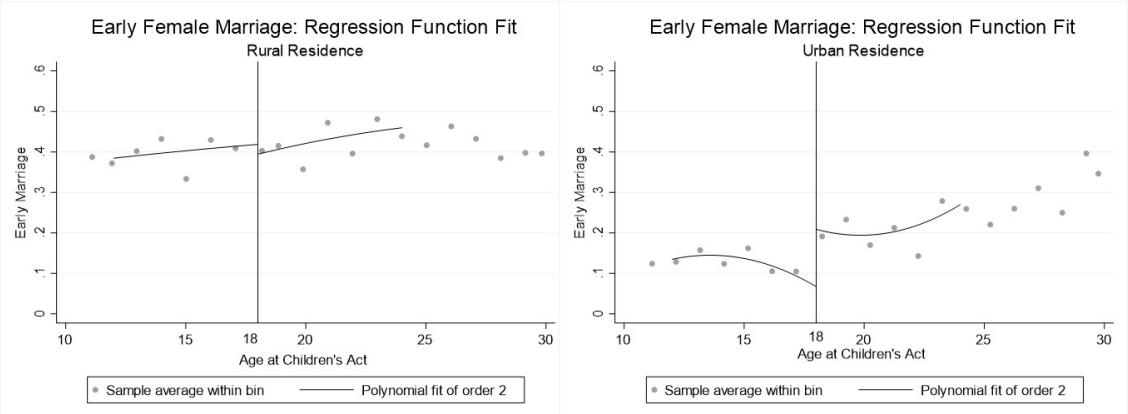

Figure 1.16: The Children's Act and Early Marriage: Urban and Rural Discontinuities

1.7.1 Identification Strategy

The Children's Act (hereafter CA) introduced legal sanctions for underage marriage in Ghana, setting a minimum threshold of 18 years for both men and women. Prior to the CA, there were no legal penalties for early marriage. Arguably, the legal change generated variation in the age of marriage faced by women of different ages, specifically:

Those women aged < 18 at the time of policy implementation were only exposed to an effective legal age of marriage at 18 years.

Figure 1.17: Age at First Marriage, Age at First Birth and Achieved Fertility, LOWESS Regression (Ghana DHS, 2008)

Those women aged > 18 when the Children's Act was approved were not directly affected by the legal age at marriage; indeed, they had been able to marry under 18 with no legal consequence.

The proposed identification strategy exploits the (potential) increase in the mean age at first marriage for those women under 18 at the time of the approval of the Children Act. Such a strategy allows us to implement a regression discontinuity design (RDD), where the forcing variable is defined at the woman's age at the time of CA implementation. We acknowledge that the approval of the CA likely *hindered* early marriage for those women younger than 18 years and not yet married when the CA was approved, but did not eradicate it among them. Exposure to a legal age of marriage at 18 does not fully determine whether a woman started her marriage after 18. Assuming imperfect enforcement and imperfect information dissemination, we must assume a fuzzy design for our regression discontinuity.

In principle, the 1998 CA provides credible exogenous variation that will allow us to estimate the effect of early marriage on demographic factors, namely fertility outcomes of Ghanaian women. Unfortunately, with the current DHS datasets, those women classified as children in 1998 have yet to reach the end of their reproductive lifespan. Therefore, it would be misleading to use "Achieved Fertility" as the outcome variable in our proposed estimation strategy, as that data is not yet "complete" per se. Instead, we propose to use age at first birth as the outcome variable (which, in turn, has an imputed relationship with achieved fertility as demonstrated by the LOWESS regression in Figure 1.17).

For our discontinuity design, we wish to estimate the effect of women's age at first marriage on the age at first birth of women. To do so, we estimate the following equation:

$$AFBirth_i = \beta_0 + \beta_1(\widehat{AFM}_i) + \beta_3 F(Age\,at\,CA_i) + \beta_4 X_i + u_i \tag{1.2}$$

where $AFBirth_i$ is the age at first birth of individual i and $\widehat{AFM}_i$ is the predicted age at first marriage for woman i. The parameter $\widehat{AFM}_i$ is generated from first estimating the impact of exposure to a legal age of marriage at 18 on women's age at first marriage:

$$AFM_i = \alpha_0 + \alpha_1(Age\,at\,CA < 18_i) + \alpha_3 F(Age\,at\,CA_i) + \alpha_4 X_i + \mu_i \tag{1.3}$$

where AFM_i is the age at first marriage of individual i, $Age\,at\,CA < 18_i$ is a dummy variable that indicates whether the woman was a "child" when the CA was approved and thus exposed to an effective legal age of marriage at 18 years. $F(Age\,at\,CA_i)$ is a function of the woman's age in years when the legal age of marriage was enforced. X_i is a vector of control variables including the region of residence, her ethnicity and religion, education in years and a dummy variable indicating whether the woman lives in a rural area. These controls are used throughout specifications. We also restrict our sample to observe those women aged <30 at the time of legislation, and married only once. Polygynous and polyandrous marriage arrangements have been excluded from the analysis. Throughout, the female sampling weight provided by the DHS is applied for all specifications.

Equation 1.3 is the first stage regression. The parameter α_1 measures the effect of the exposure to a legal marriage age of 18 on the age at first marriage of a woman, i, relative to women who were exposed to no such legal instrument. Equation 1.2 is the second stage equation which regresses age at first birth against the predicted age at first marriage estimated from equation 1.3. The parameter β_1 yields the effect of a one-year delay in women's age at first marriage on the age at first birth of woman i.

Equations 1.2 and 1.3 are estimated using non-parametric, local polynomial regressions based on triangular kernel functions. We adopt procedures from Calonico et al. (2014), Calonico et al. (2019) and most recently Calonico et al. (2020) to select optimal bandwidth and to calculate robust, bias-corrected RD estimates (and inference) "with valid variance estimators under both heteroskedasticity and clustering" (Calonico et al., 2019, p. 444). As recommended by Lee and Lemieux (2010), for RDDs based on discrete forcing variables, standard errors are clustered at the running variable level.

The RD strategy proposed here relies on two key assumptions. First, our identification assumption requires that facing an effective legal age of marriage increases the mean age at first marriage for women. If the Children's Act did not sharply affect the mean age of marriage at the cut-off, the estimated parameter β_1 in equation 1.2 would not be efficient, resulting in a weak instrument (Bound et al., 1995). Second, the RD identification strategy assumes that the determinants of age at first birth unaffected by the legal instrument should be continuously related to the forcing variable at the cut-off. While this condition cannot be tested for every determinant of achieved fertility, we later examine, in a series of placebo tests, the existence of discontinuities at the cut-off for some of these determinants (that are unlikely to be affected by the legal age at marriage). If one were to observe discontinuities at the cut off for some of these variables, there is a strong possibility that confounding factors are driving any results.

1.7.2 Results

The causal effect of women's age at first marriage on the age at first birth is given by the parameter β_1 in the second stage equation 1.2. The results for the non-parametric estimations are reported in columns (1), (3) and (5) of Table 1.9. Across all procedures, estimates suggest that a one-year delay in the age at first marriage increases age at first birth by approximately 1.1 years. This effect is statistically significant at the 1% level, and graphically depicted in Figure 1.18. When interpreting the coefficients of the second stage equation, we must acknowledge that the estimated effect of delayed marriage on the age at first birth are local, average treatments effects. In other words, the parameter of interest in our regression measures the effect of a one-year delay in the age at first marriage for those women in the DHS sample that were < 18 when the Children's Act was approved. These women then delayed marriage due to their exposure to legal sanctions that criminalised underage marriage.

Thus, the validity of our identification strategy relies on a discrete change in the mean age at first marriage at the cut-off. The size and statistical of this discontinuity is represented by the parameter α_1 from the first stage equation 1.3. Columns (2), (4), and (6) of Table 1.3 report the estimates for this parameter using non-parametric techniques and the three estimation procedures described in Calonico et al. (2020). Overall, results indicate that exposure to a legal age of marriage increases women's age at first marriage by approximately 0.8 to 1.2 years amongst those under 18 at the time of legislative change. Across the three procedures, all estimations are highly statistically significant, with the preferred estimate reported in column (4) of Table 1.9.

Complementary to the original analysis examining the impact of the law on nuptiality and fertility patterns, we empirically examine whether the law differentially affected several alternative outcomes commonly associated with

Table 1.9: Non-Parametric Methods: < 18 at Children's Act, Age at First Marriage and Age at First Birth

	Conventional		Bias-Corrected		Robust	
	(1)	(2)	(3)	(4)	(5)	(6)
	Second Stage: Age at First Birth	First Stage: Age at First Marriage	Second Stage: Age at First Birth	First Stage: Age at First Marriage	Second Stage: Age at First Birth	First Stage: Age at First Marriage
Age at First Marriage	1.162***		1.106***		1.106***	
	(0.218)		(0.218)		(0.270)	
Age < 18 at Children's Act		0.791***		1.235***		1.235***
		(0.215)		(0.215)		(0.241)
N	1295		1295		1295	
N Effective Observations	523		523		523	
Bandwidth	3.600		3.600		3.600	

Standard errors are clustered at the forcing variable and are in parentheses. *** p<.01, ** p<.05, * p<.1

Notes: This table reports the estimates of interest for the second stage and first stage equations using the three procedures described in Calonico et al. (2020): conventional variance estimator, bias-corrected variance estimator, and robust variance estimator. The coefficients for the variable *Age at First Marriage* measure the effect of delaying marriage by one year on the age at first birth of a Ghanaian woman (second stage equation 1.2). These coefficients are presented in columns (1), (3), and (5). The coefficients for the variable *Age* $<$ *18 at Children's Act* measure the effect of the CA on the age at first marriage (first stage equation 1.3) in columns (2), (4) and (6). Results are estimated using the optimal bandwidth calculated following Calonico et al. (2020) procedures. Specifications include the following control variables: rural/urban dummy, religious and ethnic dummies, years of education, and dummies for the regions of residence.

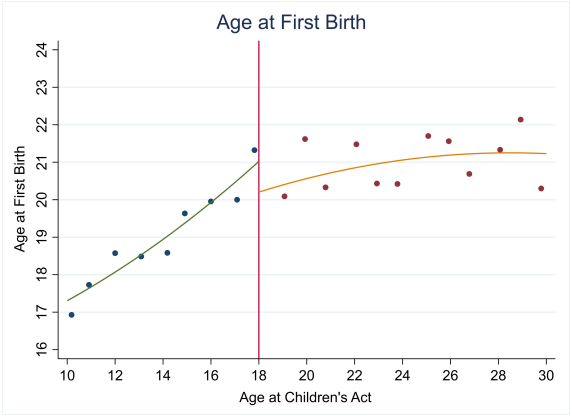

Figure 1.18: Main Analysis: Age at First Birth at the cut-off

women's later age at marriage. To do so, we estimate the reduced form equation:

$$Y_i = \delta_0 + \delta_1(Age\ at\ CA < 18_i) + \delta_3 F(Age\ at\ CA_i) + \delta_4 X_i + \epsilon_i \tag{1.4}$$

where Y_i is the outcome of interest and δ_1 measures the effect of the legal instrument on the outcome variable, relative to the absence of the legal mechanism.

In Table 1.10 we present robust RD estimates with optimal bandwidths calculated using Calonico et al. (2020) procedures. First, we estimate the impact of the CA on the incidence of early marriage and find a 6% reduction in its occurrence. This effect is statistically significant at the 5% level. Second, we investigate the law's impact on women's age at first sexual intercourse and find no significant effect. Third, we examine pregnancy termination and find a statistically significant increase (8.2%) in women terminating pregnancies post Children's Act. However, we are reluctant to infer causality due to the likelihood of improved service and healthcare delivery in the decade after the Act. Furthermore, due to data limitations, we cannot disentangle whether increased terminations are due to increased female agency, or to enhanced capacities leading to increased uptake of female sexual and reproductive services.

Finally, we investigate incidences of domestic violence; specifically, we look at incidences of emotional, physical and sexual violence perpetrated by the spouse. Please see the footnote in Table 1.10 for more precise details of these variables. Overall, it appears that the Children's Act of 1998, while not perfectly enforced (see McCrystal and Manful (2011) where "findings suggest that there is a gap between legal intent and practice") did have an overall welfare improving effect. Women under 18 at the time of the Act report 4.8% less physical violence (significant at the 10% level), 10.2% less emotional violence, and 3.1% less sexual domestic violence in the household; however, the latter two coefficients are insignificant.

1.7.2.1 Placebo Analysis

To assess the validity of the identification strategy, we examine the existence of discontinuities in variables that are plausibly not affected by the Children's Act. Such variables include the religion and ethnicity of women in the sample. Examining these discontinuities (or lack thereof) acts as an indirect empirical test for the identification assumption discussed prior; the determinants of age at first birth should be continuously related to the forcing variable at the cut-off. To test for this, we again estimate equation 1.2 (and 1.3) using bias-corrected RD estimates for whether the individual is Pentecostal/Charismatic Christian or from

Table 1.10: Non-Parametric Methods: < 18 at Children's Act and Alternative Outcomes

	(1) Early Marriage	(2) Age at First Intercourse	(3) Terminated Pregnancy	(4) Emotional Domestic Violence	(5) Physical Domestic Violence	(6) Sexual Domestic Violence
Age < 18 at Children's Act	-0.060**	-4.467	0.082*	-0.102	-0.048*	-0.031
	(0.028)	(7.333)	(0.044)	(0.314)	(0.025)	(0.117)
N	1448	1448	1446	865	865	864
N Effective Observations	852	852	685	410	354	410
Bandwidth	5.138	5.183	4.771	4.453	3.337	4.101

Standard errors are clustered at the forcing variable and are in parentheses. *** p<.01, ** p<.05, * p<.1

Notes: This table reports the estimates of interest for reduced form equation using the robust variance estimating procedure outlined in Calonico et al. (2020). The coefficients for the variable *Age < 18 at Children's Act* measure the effect of the CA on six outcome variables. *Emotional Violence* is a binary variable taking the value 1 if a woman ever experienced humiliation, threats of harm, insults from her husband; 0 if otherwise. *Physical Violence* is a binary variable taking the value 1 if a woman ever experienced the following forms of severe physical violence: strangulation, burning, threatened or attacked with knife/gun or other weapon; 0 if otherwise. *Sexual Violence* is a binary variable taking the value 1 if a woman was ever physically forced to have sex with her husband when not wanted, or was forced to perform other sexual acts when not wanted; 0 if otherwise.

the Akan ethnic group as outcome variables[18]. The results of these estimations are provided in columns (1)-(4) of Table 1.11, and illustrated in Figure 1.19. The coefficients for the second stage regressions are small and insignificant, confirming the absence of discontinuities in the value of these placebo variables at the cut-off.

We also examine whether differences in age at first birth are driven by systematic differences between women born in different years rather than exposure to a minimum age at marriage law. To assess this, we re-estimate our equations using the same data but act as if the law were placed four years before its actual implementation. The results of this exercise are reported in columns (5) and (6) of Table 1.11, and again illustrated in Figure 1.19. If results were driven by systematic differences between women born in different years, we would expect a significant discontinuity in age at first birth every year. Coefficients for age at first birth and mean age at first marriage are positive but not statistically significant, and the standard error far exceeds the value of the coefficient. There is likely a natural trend toward delayed marriage and first birth, but not significantly different year to year. This finding adds weight to the main conclusions of this study by confirming that discontinuities are not due to systemic differences between Ghanaian women born in different years.

[18]Pentecostal/Charismatic is the dominant denomination of Christianity in Ghana, and the Akan are the most prevalent ethnic group based on the 2008 DHS statistics.

Table 1.11: Robustness Check: Placebo Analysis

	Religion		*Ethnicity*		*Four Years Before CA*	
	(1) Second Stage: Pentecostal/ Charismatic	(2) First Stage: Age at First Marriage	(3) Second Stage: Akan Ethnicity	(4) First Stage: Age at First Marriage	(5) Second Stage: Age at First Birth	(6) First Stage: Age at First Marriage
Age at First Marriage	0.027		0.103		1.766	
	(0.160)		(0.105)		(5.882)	
Age < 18 at Children's Act		0.856**		0.960***		0.776
		(0.398)		(0.375)		(1.259)
N	1448		1448		1295	
N Effective Observations	852		685		470	
Bandwidth	5.118		4.451		3.245	

Standard errors are clustered at the forcing variable and are in parentheses. *** p<.01, ** p<.05, * p<.1 *Notes*: This table reports the estimates of interest for the second stage and first stage equations using the robust variance estimating procedure outlined in Calonico et al. (2020). Results are estimated using the optimal bandwidth calculated following Calonico et al. (2020) procedures. Specifications include the following control variables: rural/urban dummy, religious and ethnic dummies, years of education, and dummies for the regions of residence.

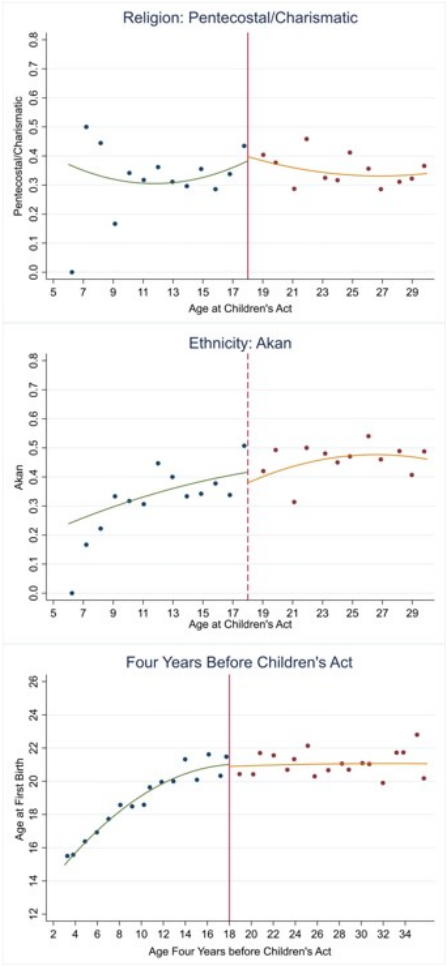

Figure 1.19: RDD Placebo Testing: Religion, Ethnicity and Four Years Before Children's Act

1.7.2.2 Alternative Cut-Off

In our first stage and reduced form equations (1.3 and 1.4) we use $Age\,at\,CA < 18_i$; a dummy variable indicating whether the woman was a legally defined 'child' at the time of legislation. However, women not married by late adolescence are less likely to be exposed to the treatment *per se*, as their decision to marry later is likely endogenous. Since they have exceeded the mean age at early marriage of 15, young women not married by 16 or 17 have presumably taken the decision to marry later. They, therefore, do not technically fall into the treatment assigned by the Children's Act, and so the results presented in Table 1.9 may be biased.

In an RDD of this nature, it is arguably more appropriate to observe women below 15 when the policy was implemented, as they are the 'target' demographic. The decision to examine 15 years as an alternative cut-off is further motivated by the discontinuities observed earlier in Figures 1.13 and 1.14 on page 1-38. For younger cohorts of women, the discontinuity in the density of women who first married their partner at 18 appears larger. Therefore, in this section we re-estimate equation 1.3 using the dummy $Age\,at\,CA < 15_i$, and results are presented in Table 1.12.

Table 1.12: Non-Parametric Methods: < 15 at Children's Act, Age at First Marriage and Age at First Birth

	Conventional		Bias-Corrected		Robust	
	(1)	(2)	(3)	(4)	(5)	(6)
	Second Stage: Age at First Birth	First Stage: Age at First Marriage	Second Stage: Age at First Birth	First Stage: Age at First Marriage	Second Stage: Age at First Birth	First Stage: Age at First Marriage
Age at First Marriage	0.697***		0.908***		0.908**	
	(0.267)		(0.267)		(0.506)	
Age < 15 at Children's Act		0.439***		0.523***		0.523**
		(0.151)		(0.151)		(0.299)
N	1295		1295		1295	
N Effective Observations	440		440		440	
Bandwidth	3.454		3.454		3.454	

Standard errors are clustered at the forcing variable and are in parentheses. *** p<.01, ** p<.05, * p<.1

Notes: This table reports the estimates of interest for the second stage and first stage equations using the three procedures described in Calonico et al. (2020): conventional variance estimator, bias-corrected variance estimator, and robust variance estimator. Results are estimated using the optimal bandwidth calculated following Calonico et al. (2020) procedures. Specifications include the following control variables: rural/urban dummy, religious and ethnic dummies, years of education, and dummies for the regions of residence.

Compared with the coefficients from Table 1.9, estimates from Table 1.12 are all slightly lower, particularly first-stage estimates for age at first marriage. This is likely due to removing a probable source of bias, as the decision to marry later by late adolescents (particularly those aged 16 and 17) is conceivably endogenous.

Overall, results indicate that exposure to a legal age of marriage increases the age at first marriage by approximately 0.4-0.5 years for women under 15 at the time of legislation. Across the three procedures, all estimations are highly statistically significant, with the preferred estimate reported in column (4). Estimates further suggest that a one-year delay in the age at first marriage for those women in the DHS sample younger than 15 at the time of legislation increased their age at first birth by approximately 0.7 to 0.9 years. Again, all estimates are highly statistically significant. We similarly conduct Placebo testing using the under 15 sample for unrelated variables: religion and ethnicity. The coefficients for the second stage regressions are small and insignificant, with large standard errors[19]. Like before, we can confirm the absence of discontinuities of these placebo variables at the cut-off.

1.8 Discussion and Conclusion

Early marriage remains highly prevalent in many Sub-Saharan African countries. Unlike the previous empirical literature examining nuptiality and fertility patterns in SSA, we decompose early marriage to more refined adolescent age groupings to better capture age-specific variations in achieved fertility.

In doing so, we found considerable differences between women and between countries. Aggregated data suggests that across the SSA region, marriage in middle adolescence (ages 15 to 17) is associated with 4% higher fertility than those women marrying over 18, robust to the inclusion of controls. For late adolescence (18 years), we similarly observe statistically higher fertility. However, contrary to the Bongaarts et al. (1984) model, we do not observe higher fertility among early adolescents (≤ 14); for some countries we actually observe a statistically negative association between fertility levels and this age category. Overall, our results suggest that marriage specific fertility among 15 to 18-year-olds contributes to SSA's persistently high fertility rates.

We find some evidence that those married in early adolescence engaged in pre-marital sexual activity that led to a birth before marriage (with a probability of 0.022) or a birth within the first eight months of marriage (probability of 0.118). While these figures are small, they are of great concern for public health given the high likelihood of complications at birth for mother and child. More complete, retrospective data is needed to understand better the dynamics of adolescent sexual and reproductive health transitions. Studying the evolutions of these transitions can help establish whether trends have increased and so better identify those most vulnerable.

Overwhelmingly, however, the majority of martial fertility occurs after the point of marriage across all age categories. Much like the experiences of Europe pre-industrial

[19]Pentecostal: 0.05 (0.05). Akan: 0.013 (0.025)

revolution, passing direct and unconditional laws increasing age at marriage should dampen fertility by reducing the number of years fecund women live in matrimony. However, the current lack of coherence and consistency in marriage laws across SSA remains a severe obstacle, exploited by those whose intention it is to marry young or force those to marry under threat of shame or punishment.

This chapter concluded with a case study on Ghana, examining whether the 1998 Children's Act, which criminalised underage marriage, affected young Ghanaian women's nuptiality and fertility patterns. Using a multi-stage regression discontinuity design, the case study exploits variation in the age of marriage faced by women due to a legal change. The study then estimates the causal effect of age at first marriage on women's age at first birth. The RDD estimates suggest that criminalisation of marriage under 18 increases women's age at first marriage by 0.8 to 1.2 years and reduces incidences of early marriage by approximately 6% among women. This study also found evidence that the Act had an overall welfare improving effect, with an approximate 5% reduction in women experiencing physical domestic violence in the household.

Estimates further suggest that criminalising underage marriage increases women's age at first birth in Ghana. A one-year marriage delay increases the age at first birth by approximately 1.1 years, suggesting improvements in adolescent sexual and reproductive health. This result is robust to the inclusion of alternative variables and estimation methods. Furthermore, Placebo testing confirms that discontinuities are not due to systemic differences between Ghanaian women born in different years. Our analysis also acknowledges that the decision to marry later may be endogenously determined, particularly for those women in the upper threshold of adolescence (16 and 17). We, therefore, rerun our RDD using 15 years as the cut-off to account for possible bias. We similarly obtain highly statistically significant results that legislation increased age at first birth by 0.9 years.

While there are apparent gaps between legal intent and practice (McCrystal and Manful, 2011), Ghana's Children's Act of 1998 did simultaneously increase the age at first marriage and age at first birth for women. Much like Hertrich (2017), we feel that the impact of increased age at marriage on fertility is mediated through changes in conjugal and gender relationships. Women who marry later are more likely to control their childbearing actively, including their expression of fertility preferences, decisions and practices. This perhaps gives explanatory power to the result we received for increased pregnancy termination due to the Children's Act; however, further investigation is required to substantiate this claim.

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Appendix A: List of Studied Countries and Latest DHS Survey Year

Data was downloaded with relevant permissions from The DHS Program (available at: https://dhsprogram.com/data/). An application was submitted and approved by the relevant online DHS authority.

Table 1.13: Summary Statistics of Age at Marriage by Adolescent Age Stratifications

Country	Year	Number of Women Married Once and aged ≤ 49	% Married Early Adolescence	% Married Middle Adolescence	% Married Late Adolescence	% Married as Adults
Angola	2015-2016	2,095	11.63	32.40	12.02	43.95
Burkina Faso	2010	4,528	10.98	47.06	14.36	27.59
Benin	2017-2018	3,564	15.97	26.84	12.03	45.16
Burundi	2016-2017	3,329	3.62	22.49	14.12	59.77
DRC	2013-2014	3,714	13.81	35.55	11.45	39.19
Congo	2011-2012	1,720	11.18	27.18	10.69	50.95
Cote d'Ivoire	2011-2012	1,812	13.86	33.83	9.80	42.51
Cameroon	2011	2,381	17.71	34.25	11.39	36.65
Ethiopia	2008	5,223	24.34	38.55	10.65	26.46
Gabon	2012	1,338	9.47	22.24	7.26	61.03
Ghana	2014	1,468	7.28	23.05	10.25	59.42
Gambia	2013	1,259	18.27	32.81	10.53	38.40
Guinea	2012	1,948	32.16	38.86	8.29	20.69
Kenya	2014	4,902	5.97	25.62	12.77	55.63
Comoros	2012	665	10.19	27.35	8.17	54.29
Liberia	2013	1,283	9.74	33.92	10.61	45.73
Lesotho	2014	709	2.56	26.13	11.94	59.37
Mali	2012-2013	2,854	21.75	37.07	10.39	30.78
Malawi	2015-2016	3,133	9.83	38.91	18.38	32.88
Mozambique	2011	1,710	15.91	36.30	12.07	35.72
Nigeria	2013	7,771	25.53	32.40	7.57	34.50
Namibia	2013	917	3.72	13.06	5.46	77.76
Rwanda	2014-2015	2,659	0.69	11.50	9.53	78.28
Sierra Leone	2013	2,908	17.36	37.07	11.58	33.98
Senegal	2017	2,312	12.23	29.95	10.73	47.09
Chad	2014-2015	2,730	32.34	44.72	7.30	15.64
Togo	2013-2014	1,927	9.34	26.16	13.08	51.42
Uganda	2016	2,009	10.46	34.19	15.43	39.92
Zambia	2013-2014	6,035	8.79	40.20	13.43	37.58
Zimbabwe	2015	2,984	4.64	31.16	15.77	48.43

Notes: Early Adolescence refers to those women married ≤ 14; Middle Adolescence for those women married 15-17 (inclusive); Late Adolescence for those women married at 18; and Adult refers to those women married > 18. % statistics are weighted using the female sampling weight provided by the DHS.

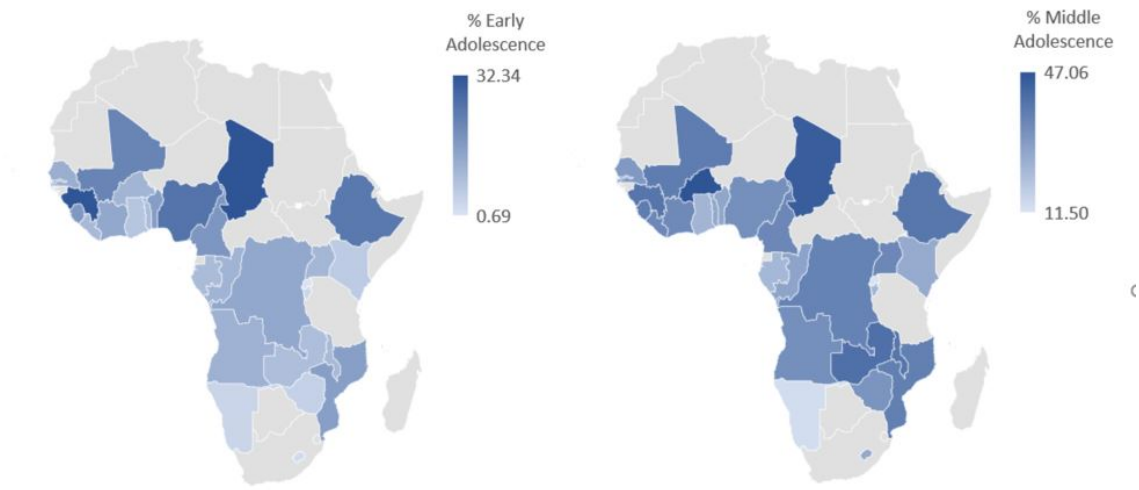

Figure 1.20: Heat Maps for Age at Marriage (Early Adolescence, Left; Middle Adolescence, Right)

Appendix B: Marriage Laws for Studied Countries

Table 1.14: Marriage Laws for 30 Studied Countries

Country	Marriage Law with Comments	Source
Angola	The legal age for marriage for both men and women is 18 years old; with parental consent, 15 years for girls and 16 for boys. Where consent is not provided, an appeal may be made to the court to obtain permission for marriage. The government and legal system does not enforce this restriction effectively, and child marriage (legal or customary) is prevalent Age at marriage in lower-income groups coincides with the onset of puberty. Common-law marriage is widely practiced.	*Angolan Family Code 1988; Article 24*
Burkina Faso	Marriage can only be contracted between a man over the age of 20 and a woman over 17; exemptions are granted for 'serious reasons' by the civil court, however age exemptions cannot be granted 'under any circumstances' for a man under 18 and a woman under the age of 15. The law only applies to marriages registered by the state, but not for traditional or religious ones.	*Burkina Faso Code of Persons and Family 1989; Article 238(1)*
Benin	The marriage may be contracted only between a man who is at least 18 years old and a woman who is at least 18 years old, unless an exception is granted on grounds of age by 'order of the presiding trial court on motion by the Crown'. Underage marriage (14-17) is allowed with parental consent, the consent of both underage individuals, and the authorisation of a judge. Early and forced marriage includes barter marriage and marriage by abduction (and rape); practice is widespread in rural areas, and local NGOs report that some communities conceal the practice.	*Benin Code of Persons and Family 2002; Article 120 & 123*

Table 1.14 Continued from Previous Page

Burundi	The legal age of marriage is 18 years old for women and 21 years old for men; the governor of the province can, however, grant authorisation for marriage under the legal age in extenuating circumstances. Forced marriages are illegal and rare, although they are reported in Southern, heavily Muslim areas.	*Burundi Code of Persons and Family; Article 88*
DRC	The legal minimum age for marriage for women and men in the DRC is 18 years old. The law also specifically prohibits children, even emancipated, from contracting marriage.	*DRC Family Code 2016 (Revised); Article 357*
Congo	The law prohibits child marriage, and the legal age for marriage is 18 for women, and 21 for men. Underage marriage is possible with a judge's permission, and with the permission of both sets of parents; the law however, does not specify a minimum age in such a case. In practice, many couples engage in an informal common-law marriage, not legally recognised.	*Congo Family Code; Article 128*
Cote d'Ivoire	Legal age of marriage is18 for women and 21 for men. The court can, however, make exceptions for serious (unspecified) reasons. While the law prohibits early and forced marriages, as well as the payment of dowry, it is rarely enforced.	*Cote d'Ivoire Civil Code 1983 'Mariage: Chapitre Premier Des Conditions Requises Pour Pouvoir Contracter Mariage'; Article 1*
Cameroon	Until 2016, the minimum legal age for marriage is 15 for girls and 18 for men; legal changes to Section 356 of the Penal Code in 2016 raised the minimum age from 15 to 18 years. Early marriage remains heavily prevalent in the region of Adamaoua, where many girls as young as 9 face severe health risks as a result of pregnancies.	*Ordinance No. 81-02 (29 June 1981) on the civil service; Article 52 Republic of Cameroon Penal Code 2016; Section 356*

Table 1.14 Continued from Previous Page

Ethiopia	The law sets the legal marriage age for girls and boys at 18; Article 648 of the Criminal Code criminalises child and forced marriages. However, the Minister of Justice may grant a dispensation for individuals to marry at 16 upon application by the couple, and from their parents. The legal age for marriage is rarely enforced uniformly, and rural families are often unaware of this provision. Girls continue to marry early in religious or customary arrangements.	*Constitution of the Federal Democratic Republic of Ethiopia 1994; Article 34(1)* *Revised Family Code 2000; Section 2, Article 7* *Ethiopia Criminal Code 2005; Article 648*
Gabon	The minimum age for consensual sex and marriage is 15 for girls and 18 for boys. Article 203 also provides that the President of the Republic or President of the Supreme Court may approve marriages below the minimum age for 'serious reasons'. Reports indicate that it is rare for girls under age 18 to marry but common for them to be in relationships with men outside of marriage. Teenage pregnancy is widespread.	*Gabon Civil Code 1972; Article 203*
Ghana	The minimum legal age for marriage for both sexes is 18 years. Forced child marriage, while illegal, remains a serious problem. Child marriage is very prevalent in Upper East Region, West, and Upper West Regions.	*The Children's Act (Act 560) 1998; Part 1, 14(2)*
Gambia	Until recently, The Gambia did not have an official legal minimum age of marriage. However, in July 2016, President Yahya Jammeh declared marriage under the age of 18 to be illegal for both boys and girls. Anyone involved in the marriage of a person(s) under the age of 18 including parents, the spouse and religious leaders can be punished by a sentence of up to 21 years in prison. However, there is no minimum age of marriage under Islamic Sharia law, which is the dominant tradition governing family law in The Gambia.	*The Children's (Amendment) Act 2016*

Table 1.14 Continued from Previous Page

Guinea	Article 284 of the Guinean Civil Code states that both men and women under the age of 21 cannot marry without the consent of their father (or the head of the household, if the father is absent). In terms of the legal age of marriage, the Guinean Child Code prohibits men and women under the age of 18 from marrying. Early and forced marriages are, however, still practiced in Guinea.	*Civil Code of the Republic of Guinea 1983; Article 284* *Child Code of the Republic of Guinea 2008; Article 268*
Kenya	The legal age of marriage for both women and men is 18. The law does not provide for any legal exceptions in this regard. The minimum age applies to all forms of marriage, i.e. civil, Christian, Hindu, Islamic and customary. In addition, the Counter Trafficking in Persons Act, 2010 classifies child marriage as a form of exploitation.	*Kenya Marriage Act 2014; Section 4* *Kenya Counter Trafficking in Persons Act 2010*
Comoros	The legal age of marriage for women and men is 18 years old. A judge can authorise marriage below the legal age in extenuating circumstances, and if both spouses consent.	*Comoros Family Code 2005 Article 14 & 15*
Liberia	Marriage of any child under the age of 16 is prohibited both under civil and customary law. The legal age of marriage for women is 18 years, while the legal age for men is 21 years. For those under the minimum legal ages, but over the age of 16 years, the consent of a parent, guardian or judge is required for marriage.	*Children's Law 2011; Section 4* *Domestic Relations Law 1973; Chapter 2* *Equal Rights of Customary Marriage 1998; Section 29, 2.10*

Table 1.14 Continued from Previous Page

Lesotho	The legal age of marriage for both women and men is 21.Under certain exceptions, males at the age of 18 and females at the age of 16 may enter into marriage with the written consent of the Minister responsible if such marriage is considered desirable. In addition, the consent of both parents of minors is required. There is some inconsistency regarding the marriage age as the Children's Protection and Welfare Act sets legal age of 18 and does not stipulate any exceptions. Early marriages are common in rural areas since the customary law does not set a minimum age for marriage.	*Marriage Act 1974; Section 25 & 27 Children's Protections and Welfare Act 2011; Section 3*
Mali	In civil law, the legal minimum age set for marriage is 16 years old for girls and 18 years old for boys. Persons under the minimum age (but at least 15 years old) may still enter marriage provided there is permission by a judge and parental consent. Authorities do no effectively enforce the law, particularly in rural areas. In addition, most customary marriages are unregistered especially those involving children as they lack birth registration documents.	*Mali Code of Persons and the Family 2011; Article 281 & 284*
Malawi	Under the Constitution and the Marriage, Divorce and Family Relations Bill No. 5 (2015), the minimum legal age of marriage is 18 years with no exceptions. Despite legal prohibitions, child marriage continues to be practiced.Under customary and religious tradition, puberty is commonly used as a marker to determine whether a person is ready for marriage (Human Rights Watch, 2014).	*Constitution of the Republic of Malawi 2004 Marriage, Divorce and Family Relations Act 2015; Bill No. 5*
Mozambique	The legal minimum age of marriage for girls and boys is 18 years old. A 'no exemptions' addendum was included in 2019.	*Mozambique Family Law 2004 Family Law Amendment 2019*

Table 1.14 Continued from Previous Page

Nigeria	There are several different laws related to the minimum legal age of marriage in Nigeria. Under civil law, the minimum legal age of marriage is 21 years old for men and women. The consent of a legal authority (parent, court, administrative officer) is required for marriage of a person under the legal age. Under the Child Rights Act 2003, the minimum legal age of marriage is 18 years, without exception. However, out of 36 Nigerian federal States, 12 (11 of which are located in the north of the country) have not included the Act in their internal legislation. It follows that in those States local laws are applied, most of which are Islamic (Sharia) Law provisions. There is also a lack of harmonisation between the Child Rights Act 2003 which sets 18 years as the minimum age of marriage and the Sexual Offences Bill 2015 which sets the minimum age of sexual consent at 11 years.	*Marriage Act 1990* *Child Rights Act 2003* *Sexual Offences Bill 2015*
Namibia	The legal age of marriage for both men and women is 18. However, under Article 24 girls and boy under the age of 18 can marry with the written permission of a minister (or any staff member in the Public Service authorised by the minister). Customary marriages are not recognised under Namibian law.	*Married Persons Equality Act 1996; Article 24*
Rwanda	As per the Law Governing Persons and Family, the minimum legal age of marriage is 21 for both men and women, without exceptions. Marriages of persons under the age of 21 are subject to automatic, absolute annulment. Anecdotal evidence suggests that child marriage is more common in rural areas, and in refugee camps.	*Law Governing Persons and Family 2016; Article 168 & 193*

Table 1.14 Continued from Previous Page

Sierra Leone	Under the Child Rights Act 2007 the minimum legal age of marriage is 18 years. However this is contradicted by the Customary Marriage and Divorce Act 2009 which similar sets a legal threshold of 18, but allows underage children to be married off with parental consent, (and does not stipulate a minimum age of marriage).	*Child Rights Act 2007; Section 46 Customary Marriage and Divorce Act 2009*
Senegal	While Article 276 of the Family Code establishes that minors cannot get married without the consent of their parents (a minor is considered as a person under 18 years according to the Family Code), Article 111 of the same code permits marriage at the age of 16 years for girls, and 18 years for boys. Child marriage is penalized only under civil law, by the annulment of marriage. However, there is no penalty under criminal law, unless the husband consummates a customary marriage with a minor under 13 years of age. In general, laws are not enforced in most communities where marriages were arranged.	*Family Code 1989; Article 111 & 276 Senegal Criminal Code 1977; Article 300*
Chad	The minimum age of marriage in Chad is 18 for girls and boys, with no legal exceptions. According to Article 277 of the Criminal Code, customary law marriages of girls above 13 are legal (before 13 is 'deemed to be rape and punishable as such').	*The Decree on the Prohibition of Child Marriage 2015; Article 2 Criminal Code 1967; Article 277*
Togo	In 2012, the state's Personal and Family Code amended the legal age for both women and men to 18 years old, aligning it with the Children's Code which also sets the minimum age for marriage at 18 years old. Previously, the minimum age for marriage was 20 years old for men and 17 years old for women (1980). It is possible to marry at 16 years for serious cause, with permission from judicial and parental consent.	*Personal and Family Code 2012 Children's Code 2007; Article 267*

Table 1.14 Continued from Previous Page

Uganda	The minimum legal age of marriage is 18 years for both girls and boys. The Children's Act formalises the parameters of child marriage and includes formal and informal unions. The Ugandan Constitution (amended) also sets the minimum legal age of marriage at 18. There is however complexity in Ugandan legal system and it is not clear how provisions in civil, religious and customary laws interact with one another. The Marriage Act for civil marriages sets the legal age at 21, but 18 with parental consent. The Customary Marriage (Registration) Act sets the minimum age of marriage at 16 for girls and 18 for boys. The Hindu Marriage and Divorce Act sets the minimum age at 18 for boys and 16 for girls. Girls aged 16 require parental consent. The Marriage and Divorce of Mohammedans Act does not set a minimum age of marriage. Authorities rarely enforce laws, and parental arrangements are common, particularly in rural areas.	*Ugandan Children's Act 2016* *Ugandan Constitution (Amended) 2016; Article 31* *The Marriage Act 1904* *Customary Marriage Act 1973; Chapter 248* *The Hindu Marriage and Divorce Act 1961* *The Marriage and Divorce of Mohammedans Act 1906*
Zambia	The legal age of marriage for both women and men is 21. Under certain exceptions, women and men under legal age may enter into marriage with the written consent of the father. In case of refusal parent or guardian, the consent may be granted by a Judge of the High Court. Nonetheless, a marriage between persons either of whom is under the age of 16 years becomes void. Moreover, child marriage is recognised as a form of "physical, mental, social or economic abuse" and criminalised under the Anti-Gender-Based Violence Act. The ban of child marriage is also supported by the criminalisation of sexual intercourse with a person under the age of 16. The customary law does not set a minimum age for marriage but anecdotal evidence suggests that girls are married as soon as they reach puberty.	*Marriage Act 1964; Section 10, 17 & 33* *Anti Gender-Based Violence Act 2011; Section 2 & 3* *Penal Code (Amended) 2005; Section 138*

Table 1.14 Continued from Previous Page

Zimbabwe	In 2016 Zimbabwe's Constitutional Court outlawed child marriage in accordance with the constitutional definition of "child" and the right to equal treatment. As a result, no one before the age of 18 may enter into marriage, without exception. The ruling includes marriages under the Customary Marriages Act which had previously not had a minimum age requirement.	*Constitution of Zimbabwe 2013* *Girls Not Brides 2016* *Zimbabwe: Former child brides win case to make child marriage illegal*

Appendix C: Supplementary Material

Table 1.15: Full Descriptive Statistics

Variable	Obs	Mean	Standard Deviation	Min.	Max.
Age at First Marriage:					
Early Adolescence	81887	0.142	0.349	0.000	1.000
Middle Adolescence	81887	0.334	0.472	0.000	1.000
Late Adolescence	81887	0.115	0.319	0.000	1.000
Adult Status	81887	0.409	0.492	0.000	1.000
Age:					
15-19	81887	0.078	0.268	0.000	1.000
20-24	81887	0.195	0.396	0.000	1.000
25-29	81887	0.237	0.426	0.000	1.000
30-34	81887	0.191	0.393	0.000	1.000
35-39	81887	0.148	0.355	0.000	1.000
40-44	81887	0.094	0.292	0.000	1.000
45-49	81887	0.056	0.230	0.000	1.000
Sex of Household Head:					
Male	81887	0.952	0.215	0.000	1.000
Female	81887	0.048	0.215	0.000	1.000
Currently Working	81735	0.650	0.477	0.000	1.000
Religion:					
Catholic	81720	0.180	0.385	0.000	1.000
Methodist	81720	0.003	0.051	0.000	1.000
Assembly of God	81720	0.004	0.063	0.000	1.000
Universal	81720	0.000	0.016	0.000	1.000
Jehovah's Witnesses	81720	0.001	0.031	0.000	1.000
Protestant	81720	0.157	0.364	0.000	1.000
Islamic	81720	0.336	0.472	0.000	1.000
Animist / Traditional	81720	0.016	0.124	0.000	1.000
No Religion	81720	0.023	0.148	0.000	1.000
Adventist	81720	0.010	0.098	0.000	1.000
Evangelical	81720	0.013	0.113	0.000	1.000
Orthodox	81720	0.022	0.148	0.000	1.000
Anglican	81720	0.011	0.103	0.000	1.000
Christian	81720	0.188	0.390	0.000	1.000
Other	81720	0.037	0.190	0.000	1.000
Region:					
Urban	81887	0.319	0.466	0.000	1.000
Rural	81887	0.681	0.466	0.000	1.000
Wealth Index:					
Lowest	81887	0.223	0.416	0.000	1.000
Low	81887	0.209	0.407	0.000	1.000
Middle	81887	0.194	0.395	0.000	1.000
High	81887	0.187	0.390	0.000	1.000
Highest	81887	0.187	0.390	0.000	1.000

Table 1.15 continued from previous page

Variable	Obs	Mean	Standard Deviation	Min.	Max.
Female Education:					
No Education	81881	0.406	0.491	0.000	1.000
Primary	81881	0.334	0.472	0.000	1.000
Secondary	81881	0.223	0.417	0.000	1.000
Higher	81881	0.037	0.189	0.000	1.000
Age Difference with Spouse:					
Wife Older	81887	0.035	0.185	0.000	1.000
Same Age	81887	0.029	0.168	0.000	1.000
Husband Older by 1 to 9 years	81887	0.655	0.475	0.000	1.000
Husband Older by 10 to 19 years	81887	0.244	0.430	0.000	1.000
Husband Older 20+ years	81887	0.036	0.187	0.000	1.000
Male Age at First Marriage:					
Early Adolescence	81887	0.003	0.050	0.000	1.000
Middle Adolescence	81887	0.067	0.250	0.000	1.000
Late Adolescence	81887	0.046	0.210	0.000	1.000
Adult Status	81887	0.884	0.320	0.000	1.000
Achieved Fertility	81887	3.237	2.200	0.000	15.000
Marriage Length	81887	11.702	8.042	0.000	39.000
Polygynous Arrangement	81887	0.181	0.385	0.000	1.000
Pre-Marital Birth	76166	0.149	0.356	0.000	1.000
Pre-Marital Conception	76166	0.165	0.371	0.000	1.000
Marital Conception	76166	0.686	0.464	0.000	1.000

Table 1.16: By Country: Post-Estimation Wald Testing for Negative Binomial Model

Country	Angola	Burkina Faso	Benin	Burundi	DRC	Congo	Cote d'Ivoire	Cameroon	Ethiopia	Gabon	Ghana	Gambia	Guinea	Kenya	Comoros
Wald Tests (post-estimation)															
a=b	0.13	0.11	2.67	1.06	0.45	0.43	1.36	3.36	3.15	0.37	5.43	0.16	4.07	1.28	0.10
χ^2(p-value)	0.7213	0.7368	0.1021	0.3025	0.5044	0.5135	0.2434	0.0668	0.0759	0.5409	0.0198	0.6882	0.0436	0.2585	0.7460
a=c	0.13	0.12	1.27	4.31	0.82	0.00	0.50	0.76	0.20	0.26	7.00	0.73	0.25	0.12	0.02
χ^2(p-value)	0.7137	0.7262	0.2604	0.0378	0.3652	0.9768	0.4790	0.3846	0.6566	0.6095	0.0082	0.3922	0.6160	0.7333	0.8895
a=d	1.80	0.14	0.03	2.47	0.00	0.56	0.26	2.33	0.02	5.44	4.93	0.80	0.98	0.29	0.46
χ^2(p-value)	0.1802	0.7094	0.8731	0.1159	0.9954	0.4535	0.6089	0.1268	0.8789	0.0196	0.0263	0.3712	0.3225	0.5912	0.4953
b=c	0.73	0.02	0.06	4.79	3.67	0.42	0.00	0.35	0.79	0.00	1.10	0.59	0.51	0.61	0.36
χ^2(p-value)	0.3930	0.8945	0.8090	0.0286	0.0554	0.5155	0.9502	0.5530	0.3730	0.9781	0.2938	0.4409	0.4744	0.4359	0.5482
b=d	5.75	0.05	3.95	1.70	0.53	0.24	3.55	0.29	1.36	16.53	0.17	0.90	7.36	0.31	2.25
χ^2(p-value)	0.0164	0.8276	0.0467	0.1920	0.4647	0.6253	0.0597	0.5878	0.2444	0.0000	0.6814	0.3430	0.0067	0.5792	0.1335
c=d	1.70	0.01	3.18	0.95	1.17	0.97	2.20	1.15	0.10	13.51	0.46	0.05	2.74	0.08	0.68
χ^2(p-value)	0.1921	0.9131	0.0747	0.3307	0.2785	0.3251	0.1377	0.2834	0.7493	0.0002	0.4987	0.8158	0.0981	0.7807	0.4090

Country (cont.)	Liberia	Lesotho	Mali	Malawi	Mozambique	Nigeria	Namibia	Rwanda	Sierra Leone	Senegal	Chad	Togo	Uganda	Zambia	Zimbabwe
Wald Tests (post-estimation)															
a=b	0.42	0.07	0.13	13.13	0.11	5.80	0.08	6.03	0.26	1.22	0.81	3.20	2.72	2.09	0.00
χ^2(p-value)	0.5146	0.7848	0.7203	0.0003	0.7449	0.0160	0.7784	0.0141	0.6096	0.2699	0.3668	0.0737	0.0991	0.1486	0.9515
a=c	1.96	1.10	0.84	11.68	0.38	6.33	0.83	9.77	2.15	2.77	0.04	1.85	0.09	4.02	0.66
χ^2(p-value)	0.1617	0.2953	0.3587	0.0006	0.5366	0.0119	0.3635	0.0018	0.1423	0.0958	0.8457	0.1732	0.7610	0.0448	0.4175
a=d	3.43	0.05	2.97	9.03	0.46	3.36	1.17	8.90	11.68	0.53	0.43	1.92	1.12	8.32	1.46
χ^2(p-value)	0.0639	0.8278	0.0846	0.0027	0.4985	0.0669	0.2790	0.0029	0.0006	0.4664	0.5106	0.1661	0.2893	0.0039	0.2272
b=c	1.59	4.35	0.71	0.06	1.45	1.56	2.74	6.50	1.53	1.03	0.15	0.02	2.46	1.25	1.57
χ^2(p-value)	0.2076	0.0370	0.4007	0.8128	0.2279	0.2111	0.0982	0.0108	0.2159	0.3092	0.7008	0.8962	0.1171	0.2630	0.2101
b=d	4.18	0.60	4.35	0.00	1.70	0.26	4.76	4.95	14.30	0.01	1.95	0.00	11.25	5.74	3.85
χ^2(p-value)	0.0409	0.4400	0.0370	0.9807	0.1924	0.6126	0.0291	0.0262	0.0002	0.9357	0.1621	0.9731	0.0008	0.0166	0.0499
c=d	0.31	1.90	0.86	0.03	0.07	0.59	0.05	0.38	1.98	1.06	0.97	0.01	4.67	0.80	0.62
χ^2(p-value)	0.5785	0.1684	0.3542	0.8647	0.7846	0.4430	0.8292	0.5385	0.1596	0.3041	0.3238	0.9215	0.0307	0.3698	0.4305

Table 1.17: Probit Model for the Effects of Socio-Demographic Variables on Pre-Marital Births

Variables	Probit Model
Age at First Marriage	0.148***
	(0.002)
Age	-0.011***
	(0.001)
Male Household Head	-0.12***
	(0.035)
Currently Working	-0.03*
	(0.016)
Rural	-0.279***
	(0.020)
Wealth Index	
Lowest	0.025
	(0.024)
Low	0.035
	(0.023)
Middle (ref. group)	
High	-0.125***
	(0.025)
Highest	-0.285***
	(0.029)
Education	
No Education (ref. group)	
Primary	0.245***
	(0.018)
Secondary	0.305***
	(0.022)
Higher	-0.214***
	(0.050)
Age Difference with Partner	
Wife Older	-0.089
	(0.055)
Same age (ref. group)	
Husband older by 1 to 9 years	0.212***
	(0.042)
Husband older by 10 to 19 years	0.451***
	(0.046)
Husband 20 years older +	0.421***
	(0.062)
Male Age at First Marriage	-0.034***
	(0.002)
Constant	-2.775***
	(0.079)
Observations	76,024
Mean Dependent Variable	0.149
SD Dependent Variable	0.356
Pseudo R^2	0.152

*** p<.01, ** p<.05, * p<.1

Appendix D: Ghana Case Study DHS 2008

Table 1.18: Summary Statistics for Ghanaian Women, DHS 2008

Variable	Mean (Standard Deviation)	Min	Max	N
Women Characteristics				
Age	29.00 (9.70)	15	49	4,916
Age at Children's Act	20.00 (9.70)	6	40	4,916
Years of Education	6.15 (4.53)	0	19	4,897
Rural	0.56 (0.50)	0	1	4,916
Muslim	0.17 (0.38)	0	1	4,913
Akan Ethnicity	0.43 (0.50)	0	1	4,914
Marriage Market				
Age at First Marriage	19.00 (4.16)	4	43	3,370
Early Marriage	0.28 (0.45)	0	1	4,916
Polygynous Arrangement	0.21 (0.41)	0	1	2,925
Age of Spouse	41.19 (13.30)	18	99	2,950
Experienced Emotional Domestic Abuse	0.33 (0.47)	0	1	1,835
Experienced Physical Domestic Abuse	0.21 (0.41)	0	1	1,832
Fertility Outcomes				
Achieved Fertility	2.13 (2.18)	0	11	4,916
Age at First Birth	19.91 (3.98)	12	43	3,299
Pre-Marital Birth	0.15 (0.35)	0	1	3,128
Pre-Marital Conception	0.19 (0.39)	0	1	3,128
Marriage-Birth Interval (months)	23.47 (25.59)	0	324	2,673
Ideal Number of Children	4.46 (2.08)	0	25	4,829

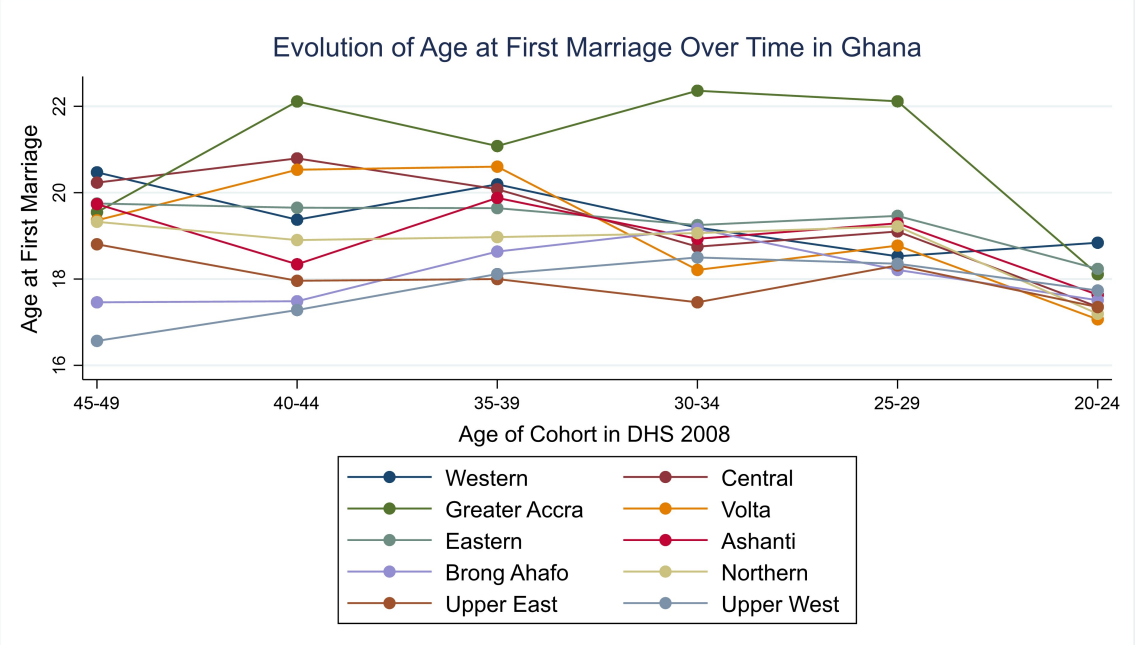

Figure 1.21: Regional Mean Age at First Marriage Over Time Using Age Cohorts (Ghana DHS, 2008)

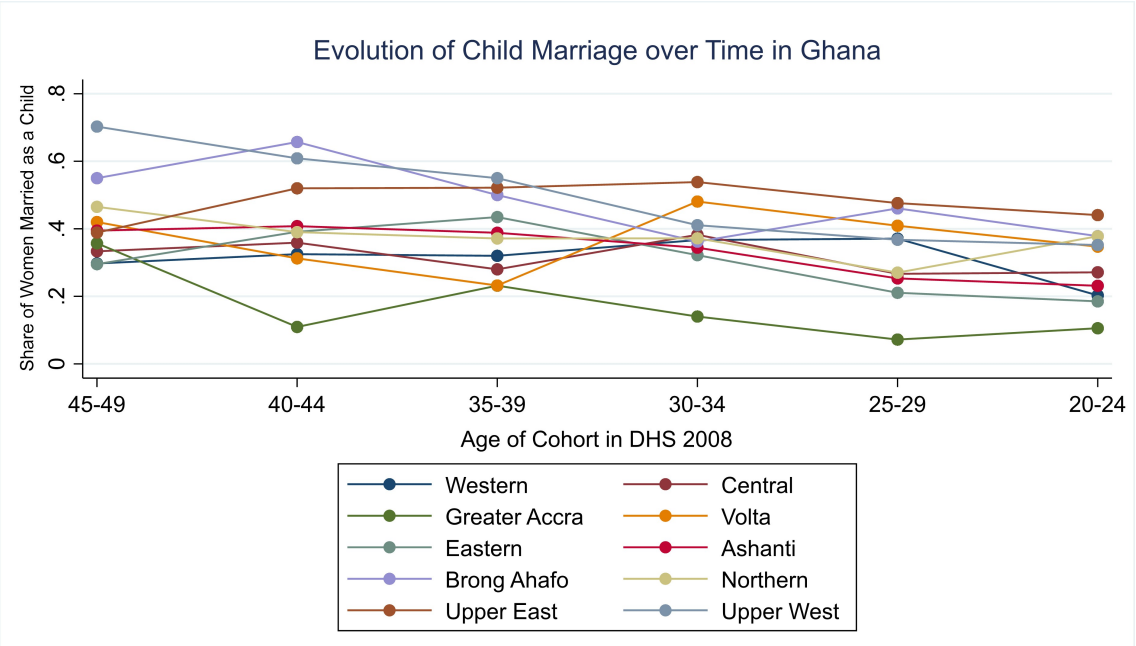

Figure 1.22: Regional Proportion of Women Married as a Child Over Time Using Age Cohorts (Ghana DHS, 2008)

Chapter 2

Cooperation and Age at First Marriage: An Experimental Analysis

ABSTRACT
Using lab-in-the-field experimental and comprehensive survey data, this chapter examines whether age at first marriage affects the willingness of husbands and wives to cooperate to maximise household gains. Among the Bagisu of East Uganda, we find that women who marry older are more cooperative with their husbands. In a series of corresponding inter-household games, we conclude that female behaviour is not driven by the selection of more cooperative women into a later marriage but by the marriage institutions' effect. As an extension to the core analysis, we further examine the role of education and the cultural practice of Bridewealth on rates of cooperation. This chapter concludes by evaluating the linkages between the behaviour exhibited in our intrahousehold games and spousal behaviour in everyday lives. We find that pre-existing cooperative behaviours positively correlated to in-game contributions, particularly for husbands.

Keywords: Age at Marriage, Field Experiments, Household Production and Intrahousehold Allocation

2.1 Introduction

The success of poverty-reducing programs in low-income countries by transferring cash or in-kind resources is contingent on how decisions are taken at the household level, and the efficiency of their response. On this basis, considerable attention has been given to husband-wife differences in resource allocation and spousal cooperativeness in developing countries (Iversen et al., 2011; Cochard et al., 2016; Munro, 2018; Barr et al., 2019). Given that the tradition of early marriage is pervasive across Sub-Saharan Africa (hereafter SSA), with some studies estimating that more than half of girls marry before 18 (Koski et al., 2017; UNICEF, 2018), acknowledgement of bride's age at first marriage and its capacity to infringe on intrahousehold decision-making is remarkably limited.

Current research indicates that early marriage can affect long-run growth potential via its interactions with education, formative adolescent development, and female autonomy (Wodon et al., 2017). Thus, policies aimed at increasing women's age at marriage - away from child and adolescent status - should elevate women's position in the household due to increased capacities and the stabilisation of pubescent hormonal imbalances (Dixon-Mueller, 2008). Indeed, part of our investigation in Chapter 1 found that a change in a marriage law increased female wellbeing, with reduced incidence of domestic violence.

Using a lab-in-the-field experiment, this chapter investigates whether and to what extent spousal cooperativeness differs according to the bride's age at marriage. We hypothesise that cooperation will increase with increased age at first marriage, partially driven by increased education levels. Our reasoning is derived primarily from the literature investigating gender and age bias in intrahousehold allocation (Deaton, 2019), which suggests that women's lower punishment capacities against her husband (proxied by a lower age at marriage) may induce her to adopt passive non-cooperative behaviour within marriage (Baland and Ziparo, 2018).

This chapter contributes to the growing literature on cooperation between spouses in lab-type experiments. Many of the early expositions into intrahousehold cooperation focus on monogamous households, augmenting features of experimental games to investigate specific behavioural paradigms, such as bargaining, efficiency, asymmetric information, and communication. Key studies are summarised in Munro (2018), accompanied by a discussion of general themes that have emerged from the intrahousehold literature. Such themes include the absence of efficiency, and how the transparency of individual decisions affects intrahousehold allocations.

More recent intrahousehold studies have examined specific marriage patterns, including polygamy (Munro et al., 2010; Barr et al., 2019), matrilineal kinship (Lowes, 2017), and patterns of divorce (Haddad, 2015). To our knowledge, this is

the first study to address explicitly the bride's age at first marriage and its effect on intrahousehold cooperation.

Using a multi-stage stratified sampling procedure, we obtain a final sample with sufficient variation in women's marital age; in particular, we made sure to have an equal distribution of women married below 18 and above 18 in our final sample. By inviting spouses to make decisions with actual monetary outcomes in a series of two-person public good games (PGG), we generate directly comparable measures of the extent to which husbands cooperate with their wives, wives with their husbands, and husbands and wives with members of other households. Throughout, we monitor the coefficient for age at marriage, and whether it varies depending on who is interacting with whom.

Overall, we find that increasing women's age at marriage by one year increases their intrahousehold cooperativeness by contributing 1% more to the common pool, *ceteris paribus*. Coupled with secondary education, delaying women's age at marriage increases contribution rates by 4% for our sample of Ugandan women. However, we find that a households' low wealth status will continually undermine the potential for cooperative gains through delayed marriage, irrespective of women's increased education. Throughout specifications, results for wives were compared with a male stranger counterfactual in an interhousehold treatment. We find that the effect of increased age at marriage is isolated uniquely to the intrahousehold treatment.

Nested within the intrahousehold literature, we find evidence of household inefficiency and low voluntary contributions to a common pool when individual actions are concealed via a plausible deniability mechanism. Our results suggest that the quantitative cost of household inefficiency between spouses amounts to one-and-a-half days agricultural wage. Furthermore, we contribute to the small, but growing, literature comparing behaviour in lab-type settings with real-life household behaviour. Here, our findings suggest that pre-existing cooperative behaviours, in the form of joint decision-making on household financial matters, correlate positively with contributions to the common pool, but only for husbands. This result adds substantial weight to the notion that lab-in-the-field methods are capturing real life, analogous behaviour.

The remainder of this chapter is structured as follows: Section 2.2 begins with reviewing the current intrahousehold literature, discussing how potential mechanisms affecting cooperation interact with early marriage practices. Section 2.3 details our area of study in East Uganda, discussing recruitment and sampling procedures and presenting descriptive statistics. Section 2.4 describes our experimental design, and our estimation strategy is presented in Section 2.5. Results are then presented and discussed in Section 2.6. Section 2.7 discusses linkages between the behaviour observed in the lab with the self-declared behaviour of households, and in Section 2.8, we conclude.

2.2 Motivation and Related Literature

Early marriage leads to substantial changes in the lives of young women, and requires transitioning abruptly into adult roles and responsibilities - often before she is developmentally ready to take on these responsibilities (Mathur et al., 2003). For many brides, traditional marriage involves moving to a new home (possibly, a new community), which necessitates building new social networks. Research has found that such transitions can significantly affect her mental health and wellbeing (Parsons et al., 2015; John et al., 2019). Early marriage also limits the assets and resources available to a young woman by abruptly curtailing her education, consequently diminishing valuable life, capacity, and adaptivity skills. The ability of these young women to exercise choice and agency in their lives is compromised (Murphy-Graham and Leal, 2015; Solanke, 2015; John et al., 2019), which in turn have intergenerational effects impacting the education, nutritional status and physical health of offspring. While much has been documented on the factors contributing to the perpetuation of early marriage practices, relatively little research has focused on understanding the role of age at first marriage on intrahousehold efficiency and whether any effects are enduring.

Often, brides below the age of eighteen begin as subordinates in the family due to their low levels of education. In addition to facing gender-based inequalities, with early marriage her disempowerment is also the result of age-based inequalities (Otoo-Oyortey and Pobi, 2003). Husbands may see their young bride incapable of managing household finances or making key financial decisions based on their immaturity and lack of life experience. These unequal power imbalances between the spouses, established so early on in household formation, can set a precedent lasting for the duration of the union.

The current evidence suggests that early marriage practices - and other interrelated traditions such as forced and arranged marriages - affect the relative position of women in marriages. Furthermore, Baland and Ziparo (2018) propose that early marriages reduce the symmetric, other-regarding preferences in the resulting couple. This combination can have severe repercussions for intrahousehold cooperation and efficiency, however quantitative analysis has yet to provide convincing evidence to substantiate this claim. To conceptualise this further, we will address the current intrahousehold literature examining cooperation between spouses in developing contexts. From this basis, we will then identify the precise mechanisms that lead to inefficient allocations, and how the age at which a woman marries potentially interacts with said mechanisms.

Economists have taken various approaches to deal with the multiplicity of decision-makers in a household. Universally adopted until the 1980s, the *"unitary"* approach treats households as "monolithic entities" (Deaton, 2019, p. 225), endowed with preferences and a unique utility function - as if the household were an individual. Under the assumptions of the unitary model, for a decision to be made, a consensus

must be reached. In an early definition, Samuelson (1956) defines consensus as a "meeting of the minds or a compromise between family members" (p.9). Samuelson does not, however, specify by which mechanism the household members can reach an agreement on the intrahousehold distribution of welfare. Later, this problem is partially solved by Becker (1981), who demonstrates that when the household is composed of an altruistic person and one (or several) egoistic persons, the household will behave as if the altruist's utility function was maximised; this result is commonly referred to as "The Rotten Kid Theorem" (Becker, 1981).

In the case of married couples, the unitary model predicts that household members aim to maximise joint earnings and will choose cooperative strategies to achieve this goal. Consequently, household consumption is the observable result of maximising (fixed) household preferences, constrained by a household budgetary restriction. The unitary model's predictions lend themselves to the income pooling hypothesis, in which only the total exogenous income matters to explain household behaviour. The precise distribution between household members and the source of this exogenous income does not matter.

However, contrary to theory, empirical evidence for developing countries confirms the pervasiveness of household inefficiencies. Given limited resources, these inefficiencies can have severe welfare repercussions for household members. The extensive literature highlights systematic under-contribution to public goods through the use of experimental games between spouses. For example, Hoel (2015) found that 97% of households in Kenya do not maximise their gains in a standard public goods game, with an average loss of approximately 16%. Other forms of inefficiency manifest via imperfect risk sharing (Dercon and Krishnan, 2000), lying and income hiding (Ashraf, 2009), and strategic appropriation of resources (Anderson and Baland, 2002). In particular, evidence from Ashraf (2009) reveals that women frequently 'cheat' in scenarios where their husbands cannot find out (if they are away from home, for example) but stick to the 'status quo' when dealing with easily observable outcomes. Baland and Ziparo (2018) present a comprehensive overview of the empirical regularities in developing countries, which cumulatively point towards strategic decision-making among spouses.

Due to both theoretical and empirical weaknesses of the unitary approach, more recent models of household behaviour orientate themselves toward a non-unitary representation of intrahousehold decision-making. These models share the same theoretical postulate that each person in the household is characterised by specific preferences. These models do not, however, presuppose a common mechanism to explain how preferences are converted into household decisions. Typically, economists have adopted two alternative approaches to the so-called *"non-unitary"* models of household behaviour. In the strategic approach, decisions within the household are determined by a Nash Equilibrium; each household member maximises their own utility (subject to a budget constraint), taking the actions of other household members as given.

The collective approach postulates *"a priori"* that the decision process leads to Pareto-efficient outcomes. This means that, at the equilibrium, the welfare of one person cannot be increased without decreasing the welfare of the other person in the same household. The models originating from this approach include those based on the axiomatic theory of bargaining, which rely on the specification of an explicit threat point. In a married household, the threat point is generally the level of utility attained by spouses if they were to separate or cease cooperating in the marriage.

The collective model provides a richer behavioural structure than the unitary approach. For example, the allocation between a husband and wife will depend on what each would get should the marriage dissolve. Such models predict differences in household consumption patterns according to the relative earnings of each partner, unlike the unitary approach in which all resources are pooled. Furthermore, it intuitively makes sense that individuals in a household care for one another, derive pleasure from each other's consumption and their own, or get pleasure from each others' pleasure. Theoretically, therefore, households are an ideal arena for cooperation. Spouses mutually benefit from investments in household public goods and risk-sharing, while repeated interaction allows for the punishment of behaviour that deviates from the cooperative norm. A household cooperative (or collective) equilibrium is thus facilitated by common information, similar preferences, mutual affection, and shared behavioural norms. An absence of any of these conducive factors can result in non-cooperative behaviour, leading to inefficient outcomes.

With face-to-face interactions, it is possible for social norms, signalling and emotions to cause more efficient outcomes. While most interactions within a couple are repeated and communication possible, many decisions in the household are actually taken independently. Task specialisation further encourages independent decision-making, particularly in agricultural settings where there is typically a gendered division of labour. The unobservability of spousal actions and the opportunity for private gains create an environment conducive to free-riding. As several authors have already documented (including, *inter alias*: Ashraf (2009); Iversen et al. (2011); Cochard et al. (2016); Castilla (2019)), asymmetric information concerning resources is a feature of many domestic relationships.

The social preferences of family members are significant when modelling non-unitary household behaviour. Concepts such as reciprocity, altruism, inequity aversion and fairness preferences (among others) are necessary to consider. An intrahousehold public goods game is perfectly designed to test possible free-riding among spouses and connected theories of social behaviour. A purely selfish player will play 'defect' as a dominant strategy. A player who aims to maximise their spouse's pay-off (extreme altruism) would 'cooperate' as a dominant strategy. An inequality-averse agent will only cooperate if they anticipate that their spouse will do the same (hence the public goods game represents a coordination game for inequality-averse players). Finally, players aiming to maximise joint earnings (household efficiency seekers) are predicted to play a cooperative strategy, even if they expect their partner to play a

defect strategy.

Several mechanisms may explain the ability of each spouse to commit to a long-term sharing rule and thus sustain a cooperative outcome within a household - even in the presence of asymmetric information. Here we make specific reference to repeated interactions with a punishment threat and other-regarding behaviour.

Within the household, the largest rational punishment that can be imposed on the other spouse is typically associated with what one considers to be the alternative, or "outside option" (Baland and Ziparo, 2018, p. 76). One such option is separation or divorce. In this case, each spouse compares their pay-off in the marriage to those if she or he were to live alone (whilst taking into account the direct and indirect costs associated with separation). Another alternative is that - as punishment - one or both partners behave non-cooperatively whilst remaining a couple. For example, in the collective model of household decision-making with public goods (Chiappori and Donni, 2009), the non-cooperative strategy appears intuitively as the outside option, whereby "equilibrium allocations correspond to a Nash equilibrium" (Baland and Ziparo, 2018, p. 76). Public goods are then invariably underprovided, as spouses no longer internalise the marginal value of the goods to their partner (Baland and Ziparo, 2018).

The second mechanism facilitating intrahousehold cooperation is other-regarding behaviour. Again, under the assumptions of the collective model, this mechanism should manifest by increasing the size of the collective surplus. In the non-unitary literature, altruism typically increases resource sharing (Foster and Rosenzweig, 2001). Similarly, Cherchye et al. (2015) found the intrahousehold consumption outcome critically depends on the degree of caring between the household members. Moreover, other-regarding behaviour encompasses emotions such as guilt and betrayal. Even in one-shot scenarios, the incentives to free-ride are systematically reduced within couples.

In developing contexts, the ability to punish a partner may be severely constrained by social norms that limit the scope of action both inside the household and beyond. This can either be due to a devaluation in the alternative option, or a limitation on their right to exercise it. For example, in strictly religious communities, divorce is not always an option. For a young woman with a low level of education and a poor social network, separation from one's partner can be a daunting prospect - particularly if children are involved. Lower punishment capacities may thus induce the partner to adopt passive non-cooperative behaviour within the marriage. Moreover, early marriage likely limits the existence of symmetric other-regarding preferences; in scenarios where choices are concealed from their spouse (and thus, limited repercussions), reduced other-regarding preferences could induce women to retain what limited resources they have for themselves.

There remain significant gaps in our understanding of non-unitary intrahousehold behaviour, which in turn necessitates a far better understanding of how 'early marriage relationships' and power dynamics play out in different contexts. Such dynamics have clear implications for programs and domestic policies, as well as the overall well-being of households and society at large. Consequently, any quantitative research in this area needs to be accompanied by an extensive analysis of the context of the communities researched, covering aspects such as existing policies and legislation, services available and contextualisation of socio-cultural and historical factors.

2.3 Context and Data

Experimental and survey data for the research project were collected between October 2018 and March 2019 (with a brief intermission for the Christmas period) in the mountainous sub-counties of Bukise and Buhugu, both located in the Sironko District of Eastern Uganda. The research team was based in the adjacent city of Mbale and travelled collectively to the research sites daily. A map of Ugandan district borders, with the Sironko district highlighted, is depicted in Figure 2.1. For further information on Bukise and Buhugu sub-counties, as well as a complete timeline for fieldwork, please consult Appendices A.1 and A.2 on pages 2-54 and 2-55.

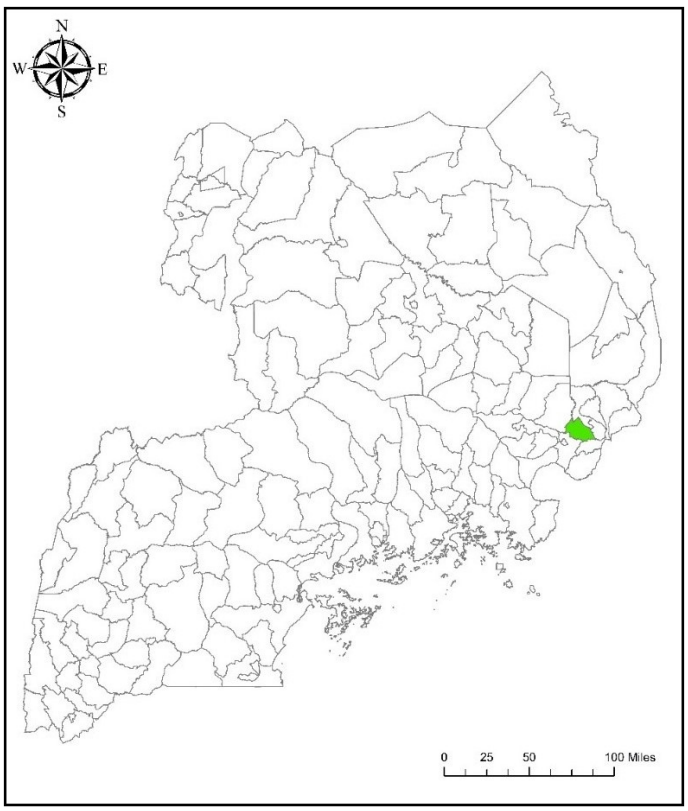

Figure 2.1: Uganda with District Borders; Sironko district coloured green

The most populous ethnic group in Sironko district is the Bagisu (frequently shortened to "Gisu")[1], and while there are many different religious groups represented across the district, almost all are monotheistic. Livelihoods for Gisu men and women are overwhelmingly agricultural, with most household engaged in some form of crop production (food and cash crops) and livestock rearing (Iversen et al., 2011, p.571). With the introduction of Uganda's Universal Primary Education (UPE) program in 1997, the majority of adolescent to middle-aged Ugandans possess at least some years of formal education, although secondary education remains an ongoing issue in the region[2].

Gisu gender relations have been the focus of much attention by anthropologists and have historically been expressed in terms of absolute male control (Heald, 1998). Marriage rites amongst the Gisu follow a *rite de passage*, the girl being first under her father's jural authority, and her status then transferred to that of a married woman. Among the Bagisu, modern-day marriage is typically initiated through elopement; when a girl decides to marry, she runs away from her natal home to go live in the home of the man who is to be her husband. Thus, in the interim between her status as daughter and wife, there is a period of transition whereby she lives in her husbands home as a guest (Mukiza-Gapere and Ntozi, 1995).

Historically, the Gisu institution of marriage is formally an authoritarian regime of male control, with women bearing few rights and experiencing high degrees of intimate partner violence (Karamagi et al., 2006; Jackson, 2013). However, some literature points to everyday forms of conjugal "resistance" exercised by women to disrupt the formal power accorded to men within marriage (Jackson, 2013). For Bagisu women, "freedom to divorce is perhaps [her] strongest sanction in their relationship to their husbands" (Heald, 1998, p. 101). The leverage she possesses is primarily due to the implications of divorce being vastly different for men and women. In Gisu society, a woman is never committed to one particular household for either her livelihood or status; thus, she has tremendous freedom to divorce and remarry. However, a man's dependence on their wife for reputational integrity and agricultural livelihood leaves them anxious to sustain their first marriage. Failure to do so can have severe repercussions for men, including social ridicule, suspicions (and outright accusations) of sorcery and theft, and sometimes met with male-on-male violence (Heald, 1998, Jackson, 2013).

Arguably, the practice of bridewealth - which remains prevalent among the patrilineal societies of East Uganda (for more information, please consult Appendix A.3 on page 2-55) - can be viewed as a modest attempt to mitigate

[1]To provide a brief history, the Bagisu originally occupied the Eastern plains around Mt. Elgon, before moving to its slopes in the 16th Century due to attacks from the Masai and Nandi tribes. In 1896, the British Empire took control of Uganda, naming the region the "Ugandan Protectorate". In these early years of colonialism, the Bagisu moved farther north due to land constraints, sparking territory conflict with the Sebei. Arabica Coffee was introduced to the region in 1912; today the Bagisu is a strong producer, utilising Mt. Elgon's fertile soil to produce 10% of the nation's coffee.

[2]Three Sironko Sub-Counties Operate Without Secondary Schools, 14th August 2019: https://ugandaradionetwork.net/story/three-sironko-sub-counties-operate-without-secondary-schools

female power in the household. For income and resource-poor families, bridewealth payments can augment the resources of the bride's family, ensuring their continued survival. In some instances, this can create pressure for women to marry early and to sustain that marriage (particularly if repayment is demanded in the event of dissolution). Furthermore, research in the area has found that wealth-differentials in the household mean that women are much less likely to initiate divorce, despite having less influence within that marriage (Jackson, 2008). Bagisu women appear to face a trade-off between material wellbeing in marriage, and marital power (Jackson, 2008).

It is clear that Bagisu marriage is not a simple institution that reinforces the gender order of male dominance, but an active field of struggle for voice and agency; women are simultaneously empowered and disempowered in ways that can affect their relations within the household and beyond. The complex interdependencies of husbands and wives in Gisu marriage should provide an excellent and unique setting to investigate intrahousehold behaviour, and the validity of household economic models.

Examining survey data from the most recent Demographic and Health Survey of Uganda in 2016, it is clear that early marriage is prevalent among the Bagisu. Figure 2.2 on page 2-11 plots the kernel density estimates for male and female ages at first marriage; the red vertical dotted line indicates the 18-year threshold for adult status (as defined by the United Nations Convention on the Rights of the Child (UNCRC)). Early marriage appears a distinctly gendered phenomenon, disproportionately affecting young Bagisu women relative to men. As we have previously discussed, the underlying mechanisms for why men marry early vary drastically from those attributable to women. We believe this is further expounded by the context in which we are studying; the Baigsu are well known for their male circumcision ceremonies (known locally as *"imablu"*), which on average, occur between the ages of 18 and 25 (although young men aged 16+ "qualify" for the ceremony). This initiation into manhood signals a man's eligibility to marry and is a possible indication of why early male marriage rates are low. For this reason, when we distinguish between early and later marriages in the forthcoming sampling strategy, we explicitly focus on *female* marital ages.

Figure 2.3 on page 2-11 illustrates a quantile-quantile plot for male and female ages at first marriage, with women consistently marrying younger than their male counterparts. Unlike many contexts where early marriage is prevalent (and so bias the sample), the Bagisu have a relatively broad distribution of ages at first marriage for women, ranging from a low of 10 to a high of 43 years. This wide distribution creates relevant and interesting variation to examine the relationship between early marriage and within-household behaviour.

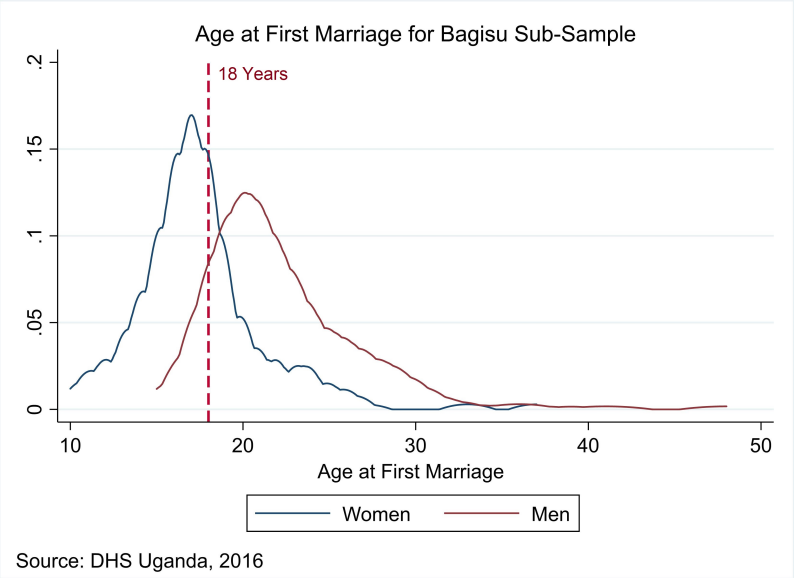

Figure 2.2: Kernel Density Estimates for Male and Female Ages at First Marriage
Notes: The kernel densities presented here show the age at first marriage of a cross-section of married men and women in the survey period. The highest density for women is below the "adult" threshold of 18 years, while for men, the highest density is above the adult threshold.

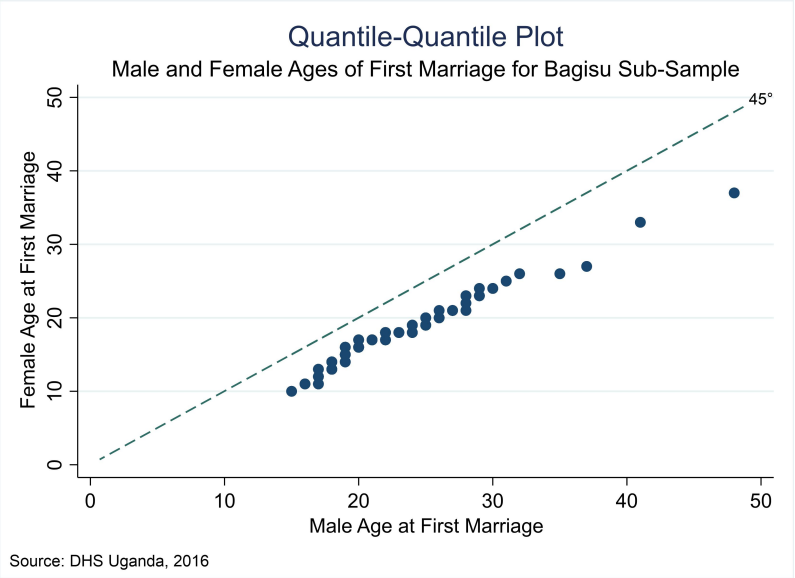

Figure 2.3: Ages at First Marriage Quantile-Quantile Plot

2.3.1 Recruitment and Sampling

Households were recruited between October and November of 2018, using a multi-stage stratified sampling strategy involving random and targeted sampling methods within the Sironko district. For context, Uganda has a Local Council structure of local government, which consists of elected government officials at various administrative levels – so-called "LCs". LCs start at the village level (LC1) and progress through the parish (LC2) to the sub-county (LC3), county (LC4) and finally, district level (LC5). After consultations with our field partner and the LC5 Chairperson for the Sironko district, we purposely selected Buhugu and Bukise sub-counties. Alongside considerations of accessibility and safety[3], we also considered representativeness and geographic proximities[4]. From Buhugu and Bukise sub-counties, we randomly selected 20 villages from an overall pool of 101 villages. If the research team felt that a selected village did not have enough households, the project lead would return to the originally compiled list of villages and randomly select an alternative.

Our procedure then employed an initial census, organised in collaboration with the LC1s responsible for the randomly selected villages. Each household was approached and asked a series of questions, eliciting information about husband and wife and the age at which they married. Questions specifically asked for the names of the

[3]At the time of fieldwork in the neighbouring district of Bududa, torrential rains caused a landslide that killed over 40 people (https://www.bbc.co.uk/news/world-africa-45836381).

[4]We note the following reason given the possible implications for future research and work in the area. Throughout fieldwork, we noted an interesting phenomenon that frequently occurred in our study area of East Uganda; the regular division and sub-division of Ugandan sub-counties. Relevant bodies approve such divisions (invariably the Chairperson of the Local Council (LC5)) and have significant border repercussions at the parish level, trickling down to the village level. One such implication of these frequent divisions is the reconfiguration of borders, often cutting directly through villages, rendering them much smaller in terms of population. In one instance, we recall a single village in Bukise comprising of merely seven households.

From local and unofficial sources, we learnt that sub-county division was primarily driven by minority group self-interest. Parishes in East Uganda house many different communities, comprising of multiple religions. In terms of population figures, a majority group invariably emerges, who often hold high-level positions in the community and parish. Minority groups subsequently feel neglected from the political, social and economic agenda, calling for the creation of their own parish to govern themselves. There are perhaps more complex and overlapping reasons for the divisions than what we have documented here. Irrespective, however, the implications for our sampling strategy are clear. First, with small household-population villages, we risk randomly selecting multiple villages that do not meet our selection criteria. To mitigate this risk, we purposely selected two sub-counties instead of one. By adopting this strategy, we hoped to have a wider pool of villages that would meet the criteria for our research and increase the chances of randomly selecting villages further apart from one another, minimising the risk of contamination. Second, where one village was randomly selected, we consulted with the relevant LC1 chairpersons to determine whether that village had recently been divided. Where division had occurred in the last year, we combined "parent" and "child" villages, retaining the parent's name and treating both as a single village. Given our understanding of parish divisions (that is, a division is partly driven by those identifying as a minority group seeking independence from the majority), there is a high probability of selecting villages where only one group were represented. Our final sample would therefore be biased. By combining villages, we hope to have a more representative example of indigenous people and a wider distribution of married couples.

married couple, their current ages, highest levels of education, ages at marriage, any previous marriages, whether the household was in a monogamous or polygynous arrangement, and finally, whether the main economic activity of the household was farming. These screening questions would later allow us to identify which households fall into our "early" and "later" marriage stratifications. Simultaneously, given the broad nature of questioning, both mobilisers and participants were blind to our research aims and targeted interest in marriage details.

For households to participate in the research project, strict eligibility criteria had to be met. Specific criteria included the following: the head of the household must **self-identify as "married"** and should be cohabiting with their partner at the time of research. Eligible spouses must not have been married before; current marriages should be their first and only. Widows and divorcees were thus not eligible to participate. Households must not be in a polygynous arrangement; that is, the husband's wife should be his one and only wife. Households who met this eligibility criterion would then qualify for random selection.

These specific criterion decisions were taken to ensure that confounding factors were kept to an absolute minimum. For example, we decided to exclude those men and women who had remarried, either due to the death or divorce of their first spouse. The probability of their being older in a second marriage is much higher (particularly for women), reducing our estimated effects of age at marriage and early marriage. By focussing on age at the point of a first marriage, we develop a more comparable sample fit for hypothesis testing. Our second decision to exclude polygynous households from our sample was driven primarily by behavioural considerations. A 2019 paper by Barr et al. found that, compared to monogamous households, polygynous husbands and wives are less cooperative with one another. The authors also found evidence indicating that polygynous households are "more reciprocal and less apparently altruistic than in monogamous households"(Barr et al., 2019, p. 268).

In addition to behavioural differences, there are also systematic differences in households' economic and demographic profiles in a polygynous arrangement. Heald (1998) states that amongst the Bagisu, where women's freedom to divorce is perhaps their strongest sanction in their relationship to their husband, "richer men tend to achieve stable polygamous unions since they can offer both wives a relatively high standard of living and provide sufficient land for their use" (p.99). This wealthy prerequisite for more than one wife is perhaps why polygyny figures are so low in the area. From the Bagisu sub-sample of the 2016 Ugandan DHS, 6% of men claim to have more than one wife; this figure is low compared to the national figure of 16.7%. In terms of demographic composition, households are significantly larger in a polygynous arrangement than in a monogamous household; the latter has an average of 4 children, compared to 7 children for the former (DHS Uganda, 2016). Given the anomalous nature of polygynous households, they have been excluded from our study sample.

From each village, eligible households were divided into two strata (categories of the stratification variable: age at first marriage of the bride); "early" marriage households (where the bride's age at marriage is below 18), and "later" marriage (where the bride is 18+ at marriage). For each village, a master list of households was compiled by strata. For allocation to be proportional to the national average (DHS Uganda, 2016 states that 49% of women marry below the age of 18), we assign a 50/50 split to each stratum (that is, an equal number of early households to later households per village). Up to 12 households were represented in each village; 6 households from each stratum. Stratums with fewer than 6 eligible households were fully sampled. For transparency, the random selection of households was carried out in each village and witnessed by the village leader, enumerators, and primary investigators.

The last step to our sampling procedure was to hold a "final recruitment meeting", where we invited our randomly selected households (both men and women) to attend a meeting in their village. At this meeting, a standardised text with information concerning the research project was read aloud to individuals. We provided several opportunities for individuals to ask questions before asking for their final (verbal) consent to participate. This information is kept and presented as informed consent. We also used the recruitment meeting as an opportunity to show our invited participants documented proof of ethical approval, both from the University of East Anglia and from our affiliate institution, Makerere University based in Kamapala, Uganda.

Where there was a moderate risk of contamination between villages through information leakages, experimental workshops were held on consecutive days. Villages (randomly selected) that bordered one another, or those had been recently administratively split into 'parent' and 'child' villages, were combined to avoid obvious contamination. Consultation with the relevant LC3 chairpersons responsible for the Bukise and Buhugu sub-counties indicated that between-village contamination was unlikely to occur due to geographical distance.

2.3.2 Selection Effects

The argument has long existed that participants who take part in laboratory experiments are not representative of the population at large, nor of the target population one is researching, and this can be for a variety of reasons (see Henrich et al., (2010) for more information). With married couples, two additional factors can determine a households' agreement to participate, which has implications for any (potential) selection bias. The first factor concerns the high opportunity cost for obtaining the joint attention of both husband and wife for an allotted amount of time in a day. The second – raised by Munro (2018) – concerns the expectation that, at least in some societies, household samples will be biased in favour of couples with relatively healthy and stable relationships; such couples would be

more inclined to accept the invitation to participate in an experiment, given that they would be more comfortable being the focus of an investigation.

Regarding the first issue; before entering the field, we recognised that asking both husband and wife to devote a significant proportion of their day to attend a research workshop is a 'big ask'. Individual and joint considerations of childcare, daily domestic duties, foregone wages (if in salaried employment), and foregone labour on domestic farms are just some of the factors households are assumed to consider before accepting (or rejecting) an invitation to participate in research. Given these considerations, we allotted a substantial portion of time and effort into our recruitment and how we could sufficiently compensate participants for their time.

In addition to an exceptionally hardworking team, we must attribute the success of our recruitment and the generation of our final sample to seasonal timing. By design, data collection took place between October and early December, which coincides with Uganda's second rainy season. In terms of agricultural production, actively farming households were nearing the end of land preparation and primarily engaged in weeding/maintenance activities. Seasonal migration to Kampala and northern portions of the country was minimal; most – if not all – households were home when assembling census data. Furthermore, we were fortunate that primary and secondary schools were nearing the end of their academic year; this helped in hiring experimental venues (due to classroom availability) and relieved many households of domestic duties, as older children could assume the work of the parents. For very young children, we explicitly stated in the recruitment speech that infants and babies were welcome to accompany their parents on the day of the workshop. In addition to providing refreshments for the experimental participants, we would be providing children with refreshments – free of charge – and amenities would be made available to them (additional seating and toilet facilities). We also assured participants that they would assume no out of pocket expenses on the day of the research project; we would compensate individuals for travel expenses to the centralised venue (a flat fee), and refreshments would be free of charge. However, it is important to note that we did not tell participants that they would receive an additional pay-out from one of the decisions they made on the day of the workshop, as we did not want to incite, nor condition participants with a 'money-making' motive.

While researchers have acknowledged the second issue of selection bias, it remains to be seen whether this factor is critical for external validity. Nonetheless, we theorise that this issue has little relevance to our sample of Ugandan participants. We found that there was very little attrition between the original invitation extended to our randomly selected households and the day of the workshop (less than 4%). Where participants did drop out, severe illness and work commitments were cited. Furthermore, we argue that participants were not acutely aware that "marriage" and "interpersonal dynamics" were the focus of our research project. Participants were told to arrive at the venue at the designated time and to arrive with their spouse to make registration easier. The representativeness of our final sample is

discussed with respect to the latest Ugandan DHS data in the following descriptive section.

2.3.3 Descriptive Statistics

Table 2.1 on page 2-17 contains summary statistics on individual and household characteristics for the experimental sample. Data was collected via individual surveys administered after the experimental workshops, separately for husbands and wives[5]. Below each statistic, standard deviations are reported in brackets. While we cannot claim that our experimental participants are representative of the Ugandan population, we present evidence of relevant household characteristics from the most recent Ugandan DHS (2016) for comparison. Country specific DHS datasets are renowned for being an unbiased, nationally representative data source that randomly samples households from all regions and villages of Uganda, including a Bagisu sub-sample which we similarly present in column 2 of Table 2.1.

On average, our sampled households have 6.5 members (including the respondent) and at least one son and one daughter under the age of 18 currently living at home. The majority of our participants align themselves with Christianity; the three major religions to emerge from our data are Catholicism, the Church of Uganda (COU) and the Pentecostal religion[6]. Most of our sample claim to have several years of formal education, which we attribute to Uganda's Universal Primary Education (UPE) program of 1997. Indeed, only 4% of our total sample declare themselves to have no formal education at all. Consistent with the DHS, women tend to have less schooling than men averaging 6 years, with men averaging 7. Most women appear to terminate their education after primary school, and men tend to have 1 to 2 years of secondary schooling.

Experiments were conducted amongst rural households of randomly selected villages. It was, therefore, expected that the households in the experimental sample were more likely to own or cultivate land, relative to the Bagisu population and national average. The large differential between the experimental and DHS data for the variable "Works on Household Farm" is thus explained by elements of our sampling design. In addition to farming activities, 40% of men in our sample are self-employed, running their own business. For women, 29% declare that they are self-employed. For this question, enumerators were asked to stress that this business (or self-employment) should be separate to household farming activities.

[5]One to one interviews were conducted in the subjects home, by appointment only. Men and women were questioned at the same time in separate rooms by the same gendered enumerator. Verbal consent was again asked for and documented by enumerators.

[6]Church of Uganda, a subsect of the Anglican faith, was not directly posed to respondents in the DHS data as a response option. Thus, we present Anglican and COU statistics together for the purposes of comparison with the DHS data. Pentecostal was also not available for comparison.

Table 2.1: Summary Statistics

Variable	**Experimental Data (N=294)**		**DHS Bagisu (N=318)**		**DHS Uganda (N=4,958)**	
	Male	*Female*	*Male*	*Female*	*Male*	*Female*
Age	39.69 (13.63)	34.27 (12.77)	34.92 (8.74)	29.35 (8.28)	35.17 (8.79)	29.72 (8.02)
Number of Children*	3.89 (2.39)		3.57 (2.19)		3.64 (2.44)	
Number of Male Children	1.92 (1.61)		1.89 (1.41)		1.81 (1.52)	
Number of Female Children	1.97 (1.53)		1.67 (1.38)		1.83 (1.57)	
Household Size	6.48 (2.50)		5.28 (2.01)		5.75 (2.58)	
Years of Education	7.36 (3.18)	5.82 (3.18)	7.25 (3.52)	6.42 (2.96)	7.14 (4.19)	5.75 (3.82)
Bagisu Ethnicity	0.98 (0.14)	0.94 (0.24)	0.75 (0.44)	0.75 (0.43)	0.06 (0.24)	0.06 (0.23)
Works on Household Farm	0.84 (0.37)	0.89 (0.31)	0.57 (0.50)	0.52 (0.50)	0.51 (0.50)	0.48 (0.50)
Self-Employed	0.40 (0.49)	0.29 (0.46)				
Wealth Index$^{\Phi}$	-0.003 (1.507)	-0.472 (1.364)				
Gender Index$^{\Phi}$	-0.92 (0.87)	0.85 (0.71)				
Religion:						
Catholic	0.24 (0.43)	0.20 (0.40)	0.28 (0.45)	0.26 (0.44)	0.41 (0.49)	0.41 (0.49)
Church of Uganda / Anglican	0.44 (0.50)	0.39 (0.49)	0.45 (0.50)	0.37 (0.48)	0.36 (0.48)	0.32 (0.47)
Islam	0.05 (0.23)	0.03 (0.18)	0.14 (0.35)	0.16 (0.37)	0.11 (0.32)	0.11 (0.31)
Seventh Day Adventist	0.06 (0.24)	0.03 (0.18)	0.01 (0.11)	0.04 (0.19)	0.01 (0.12)	0.02 (0.13)
Pentecostal	0.21 (0.41)	0.32 (0.47)				
Marriage History:						
Age at First Marriage	23.52 (5.70)	18.40 (4.39)	22.23 (4.61)	17.51 (3.75)	22.48 (4.78)	18.15 (3.84)
Married Below Legal Age Threshold (<18)	0.07 (0.26)	0.46 (0.50)	0.07 (0.25)	0.57 (0.50)	0.11 (0.32)	0.49 (0.50)
Age Difference with Spouse	5.95 (4.36)		6.01 (4.96)		6.02 (4.54)	
Years Married	16.12 (12.55)	15.92 (12.87)	12.15 (7.91)	11.33 (8.07)	12.24 (8.63)	11.11 (8.32)
Traditional Marriage Ceremony	0.39 (0.49)	0.52 (0.50)	0.45 (0.50)	0.27 (0.45)	0.59 (0.49)	0.43 (0.49)

Notes: Eight participants could not be located after the experiment (likely due to migration), and thus survey variables are available for 294 out of a total of 302 experimental participants. DHS data was obtained with relevant permissions from the Ugandan Demographic and Health Survey, 2016. *All variables were collected separately for husbands and wives, however we only use female responses for the variable "number of children". We found that men consistently under-reported their number of children, in particular, omitting their most recently born child. $^{\Phi}$ Calculated from our data using the polychoric method. For more information, please consult Appendices D and E. Equivalent measurements could not be found in the DHS and were thus excluded from the table.

Figure 2.4: Histograms for Age at First Marriage by Gender

Wealth and Gender indices were calculated from the data using the polychoric method (please see Appendix D and E for a detailed description of their construction). Equivalent measurements for these indices could not be found in the DHS data and were thus excluded from Table 2.1. Nonetheless, the differences between men and women for these variables are interesting to note. Given the well-documented relationship between wealth and reputation among the Bagisu (see Heald (1998)), we anticipated that men would over-inflate household assets. This possibly explains why we see such differences between male and female averages for wealth. Our self-calculated gender index was constructed from a series of belief statements (regarding gender equality) posed to our participants. Women, on average, score much higher in terms of their gender equal beliefs compared to men, but there is significant variation in the data.

Men are, on average, six years older than their wives. Couples in our sample have been married for 16 years on average, though there is a slight discrepancy in male and female responses; this pattern, however, is similar to both the DHS Bugisu sub-sample and national average. As expected, there is considerable variation in the length of marriage: the youngest couples have been married for 1 year, while the eldest for 59 years. Average male and female ages at first marriage are similar to the DHS data, but again with considerable variation; however, this was expected given the sampling design. Figure 2.4 depicts age at first marriage distributions for the men and women of our sample, with a normal-density plot overlay. Remarkably, the proportions of men and women married below the legal age threshold of 18 years old are close - if not identical - to the DHS data. Women are more likely to marry below 18 than men, but that is not to say early male marriage does not occur. Overall, the experimental sample is not too different from the Bugisu or national averages in observable characteristics.

Our survey also asked participants to provide a comprehensive history of their lives before, and at the point of marriage. These statistics are presented in Table 2.2 on page 2-20. While not all of these variables are considered in later analysis, we feel

that they warrant discussion here, as they provide context to our participants. For example, most men and women believe their parents rank "poor" or "average" in terms of wealth. Around half our male and female sample do not perceive themselves as marrying *into* wealth, as the perceived wealth of spouse's parents is recorded as "the same" for 49% and 53% of men and women respectively.

The majority of our participants lived with their parents up until the point of marriage and were involved in some form of farm labour. While livelihoods overlap tremendously, 31% of women were recorded as students up until the point of marriage, compared to only 7% of men. The low age at first marriage for women likely explains this point of observation. Participants were also asked to provide a detailed inventory of bridewealth transfers, the majority in the form of livestock (cattle and goats). We estimate the average bridewealth transfer in our sample at 660,000 Ugandan Shillings, which is around US $175 at the time of data collection. However, bridewealth remains an outstanding payment in the majority of households, as 82% of women recorded "no" to the question: "have you and/or your parents received the agreed-upon bridewealth in full?".

2.4 Experimental Design and Implementation

Ethics Statement: Experimental design and procedures - including the verbal consent process - were checked and approved by the International Development Ethics Committee Chair at the University of East Anglia, UEA (Granted: 11/08/2018) and Makerere University School of Social Sciences Research Ethics Committee, MAKSS REC (Granted: 20/09/2018).

2.4.1 Experimental Task

Data on cooperative behaviour was generated by engaging each participant in a series of linear two-person public good games (hereafter, PGG). At the start of each game, participants were individually handed two envelopes; one envelope was labelled "KEEP", and the other "SEND". These words were handwritten on the envelopes in English[7] and explained by the enumerators to the participants. In the envelope labelled "Keep", participants received an initial endowment ("Send" envelope was empty); initial endowments varied and were known only to the

[7]In round-table discussions with the experimental team, it was decided that words on envelopes should be written in English, not the local dialect (Lugisu). Participants, while fluent in their language, are often unable to read Lugisu. Instead, participants are more adept at reading English words or identifying letters associated with the relevant words.

Table 2.2: Family and Pre-Marriage History

Variable		**N=294**	
		Male	*Female*
Parent Wealth Status			
	Very Poor	0.16	0.19
		(0.36)	(0.39)
	Poor	0.41	0.27
		(0.49)	(0.44)
	Average	0.37	0.46
		(0.48)	(0.50)
	Rich	0.05	0.08
		(0.21)	(0.27)
Perceived Wealth of Spouses Parents			
	Richer	0.26	0.25
		(0.44)	(0.44)
	Poorer	0.19	0.19
		(0.39)	(0.39)
	The Same	0.49	0.53
		(0.50)	(0.50)
Living with Parents Before Marriage		0.78	0.76
		(0.41)	(0.43)
Student Prior to Marriage*		0.07	0.31
		(0.26)	(0.47)
Years of Farming Experience Before Marriage		7.65	5.29
		(5.65)	(4.38)
Bridewealth Value of Livestock (per 1,000 Ugandan Shillings)		660 (1045)	
Outstanding Bridewealth Debt$^{\Phi}$		0.75	0.82
		(0.43)	(0.38)

Notes: *Livelihoods overlap tremendously in our sample, particularly for women. Almost all women who stated that they were a "pupil/student" before marriage combined this with other activities including "working on the household farm" or someone else's farm, "looking after livestock", "self-employed", "regular salaried employment", "non-farm wage work" and "household chores." $^{\Phi}$ To this question, we received the largest number of non-responses from men; 54 out of 147 men did not (or refused) to answer this question. For women, we had 7 non-responses.

recipient[8]. With a 95% probability, a participant's initial endowment was 8,000 Ugandan Shillings in each game. This is approximately US$2.10 at the time of data collection, equivalent to over two days wage of an agricultural labourer; a sufficiently large enough sum to encourage careful and deliberate thought over each decision.

However, each participant faced a 5% chance of receiving an initial endowment between 7,000 and 0 Shillings (zero). The range of possible endowments was made common knowledge to all participants in the experimental instructions. Participants, however, were unaware of the probabilities associated with each; a participant's spouse would not know with certainty the amount received by their partner. Endowments were given in increments of 1,000 Ugandan Shilling notes (the lowest denomination of note).

Each participant was then asked to allocate their endowment across two envelopes; in the envelope labelled "Keep", participants were asked to place an amount they wished to keep for themselves. In the envelope labelled "Send", participants were asked to place an amount they wished to contribute to a shared fund (between them and their designated playing partner, whom they were made aware of in advance).

Participants were told that their contribution to the shared fund would be combined with their playing partners contribution to the same fund. This amount would then be multiplied by 1.5 and divided equally between the two. The total amount of money each respondent received would thus be the sum of what they placed in the "Keep" envelope for themselves, plus half of the multiplied, shared fund.

Given the structure and design of the linear PGG, participants were able to maximise their joint earnings from the game by contributing their entire initial endowment to the shared fund. However, a participant could maximise their individual earnings – given any playing partner's contribution – by contributing zero to the shared fund and receiving, as their final pay-out, their initial endowment plus three-quarters of their playing partner's contribution.

Arguably, the intrahousehold PGG combines several key elements of the interactive dynamics between married couples. First, there is a real opportunity for income hiding between spouses, which growing experimental data confirms to be widespread (Ashraf, 2009; Munro et al., 2014; Castilla, 2019). Participants are given a clear choice of deciding how much of their income they wish to keep for themselves and how much they would like to contribute to the household (represented in this instance by the shared fund). To maximise household income, each partner would need to contribute their entire endowment to the shared fund. Any deviations from this strategy would result in an income loss at the household level. Contributions made to the household have a positive return, but each spouse runs the risk of their partner

[8]This design feature allowed spouses the chance to "hide" money from one another and is an essential component to the plausible deniability mechanism, discussed in more depth later.

free-riding. A spouse could easily decide to keep all their income, contributing zero to the shared fund, but still reap the benefit of the fund being split equally between household members.

2.4.2 Treatments

Using a within-subject design, each participant was exposed to two different treatments; each treatment involved a different playing partner in the PGG. Participants were asked to play the PGG two times in an experimental session, each time reflecting one of the assigned treatments. At the start of each game, participants were individually informed with whom they were playing.

Treatment 1(T1) we designate the **Intrahousehold Game**, where every husband (wife) plays one game with their wife (husband).

Treatment 2 (T2) we designate as the **Interhousehold Game**, where every male (female) participant plays one game with a female (male) from another household in the same village. The precise identity of the playing partner was not revealed, only their gender. By implementing a stranger counterfactual in T2, we can test whether observable differences in T1 behaviour are due to the marriage institution's effect, rather than the selection of less or more cooperative people into our age of first marriage stratification.

The order of treatments was randomised with each experimental session to control for potential order effects. No feedback was given between treatments. Participants received no indication that husbands and wives would play together until the start of Treatment 1. From the outset, participants were informed that their final earnings would be determined via a lottery, corresponding to only one of their decisions taken that day. In combination, these design details minimised the likelihood that participants played each treatment in the PGG as a portfolio rather than a series of separate interactions.

2.4.3 Procedures

A single team conducted the experimental sessions in all 13 villages. All sessions were held in primary or nursery schools, with at least three separate rooms[9]. On average, an experimental session involved 24 participants (or 12 households) and

[9]At the time of data collection, schools had finished for the semester, and whole premises were available.

participants earned around 9,000 Ugandan Shillings, plus a 2,000 show-up fee described as "reimbursement for transportation costs" to the experimental venue.

Sessions were held once per day on consecutive days, breaking for Sundays. Two games were played in each session; a modified version of the Investment Game (pioneered by Berg et al. (1995) and analysed in Chapter 3 of this thesis, and the PGG described above. Sessions lasted for no more than four hours, with a break in between games for refreshments[10]. Substantial care was taken to avoid cross-group contamination; participants were asked to remain with their group, and to not interact with their spouse.

For each session, participants from a village were asked to arrive at the experimental venue with their spouse at the designated time. After registration, married couples were invited to seat themselves in one of the venue rooms, where we introduced the team and explained (in general terms) the overall format of the day. At every stage of an experimental session, the team closely adhered to scripts and detailed protocols. All sessions were conducted in the local dialect, Lugisu[11].

After the introductory remarks, men and women were asked to separate and follow an enumerator of the same sex to different rooms. Given the nature of our venues, we were able to place male and female groups in separate classrooms, where neither could be overheard. Separating the experimental rooms was a private room designated for data recording. One member of the recording team inputted all data into an Excel spreadsheet. The second member of the recording team was in charge of all envelopes; the primary investigative lead was the only member of the experimental team authorised to remove, count and replace money in envelopes.

Once participants were settled, enumerators delivered a detailed and repetitive description of the PGG, followed by a set of examples demonstrating how different combinations of decisions yield particular pay-offs for each player. These examples were addressed to the room by the enumerator delivering the script. Where participants had questions or required clarification, relevant parts of the script were repeated by the enumerators. Following questions, enumerators conducted one-to-one interviews, where each participant was asked a series of test questions to ensure their comprehension. Individuals unable to demonstrate a core understanding of the Game were allowed to play, but their decisions have been omitted from the final analysis. Throughout, examples and questions were designed to demonstrate core features of the PGG while minimising the extent to which a player could be led to behave in a certain way.

To assist with money counting and multiplication, participants were assured that enumerators in the room were on hand to provide individual assistance. To minimise the impact of potential subject-experimenter effects, great care was taken

[10]Refreshements were provided free of charge to participants.

[11]For detailed protocols and English translations of scripts, please consult Appendix C.

to follow identical assistance procedures with each participant that requested help. Enumerators were also asked to discreetly record the ID of participants that received assistance. With this data, we employ econometric methods *ex-post* to test for this potential source of bias[12].

Participants made their allocation to the two envelopes in private[13], with real money. Used, rather than new, 1,000 Ugandan Shilling notes were provided to the players throughout the experiment. While there has been a substantial increase in monetary transfers via mobile telephones, village economies remain heavily cash-based. The majority of our sample pool is involved in agricultural activity and trade frequently amongst themselves. Arguably, participants would be more accustomed to well-worn (used) currency, perhaps even distrustful of freshly printed notes; this would undoubtedly affect play. This procedure was first brought to our attention by Barr (2003) and confirmed by our field partner.

With each treatment, enumerators collected envelopes from each participant and collectively brought them to the data recording room. The money allocated to the envelopes was counted in the private room and recorded using MS Excel. The amount of money each respondent earned was automatically calculated and recorded on a separate Excel sheet. Participant earnings were based on only one of the decisions they took in the experimental session, determined randomly at the end of the day. Decisions include all those made in both the PGG and the Investment Game played in the same session. We discuss some of the advantages and challenges associated with a random payment later in Chapter 3; however, we conclude that in a multi-decision experiment, a 'pay-one' approach would likely eliminate the opportunity for wealth and portfolio effects. In a game with high earning potential, we argue that this feature is essential.

Random payment (and the fact that initial endowments are known only to the individual) meant that participants could contribute significantly less than their endowment while later claiming to have contributed all. These features form the basis of our plausible deniability mechanism, which allows each participant to deny responsibility for any decision taken throughout the day. Deniability claims are conceivably legitimate due to the lack of traceable evidence that would later confirm a decision(s). We discuss this mechanism and its necessity in greater depth later in Chapter 3.

[12]70 participants were documented as receiving assistance from enumerator: 21 male, and 49 female.

[13]Individual seating allowed the research team to place participants a reasonable distance away from each other so that their neighbour could not overlook their decisions. When the time came to take decisions, participants were asked to turn their chairs to face the wall.

2.5 Estimation Strategy

The socio-economic conditions of decision-makers likely play a significant role in shaping beliefs, preferences, and behaviour, as well as constraining the overall strategy sets of players. Concurrently, decisions taken in the context of low socio-economic status may dynamically contribute to shaping the decision-makers economic prospects. The precise relationship between decision-making and poverty remains an ongoing area of research, but nonetheless highlights the necessity of including an extensive set of socio-economic control variables to investigate the robustness of any finding.

Regression methodology allows us to control for alternative contextual factors that potentially influence cooperative behaviours between married couples. We thus deploy a series of empirical regression models to address the leading research question of this chapter - *to what extent does a female's age at first marriage affect intrahousehold cooperation?* – which shares the generalised linear structure:

$$y_i = \boldsymbol{X}_i\boldsymbol{\beta} + u_i \tag{2.1}$$

where y_i is the contribution rate (contribution to common pool/initial endowment) as the dependent variable, and $\boldsymbol{X}_i$ includes our key explanatory variables. While there is debate over the appropriateness of using raw ratios as a dependent variable in regression analysis (see, for example Kronmal (1993)), we have opted to retain the original contribution/endowment ratio for two key reasons. First, we observe several zero contributions in the data, and so a log transformation is not an appropriate alternative to the econometric issues of single raw ratios. Second, we wish to retain comparability with other papers, particularly those using a married couple sample.

Throughout the various specifications, our first empirical model tests whether the age at which one marries differentially affects cooperative behaviours when one is paired with members of the opposite sex, including one's own spouse. To this effect, we use the contribution rate as a proxy for cooperation between two players: *Contribution Rate*. This variable is then regressed upon our survey measured variable, age at first marriage AFM_i. These variables are then used to estimate the following base empirical model[14]:

$$Contribution\ Rate_{i,t} = \alpha_i + \gamma AFM_i + \mathbf{X}_i\beta_1 + \mathbf{X}_{i,t}\beta_2 + \mu_{i,t} \tag{2.2}$$

Where $Contribution\ Rate_{i,t}$ represents the contribution rate of participant i in

[14]We similarly use this empirical model for robustness checks later in the analysis.

experimental treatment t, (our unit of observation); a decision taken twice by each participant, under different circumstances, during the experimental session. Each situation reflects one of the two treatments the participant is exposed to and is randomised with each session; α_i captures person-specific unobserved effect (which may include unobserved features of the couple); AFM_i is the age at first marriage of individual i; $\mathbf{X}_i$ is a vector of covariates for individual i including age, education, ethnicity, religion, household size and composition, wealth and gender equality indices, self-employment status, age difference with partner (in years) and marriage length (log-form); $\mathbf{X}_{i,t}$ is a series of experimental controls for individual i in experimental game t, including a binary indicator for whether the participant received a lower endowment, an indicator for whether the intrahousehold game was played before the interhousehold game, and an additional indicator for whether the participant received help from the enumerators in a treatment. Regressions are run separately for men and women to allow for heterogeneous responses to the treatment settings[15].

Abadie et al. (2017) propose that we adjust standard errors for clustering at the village level (our level of randomisation), given that we only observe a few clusters from the total population[16]. Where there are clusters, it is crucial to implement a cluster-robust variance matrix estimator (CRVE), robust to both intra-cluster correlation and heteroskedasticity of unknown form[17]. One recommended method is to use 'bootstrap' methods. With this option, one can generate a sufficiently large number of bootstrap samples that mimic the distribution from which the actual sample was obtained[18].

Cameron, Gelbach and Miller (2008) sought to investigate "whether bootstrapping to obtain asymptotic refinement leads to improved inference for OLS estimation with cluster-robust standard errors *when there are few clusters*" (p.414). Their investigation found that a variant of Roodman et al. (2019)'s wild bootstrap method does exceptionally well in this area. Specifically, their method imposes equal weights and probability and uses residuals from OLS estimation that imposes the null hypothesis. This bootstrap method (which we hereafter refer to as the "CGM method") appears to work well in the authors' own simulation exercise, and later proven in Djogbenou et al. (2019).

[15]We also run our regressions on the full sample, with a gender dummy included.

[16]For more information and mathematical proofs, please consult Abadie et al. (2017)'s full paper.

[17]Inference based on the standard errors produced by adding the "cluster" option at the end of the specification can work well when asymptotic theory provides a good framework for the finite-sample properties of the CRVE; specifically if the number of clusters is large and reasonably homogenous. In a specification with a small number of clusters, however, the cluster-robust standard errors will be invariably downward biased, and thus inference – misleading.

[18]As a general rule, bootstrap inference will be more reliable the closer the bootstrap data generating process (DGP) is to the (unknown) true DGP. For many models, the "wild" bootstrap (Wu, 1986; Liu et al., 1988) is a consistent and reliable method of matching the true DGP. The "wild" method is implemented by multiplying the residuals from the original linear model by certain random weights to construct bootstrap samples, with dependant variables related to the independent variables by the same linear model (Roodman et al., 2019, p. 2).

We are fortunate to be in a position where we can take advantage of both theoretical insights and practical advancements in bootstrap methods. In STATA we use the command "cgmwildboot" (Caskey, 2010)[19], which resembles the "cgmreg" regression command, except that it bootstraps along one of the clustering dimensions using the wild bootstrap procedure described in Cameron, Gelbach and Miller (2008). Bootstrap methods were similarly applied in Barr et al. (2019).

2.5.1 Study Variables

Before finalising our study variables, it was necessary to check for multicollinearity, particularly among marriage variables. Running the STATA command "collin"[20], we compute several collinearity diagnostic measures including Variance Inflation Factors (VIF), tolerance, condition index, and the R-squared[21]. Diagnostics calculate a mean VIF of 2.86, which we deem acceptable. The following is a description of the study variables employed in the forthcoming analysis:

[19] Caskey, J. 2010. cgmwildboot. (https://sites.google.com/site/judsoncaskey/data).

[20] "collin" is a user written command by Philip B. Ender (2010) and downloaded from https://stats.idre.ucla.edu/stat/stata/ado/analysis

[21] Due to the presence of multicollinearity between marriage length and age variables, we decided to take the log of marriage length and include this variable in our specifications.

Table 2.3: Study Variables*

Variable	Description
Contribution Rate	Ratio of the participants contribution to the public pool / their initial endowment
Intrahousehold Game (*T1*)	Treatment 1; where every husband (wife) plays with his (her) wife (husband) [dummy]
Interhousehold Game (*T2*)	Treatment 2; where every male (female) plays with a female (male) from another household [dummy]
Female Age at First Marriage	Female participant's age at first marriage
Early Marriage	Household is in an early marriage arrangement (female married below the age of 18) [dummy]
Age	Participant's age in years
Bagisu	Whether the participant belongs to the Bagisu ethnic group [dummy]
Church of Uganda	Whether the participant affiliates themselves with the Church of Uganda [dummy]
Self-Employed	Participant runs a business/is self-employed other than farming [dummy]
Education	Participant's years of completed formal education
Education (*category*):	*No Education, (Some) Primary, Graduated Primary, (Some) Secondary,* and *Higher Education*
Household Size	Number of people currently living with/in participant's residence
Number of Children	Number of children under the age of 18 currently living in the participant's household
Wealth Index	Participant's calculated wealth index based on household assets
Gender Index	Participant's calculated gender index based on gender equal beliefs
Age Difference	Participant's age difference with spouse [non-negative integer]
Marriage Length	Years married with spouse [log form]
Lower Endowment	Participant's received an endowment other than 8,000 Ugandan Shillings [dummy]
Order of Rounds (T1 First)	Intrahousehold game (T1) was played before Interhousehold game (T2) in experimental session [dummy]
Received Help	Participant received help in experimental session [dummy]

*Full descriptive statistics of all explanatory variables (by gender) are displayed in Appendix A.4, page 2-60.

2.6 Results

2.6.1 Contribution by Age at First Marriage

We begin our analysis by examining differences in contribution rates in our Intrahousehold Treatment, T1. Figure 2.5 on page 2-30 presents the distribution of contributions rates for husbands and wives when playing one another in the Intrahousehold Game, and the bars in Figure 2.6 present the corresponding mean contribution rates. The test results in Figure 2.6 pertains to the null hypothesis that mean contribution rates do not differ between husbands and wives.

Overall, intrahousehold contribution rates are remarkably low and households do not attain the household earning maximisation outcome; only 3% of the whole sample contribute their entire endowment to the common pool. Similarly, only a very small proportion of the sample contribute zero to the shared fund (only 2%). Total household earnings (calculated as the sum of husband and wife final earnings) average at 18,900 Ugandan Shillings. Where endowments were 8,000 Ugandan shillings, household earnings were marginally higher at 19,100; this constitutes 79.6% of maximum joint potential earnings.

Our average household efficiency level, defined by Munro (2018) as the percentage of income received by a household as a fraction of potential income, is slightly higher than levels found in other countries, including Ethiopia (Kebede et al., 2014) and Nigeria (Munro et al., 2010). However, when quantifying efficiency loss at approximately 5,000 Ugandan Shillings, we find that households forgo one to one-and-a-half days agricultural wage, which is quite substantial. In terms of individual earnings, women fare slightly better than men, earning an average of 9,700 and men earning 9,200 Shillings. This difference is highly statistically significant[22].

Figure 2.5 reveals that for men, while there is heterogeneity in behaviour, there is a clear and distinct mode at 0.5. This mode could be indicative of a general 50/50 sharing rule between spouses. Overall, however, we find that the mean contribution rates of men and women are not statistically equal to 50%[23]. For women, the more obvious mode in Figure 2.5 is at 0.25, but also at 0.38, representing 3,000 Ugandan shillings for an 8,000 endowment. Whether these modal values serve as focal points for participants or whether these precise values are associated with behavioural norms is subject to continued debate and investigation. In either case, Figure 2.6 indicates that wives were significantly less cooperative than their husbands in our version of the PGG (p=0.018). On average, husbands contribute 46% of their initial endowment to the shared fund, while wives contribute 40%.

[22] t-statistic=3.1 (p-value=0.002).

[23] Men: t-statistic=-2.22 (p-value=0.028). Women: t-statistic=-6.09 (p-value=0.000).

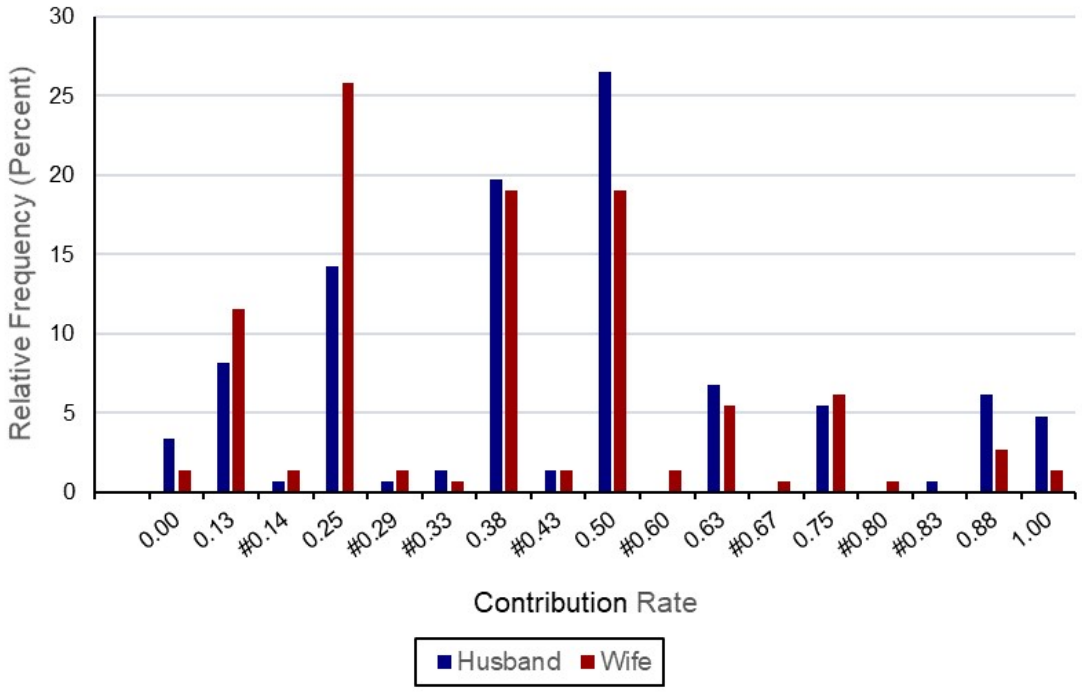

Figure 2.5: Distribution of T1 Contributions to the Shared Fund by Gender

Notes: Contribution rate is the amount contributed to the shared fund as a proportion of initial endowments. Each observation is a contributing decision. # = bin expanded to accommodate marginally higher and lower contribution rates owing to initial endowments not always equaling 8,000 Ugandan Shillings.

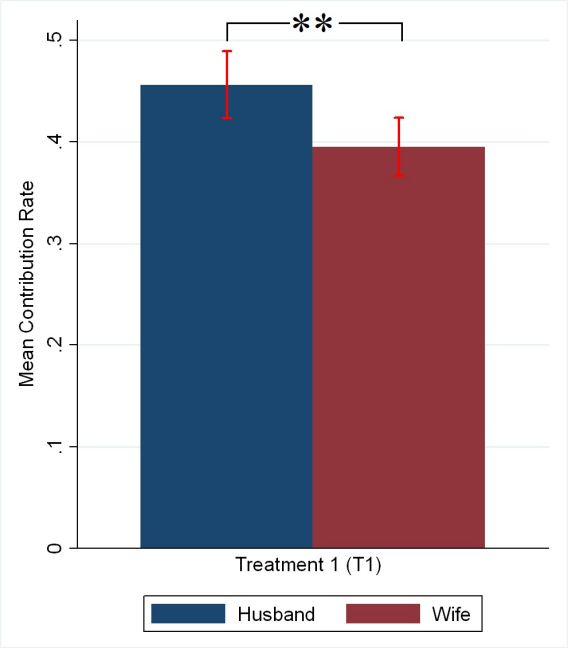

Figure 2.6: Mean T1 Contribution Rates by Gender

** = statistically different at the 5% level.

Notes: Red vertical whiskers are 95% confidence intervals, generated using a linear regression of contribution rates on gender. The test result indicated by the horizontal bracket at the top of the panel is derived from the same regression.

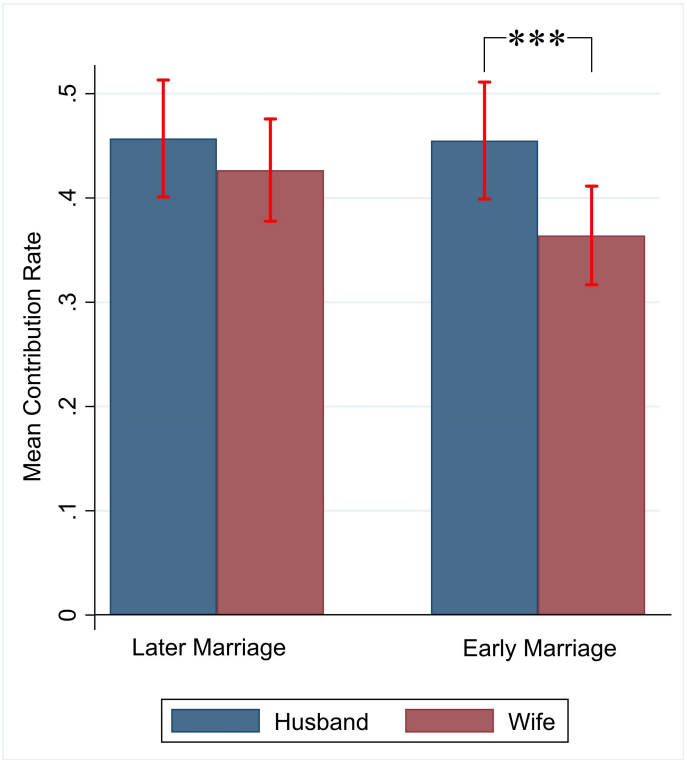

Figure 2.7: Mean T1 Contribution Rates by Marriage Age Stratifications
*** = statistically different at the 1% level. *Notes:* Red vertical whiskers are 95% confidence intervals, generated using a linear regression of contribution rates on early marriage status, using village clustered wild bootstrap. The test result indicated by the horizontal bracket at the top of the panel is derived from the same regression.

Figure 2.8: Locally Weighted Regression of Contribution Rates on Age at First Marriage by Gender

Next, we investigate whether cooperation between husband and wife varies systematically by our dichotomous age at first marriage stratifications: early and later. When playing with their spouse, households where the bride married as a child contributed slightly less than households where the bride married at, and over, the legal threshold: 41% on average, compared to 44%. This result, however, is not statistically significant (p=0.242). Figure 2.7 indicates that differences between households, while not significant, are primarily driven by gender differences. While husbands' and wives' contributions rates were statistically indistinguishable in the later household stratification, women who marry as children contribute significantly less than their husbands; 36% and 46% (p=0.05 using wild bootstrap).

Further dividing the sample reveals that, when playing with their wives, husbands that married children contribute on average the same as if they married an adult female: 46%. Examining the distribution functions of men, it is clear that we do not have enough evidence to reject the null that the distributions are identical[24]. In contrast, women who marry as children contribute less to the shared fund than those who marry as adults; 36% compared to 43%. This result, while not significant using wild bootstrap, is significant at the 10% level using OLS. Examining the distributions, a two-sample Wilcoxon rank-sum test (also known as the Mann-Whitney test) reveals that contribution rates for women across the marriage stratifications do not have the same distribution function[25].

Considering now our primary variable of interest - age at first marriage - Figure 2.8 illustrates a locally weighted regression of contribution rates on age at first marriage for husband and wife sub-samples. While there is no clear trend for men, the female trend line hints at a concave-positive relationship between contribution rates and age at first marriage. Due to the distinct and significant differences in husband and wife behaviour, we feel justified in focussing our analysis explicitly on gendered sub-samples. Using wild bootstrap methods, regression analysis reveals that as female age at first marriage increases by one year, contribution rates of women increase by 1%. This result is significant at the 5% level (p=0.043)[26]. For men, their age at first marriage has no significant effect on contribution rates in an intrahousehold setting.

[24]Two-sample Kolmogorov-Smirnov test for equality of distribution functions: 0.0476 (p=1.000); Epps-Singleton Two-Sample Empirical Characteristic Function test: 2.911 (p=0.573); Two-sample Wilcoxon rank-sum (Mann-Whitney) test: -0.187 (p=0.8517).

[25](p=0.069). However, we do not have enough evidence to reject the null using the two-sample Kolmogorov-Smirnov test (p=0.429), nor the Epp-Singleton two-sample Empirical Characteristic Function test (p=0.228).

[26]Running the same regression with a squared term reveals that as female age at first marriage increases, contribution rates increase at a decreasing rate. These coefficients, however, are not significant.

Table 2.4: Intrahousehold and Interhousehold Contribution Rates by Player

Dependent Variable: Contribution Rate = contribution/initial endowment	(1) Intrahousehold No Controls	(2) Intrahousehold Controls	(3) Interhousehold No Controls	(4) Interhousehold Controls
Panel A. Full Sample				
Age at First Marriage	0.01	0.01	-0.00**	0.00
	(0.004)	(0.004)	(0.002)	(0.004)
Observations	293	230	293	230
Panel B. Husband Contributions Only				
Age at First Marriage	0.00	0.01	-0.00	0.00
	(0.005)	(0.008)	(0.002)	(0.014)
Observations	146	100	146	100
Panel C. Wife Contributions Only				
Age at First Marriage	0.01**	0.01***	-0.00	0.01
	(0.003)	(0.004)	(0.003)	(0.005)
Observations	147	130	147	130

*** p<.01, ** p<.05, * p<.1
Bootstrapped standard errors are reported underneath coefficients in parentheses.
Notes: This table presents coefficients from linear regressions and significance stars correspond to p-values of two-tailed tests of H_0: coefficient equals 0. In Panel A, the explanatory variable of interest is age at first marriage for the full sample of men and women; Panel B uses male age at first marriage for the male sub-sample (husband only contributions); and similarly, Panel C uses female age at first marriage for the female sub-sample (wife only contributions). Throughout, p-values are adjusted to account for inter-dependence within villages using a wild bootstrap. For full tables with socioeconomic and experimental control coefficients included, please consult Appendix F.

2.6.2 Controlling for Other Factors

Next, we investigate whether the differences described in the preceding section are owing to sub-sample variations in the participants' experiences during the experimental sessions or individual characteristics. Column 1 in Table 2.4 presents the regression results supporting the key comparisons-of-means findings already described for age at first marriage. Column 2 presents the same set of regression results, but after an extensive list of socioeconomic and experimental controls have been included in the model.

In Panel A of Table 2.4, our explanatory variable of interest is the age at first marriage for the full sample of men and women. With no controls, the coefficient is positive and just shy of significance (p-value=0.148). However, after adding controls, the size of the coefficient for age at first marriage decreases and moves further away from significance. In Panel B, adding controls has little to no impact on the size of the coefficient for men's age at first marriage, remaining insignificant throughout. Panel C focuses on wives' contributions only. When controls are added to the model, the size of the coefficient for female age at first marriage remains the same (a 1% increase in cooperation levels *ceteris paribus*), and statistical significance increases from the 5% to the 1% level. By adding controls to the model, we reduce

female observations to 130 (from 147), and the bootstrapped standard error increases modestly from 0.003 to 0.004. These controls, however, are necessary as they help address the heterogeneity of our sample of Ugandan women.

2.6.3 Selection vs. Causation

Next, we investigate whether factors related to the age at which one marries causally affects contribution rates, i.e. the older one marries, the more cooperative one is - or whether it owes to selection, i.e. more cooperative people purposefully select into a later marriage. If cooperation is higher amongst those who marry later (particularly women) due to selection, one would similarly expect a high degree of cooperation, based on increased age at first marriage, when playing with members of *other* households; that is, when playing the Interhousehold Treatment, T2.

First, it is clear from Figure 2.9 that contributions were significantly lower in the interhousehold game, dropping from an average of 43% to an average of 29% (p-value=0.000). For men, contribution rates dropped by 20%, and for women, 8%. Gender differences in and between games are highly statistically significant, as indicated by the horizontal brackets in Figure 2.10.

For age at first marriage, in Table 2.4, columns 3 and 4, we show that this variable lacks statistical significance for both men and women (Panel B and C, respectively), with and without the inclusion of controls. Interestingly, with no controls, the age at first marriage coefficient is negative and highly statistically significant (p-value=0.01). Adding controls dramatically reduces the significance of the household's age at first marriage variable, moving from a p-value of 0.01 to 0.775 (bootstrapped standard error also increases from 0.002 to 0.004). We find that this loss of significance is due to the inclusion of two specific variables; gender and number of children.

In sum, these estimations yield no evidence of the selection of women into a progressively later marriage based on their differential willingness to cooperate with men. Thus, we conclude that increased female cooperation, due to their increased age at marriage, was due to the marriage institution's effect rather than purposeful selection. Women who marry older are more cooperative with their husbands.

As a robustness check and to account for possible outliers in the exploratory analysis conducted in Sections 2.6.1 to 2.6.3, we drop those observations where the age at first marriage exceeds 30 years for our sample of women. In the intrahousehold game with no controls (n=143), the coefficient for female age at first marriage remains the same at 0.01, but drops in statistical significance to the

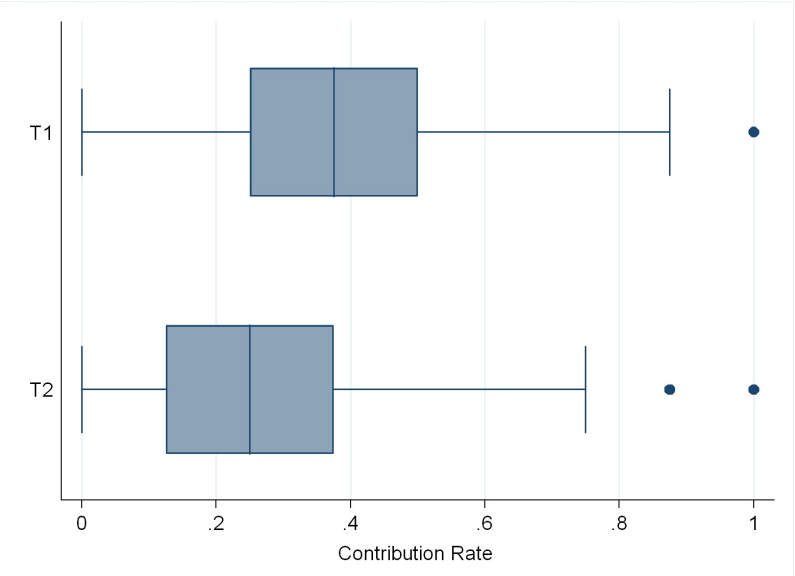

Figure 2.9: Box Plot of Contribution Rates by Treatment

Note: T1 refers to the Intrahousehold Game, and T2 refers to the Interhousehold Game. Dots represent outliers in the data.

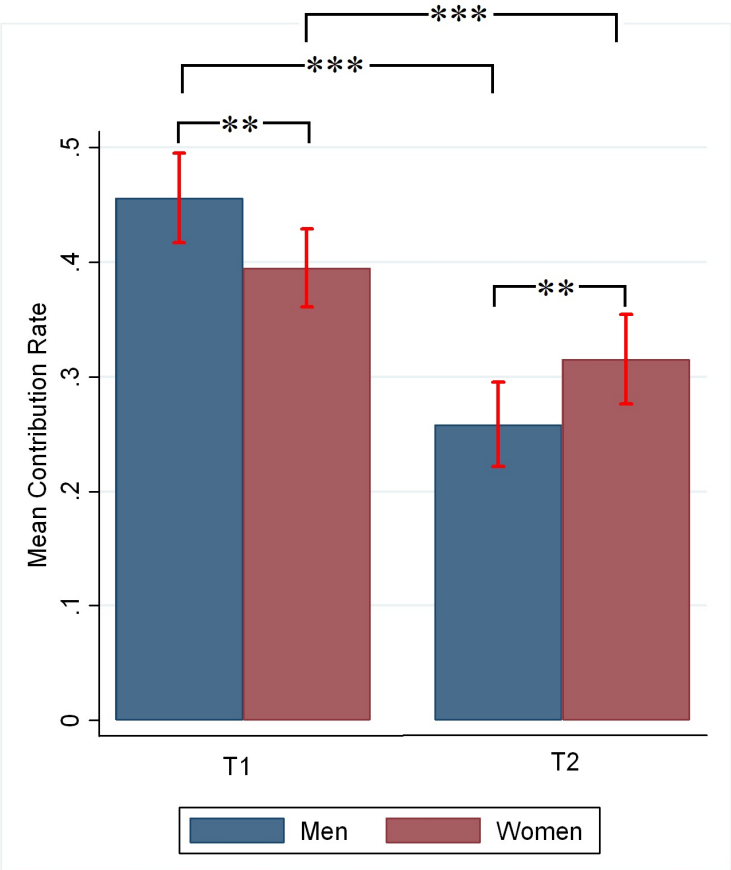

Figure 2.10: Mean Contribution Rates by Gender and Treatment

** = statistically different at the 5% level; *** = statistically different at the 1% level.

Notes: Red vertical whiskers are 95% confidence intervals, generated using a linear regression of contribution rates on gender, by treatment using village clustered wild bootstrap. The test result indicated by the horizontal bracket at the top of the panel is derived from the same regression.

10% level [27]. Introducing controls to the model (n=128), the coefficient remains 0.01 and is significant at the 5% level [28]. The coefficients for the additional socioeconomic and experimental controls similarly remain the same. Likewise, we observe no significant results for the interhousehold games by excluding age outliers. Overall, results appear robust to outlier exclusion, and the positive effect of female age at first marriage on intrahousehold cooperation rates is further corroborated by this additional analysis.

2.6.4 Early Marriage, Education and Cooperation

This section will explore further the linkages between female age at first marriage, education and intrahousehold cooperation, using survey data collected post experimental workshops. From the survey, self-constructed education dummies were generated; this was to ensure equal distribution across the education categories and accommodate the structure of Uganda's formal education system. For further information, please consult Appendix A.3 on page 2-55.

Despite the increasing number of women with an education, our figures (corroborated earlier by DHS statistics) reveal that only 22% of women complete their secondary education or higher in the Bagisu region, whereas 37% of men have completed secondary or higher education. Very few women with secondary or higher education are from low-income households. When asked to rank their parents in terms of prosperity, from "very poor, poor, average and rich", the majority of women with secondary education ranked their parents as "average" (with lower education levels, the distribution of the response was more varied). For men with secondary education, there is greater variation in parental wealth, particularly for the higher education dummy.

Several factors have been discussed in the literature addressing gender disparities in education, among which poverty and socio-cultural norms are frequently cited. Within the socio-cultural norms paradigm, early marriage plays a particular role in hindering gender parity. When interacted with poverty, the influence (and likelihood) of early marriage becomes more prevalent. The UNFPA (2012) found that girls in the lowest wealth quintile are more than three times as likely to marry early than those from the highest wealth quintile; furthermore, the report found that early marriage rates of girls with no schooling is three times larger compared with those who hold some secondary education.

Low levels of schooling among women who married early can also be linked to common factors related to cognitive ability, poverty, and strong cultural norms. Thus, the early marriage-education relationship is likely to be endogenously

[27] bootstrapped standard error increases to 0.006.
[28] bootstrapped standard error = 0.004.

determined. However, this study does not intend to examine the precise nature of the early-marriage dynamic; instead, we are interested in exploring their interactions and subsequent bearing on intrahousehold cooperation (whilst controlling for alternative socio-economic factors). To achieve this, we employ standard OLS regression, with clustered robust standard errors at the village level. Results are reported in Table 2.5 on page 2-38 where we focus exclusively on wife contributions.

With no interactions in column (1), the model implies that, against the baseline of no education, more educated women contribute significantly more in the intrahousehold game; for example, compared to women with no education, those who have some primary education contribute 10% more to an intrahousehold common pool; those with some secondary contribute 12% more. Post-estimation confirms that education dummy coefficients are statistically different from one another[29].

In column (2), we include interaction terms between age at first marriage and education dummies; here, we find that the slopes of the linear regression lines between cooperation and age at first marriage are indeed different for different education categories. Significance, however, is only obtained for secondary education dummy; with some secondary education, an incremental increase in female age at first marriage by one year increases intrahousehold cooperation by 3%, compared with women of lower educational status.

Due to the well-documented links between education, poverty and intrahousehold behaviour, we include interactions between current low wealth status and our education dummies. In creating our wealth index (the full details of which are documented in Appendix D), we classified households according to wealth levels derived from the index. Those in the bottom 40% of the polychoric wealth index were designated "low wealth" (n=110). Interactions between our education dummies and low wealth status are included in column (3), where we find increased education with low wealth status reduces intrahousehold cooperation for women. Controlling for these interactions, we once again find a strong, positive relationship between age at first marriage with secondary education and cooperation rates[30]. However, it is clear that the cooperative gains from secondary education are outweighed by the negative impact of the household's current low wealth status.

Finally, in column (4), our interactions from column (3) are again included in the model, now with the addition of game and socio-economic variables at the household and individual level. Our previous finding of some secondary education interacted with age at first marriage is confirmed, increasing from 3% to a 4% contribution to the common pool. Once again however, this gain is not enough to offset the negative impact of low wealth status on contribution rates.

[29]With the exception of tertiary; this is likely due to the low number of observations.

[30]The number of women with some secondary education and are of current low wealth status in our sample is n=18.

Table 2.5: Intrahousehold Cooperation: Age at First Marriage and Education Interactions

	Wife Only Contributions			
VARIABLES	(1)	(2)	(3)	(4)
Age at First Marriage (AFM)	0.01*	-0.00	-0.00	-0.00
	(0.004)	(0.004)	(0.001)	(0.007)
Low Wealth	-0.05	-0.06	0.14***	0.20***
	(0.042)	(0.043)	(0.040)	(0.064)
Some Primary	0.10***	-0.04	-0.01	0.06
	(0.032)	(0.097)	(0.107)	(0.172)
Graduated Primary	0.09	-0.12	-0.07	-0.07
	(0.074)	(0.251)	(0.283)	(0.351)
Some Secondary	0.12*	-0.38*	-0.36*	-0.42
	(0.054)	(0.195)	(0.169)	(0.253)
Tertiary	0.43***	-0.23	3.05***	2.08
	(0.061)	(0.629)	(0.037)	(2.222)
Some Primary * AFM		0.01	0.01*	0.01
		(0.005)	(0.004)	(0.007)
Graduated Primary * AFM		0.01	0.01	0.02
		(0.015)	(0.017)	(0.021)
Some Secondary * AFM		0.03**	0.03**	0.04**
		(0.011)	(0.011)	(0.014)
Tertiary * AFM		0.03	-0.12***	-0.07
		(0.033)	(0.001)	(0.104)
Some Primary * Low Wealth			-0.20**	-0.23**
			(0.071)	(0.101)
Graduated Primary * Low Wealth			-0.28**	-0.29*
			(0.121)	(0.142)
Some Secondary * Low Wealth			-0.25***	-0.26***
			(0.075)	(0.071)
Tertiary * Low Wealth			-0.64***	-0.57
			(0.040)	(0.390)
Constant	0.21**	0.36***	0.33***	-0.25
	(0.080)	(0.077)	(0.037)	(0.235)
Observations	147	147	147	136
R^2	0.114	0.143	0.180	0.242
Game Controls	No	No	No	Yes
Socio-Economic Controls	No	No	No	Yes

*** p<.01, ** p<.05, * p<.1

Notes: Dependent Variable: Contribution Rate = contribution/initial endowment
Coefficients and cluster robust standard errors in parentheses from OLS regressions.

2.6.5 Bridewealth

As an extension to the original analysis, we wish to investigate the role of 'bridewealth' in our intrahousehold PGG, given its prevalence in East Uganda and its potential linkages to the brides' age at first marriage. Throughout, we maintain strict adherence to Goody et al. (1973)'s definition of bridewealth; it is the marriage prestations made by the groom (or his kin) to the bride's family. Such a strict observation is necessary, as misclassification of bridewealth can occur; specifically, bridewealth has included instances whereby the ultimate recipient of the marriage gift/s is the bride herself – not her kin. Consequently, the gifts exchanged form part of a joint conjugal fund rather than a circulating societal one (Goody et al., 1973, p. 2). It would, therefore, be misleading to refer to these transactions as bridewealth, with Goody preferring the term 'indirect dowry'. Bridewealth and indirect dowry are identified as separate variables in our analysis, given the latter's potential for augmenting household resources.

The practice of Bridewealth in Uganda ranges from a mainly ritualistic transfer of tokens of esteem[31], to an outright purchase in which the groom reserves a right to ask for a refund from the wife's kin if he can support a claim that she failed to fulfil her part of the exchange. However, as of 2015, the Supreme Court in Kampala ruled in a majority judgement that the traditional practice of demanding a brideprice refund if a marriage breaks down is unconstitutional[32]. For further information on Bridewealth data collection, please consult Appendix A.3 on page 2-55.

Throughout Sub-Sub-Saharan Africa, cattle and other livestock appear to be the norm for bridewealth payments (Wendo, 2004). Looking to Uganda, it appears that the content (or "type") of bridewealth payment can vary substantially among different ethnic groups. The Bigisu – the largest ethnic group represented in our sample (96%) - traditionally use cattle and goats, similar to other ethnic groups found in Northern and Eastern Uganda (Wakabi, 2000). Looking at our data, this tradition is apparent as the most substantial payments (in terms of both monetary value and quantity) are for livestock – particularly cows and goats. Table 2.6 itemises the exchange of goods (both indirect dowry and bridewealth) that was hitherto agreed upon by the household of the wife and the household of the groom. We also record whether both parties agreed that these gifts should be returnable in the event of a divorce.

Historically, Western anthropologists favoured the application of 'exchange theory' to bridewealth practices, with payments linked to an unbalanced cost-benefit ratio as perceived by the bride's and groom's families. Where there are variations in the

[31] If one regards the passage of property as symbolic of the transfer of rights, then the nature and monetary value of the objects exchanged is of little importance.

[32] This ruling is rarely enforced and, at the time of writing, Uganda has yet to pass the Marriage and Divorce Bill which proposes a punishment of up to one year in prison for any man who demands a brideprice refund.

Table 2.6: Payments at Marriage; Indirect Dowry and Bridewealth Livestock Transfers

Livestock		**Indirect Dowry**	**Bridewealth**	***Notes:***
Oxen	Quantity			*Male Response = 26*
	1	20	18	*Female Response = 23*
	2	5	5	
	3	0	1	*2 complete household responses*
	Total	**25**	**24**	*Neither household was in*
Returnable?	*Yes*	-	-	*agreement over the precise quantity of*
	No	25	24	*oxen (given their different responses)*
Cows	Quantity			
	1	13	20	*Male Response = 48*
	2	8	32	*Female Response = 52*
	3	0	22	
	4	1	4	*18 complete household responses;*
	Total	**22**	**78**	*6 in agreement,*
Returnable?	*Yes*	-	2	*12 do not agree on precise quantities*
	No	22	76	
Goats	Quantity			
	1	6	13	*Male Response = 49*
	2	6	31	*Female Response = 53*
	3	12	32	
	4	0	2	*22 complete household responses;*
	Total	**24**	**78**	*13 in agreement,*
Returnable?	*Yes*	-	2	*9 do not agree on quantities*
	No	24	76	

size of payments, we work with the assumption proposed by Mulder (1995) that each party seeks to maximise some value, be it material, social or political.

One purpose of bridewealth is to purportedly compensate the bride's father for the loss of the daughter's child-bearing potential (Kressel et al., 1977). Like husbands at the point of marriage, we cannot adequately measure a woman's reproductive capabilities; the only proxy one has is her age. A younger age implies a greater window for birthing children and higher fertility. Mulder (1995) found that, in Kenya, high bridewealth was paid for women who reached menarche relatively early. However, Mulder (1995) also found that specific ideals about family size are themselves heavily affected by socioeconomic conditions. This is perhaps why, from 1982 onwards, the relationship between menarcheal age and high bridewealth disappears. This result implies a monetary devaluation of women's fertility capabilities.

Preliminary data analysis predicts a positive linear relationship between a female's age at first marriage and the total value of the bridewealth her family receives. Figure 2.11 illustrates this relationship while controlling for marriage duration (that is, controlling for a time trend). The coefficient for female age at first marriage, however, is not significant for the linear prediction (p-value= 0.769); this could be due, in part, to fewer observations per age at first marriage observation. To improve our understanding, we turn now to our dichotomous variable of 'Early Marriage'.

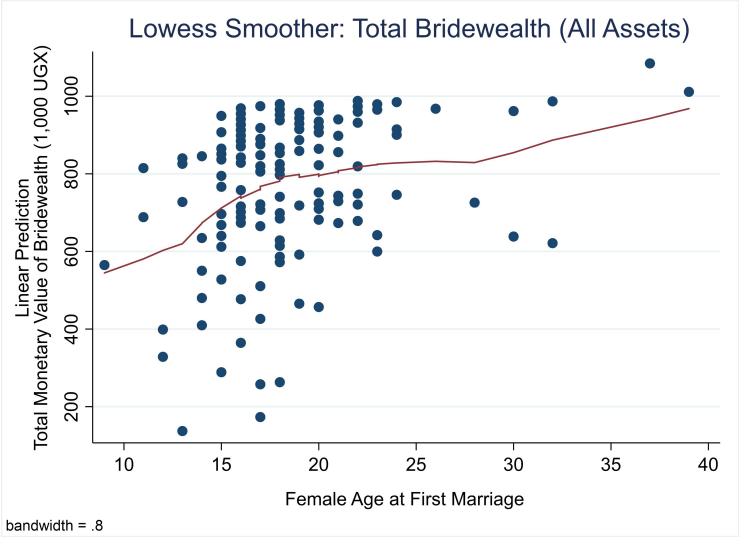

Figure 2.11: Linear Prediction; Total Monetary Value of Bridewealth against Female Age at First Marriage

When examining the differences between the total bridewealth for those women who married below 18 and those who married as a legal adult, a one-sided t-test reveals a statistically significant difference (p-value = 0.0587), with a larger mean payment for adult women (see Figure 2.12 on page 2-42). Looking at the livestock value of bridewealth payments, a two-sided t-test similarly reveals a statistically significant difference between the two 'types' of marriage (early and later), with early marriages averaging 462, 437 Ugandan Shillings and adult women marriages averaging higher at 810, 812 Ugandan shillings (p-value = 0.095) (see Figure 2.13 on page 2-42).

Running a bootstrapped regression, the results of which are presented in Table 2.7, we can see that early marriage reduces the total value of bridewealth by approximately 360,000 Ugandan Shillings relative to marrying a woman 18 years or older. Early marriage reduces livestock bridewealth by almost 370,000 Ugandan Shillings; this value is equivalent to almost US$100 and is significant at the 5% level (p-value = 0.037).

For the bootstrapped specifications, we also control for variables known to influence bridewealth (see Mulder (1995)), including years of farming experience prior to marriage. Bridewealth can be seen as a means to compensate the bride's father's household for the loss of her labour contribution. Bridewealth should, therefore, be a positive function of women's labour productivity (Kressel et al., 1977). We observe a positive - but insignificant - coefficient for bridewealth with respect to female years of farming experience before marriage[33]. Similarly, bridewealth is hypothesised to be a positive function of education (in years); bridewealth can be seen as an attempt

[33]We believe this result is due to an overall decline in the labour value of women's agricultural work. This is not to imply that women work less; rather, with acute shortages of land in the Sironko district (which limit the expansion of agricultural production), men perceive improved agricultural productivity via greater diversification, fertilisers, and mechanised equipment rather than increased labour (women) power.

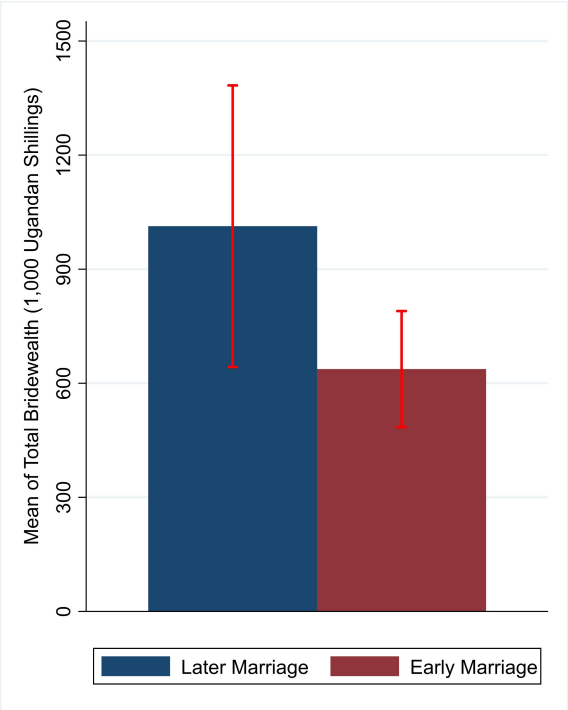

Figure 2.12: Mean of Total Bridewealth (1,000 Ugandan Shillings) by Marriage Type

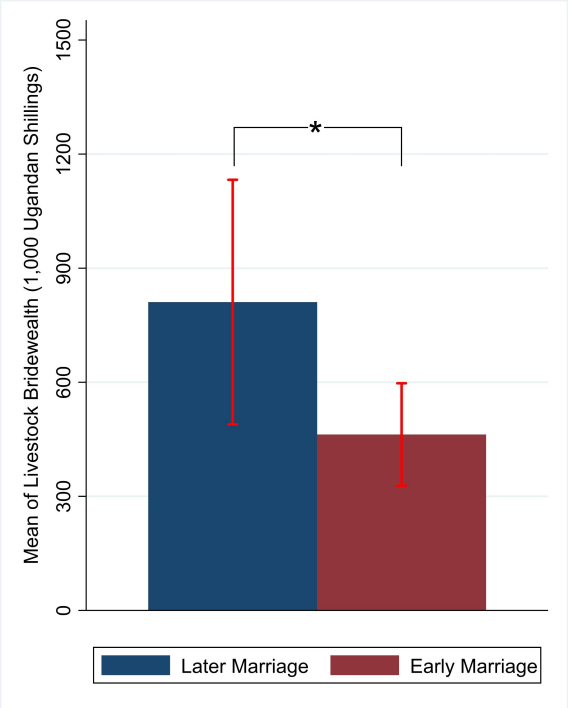

Figure 2.13: Mean of Livestock Bridewealth (1,000 Ugandan Shillings) by Marriage Type

Notes: * = statistically different at the 10% level.

Table 2.7: Early Marriage and Bridewealth

	(1) Total Bridewealth (1,000 Ugandan Shillings)	(2) Livestock Bridewealth (1,000 Ugandan Shillings)
Early Marriage	-361.60* (0.094)	-370.85** (0.037)
Female Years of Farming Experience (Prior to Marriage)	9.76 (0.499)	12.25 (0.298)
Education (Years)	37.38 (0.253)	18.92 (0.380)
Marriage Length (Years)	-13.10 (0.309)	-6.30 (0.567)
Constant	1023.46** (0.044)	790.88* (0.052)
Observations	86	86

*** p<.01, ** p<.05, * p<.1
p-values are in parentheses.

to repay the bride's parents for school fees (Mulder, 1995). Again, we observe a positive but insignificant correlation between years of education and payments.

Having established a correlation between early marriage and bridewealth payments, we return now to intrahousehold cooperation. We re-run our bootstrapped regression, with the contribution rate as our dependent variable. We include interactions for the total bridewealth and livestock bridewealth with early marriage (a binary variable). Results are presented in Table 2.8. Column (1) presents coefficients with no controls, and column (2) with additional control variables. Throughout intrahousehold play, bridewealth and its interaction with early marriage has a negligible effect on cooperation rates between spouses. With the inclusion of controls, these interactions move further away from significance, and remain negligible.

While undoubtedly an important area of research that warrants more attention, we remain cautious in drawing any substantive conclusions from our data. Many participants were unwilling or unable to provide an inventory list for gifts at marriage. This could, in part, be due to recall bias, particularly for those couples married for a long time; however, we find no evidence of this in our Probit analysis conducted in Appendix 2.8, Table 2.13. Instead, have a large number of male non-responses to the question of whether the agreed upon bridewealth has been paid in full to the recipients. Given the Bagisu context of strong masculine identities, social emotions such as pride likely influenced rate of response. According to Roazzi et al. (2011), secondary - or social emotions - are heavily influenced by society and culture, particularly emotions of jealousy, embarrassment and pride. In discussions of indebtedness (see, for example Flores and Vieira (2014)), researchers should acknowledge the social emotion classification as

Table 2.8: Intrahousehold Cooperation, Early Marriage and Bridewealth

Dependent Variable: Contribution Rate	(1) No Controls	(2) Controls
Early Marriage	-0.10	-0.072
	(0.102)	(0.307)
Early Marriage*Total Bridewealth	0.000	0.000
	(0.135)	(0.392)
Early Marriage*Livestock Bridewealth	0.000	0.000
	(0.12)	(0.428)
Observations	98	86

*** p<.01, ** p<.05, * p<.1 *Notes*: *p*-values are in parentheses. Controls include gender, age, Bagisu ethnicity, Church of Uganda religion, education in years, number of children, wealth index and marriage duration. Total bridewealth and livestock bridewealth are also included separately in each specification.

indebtedness influences subjective issues such as shame, pride, or nervousness.

Observations are thus low, and where they do exist, we rely heavily on participants being truthful in their assessment of value. Data collection for bridewealth transfers must be improved if this area of research is to be advanced. Only with comparable data from other communities on the precise relationship between bridewealth payment size and the different characteristics of the bride, groom and their families can collection methods be thoroughly evaluated; this will allow for greater clarification on the significance of correlations modestly explored thus far. One recommendation would be to implement a randomised, longitudinal experiment, observing couples from the point of marriage for an indefinite period of time. This approach would allow the researcher to collect asset and asset price data for each time period, and so collect more accurate observations on the nominal value of bridewealth transactions. Despite these limitations, a relationship between female age at first marriage and bridewealth value has been demonstrated, particularly between our early and later marriage classifications.

2.7 Does Behaviour in the Lab link with Intrahousehold Behaviour in Real Life?

In this section, we investigate whether and how behaviour in the intrahousehold PGG is linked to the self-declared behaviour of spouses in their everyday lives. We add to the recent literature that focuses explicitly on intrahousehold decision-making and the succeeding relationship between behaviour observed in the lab and the self-declared, everyday behaviour of spouses. In particular, we

refer to the recent works of Hoel (2015) and Barr et al. (2019). Hoel (2015), using survey measures of spousal knowledge of income and expenditures, examines the impact of asymmetric information in intrahousehold dictator games. Her results found that, for some individuals, better information between spouses is positively but insignificantly associated with greater generosity in the game. For others, better information is associated with higher levels of opportunism, suggesting that for non-cooperative couples, better information reflects "more monitoring" (Hoel, 2015, p. 134). Barr et al. (2019) similarly found that contribution rates in a PGG increased with how much participants thought they knew about their playing partners' finances.

In the experimental literature, it is widely acknowledged that decisions taken in the PGG are more readily thought of as decisions concerning financial contributions to the household - the 'household' being analogous to a 'common pool'. Assuming this to be the case, one may anticipate contributions in the PGG to correlate to prior cooperative behaviours, particularly in the form of joint decision-making concerning household financial matters. Of course, the degree to which spouses make joint decisions on financial matters in the day-to-day functioning of the household has many determinants. Such determinants include, but are not limited to, individual monetary incomes, non-financial contributions to the household, social and culturally defined responsibilities, roles and autonomy, responsibilities outside the immediate home, and the number of dependants (children or elders). All of these determinants are likely to vary across individuals and households.

In our version of the intrahousehold PGG, contributions to the common pool could only be made in money out of initial endowments. Variation in these endowments was minimal, randomly determined, and solely for the purpose of plausible deniability. Information about contributions was asymmetric, and thus any enforcement (retaliation) opportunities were limited. Responsibilities and dependents could have impacted decision-making in-game, only insofar as the participant internalised those needs prior to decision-taking. The ability to exclude noisy, alternative behavioural determinants is heralded as a great advantage of lab-type experiments. Within the parameters of this chapters' primary investigative purpose, the lab approach allowed us to attribute systematic differences in observed contribution rates to differences in willingness to cooperate. This great advantage can quickly turn to a disadvantage when attempting to demonstrate linkages between behaviour in an artificial lab-type setting, and behaviour in real life.

Survey questions were devised to elicit the division of money management in the household. Participation in decision-making is usually measured by explicitly examining who makes a specific decision; for example, by posing the question: "*in general, who decides how money should be spent in the household?*". For these question types, we focus on the "joint" response, as it reflects the collective (or cooperative) nature of household money management. We hypothesise that

Table 2.9: Descriptives for Self-Declared Joint Behaviour for Household Expenditures by Husband and Wife

Variable	**Mean**		**Test for Equality of Means**	
	Male	**Female**	**t-stat**	**p-value**
Joint Finances with Spouse	0.44	0.80	-6.82	0.000
Joint decision-making in Household Spending	0.67	0.44	4.09	0.000
Jointly Keep Money in the Household	0.59	0.54	0.82	0.4124

Notes: Definitions: Joint Finances with Spouse = response to question "Do you have separate finances with your spouse? That is, do you keep and spend the money you earn without consulting your spouse?"; a "No" response to this question was coded as "joint" finances. Joint decision-making in Household Spending = response to question "Who decides how money should be spent in the household?". Jointly Keep Money in the Household = response to question "Who keeps the money in your household?".

pre-existing cooperative behaviour is embodied within this joint response. Throughout, the counterfactual to the joint response is that one spouse takes the decision alone. When posing these specific questions to the household, previous studies have found that spouses frequently report differing perceptions of how specific household decisions are taken. Disagreements suggest gendered differences in perceptions of the decision-making process. Indeed, we find some statistically significant differences in the responses between men and women, as illustrated by the t-stat and associated p-values in Table 2.9, which presents the sub-sample means for each of the everyday life variables we employ for this analysis.

To investigate the correlations, we regressed each of the "real life" variables on the PGG contribution rate in the intrahousehold game. Once again, regressions have been wild bootstrapped to account for the clustering of decisions within villages for the purposes of inference. Intrahousehold results are reported in Table 2.10 on page 2-47. For the household sample (Panel A), column (2) reveals a highly statistically significant correlation between joint decision-making in household spending and PGG contributions in the lab. Similarly, there is a positive correlation between the joint finances and jointly keep money variable with PGG contributions, as indicated in columns (1) and (3) respectively. While on the cusp of significance for the household sample, these coefficients jump in statistical significance for the husband-only sample to the 5% level. For the women-only sample, throughout the various specifications, coefficients reveal no significant correlation between prior cooperative behaviours and PGG contributions.

Our findings are consistent with the notion of there being link between behaviour in the intrahousehold games and spousal behaviour in everyday lives. Specifically, we find that pre-existing cooperative behaviours - in the form of joint decision-making on financial matters - positively correlates to PGG contributions, particularly for husbands. However, for wives, the evidence is less clear; results reveal that the joint management of household finances in life and PGG contributions in the lab is limited. Further investigation into gendered differences is necessary to further this

Table 2.10: Linkages Between Intrahousehold Behaviour in the Lab and in Real Life

Dependent Variable	**(1)** **Joint Finances with Spouse**	**(2)** **Joint Decision-Making in Household Spending**	**(3)** **Jointly Keep Money in the Household**
Panel A. Household Contributions			
Contribution Rate	0.216	0.332***	0.212
	(0.108)	(0.003)	(0.155)
Constant	0.690	0.728*	0.962***
	(0.114)	(0.079)	(0.000)
Observations	230	230	230
Panel B. Husband Contributions Only			
Contribution Rate	0.307**	0.347	0.385**
	(0.019)	(0.246)	(0.012)
Constant	0.408	0.814	0.800*
	(0.537)	(0.292)	(0.095)
Observations	100	100	100
Panel C. Wife Contributions Only			
Contribution Rate	0.002	0.182	0.217
	(1.000)	(0.446)	(0.484)
Constant	1.679	0.373	0.753
	(0.000)	(0.810)	(0.176)
Observations	130	130	130

*** p<.01, ** p<.05, * p<.1 *Notes: p*-values are in parentheses.
All regressions include experimental and socioeconomic controls, including age at first marriage.

claim, and highlights a key area of study for future intrahousehold studies.

2.8 Conclusion

> *"The null hypothesis of efficiency predicts that household members will choose the option that maximises household pay-offs"* (Munro, 2018, p. 143).

Using a carefully designed series of linear public good games to measure intrahousehold cooperation, we present evidence rejecting the null hypothesis for efficiency. Without communication and with individual actions concealed via a plausible deniability mechanism, voluntary contributions to a household common pool were low for our Ugandan spouses: 46% for husbands and 40% for wives. Such low contribution rates means that spouses failed to maximise aggregate pay-offs. On average, households earned approximately 19,000 Ugandan Shillings, constituting 79.6% of maximum joint potential earnings. The quantitative cost of this lack of cooperation between spouses amounts to one to one-and-a-half days agricultural wage.

In particular, we found that wives were significantly less cooperative than their husbands. When investigating the age at marriage mechanism, we found that an incremental increase in women's age at marriage of one year, increases her intrahousehold cooperativeness by contributing 1% more to the common pool, *ceteris paribus*. The result was found to be highly statistically significant and robust to the inclusion of individual and household level controls and to outlier exclusion. While this figure is low, differences in cooperation levels can accumulate over multiple daily interactions and become quite substantial over time. Further investigation found no evidence concerning the selection of women into progressively later marriage based on their differential willingness to cooperate with men. Increased female cooperation - due to an increase in age at first marriage - is due to the marriage institutions' effect rather than purposeful selection. Given that many decisions are taken at the household level, or occur within the household, this increase in cooperation is an important finding.

Our estimation strategy then explores interactions between women's age at first marriage, education levels, low wealth status, and intrahousehold cooperation. In the first instance, we find that the slopes of the linear regression lines between contribution rates and age at first marriage are different for different education categories. Specifically, we find that with some secondary education, an increase in female age at first marriage increases intrahousehold cooperation by approximately 4%. Second, we interact education levels with the current low wealth status of the household; increased education coupled with a low wealth status reduces intrahousehold cooperation significantly. These latter interactions far outweigh the gains from increased age at first marriage and secondary education.

Cooperation not only has the potential to increase aggregate gains, but should increase household welfare and reduce opportunism introduced by participatory decision-making. Lecoutere and Jassogne (2019), for example, recently found that cooperative behaviour by couples in a lab-in-the-field experiment is associated with greater actual investments in agricultural production and household wellbeing. Intrahousehold cooperation was found to positively affect expenditures on household public foods, including children's education, nutrition and households' overall economic wellbeing (Duflo and Udry, 2004; McCarthy and Kilic, 2017). Increasing intrahousehold cooperation is not only an 'intrinsic good', but likely leads to greater gains in income and household public goods provision. Based on our results, women's delayed entry into marriage will likely facilitate the promotion of intrahousehold cooperation; however, the benefits of delayed entry into marriage must be accompanied by increased access to female education, particularly secondary education. Furthermore, policies aimed at delaying women's entry into marriage must address underlying poverty issues. Our results show that low wealth status will continually undermine the potential for cooperative gains, irrespective of women's education levels.

Bridewealth payments are still common in East Uganda, albeit slightly more

commercialised[34]. Our survey data found some evidence suggesting lower livestock payments for women married below 18. However, regression analysis found a negligible effect for bridewealth payments on intrahousehold cooperation rates. Nevertheless, we are reluctant to dismiss this line of enquiry, given bridewealth's ability to augment household resources to the detriment of the husband and the newly formed household. Data collection encountered several obstacles that impeded the analysis. Many participants were unable or unwilling to provide inventory lists for marital gift exchange. We do not find evidence of recall bias; instead, we believe that partial or incomplete payments drove non-responses. Data collection methods for gifts exchanged at marriage must be improved if one is to advance understanding of bridewealth transfers.

This chapter concludes by examining linkages between experimental data and the real-life behaviour of our Ugandan spouses. To the best of our knowledge, very few experimental studies provide evidence of a relationship between behaviour exhibited in the lab and behaviour in everyday life, other than Hoel (2015) and Barr et al. (2019). Our findings suggest that pre-existing cooperative behaviours, in the form of joint decision-making on household financial matters, correlate positively with contributions to the common pool, but only for husbands. For wives, joint financial management in life and PGG contributions in the lab is limited and highlights a key area of study for future intrahousehold investigations and post-game interviews.

[34]See 2020 PML Daily news article https://www.pmldaily.com/features/2020/03/traditional-marriage-among-the-bagisu-facing-extinction.html:"Many a traditional leader in Bugisu sub-region are now condemning 'exorbitant' traditional marriages which they say are contrary to Bamasaba norms."

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Appendix A: Data Collection

A.1 Area of Study

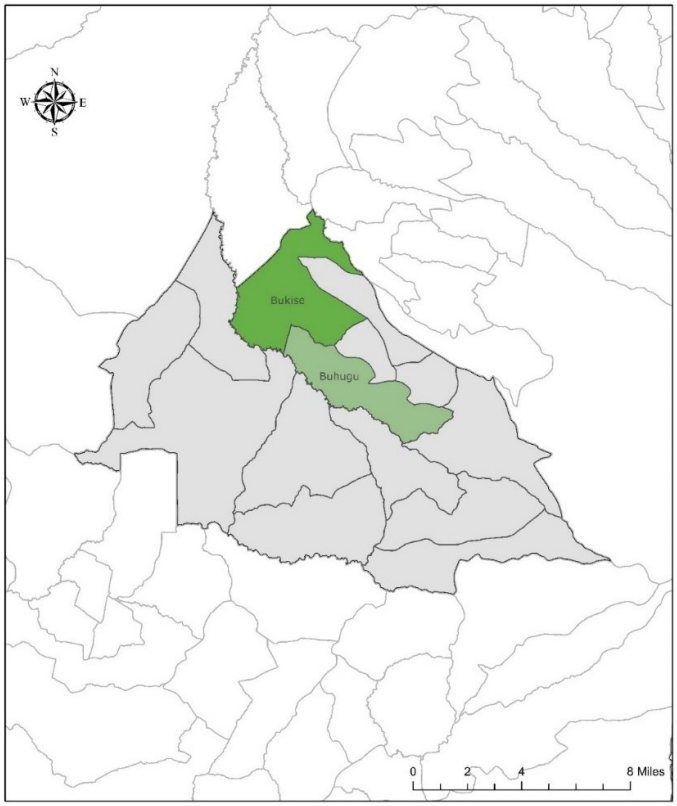

Figure 2.14: Sironko District with Adjacent Sub-counties of Bukise and Buhugu (coloured green)

Bukise Sub-County

Bukise sub-county originally comprised of 10 parishes. As of July 1st, 2018 Bukise was sub-divided to form another sub-county called "Kikobero". Following the subdivisions, Bukise retained 7 parishes while 3 were given to the newly formed Kikobero, which were in turn further sub-divided into 5 parishes. Originally, it was the intention of the research team to treat Bukise and the newly formed Kikobero as a single entity (one being the obvious "parent" and the latter its "child"). However, given the remoteness and inaccessibility of several villages in the Kikobero sub-county, the research team decided to drop Kikobero and concentrate efforts Bukise.

Buhugu Sub-County

Like Bukise, Buhugu sub-county was recently sub divided in July 2018 to form a new sub-county called "Busita" (with Buhugu as the parent). Again, given the inaccessibility of several village in Busita, the research team decided to drop this sub-county and focus on Buhugu.

A.2 Field Work Timeline

Individuals were visited a total of four times. Once for a very short screening survey to identity eligible households, once for recruitment and two times for experiments and surveys. See Table 2.11 for a complete timeline of activities, with any additional notes.

Table 2.11: Timeline of Recruitment, Experiments and Surveys

	Month and Year	*Activities*	*Notes*
Visit 1	October 2018	Screening Survey	- Compiled by Village Mobilisers
Visit 2	November 2018	Recruitment	- Eligible couples assembled at a local venue - Present were the General Mobiliser for relevant sub-county, relevant Village Mobiliser, and 7 members of the research team. - Invitation extended to attend workshop in the forthcoming weeks. - Very few declines; majority were attributed to illness/disability.
Visit 3	Late November to December 2018	Experimental Workshops	- Invited participants and the research team assembled at a localised venue. - Assembly and introductions - Trust Game - Refreshment break - Public Goods Game - Pay-Outs (including show-up fee)
Visit 4	January to March 2019	Individual Questionnaires	- Held in the household of the participant by appointment only. - Husbands and wives were questioned at the same time, in separate rooms. - Payment - Some attrition due to seasonal migration.

A.3 Additional Details on Key Variables

Education

For context, Uganda has a structure of seven years of primary education; six years of secondary education, divided into lower secondary (S1-S4) and upper secondary (S5 and S6) bands[35]; and finally, post-secondary education, categorised as

[35]Upper secondary is sometimes referred to as "Sixth Form".

"Tertiary". Tertiary can include any form of university education (public or private), vocational and technical training. Figure 2.15 illustrates the Ugandan system and the descriptive statistics of our sample.

Ugandan Formal Education Structure	**Education (By Class)**	**Men**	**Women**	**Education Dummies**	**% of Men**	**% of Women**
No Education		3	10	No Education and Very Low Levels of Primary Education	5.84	15.65
Primary Education	P1	3	5			
	P2	2	8			
	P3	7	11	(Some) Primary	35.04	46.94
	P4	4	11			
	P5	12	18			
	P6	25	29			
	P7	31	23	Graduated Primary School	22.63	15.65
Lower Secondary Education	S1	2	2	(Some) Secondary	29.93	19.73
	S2	15	11			
	S3	4	3			
	S4	19	13			
Upper Secondary Education	S5	1	0			
	S6	0	0			
Tertiary		9	3	Higher Education	6.57	2.04

Figure 2.15: Ugandan Formal Education System and Self-Constructed Education Dummies for Econometric Analysis

The compositional differences between men and women in our sample correspond with the most recent wave of the DHS in Uganda (2016), as seen in Table 2.12. Restricting the DHS to married couples in the Bagisu region of Eastern Uganda, we find that, similar to our sample, the vast majority of individuals have some level of primary education.

Table 2.12: Highest Levels of Education for Married, Bagisu Sample of Men and Women from DHS Uganda 2016

Highest Level of Education	% of Men (n=159)	% of Women (n=159)
No Education	0.63	3.77
(Some) Primary	52.83	55.97
Graduated Primary School	11.32	14.47
(Some) Secondary	26.42	21.38
Graduated Secondary School	1.89	1.26
Higher Education	6.92	3.14

Bridewealth

In the survey phase of the research project, each participant was asked to provide a detailed inventory of "Gifts at Marriage". Trained enumerators were asked to complete the table shown in Figure 2.16 using the appropriate coding.

To husband, ask: what gifts did you/your family agree to give to the bride and/or the bride's family?
To wife, ask: what gifts did you/your family agree to receive from the groom and/or the groom's family?

1. Type of Gift	Code	2. From whom	3. To whom	4. Quantity	5. Unit	6. Value	Returned to 2. in the event of a divorce/dissolution?
Oxen	201						
Cows	203						
Other Livestock [Code A]							
Other Livestock [Code A]							
Jewellery	300						
Cash	301						
Clothes/Utensils	302						
Crops [Code B]							
Crops [Code B]							
Crops [Code B]							
Other (*specify*)							
Other (*specify*)							
Other (*specify*)							
Other (*specify*)							
Other (*specify*)							

Figure 2.16: Bridewealth Inventories in Individual Surveys

The inventory asks for specifics on the "type" of gifts that were exchanged, quantity, estimated value (in Ugandan Shillings) and asks directly "from whom" and "to whom" each gift was exchanged. As a final question, enumerators asked whether each gift would be returned to the original owner (the groom or the groom's kin) in the event of a divorce or dissolution of marriage. "Type" of marriage gift was divided into six categories; Livestock (coded as oxen, cows, goats or other), Jewellery, Cash, Clothing and Utensils, Crops and "Other" . Each participant was also asked whether they received land as a gift from the groom's parents; the value of this land is included in the "indirect dowry" variable, as the recipients are the conjugal household.

Livestock is of particular interest, given the location of our study. Bridewealth (and similar marriage rites) have a long and enduring cultural value and remain primarily significant in cattle keeping and cash crop societies[36]. As most of our sample (86.6%) declare working on their household farm to be their primary occupation, we place a greater emphasis on cattle over other assets (including cash). Not only are cattle a store of value, but they also constitute the basic means of production among pastoral peoples.

Goody (1973, p.11) writes:

[36]Bridewealth payments are less substantial in matrilineal societies (which do not tend to be cattle keeping), and in Muslim areas, where more is invested in wedding expenses and on dowry.

> *"Bridewealth transactions are above all typified by the very substantial cattle payments made by the patrilineal peoples of the savannah country in Eastern and Southern Africa... Here the transfer of cattle in marriage is linked to the acquisition of a wife but above all to the production of children; hence the strength of those commonly quoted sayings "bridewealth is childwealth", or "that cattle are where the children are not".*

Mair (2013, p. 56) also comments:

> *"when cattle payments are made, the marriage of girls tends to be early for the same reason that that of men is late – that a girl's marriage increases her father's herd while that of a young man diminishes it".*

As a final question to participants, we asked whether the agreed-upon bridewealth has been paid in full. We code this variable as "outstanding bridewealth debt" if the response to this question is no. This question was addressed to both men and women of the same household. 82% of women responded that the agreed-upon bridewealth had not been fully paid to their kin; 74% of men answered that they had not paid their full bridewealth.

Remarkable, however, is the number of non-responses to this, and to inventory questions. In total, 294 individual interviews were conducted; only 98 participants provided a complete inventory list and nominal value for their bridewealth (indirect dowry inventories are not included here). For women, we had 7 non-responses to the question of outstanding bridewealth debt, and for men much higher at 47 non-responses[37].

We are confident that these non-responses are not due to measurement error on our part, as similar occurrences have been reported in other studies. For example, Bishai and Grossbard (2007, 2010) conducted 1,758 individual interviews across Uganda. Only 157 participants provided a nominal estimate for bridewealth transactions and recorded 247 non-respondents for whether a brideprice was paid. Consequently, their analysis drops the nominal level of brideprice paid, using instead a dichotomous variable indicating whether a brideprice was paid or not. Unfortunately, the authors do not address why there are such low response numbers.

We hypothesise that there is a correlation between the probability of a participant providing a full inventory list of bridewealth payments (with a nominal estimate)

[37] One male participant asked for himself and his wife to be removed from the research project following this question; enumerators were told to respect this decision but were instructed to politely inquire why a participant wished to leave the project; his response was that he was concerned we (the research team) were debt collectors.

and whether the agreed-upon bridewealth has been paid fully to the bride's kin. To investigate this, we use the following Probit model:

$$PR(Response_i = 1|x) = G(\beta_0 + \beta_1 Debt_h + \beta_2 MarLength_h + \beta_3 Age_i + \beta_4 Education_i + \beta_5 NrChild_h) \quad (2.3)$$

where $G(\cdot)$ is the Probit function.

First, we run the model separately for men and women, using an individual response variable to the question of an outstanding bridewealth debt in the household. Table 2.13 presents these results, with columns (1) and (2) presenting male and female responses, respectively. Where bridewealth has not been paid in full, both men and women are less likely to provide a response to bridewealth inventory questions.

Table 2.13: Probit Model; Dependent Variable: Probability of Response to Bridewealth Inventory

	Men (1)	**Women (2)**
Outstanding Bridewealth Debt	-0.277	-0.552
	(0.389)	(0.431)
Marriage Length (in Years)	0.025	0.021
	(0.038)	(0.033)
Age	0.006	0.051
	(0.035)	(0.033)
Education (in Years)	-0.105**	0.054
	(0.053)	(0.045)
Number of Children	0.001	0.048
	(0.068)	(0.060)
Constant	0.239	-2.215***
	(1.322)	(0.855)
Observations	80	130
R^2	0.132	0.249

Robust standard errors are in parentheses
**** p<.01, ** p<.05, * p<.1*

A.4 Descriptive Statistics for Explanatory Variables

Table 2.14: Full Male Descriptive Statistics

Male Sample					
Variable	**Observations**	**Mean**	**Standard Deviation**	**Min.**	**Max.**
Age at First Marriage	147	23.463	5.741	14	55
Age	147	39.669	13.590	18	81
Bagisu	147	0.980	0.141	0	1
Church of Uganda	147	0.432	0.497	0	1
Self-Employed	147	0.399	0.491	0	1
Education (Years)	147	7.312	3.230	0	14
Household Size	147	6.480	2.473	2	14
Number of Children	138	4.210	2.255	1	9
Wealth Index	137	-0.017	1.510	-3.715	5.409
Gender Index	145	-0.900	0.897	-3.198	1.642
Age Difference	147	5.946	4.352	0	18
Marriage Length	147	16.149	12.533	1	59
Lower Endowment	147	0.088	0.284	0	1
Order of Rounds	147	0.324	0.470	0	1
Received Help	132	0.144	0.352	0	1

Table 2.15: Full Female Descriptive Statistics

Female Sample					
Variable	**Observations**	**Mean**	**Standard Deviation**	**Min.**	**Max.**
Age at First Marriage	147	18.425	4.397	9	39
Age	147	34.253	12.815	17	75
Bagisu	147	0.938	0.242	0	1
Church of Uganda	147	0.397	0.491	0	1
Self-Employed	147	0.295	0.457	0	1
Education (Years)	147	5.856	3.158	0	14
Household Size	147	6.473	2.536	2	14
Number of Children	136	4.140	2.195	1	9
Wealth Index	140	-0.462	1.364	-3.408	3.080
Gender Index	147	0.848	0.709	-1.226	1.642
Age Difference	147	5.945	4.381	0	18
Marriage Length	147	15.884	12.901	1	59
Lower Endowment	147	0.089	0.286	0	1
Order of Rounds	147	0.329	0.471	0	1
Received Help	147	0.363	0.483	0	1

Appendix B: Recruitment Script

[**SAY**] Greetings! My name is [**AND INTRODUCE TEAM**]. Thank you very much for taking the time to listen to us today. We would like you and your spouse to participate in research that will take about half a day of your time. The research is about how households in this area make financial decisions. We are interested in learning about you and your spouses' behaviour when faced with these decisions and publish studies about it.

This research is organised by people from the University of East Anglia in England. We have also been authorised by the Ugandan government, Makerere University in Kampala, and [**RELEVANT LC1 AND LC3 CHAIRPERSON NAMES**] to our research being conducted in this region, and in your villages.

Before we tell you a bit more about the research, there are a few things that we would like you to know. Firstly, you should know that we did not purposely select your household for this research. A few days ago, we randomly selected households from your villages by drawing names out of a bag, in the presence of the LCs. It was entirely by chance that your household was selected and there was no favouritism involved.

We also want to tell you that participation is entirely voluntary, but you can earn some money if you decide to take part. The money that you earn in this research will be yours to keep, and this money is provided by the University of East Anglia in England. We will also provide you with transportation costs on the day of the workshop.

On the day of the workshop, we will gather at a local venue in your village (or near your village) where the research will take place. The only thing we ask is that you arrive at the same time as your spouse. Nothing that you and your spouse will be asked to do in the workshop will be unpleasant, nor difficult. In the past, we have found that people typically enjoy these workshops!

The workshop will last for a maximum of four hours, so if you and your spouse decide that you would both like to participate in the research, we ask that you make yourselves available for half a day to attend this workshop together.

Now, because the workshop will last for up to four hours, we are going to provide some refreshments on the day for you and for the other villagers who agreed to participate in this research. We will provide some sodas and snacks for you to enjoy. These refreshments are free, and we will not ask you to pay for any of them.

In the workshop we are going to give you a sum of money. We are then going to ask you to take some decisions about what to do with that money in private; decisions that will help us understand how you take decisions in real life. The decisions that we will ask you to make are not difficult and they are not unpleasant. What we will ask you to do will be clearly explained, and there are no right or wrong answers. We are simply interested in what you want to do in certain situations.

A week or so after your participation in the workshop, we would like to ask you individually some questions about your household, and this will take no more than two hours of your time. We will compensate your household for this time. In the interview, we are going to ask you some simple questions about you and your household, and how your household was formed. Again, none of the questions we ask will be hard, and everything you say will be completely confidential.

We want to stress that both the workshop and interview will be conducted in a safe environment. No one is going to interfere with the decisions you take, nor the answers you give in the interview. No other villager will observe or ever find out about your decisions, including your spouse. We are not going to reveal anything. Any information about the decisions you make during the workshop, and any information you provide us with when we come to ask some questions about your household, will be treated confidentially and not told to anyone.

All information that you do provide us with will be stored digitally, and this information is secure. No one other than the research team will have access to this information.

Please remember that when you make your decisions in the workshop, and when you provide us with any information in the interview about your household, no projects are going to come to this area because of the research we are doing.

Now, it is your freedom to choose whether or not to participate in this research. Participating in this research is out of your own wish. Nobody is forcing you. You are free at any point during the workshop and the interview to decide to walk out and go home. Nobody will be angry and there is no one who will take it in bad faith.

Furthermore, if you decide later that you would like to withdraw the data on your decisions made in the workshop, and the information you provide in the interview after the workshop, please contact Joshua Balungira at 0782 617 502 within a month after your interview. We will also leave our contact details with [**RELEVANT LC1 CHAIRPERSON'S NAME**] in case you wish to get in contact with us. Again, we would like to remind you that if you later decide to withdraw your data, there is no one who will take it in bad faith.

[TAKE QUESTIONS]

Figure 2.17: Recruitment Meeting in a Randomly Selected Village.

Appendix C: Experimental Protocols

C.1 Assembly and Introductory Protocols and Script

Research Assistants: all instructions in [**BOLD AND IN CAPITAL LETTERS**] please read to yourself.

MATERIALS NEEDED PER WORKSHOP (RESPONSIBILITY OF WORKSHOP ORGANISERS)

ASSUMING 20 PARTICIPANTS; CHECK NUMBERS PRIOR TO EACH WORKSHOP WITH WORKSHOP ORGANISER:

- 40 brown envelopes (20 marked "KEEP", and 20 marked "SEND"; each labelled with ID Numbers on back)
- 4 understanding Cards (1 per Research Assistant)
- Pens (for Research Team)
- 2 folders (1 Blue and 1 Pink)
- 1 bag with 6 counters (numbered 1 to 6)
- Register (with participant names, ID numbers, order of rounds, ID pairing by round, and any additional information)
- 4 clipboards (1 per Research Assistant each containing scripts)
- 20 Name Badges (for ID Numbers)
- Money (pay-outs, venue hire fee, chair hire, and refreshments)
- Computer with Excel file to record decisions
- We must ensure that we have extra materials for any additional participants that show up

VENUE SET-UP

3 ROOMS IN TOTAL:

- 1 room for female participants (females should have the largest room in the venue, particularly if children accompany them).

- 1 room for male participants.
- 1 central room for the Workshop Organisers. This room will also be used to deliver general instructions to all participants at the beginning of the workshop. PLEASE NOTE: The Workshop Organisers must not be visible to participants while they organise envelopes and record decisions. There must be a desk/table in this room for the Workshop Organisers to use.

Each room for male and female participants must be arranged with individual seating; seats must be placed far enough apart and arranged so that no participant can see what another participant is looking at. For the central room, arrange seating so all participants are facing the front and are able to hear the introductory remarks.

Figure 2.18: Central Room Set-up

PARTICIPANT ARRIVAL AND REGISTRATION:

For participant arrival, 2 Research Assistants, 1 Workshop Organiser, and relevant Village Chairperson must be present. It is extremely important that married couples are authentic (that is, they are who they say they are, and they are in fact husband and wife). The following procedure has been devised to check identities (without asking for formal identification, as this would likely unsettle participants).

When all participants are congregated outside the central room, ask men and women to separate into male and female groups. Ask one women to come forward. Welcome her, and ask for her name. The workshop organiser will provide you with a full list of invited candidates, and their unique identity numbers. Mark her name on the list with a tick. Proceed to ask her the name of her husband; then ask her to point to her husband in the male group. Ask him to step forward. Welcome him and ask for his name. Mark his name on the list with a tick. Confirm with village chairperson that identities are correct. Once confirmed, give the wife and husband name badges with their identity numbers, and ask them to place this badge on their clothing so it is visible. Please provide assistance if necessary. Explain to the couple that these identity numbers are unique and allow us to identify them throughout the workshop, whilst guaranteeing complete confidentiality and anonymity. Invite the couple into the central room where they may sit down. Repeat this procedure until all participants are seated in the central room.

INTRODUCTORY SCRIPT

DELIVERED BY ONE RESEARCH ASSISTANT WHEN ALL PARTICIPANTS HAVE ARRIVED, HAVE A VISIBLE ID LABEL ATTACHED TO THEIR CLOTHING ARE SEATED ALL TOGETHER IN THE CENTRAL ROOM, AND BOTH WORKSHOP ORGANISERS HAVE SIGNALLED TO START.

[**SAY]:** Greetings! [**INTRODUCE THE RESEARCH ASSISTANTS INDIVIDUALLY AND THE WORKSHOP ORGANISERS]. ** Thank you very much for taking the time to come here today and listen to us. We would like you to participate in research that will take up to four hours of your time. The research is about how households in this area make financial decisions. We are interested in learning about your behaviour when faced with these decisions and publish studies about it. This research is organised by people from the University of East Anglia in England, and further authorised by Makerere University (which is based in Kampala). We also have permission from [**RELEVANT LC NAMES**] to our research being conducted in this region, and in your village.

Now, because today's workshop today will last for a maximum of four hours, we are going to provide some refreshments for you and your fellow villagers here today. We have arranged to have these refreshments at the halfway point. Please note that these refreshments are free, and we will not ask you to pay for any of them.

Before we tell you a bit more about the research and what you will be doing today, there are a few things that we would like you to know.

First of all, this is not our money. We belong to a university, and this money has been given to us for research.

Second, participation is voluntary. You may still choose not to participate in today's workshop.

We also have to make it clear that this research is about your decisions. Therefore, you cannot talk with others. This is very important. I am afraid that if we find you talking with others, we will have to send you and your spouse home, and you will not be able to earn any money here today. Of course, if you have any questions, you can ask one of us.

We also ask you to please switch off your mobile phones.

Nothing that we ask you to do in today's workshop will be scary, unpleasant, dangerous nor difficult. We and the organisers of this workshop are not here to deceive or trick you in any way. This is a safe environment in which no one is

going to interfere with the decisions you take. No other villager will observe or ever find out about your decisions, including the person you came here with today. We are not going to reveal anything to them. Any information on the decisions you make here today are going to be treated confidentially and not told to anyone.

Make sure that you listen carefully to us. You will be able to make a good amount of money here today, and it is very important that you follow our instructions.

During today's workshop, you are going to play 2 different games and we are going to ask you to complete 6 tasks. In all these tasks, you are going to be paired with someone in this room. Please take the opportunity now to look around the room, and notice that there are a lot of different ages present today – some people might be older than you, some might be younger than you, and some might be of a similar age to you. You will be anonymously interacting with members of these age groups in the workshop in pairs.

[DEMONSTRATE PAIRING]

With each task, we are going to give you a certain amount of money. We are then going to ask you to take a decision on what you would like to do with that money, based on the information we provide you with. The decisions that we will ask you to make are for real money. The amount of money you earn depends on the decisions that you make, and the decisions made by the person you are paired with. Therefore, we cannot guarantee how much money you will be paid at the end of today's workshop – it could be a lot, but it could only be a small amount.

For your final payment, we are going to randomly select one task from the 6 that you complete here today and pay you for that one task. We are now going to demonstrate how we randomly select a task:

[DEMONSTRATION: USE BAG OF COUNTERS NUMBERED 1 TO 6]

Because of this procedure, we really encourage you to take each decision seriously and treat each decision individually – that is, just focus on the current decision we ask you to take and try not to think of the other decisions you have made today. You will be asked to make decisions that are not a matter of getting it right or wrong; they are about what you prefer. However, it is important to think seriously about each of your choices because they will affect home much you can take home.

Please remember that when you make your decisions in today's workshop, no projects are going to come to this area because of the research that we are doing here.

Later, you can ask any of us questions during today's workshop. For this raise your hand so that we can come and answer your question in private.

Now we would like all women to proceed into the next room with Rose and Jackie. [**FEMALE RESEARCH ASSISTANTS**]

All men, please proceed into the other room with Isaac and Apollo. [**MALE RESEARCH ASSISTANTS**]

[**DIVIDE MEN AND WOMEN INTO SEPARATE ROOMS**].

C.2 Public Goods Game Protocols and Script

Research Assistants: all instructions in [**BOLD AND IN CAPITAL LETTERS**] please read to yourself.

[**RESUME GAME AFTER REFRESHMENT BREAK. BREAK SHOULD LAST FOR NO MORE THAN 30 MINUTES**]

[THE FOLLOWING INSTRUCTIONS SHOULD BE GIVEN TO ALL SUBJECTS SIMULTANEOUSLY WHILE THEY ARE SEATED IN THE EXPERIMENTAL ROOM.]

[**SAY**]: Welcome back! Please make yourselves comfortable, and if you have a mobile phone we would appreciate if you could you please turn it off.

We would like to thank you for your patience today. This is the second and final game you are playing today. This game is different to the first game you played, so please listen to the instructions carefully, as they are different.

In this game, you will be playing with three different people; we will inform you before the start of each round who exactly you are playing with. In one game you will be playing with your [**READ AS APPROPRIATE**]: husband / wife; in another game you will be playing with a [**READ AS APPROPRIATE, ALWAYS OPPOSITE GENDER**]: man / woman who you do not know, and in another game, you will be playing with a [**READ AS APPROPRIATE, ALWAYS OPPOSITE GENDER**] man / woman who is either older, younger or of a similar age to you.

At the very beginning of each round, you will receive 8000 shillings in an envelope. However, there is a chance that you receive an amount other than 8000 shillings; for example, you could receive anything between 0, 1000, 2000, 3000, 4000, 5000, 6000, and 7000. Whatever amount you receive, that money is yours.

For each person that we ask you play with, you must decide how much of that money to keep for yourself, and how much you would like to contribute to a common pool. You do not have to contribute to the common pool; that is, you can contribute zero to the common pool if you wish.

At the same time as you are making this decision, the person you are paired with is also being asked to decide how much to keep for themselves and how much (if any) to contribute to the common pool that is shared between you and the person you are paired with.

Once you have made your decisions – that is, what you would like to keep for yourself and what you would like to contribute – any money that you have contributed to the common pool will be multiplied by one and a half. This common pool will then be split equally between you and the person you are paired with, and this will be split by the Workshop Organisers.

Let's look at some examples:

You and the person you are paired with receive 8,000 shillings each. You decide to contribute 6,000 shillings and keep 2,000 shillings for yourself. The person you are paired with has decided to contribute 2,000 shillings and keep 6,000 for themselves.

In the common pool there is 8,000 shillings. This amount is multiplied by 1.5 to become 12,000. We will then split this amount equally between you and the person you are paired with. The person you are paired with receives 6,000 shillings and you receive 6,000 shillings. In total the amount of money you have earnt is 8,000 shillings. The person you are paired with receives 12,000 shillings.

Let's look at another example:

You and the person you are paired with receive 6,000 shillings each. You decide to contribute 1,000 shillings and keep 5,000 shillings for yourself. The person you are paired with has decided to contribute 3,000 shillings and keep 3,000 for themselves.

In the common pool there is 4,000 shillings. This amount is multiplied by 1.5 to become 6,000. We will then split this amount equally between you and the person you are paired with. The person you are paired with receives 3,000 shillings and you receive 3,000 shillings. In total the amount of money you have earnt is 8,000

shillings. The person you are paired with receives 6,000 shillings.

What we have given you here are just examples. You should be free to make your own decisions.

If you have any questions, please ask us now.

[PAUSE FOR ANY QUESTIONS FROM THE GENERAL AUDIENCE. ADDRESS THE ANSWERS TO THESE QUESTIONS TO THE AUDIENCE. IF NECESSARY, CLARIFY THE INSTRUCTIONS. REFRAIN FROM GIVING ANY ANSWERS THAT MAY INFLUENCE THEIR DECISIONS].

If you would like to talk to us privately for clarification on the instructions or for any issue relating to this game, please raise your hand and we will come and talk to you individually and in private. Please do not be afraid to ask, we are here to help you.

Now we are going to come around the room and ask you individually some questions to see if you understood the instructions.

[RESEARCH ASSISTANTS MUST ASK PARTICIPANTS INDIVIDUALLY THESE TWO CONTROL QUESTIONS; SPLIT THIS TASK BETWEEN THE TWO OF YOU. MAKE SURE YOU CANNOT BE OVERHEARD BY OTHER PARTICIPANTS. IF NECESSARY, YOU AND THE PARTICIPANT SHOULD MOVE TO A DIFFERENT PART OF THE ROOM/OUTSIDE, SO YOU CANNOT BE OVERHEARD. MARK ON THE UNDERSTANDING CARDS PROVIDED IF THE PARTICIPANT CORRECTLY OR INCORRECTLY ANSWERED CONTROL QUESTION 1 AND CONTROL QUESTION 2. IF THE PARTICIPANT GAVE A WRONG ANSWER FOR AT LEAST ONE OF THE QUESTIONS, ASK HIM/HER WHAT WAS NOT CLEAR. ANSWER THEIR QUESTIONS AS CLEARLY AND ACCURATELY AS POSSIBLE. IF NECESSARY, CLARIFY THE INSTRUCTIONS; BUT NOT MORE THAN ONCE. FINALLY, PLEASE ANSWER WHETHER YOU THINK THE PARTICIPANT UNDERSTOOD THE INSTRUCTIONS WELL. MAKE SURE THAT EACH PARTICIPANT HAS BEEN ASKED THESE CONTROL QUESTIONS. PLEASE KEEP THESE SHEETS AND HAND THEM TO THE WORKSHOP ORGANISER AT THE END OF THE DAY.]

Control Question 1

Imagine that you and the person you are paired with are given 7,000 shillings.

You may decide to contribute 6,000 shillings to the common pool. The person you are paired with contributes 0 shillings to the common pool. In the common pool there is 6,000 shillings with is multiplied by one and a half to become 9,000 shillings.

How much do you receive in total? [5,500]

How much does the person you are paired with receive? [11,500]

Control Question 2

Imagine that you and the person you are paired with are given 5,000 shillings.

You may decide to contribute 1,000 to the common pool. The person you are paired with contributes 1,000 to the common pool. In the common pool there is 2,000 shillings which is multiplied by one and a half to become 3000.

How much do you receive in total? [5,500].

How much does the person you are paired with receive? [5,500]

[THE WORKSHOP ORGANISER WILL INFORM YOU OF THE ORDER OF ROUNDS. THE ORDER OF ROUNDS WILL CHANGE WITH EACH WORKSHOP SO PLEASE MAKE SURE YOU UNDERSTAND THE ORDER, SO YOU CAN TELL PARTICIPANTS THE CORRECT INFORMATION]

Now, we are going to each give you two envelopes. One is empty and marked "SEND", and the other contains an amount of money; only you know how much you have in this envelope, but it could be anything from 0 to 8000 shillings. This envelope is marked "KEEP". Please do not open your envelopes until we tell you to do so.

[HAND OUT ENVELOPES; AT THIS POINT, INFORM PARTICIPANTS INDIVIDUALLY WHO THEY ARE PLAYING WITH; THEIR SPOUSE, STRANGER, OR STRANGER WITH AGE REVEALED. WAIT FOR EVERYONE TO RECEIVE THEIR ENVELOPES]

Now, please open your envelope and count how much money is inside.

[WAIT FOR ALL PARTICIPANTS TO OPEN THEIR ENVELOPE AND COUNT HOW MUCH THEY HAVE INSIDE. IF THEY NEED HELP COUNTING, PLEASE HELP THEM DISCREETLY]

Now please take out from the envelope the amount that you would like to contribute to the common pool (if any) and place this money in the envelope marked "SEND". Again, please remember that whatever you contribute to the common pool will be multiplied by one and a half and will always be split equally between you and the person you are paired with. The amount left in your original envelope is the amount that you would like to keep for yourself. This envelope is marked "KEEP".

Please take this decision freely as we will not be seeing the decisions you make. We are going to turn our heads around while you take this decision. We will not open your envelopes. The workshop organisers in the next room will be the only one who sees what is inside each envelope. Also, please make sure that your neighbour cannot see your decision.

The game ends for you once you have handed the envelopes to us.

[COLLECT ALL ENVELOPES AT THE SAME TIME. MAKE SURE EVERYONE HAS FINISHED TAKING THEIR DECISION BEFORE COLLECTING THESE ENVELOPES. WHEN YOU HAVE COLLECTED ALL ENVELOPES, PLEASE ARRANGE ENVELOPES IN NUMERICAL ORDER (BY ID) AND PLACE THEM IN THE FOLDER. HAND THIS FOLDER TO THE WORKSHOP ORGANISER IN THEIR ROOM. ONLY LEAVE THE ROOM WHEN YOU HAVE ALL ENVELOPES. ONE RESEARCH ASSISTANT SHOULD REMAIN IN THE ROOM AT ALL TIMES.]

Appendix D: Wealth Index

This appendix provides a detailed description of how we constructed the wealth index, a measure of household well being, which plays a significant role in the above analysis. First, we describe the methodology employed to build the index and why the polychoric method was chosen. Second, we provide a comprehensive list of all the variables included in the index and how questions were phrased to participants. Finally, to complement the list of variables, we provide some descriptive statistics and check for the internal coherence of the index.

D.1 Methodology

Conventionally, wealth indices are constructed using Principal Component Analysis (PCA), which is a multivariate statistical technique used to reduce the number of variables in a data set into a smaller number of 'dimensions'. In mathematical terms, from an initial set of n correlated variables, PCA creates linearly uncorrelated indices called "principal components" (PC), where each PC is a linear weighted combination of the initial variables (Vyas and Kumaranayake, 2006). The weights for each principal component are given by the eigenvectors of the correlated matrix. The variance, σ^2, for each PC is given by the eigenvalue of the corresponding eigenvector. The PCs are ordered so that the first component (PC_1) explains the largest possible variance (that is, accounts for as much of the variability in the original data as possible), subject to the constraint that the sum of the squared weights is equal to one. As the sum of the eigenvalues equals the number of variables in the initial data set, the proportion of the total variation accounted by each PC is given by $\frac{\sigma_i^2}{n}$. The second component (PC_2) is uncorrelated with PC_1, and explains additional - but less - variation than the first component, subject to the same constraint. Subsequent components continue to be uncorrelated with previous components; therefore, each PC captures an additional dimension in the data, while explaining smaller and smaller proportions of the variation of the original variables. It is the first component however that we are most interested in, as the crucial assumption for analysis is that the factor of interest – socioeconomic status (SES) – explains the maximum variance in a set of chosen variables (i.e. variables aimed at capturing household asset worth); PC_1 is thus presumed to measure overall "wealth."

Complications arise, however, when one uses categorical (in particular, ordinal and binary) variables in PCA. Given the categorical nature of the variables, by using the standard PCA approach, one includes biases to the covariance structure (and hence, factor loadings), and ultimately there is a smaller reported proportion of explained variance (Kolenikov and Angeles, 2009, p. 161). In the presence of categorical variables, there are several options one can employ when performing PCA. We will concentrate on two of these methods, the first being the Filmer and Pritchett (2001) procedure which uses dummy variables for categories, and the

second uses the polychoric correlations. We will address each procedure in turn, and its relation to our data.

A modification of PCA, popular in Development Economics, is due to Filmer and Pritchett (2001) who used the methodology to construct "socioeconomic status" indices. The author's use data on household assets (with a particular focus on durable goods, i.e. radios, televisions, motor-vehicles), type of access to hygienic facilities (sources of drinking water, type of toilet), and the various construction materials used in the dwelling. This methodology was quickly picked up by the World Bank and The DHS Program, and became the standard way to assess the socioeconomic status of a household based on household assets and facilities.

Given its accreditation from internationally renowned institutions, and its wide and frequent application in studies using survey-based data, we decided to first employ the Filmer-Pritchett (2001) procedure to the creation of our wealth index. To do so, we first generated the relevant bi-variate variables for our various indicators of wealth including house, land and durable asset ownership. We then ran the PCA with what we considered to be all the relevant wealth indicators from our survey[38]; however, PC_1 only explained 12% of the variation in the asset indicators data. This figure is on the low side of the range of variance accounted for by the first principal component in existing studies, according to the literature reviewed (Houweling et al., 2003; Vyas and Kumaranayake, 2006). A potential reason for this low figure could be that the correlation among the wealth variables may not be (sufficiently) high, ergo indicating significant variation in the data. We thus decided to conduct the original PCA, excluding variables with eigenvectors less than 10%; this increased the explained variance (given by the eigenvalue) from 12% to 24.3%. We then ran the Kaiser-Meyer-Olkin (KMO) command, which is a measure of sampling adequacy. KMO takes values between 0 and 1, with small values indicating that the variables have too little in common to warrant a PCA analysis. Our KMO statistic is 0.66, greater than the 0.5 threshold, and thus justified in using PCA.

In their data, Filmer and Pritchett (2001)'s first principal component explains 26% of the variation (p.118); we were thus conscious that our PC_1 at 24.3% was on the low side, and could be improved. Upon further investigation, we realised that our PC_1 could be artificially low due to the inclusion of dummy indicators in the PC analysis; for example, toilet facilities were divided into 5 dummy indicators, and 3 had eigenvectors greater than 10%. Kolenikov and Angeles (2009) demonstrate that if there are several categories relating to a single factor – such as the access of hygienic facilities or the 'quality' of the dwelling materials – dividing that variable into a set of dummy indicators leads to a deterioration of indices' performance, "according to all the performance measures [they] used" (p.161). It appears as though the explained variance is most heavily affected (specifically, it is underestimated), and even more so with categories of the ordinal variables. Kolenikov and Angeles (2009) propose that the method of Filmer and Pritchett (2001) can be improved by using procedures

[38]We excluded durable assets that had very low counts, for example 'computers', where only 0.66% of our sample claimed to own 1 of these assets.

more appropriate for discrete data, such as retaining the ordinal variables without breaking them into a set of dummy variables, or by using polychoric correlations.

For a more accurate estimation of the proportion of explained variance, we thus turned to our second recommended method; polychoric correlations. The polychoric procedure first estimates the polychoric correlation matrix (Olsson, 1979), while maintaining the ordinal nature of the data; we then run the principal component analysis on the resulting correlation matrix, and score the first component (for more information, please consult Kolenikov and Angeles, 2009). Downloading the "Polychoric Correlations Package"[39] from Stata, we can simply run the command "*polychoricpca*" to our data, and obtain the following output:

Table 2.16: Principal Component Analysis on Polychoric Correlation Matrix

k	**Eigenvalues**	**Proportion Explained**	**Cumulative Explained**
1	5.287	0.311	0.311
2	2.579	0.152	0.463
3	1.307	0.077	0.540
4	1.156	0.068	0.608
5	1.090	0.064	0.672
6	0.982	0.058	0.730
7	0.928	0.055	0.784
8	0.793	0.047	0.831
9	0.686	0.040	0.871
10	0.560	0.033	0.904

The first primary component, PC_1 - which we assume to represent wealth - explains 31.1% of the variation – an improvement from the Filmer and Pritchett (2001) result. For the remainder of our analysis, we will thus proceed with the polychoric index for wealth.

D.2 List of Variables

The list of variables included in our polychoric wealth index is only a small selection of all the assets available in the household survey. The criteria employed was to restrict variables with sufficient weight in explaining the first principle component (that is, household wealth) in a preliminary analysis with a comprehensive database of household assets.

Our preliminary analysis used the principal component method, which allowed us to identify those variables with a scoring factor of 10% or higher. Deeming the

[39]Stata programme written by Stas Kolenikov (http://staskolenikov.net/stata/)

polychoric method more suitable (given the ordinal nature of some of the variables), we retained the asset variables from the initial PC analysis, specifically those household and livestock assets.

The relevant variables are listed in Table 2.17.

Table 2.17: List of Variables Polychoric Wealth Index

Category	Variable	Question Asked to Participant
Housing		
Type	*Independent House* *Tenement (Muzigo)* *Shared Housing*	What type of dwelling does your household live in?
Arrangement	*Owned* *Rented* *Borrowed (free of charnge)*	Under what arrangement are you staying in this house?
Rooms	*Rooms*	How many rooms does your house consist of (or does you house occupy if the house is shared)?
Major Roof Material	*Thatch, straw* *Banana Fibres* *Wood, planks* *Iron Sheets* *Cement*	What is the major construction material of the roof?
Major External Wall Material	*Mud and cement* *Mud and poles* *Marram and cement* *Marram and poles* *Burnt bricks with mud* *Burnt bricks with cement* *Cement blocks* *Other*	What is the major construction material of the external wall?
Water Source	*Private connection to pipeline* *Public taps* *Bore-hole* *Protected well/spring* *Unprotected well/spring* *River, stream, lake, pond* *Gravity flow scheme*	What is the main source of water in your household?
Toilet Facilities	*Covered pit latrine, private* *Covered pit latrine, shared* *VIP latrine private* *Uncovered pit latrine* *Bush/no constructed toilet*	What is the type of toilet that is mainly used in your household?
Lighting	*Electricity* *Paraffin, kerosene or gas* *Lantern* *Solar* *Other*	What is the main source of lighting in your dwelling?
Land		
Land	*Land size (in acres)*	What is the total size of the land currently owned by your household? (by this I mean all the land combined that you or anybody in your household owns, including the land that is built on)
Livestock		
	Cattle (bulls/oxen, young bulls, cows, heifer, calves) Goats	How many [. . .] does your household own currently? (present at the farm or elsewhere)
Household Assets		
	Bicycles Solar Panels Charcoal Stove Beds Radios Mobile phones	How many [. . .] does your household own?

D.3 Summary Statistics

To assess the validity of the assumption that the first principal component accurately captures household wealth, both Filmer and Pritchett (2001), and Kolenikov and Angeles (2009) suggest evaluating the internal coherence of the final index. Internal coherence is assessed based on the association between the distribution of assets, and the classification of households according to wealth levels (the latter of which is derived from the index). To this end, we propose to divide our sample into wealth categories, as designated by the polychoric wealth index. We can then examine the distribution of the asset variables with respect to our wealth classifications to assess coherence.

We classify those participants in the bottom 40% as as "low" wealth (n=110), the subsequent 40% as "middle" wealth (n=112), and the top 20% as "high" wealth(n=55). Table 2.18 presents the descriptive statistics for the relevant housing variables, and Table 2.19 presents the descriptives for land, livestock and household assets.

Table 2.18: Housing Summary Statistics

Variable	Mean	Stand. Dev.	Min	Max	Wealth			Scoring Value
					Low n=110	Med. n=112	High n=55	
Type								
Independent	0.93	0.25	0	1	0.85	0.99	1.00	0.06
Tenement	0.04	0.20	0	1	0.09	0.00	0.00	-0.34
Shared	0.03	0.16	0	1	0.05	0.01	0.00	-0.49
Arrangement								
Owned	0.91	0.29	0	1	0.80	0.98	1.00	0.07
Rented	0.06	0.23	0	1	0.13	0.01	0.00	-0.35
Borrowed	0.03	0.18	0	1	0.07	0.01	0.00	-0.52
Roof Material								
Thatch, straw	0.02	0.14	0	1	0.05	0.00	0.00	-0.61
Banana Fibres	0.01	0.12	0	1	0.04	0.00	0.00	-0.49
Wood, planks	0.00	0.06	0	1	0.00	0.01	0.00	-0.46
Iron Sheets	0.96	0.20	0	1	0.91	0.99	0.98	-0.01
Cement	0.00	0.06	0	1	0.00	0.00	0.02	0.50
External Wall Material								
Mud and cement	0.00	0.06	0	1	0.00	0.01	0.00	-0.39
Mud and Poles	0.57	0.50	0	1	0.77	0.53	0.24	-0.09
Marram and Cement	0.01	0.10	0	1	0.01	0.00	0.02	0.01
Marram and Poles	0.34	0.48	0	1	0.12	0.41	0.69	0.07
Burnt bricks with mud	0.03	0.18	0	1	0.04	0.04	0.04	0.16
Burnt bricks with cement	0.03	0.16	0	1	0.05	0.02	0.02	0.18
Cement blocks	0.00	0.06	0	1	0.01	0.00	0.00	0.19
Other	0.01	0.08	0	1	0.01	0.00	0.00	0.25
Water Source								
Private connection to pipeline	0.08	0.26	0	1	0.05	0.06	0.16	0.14
Public taps	0.10	0.30	0	1	0.13	0.07	0.09	0.09
Bore-hole	0.47	0.50	0	1	0.43	0.51	0.47	0.02
Protected well/spring	0.18	0.38	0	1	0.17	0.21	0.13	-0.04
Unprotected well/spring	0.02	0.13	0	1	0.03	0.00	0.04	-0.06
River, stream, lake, pond	0.10	0.30	0	1	0.13	0.11	0.02	-0.07
Gravity flow scheme	0.07	0.25	0	1	0.07	0.04	0.09	-0.12
Toilet Facilities								
Covered pit latrine private	0.53	0.50	0	1	0.29	0.63	0.87	0.17
Covered pit latrine shared	0.20	0.40	0	1	0.28	0.15	0.07	-0.06
VIP latrine private	0.01	0.08	0	1	0.00	0.01	0.00	-0.11
Uncovered pit latrine	0.24	0.43	0	1	0.38	0.20	0.05	-0.20
Bush/no constructed toilet	0.02	0.14	0	1	0.05	0.01	0.00	-0.42
Lighting								
Electricity	0.01	0.12	0	1	0.01	0.01	0.04	-0.61
Paraffin, kerosene or gas lantern	0.59	0.49	0	1	0.85	0.53	0.15	-0.16
Solar	0.39	0.49	0	1	0.13	0.46	0.82	0.17
Other	0.00	0.06	0	1	0.01	0.00	0.00	0.46
Rooms	3.48	1.46	1	8	2.57	3.80	4.91	
Count:								
1								-0.62
2								-0.29
3								-0.10
4								0.04
5								0.23
6								0.39
7								0.45
8								0.59

Table 2.19: Land, Livestock and Household Assets Summary Statistics

Variable	Mean	Stand. Dev.	Min	Max	Wealth			Count	Scoring Value
					Low n=110	Med. n=112	High n=55		
Land	1.64	1.61	0	12	0.80	1.52	3.69		0.29
Cattle	0.83	1.08	0	6	0.36	1.01	1.60	0	-0.20
								1	0.05
								2	0.19
								3	0.31
								4	0.35
								5	0.36
								6	0.47
Goats	0.68	1.17	0	6	0.14	0.85	1.49	0	-0.15
								1	0.12
								2	0.21
								3	0.29
								4	0.35
								5	0.37
								6	0.48
Bicycles	0.30	0.52	0	2	0.11	0.37	0.58	0	-0.11
								1	0.18
								2	0.38
Solar Panels	0.45	0.65	0	3	0.10	0.48	1.11	0	-0.22
								1	0.21
								2	0.43
								3	0.61
Stove	0.42	0.60	0	3	0.24	0.49	0.75	0	-0.10
								1	0.10
								2	0.20
								3	0.29
Beds	0.98	1.00	0	5	0.46	1.00	2.05	0	-0.26
								1	0.02
								2	0.19
								3	0.31
								4	0.37
								5	0.48
Radios	0.55	0.54	0	2	0.37	0.54	1.00	0	-0.22
								1	0.12
								2	0.44
Mobile Phones	1.28	0.91	0	5	0.76	1.45	2.02	0	-0.39
								1	-0.09
								2	0.17
								3	0.34
								4	0.38
								5	0.51

From Tables 2.18 and 2.19, the polychoric wealth index proves to be coherent with the distribution of assets among the three classifications of households. For illustrative purposes, we highlight key examples that support this conclusion.

The acreage of land ownership is significantly different among wealth groups, with the poorest owning an average of 0.8 acres, the middle group 1.52 and the richest as much as 3.7 acres.

Beds are an asset widely owned by high wealth households, with 87% reporting to have a least one. 68% of "medium" households and 45% of the poorest households own at least one bed.

Perhaps the variable most markedly distributed among groups by its ownership percentage is solar panels. Just 10% of those in the "low" classification own one solar panel, whereas 45% of households in the middle, and 84% at the top have at least one solar panel.

There has been a dramatic increase in mobile phone ownership throughout Uganda, and we feel this phenomenon is reflected in the data. Remarkably, 62% of the poorest households own at least one mobile; 92% and 100% of medium and high wealth households own mobile phones.

Similarly, there is consistency in the housing variables. For example, 87% of high wealth households own a private, covered latrine. Only 29% of low wealth households have access to such a private facility.

The average number of rooms for the wealthiest households is close to 5, while the poorest households average between 2 and 3 rooms.

Other good examples of differential distribution across the classifications are: radio, cattle, goats, bicycles, lighting and water source. The remaining variables maintain internal coherence, yet do not capture as neatly the distribution of assets among the wealth categories.

Appendix E: Gender Equality Index

This Appendix provides a detailed description of how we constructed our gender-equality index, a measure of individual gender beliefs assigned to each of our participants. First, we describe data collection methods, and the precise methodology used to build the final index. Second, we provide a detailed list of the variables included in the index. Finally, we compile some descriptive statistics and check the index for internal coherence.

E.1 Methodology

In the survey phase of the research project, each participant was read a series of statements related to gender and personal beliefs. Statements were designed to reflect the different dimensions to gender equality, including personal and professional freedoms[40]. Individually, participants were asked whether they agreed or disagreed with a particular statement, and to what extent. The following codes were used:

1 = Strongly Disagree
2 = Somewhat Disagree
3 = Neither Agree nor Disagree
4 = Somewhat Agree
5 = Strongly Agree

To respect the ordinal nature of the multinomial variables, we return to the polychoric method used to construct our comprehensive wealth index in Appendix D. For more information on this methodology, please consult Appendix D, and the work of Kolenikov and Angeles (2009). For the polychoric index to accurately capture the ordinal properties of individual responses, we assigned each response with a "score". Scores were assigned based on how conducive the response was to gender-equal beliefs; 1 (the lowest score) corresponds to gender inequality, and 5 (the highest score) gender equality. Given the framing and structure of statements, each question had to be scrutinised individually to determine the direction of scoring. To illustrate the scoring process, we will use two examples:

1. To the statement "*women and men have the same right to make their own decisions*"; if the participant responded "strongly disagree", they would score 1; "somewhat disagree", they would score 2, and so on.

[40]We were heavily influenced by the UNDP Gender Inequality Index (GII), which builds upon three dimensions; specifically health, empowerment and labour market participation. For more information, please see http://hdr.undp.org/en/content/gender-inequality-index-gii.

2. To the statement "*It is the woman's obligation to have sexual relations with her husband even if she does not want to*"; if the participant responded "strongly disagree", they would score 5; "somewhat disagree ", they would score 4 and so on.

Identifying the relevant variables for our index, we downloaded the "Polychoric Correlations Package" from Stata. Running the "*polychoricpca*" to our data, we found that the first primary component PC_1 which we are assuming represents gender-equal beliefs – explains 43% of the variation, as seen in Table 2.20.

Table 2.20: Principal Component Analysis on Polychoric Correlation Matrix

k	Eigenvalues	Proportion Explained	Cumulative Explained
1	2.151	0.430	0.430
2	1.088	0.218	0.648
3	0.767	0.153	0.801
4	0.517	0.103	0.904
5	0.478	0.096	1.000

E.2 List of Variables

The list of variables included in our gender-equality index constitute only a small selection of the gender and personal belief responses available in our individual surveys. Similar to the wealth index, the criteria employed here was to restrict variables with sufficient weight in explaining the first principle component. Questions with the least variation in responses were dropped; for example, to the statement "*Women have the right to defend themselves and to report to the authorities any mistreatment or aggression*", overwhelmingly our male and female respondents agreed or strongly agreed with the statement (98.6%). Relevant variables are listed in Table 2.21 below.

Table 2.21: List of Variables Polychoric Gender-Equality Index

Statement*
Women and men have the same right to make their own decisions.
A woman has the same capacity to earn money as a man.
The woman should be free to decide if she wants to work outside the home.
Women and men should have the same freedom for professional development.
Men and women should have equal roles in agricultural decision-making.

*All statements were translated into the local dialect by the enumerator

E.3 Summary Statistics

Unsurprisingly, we find a significant difference in the mean gender-equality index between men and women (illustrated in Figure 2.19), with women averaging at 0.85 and men -0.92[41]. This difference is highly statistically significant with a t-statistic of -18.99 and a p-value of 0.000. Therefore, in proceeding with the summary statistics, we will present the means for men and women separately. Results are presented below in Table 2.22.

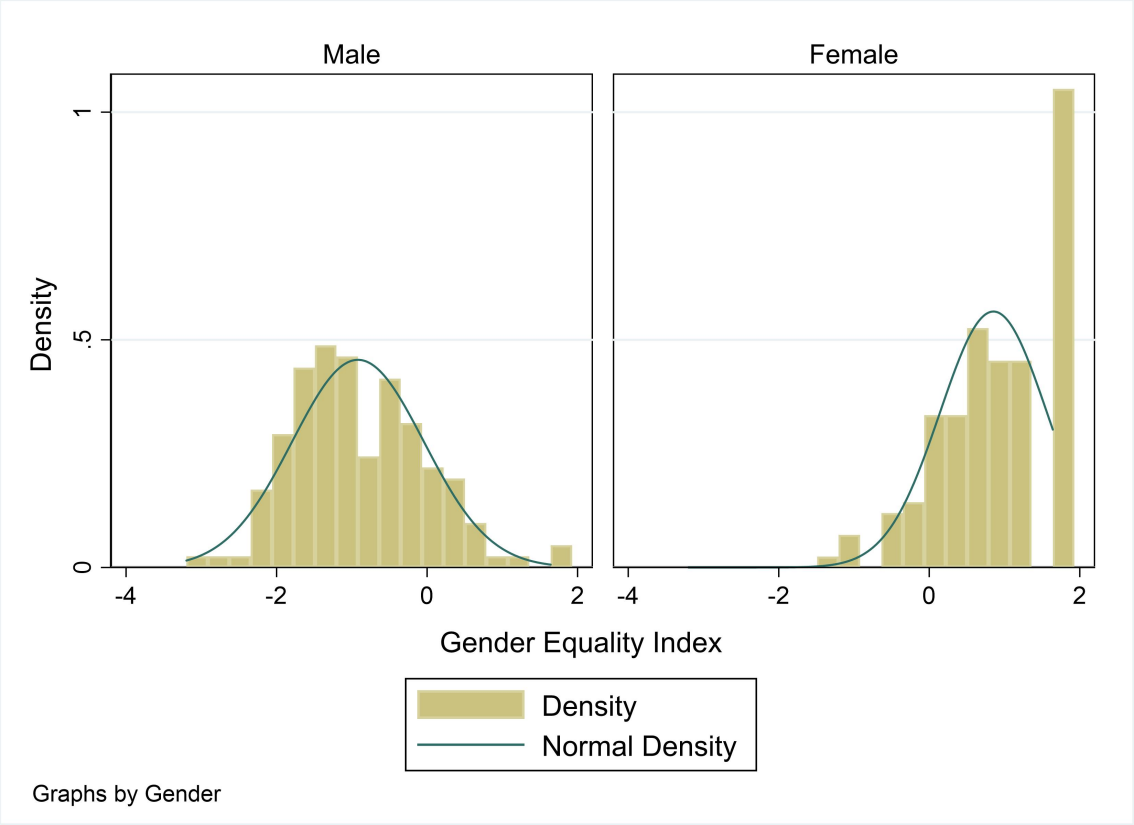

Figure 2.19: Gender Equality Indices for Men and Women.

[41]Standard error for women 0.06, and men 0.07.

Table 2.22: Gender Equality Summary Statistics

	Men		**Women**					
Statement	Mean	Stand. Dev.	Mean	Stand. Dev.	Min	Max	Gender Score	Scoring Value
Women and men have the same right to make their own decisions.	2.86	1.42	4.52	1.06	1	5		
							1	-0.751
							2	-0.359
							3	-0.214
							4	-0.085
							5	0.382
A woman has the same capacity to earn money as a man.	3.62	1.34	4.01	1.38	1	5		
							1	-0.608
							2	-0.341
							3	-0.212
							4	-0.066
							5	0.296
The woman should be free to decide if she wants to work outside the home.	2.69	1.32	4.39	1.14	1	5		
							1	-0.845
							2	-0.374
							3	-0.147
							4	-0.014
							5	0.443
Women and men should have the same freedom for professional development.	4.36	0.67	4.76	0.67	1	5		
							1	-1.309
							2	-0.979
							3	-0.757
							4	-0.376
							5	0.244
Men and women should have equal roles in agricultural decision-making.	4.12	0.95	4.91	0.35	1	5		
							1	-1.555
							2	-1.011
							3	-0.759
							4	-0.429
							5	0.277

Appendix F: Additional Regression Tables

Table 2.23: Full Table: Intrahousehold Contribution Rates by Player with Controls

VARIABLES	(1) Full Sample	(2) Husband Only Sample	(3) Wife Only Sample
Age at First Marriage	0.01	0.01	0.01***
	(0.004)	(0.008)	(0.004)
Age	0.00	0.00	-0.00
	(0.003)	(0.008)	(0.006)
Bagisu	-0.01	0.16	-0.02
	(0.071)	(0.134)	(0.104)
Gender	0.03	-	-
	(0.071)		
Church of Uganda	0.04	0.03	0.07
	(0.033)	(0.056)	(0.066)
Self-Employed	-0.01	-0.01	-0.02
	(0.037)	(0.060)	(0.068)
Education (Years)	0.01**	0.01	0.02*
	(0.005)	(0.009)	(0.011)
Household Size	-0.00	-0.00	0.00
	(0.011)	(0.012)	(0.011)
Number of Children	-0.00	0.01	-0.01
	(0.007)	(0.018)	(0.011)
Wealth Index	0.01	-0.02	0.03
	(0.011)	(0.026)	(0.021)
Gender Index	-0.00	-0.00	0.01
	(0.029)	(0.033)	(0.034)
Age Difference	0.00	-0.00	0.01
	(0.004)	(0.010)	(0.004)
Marriage Duration	0.04	0.06	0.04
	(0.036)	(0.101)	(0.042)
Received Lower Endowment	-0.03	-0.08	0.08
	(0.040)	(0.065)	(0.100)
Order of Rounds (T1 First)	0.03	0.05	0.01
	(0.036)	(0.071)	(0.032)
Received Help in-game	-0.06	-0.15**	0.01
	(0.053)	(0.062)	(0.055)
Constant	0.12	-0.12	-0.03
	(0.106)	(0.307)	(0.187)
Observations	230	100	130
R^2	0.103	0.158	0.184

Notes: This table presents coefficients from intrahousehold linear regressions and in parentheses, standard errors corresponding to two-tailed tests of H0: coefficients equals 0. Throughout, p-values are adjusted to account for inter-dependence within villages using a wild bootstrap.
*** p<.01, ** p<.05, * p<.1.

Chapter 3

Early Marriage, Trust and Reciprocity: An Intrahousehold Study Among the Bagisu of East Uganda

ABSTRACT

Trust is an essential component for the development and maintenance of human relationships. Between spouses, each partner's level of trust jointly influences how households resolve conflicts and make mutually beneficial decisions. Using an original, multi-stage sampling strategy, we investigate intrahousehold behaviour using a modified version of the Trust Game. As in previous studies, our results appear inconsistent with the assumption of Pareto efficiency in household decision-making. We identify early marriage as a channel through which trust and reciprocity can affect low household efficiency levels. Specifically, we find that women married as a 'child' exhibit less trust to their husbands than women who marry as adults. Similarly, we find weak evidence suggesting that women married under 18 trust men from other households less. Throughout, our results are robust to a wide variety of control variables, and we find evidence suggesting that lab behaviour roughly mirrors analogous real-life household behaviour.

Keywords: Early Female Marriage, Field Experiment, Household Production and Intrahousehold Allocation

3.1 Introduction

According to the leading psychological theories of dyadic trust (Larzelere and Huston, 1980) and interdependence theory (Rempel, Holmes and Zanna, 1985), trust is an essential component for the development and maintenance of human relationships. It is also a necessary factor in interpreting partner motives and attributing meaning in a romantic relationship (Rempel et al., 1985). A so-called "trusting" relationship entails a belief or expectation that others possess benevolent motives, with increased trust enabling interpersonal difficulties to be resolved more effectively. Theoretically, trust should increase when partners provide greater support to one another through greater responsiveness and reciprocity (Rempel et al., 1985).

Several major psychological theories, including attachment theory (Bowlby, 1969), and Erikson (1963)'s theory of psychosocial development, are built on the premise that higher levels of trust in early relationships lay the psychological foundation for better functioning relationships in adulthood (Erikson, 1963). Some women, particularly those across Sub-Saharan Africa (hereafter SSA), forge such early relationships through marriage.

Early marriage and its' interactions with education, formative adolescent development, social networks, and intrahousehold autonomy likely affect levels of trust within the household. Additionally, the early marriage dynamic may be a contributing factor to a woman's level of trust with other men. Supposing early relationship experience forms the psychosocial foundation shaping behaviour towards men, women may be more or less trusting of the opposite sex, depending on the interpersonal dynamics between her and her husband. However, both conceptualising and understanding the early marriage interpersonal dynamic is (currently) an underexplored area of research, and little has been written on the topic.

To address this gap, we investigate whether and how intrahousehold trust and reciprocity differ between women married below 18 (early), and those married 18+ (later). Using a multi-stage stratified sampling procedure, we invite spouses to make decisions with real monetary consequences in a series of two-person Investment Games (Berg et al., 1995). We generate directly comparable measures of the extent to which husbands trust and exhibit reciprocity with their wives, wives with their husbands, and husbands and wives with members of other households. To examine whether behaviours vary according to the wife's age at marriage, we compare trust and reciprocity levels across early and later marriage strata.

Overall, we find evidence that women married as children exhibit less trust to their husbands, as proportions sent are almost 6% lower than those married over 18. This result is significant at the 5% level and robust to the inclusion of socioeconomic and demographic controls. In games with men from other households, women married as children similarly send less than their adult counterparts (4.2%), and differences are

significant at the 10% level. Results suggest that women married below 18 have a generalised propensity to exhibit low levels of trust in men, including their husbands. Furthermore, we find that the effect of early marriage on trust remains the same across her education levels.

We similarly explore correlations between household financial management and the proportions transferred in the Trust Game. For men, separate decision-making for household finances correlates negatively with proportions sent in the Trust Game. For women, the negative coefficient for early marriage maintains its statistical significance throughout specifications. We find that for wives, her assumed responsibility for purchasing household necessities - particularly spices and oils - correlates negatively with proportions sent to her husband. Similarly, we find that husbands in the Receiver role transfer back substantially more when wives control purchasing these foodstuffs. While further investigation is required to explain gendered mechanisms in the household, we found evidence that behaviour in-game roughly mirrors real-life household behaviour.

Our results may have important implications outside the laboratory. We identify early marriage as a channel through which trust and reciprocity can affect efficiency levels in the household. Our contribution to the literature is thus two-fold. First, we add to the burgeoning literature on intrahousehold trust using experimental methods. Using a within-subject design, we distinguish between husband and wife behaviour and compare individual behaviour with stranger counterfactuals. This methodology allows us to isolate the effect of the marriage institution.

Second, we contribute to the growing literature documenting the socioeconomic repercussions of early marriage. We are the first study to use a lab-type setting to explore this phenomenon and find significant behavioural differences between those women married before 18 and those after. Furthermore, we find weak evidence suggesting that the early marriage mechanism can extend beyond the household, as women married below 18 transfer less to men in a stranger counterfactual.

The remainder of this chapter is organised as follows: Section 3.2 begins with an overview of the literature. Section 3.3 discusses our experimental design, procedures and treatments. Section 3.4 provides descriptive statistics by our age at marriage stratifications, and Section 3.5 outlines our estimation strategy. Section 3.6 presents our results and discussion, and finally, in Section 3.7, we provide some concluding remarks.

3.2 Related Literature and Motivation

We build on the widely used definition of trust by Rousseau et al. (1998) as "a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behaviour of another" (p.395). Based on this definition, an individual is said to trust if they voluntarily place "resources at the disposal of another party, without any legal commitment from the latter"

(Fehr, 2009, p. 238). Trust, therefore, has three components: the voluntary intention to make oneself vulnerable to another (i.e. social risk-taking); an expectation that the other person will not take advantage of one's vulnerability (i.e. trustworthiness expectations); and that the act of trusting will pay off in terms of the individuals' goals.

Correspondingly, we adopt a definition of reciprocity as the act of "voluntarily repaying a trusting move at a later point in time, although defaulting on such repayment is in the short-term self-interest of the reciprocator" (Gunnthorsdottir et al., 2002, p. 50). Trustworthiness is thus considered a form of reciprocity, with the purpose of maintaining mutually beneficial relationships. With trusting and reciprocal exchanges, the action of one party triggers the response of the other - the anticipation of which affects the first party's decision in turn.

In repeated social dilemmas, a person initiates cooperative behaviour based on three factors: prevailing norms; trust that others are reciprocators (based on their knowledge of general standards and the other person's reputation); and context-specific structural variables (affecting their behaviour and expectations of others) (Ostrom, 2003). Prior knowledge of someone's level of cooperativeness, gleaned from previous interactions, creates a reputation for being trustworthy. Trust, reciprocity, and reputations for being cooperative are thus positively reinforcing, as demonstrated in Figure 3.1:

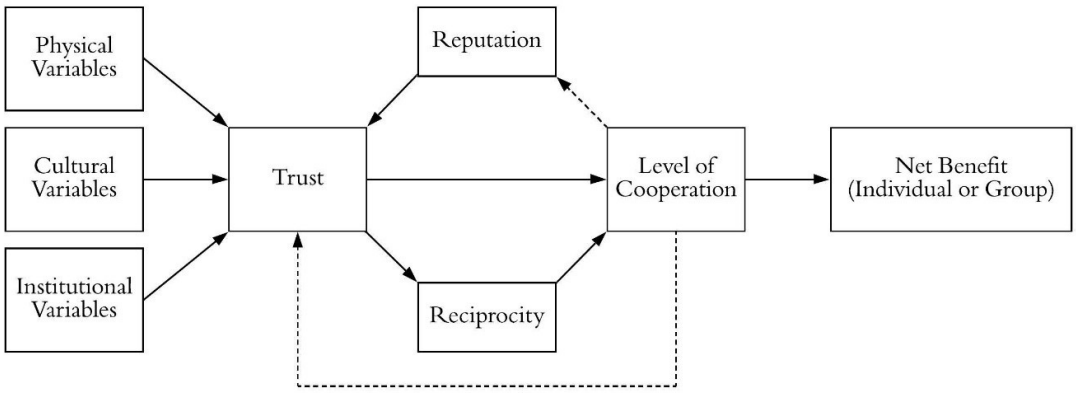

Figure 3.1: Feedback in Repeated Social Dilemmas. Configuration replicated from Ostrom (2003)

A game-theoretic approach, analysing strategic decision-making, is thus an appropriate methodology for studying the interrelated behaviours of trust and reciprocity (Murnighan, 1994). To this end, behavioural research and social scientists have used the canonical "Investment Game" developed by Berg, Dickhaut and McCabe (1995) as a measure of both trust and reciprocity. At its core, the Investment Game is a two-person, sequential prisoner's dilemma. Since no third party can force the hand of the truster and trustee, agent actions are not

contractible. Trust, reciprocity, and levels of cooperativeness should eliminate the frictions of incomplete contracting, facilitating more efficient behaviour. However, a decrease in any one of these can lead to a "downward cascade" Ostrom (2003).

Arguably, repeated social dilemmas occur most frequently within the household. Thus, established married couples are the most suitable population to examine whether trust can result in socially efficient outcomes. Traditional marriage and contract theories presuppose the attainment of socially efficient outcomes due to the household's inherent and overlapping characteristics, specifically repeat interactions, learned behaviour, and mutual affection. The inability to write contingent contracts means that spouses rely on informal contracting enforcement mechanisms to hinder the egotistic incentives that drive potential non-cooperative behaviour. Factors including the ability to talk and exchange promises have widely been observed to increase trust and trustworthiness.

Empirical research has confirmed the importance of trust in romantic relationships by demonstrating that higher levels of trust in one's partner is linked to greater relationship satisfaction for individuals and within couples (Chao and Kohler, 2007; Fitzpatrick and Lafontaine, 2017). Further, romantic partners that report greater trust tend to approach conflict in a more collaborative way (Shallcross and Simpson, 2012) and have more optimistic expectations of their partner's intentions (Rempel et al., 2001). In contrast, mistrust of one's partner is typically linked to adverse outcomes. Low levels of trust can negatively affect one's physical and mental health (Schneider et al., 2011) with increased anxiety and depression. For couples, greater mistrust is also associated with lower relationship satisfaction (Rempel et al., 1985) and heightened odds of intimate partner violence, particularly against women (Copp et al., 2017).

Trust lies at the foundation of nearly all theories of interpersonal dynamics. Each partner's level of trust jointly influences how households handle stressful situations, resolve conflicts and make mutually beneficial decisions for the household (Simpson, 2007), including those decisions that would increase aggregate income. However, many decisions are made without consultation or deliberation between spouses. The unobservability of spousal actions and the opportunity for private gains creates an environment conducive to free-riding, resulting in inefficiencies and under-investment in household public goods (Munro, 2018).

Experimental evidence has consistently found that married couples routinely fail to choose optimal strategies that maximise household surplus. In a closely aligned study to ours, Iversen et al. (2011) found that cooperative gains are often not realised; spouses do not contribute everything to the common pool, even when they are in charge of its allocation. Our investigation in the previous chapter confirms this finding, as our sample of Ugandan spouses failed to maximise aggregate pay-offs in a public goods game. These results are also consistent with the recent work of Mani (2020), who reports on an experiment using married couples in rural Andhra Pradesh, India. Results found that men, in particular, fail to seize opportunities to maximise household income. Instead, these men preferred to keep money for themselves, even when passing money to their spouse would

produce aggregate pay-offs one-third higher. A similar conclusion was drawn by Ashraf (2009), who documented that one-fifth of participants in a lab-in-the-field experiment were willing to give up money to keep returns hidden from their spouse, thereby creating household efficiency losses. In Ghanaian households, public transfers increased expenditures on household goods, while private transfers were primarily used for private or concealable expenditures (Castilla and Walker, 2013).

To the best of our knowledge, there are only three studies that conduct a standard Investment Game between established married couples[1]: Chao and Kohler (2007) in Uganda; Kebede et al. (2014) in Ethiopia, and Castilla (2015) in India. Chao and Kohler (2007) found that, relative to neighbours, spouses transfer more in the Trust Game; this result was expected given high levels of social connectedness between husband and wife. The second key finding from Chao and Kohler (2007) is that second-movers with better mental health reciprocate more in the Trust Game; this result was found in all game sub-groups, including spousal games.

In Kebede et al. (2014), four out of fourteen treatments in a Voluntary Contribution Mechanism (VCM) resemble the sequential Trust Game structure of Berg et al. (1995). Their results suggest that wives transfer, on average, 55% of their initial endowment to the common pool, and husbands contribute 58%. Contribution rates are far below efficiency levels, as spouses do not contribute their entire endowments to a common pool, even when these endowments are made public knowledge. Furthermore, Kebede et al. (2014) found that in these treatments, expectations and actual behaviour were quite similar when endowments were made public knowledge; this result suggests a level of accuracy in predictive behaviour.

Castilla (2015) similarly found that couples fail to choose the strategy that maximises household earnings, as only 3% of participants transfer their entire initial endowment to their spouse. Neither Kebede et al. (2014) nor Castilla (2015) implement a stranger counterfactual in their design to compare intra- and inter-household behaviour. Castilla (2015)'s analysis relies on past literature to draw comparisons between the observed intrahousehold behaviour and behaviour when paired with a stranger.

Intrahousehold Trust Games are still very much in their infancy, despite their great theoretical importance. Little research has examined how and why trust is developed and maintained in the household unit. Simpson (2007) believes that research in this area should explore how and why "certain combinations of partner

[1]Using a Voluntary Contribution Mechanism (VCM), a study by Munro et al. (2010) incorporates a 'trust-like' mechanism into one of their intrahousehold treatments. This treatment involves individual contributions to a common pool, the sum of which is multiplied. The husband chooses how much to allocate to each person in the household. The husband's decision is elicited via the strategy method, not as a direct response. However, we are unsure whether the wife is aware of the husband's role, as it is not made explicit in the design. Similarly, in a later paper, Munro et al. (2014) with the same design (except now there is a treatment for female allocation), the authors do not make explicit whether participants are informed of the wife's (husband's) final allocation decision.

attributes promote or impede the development and maintenance of trust" (p.267). Simpson (2007) then goes on to provide an example of intrahousehold power dynamics: a relationship where one partner has more power than the other can hinder the development of trust if the powerful partner self-servingly takes advantage of the less powerful partner. However, the inverse can also happen; this combination could enhance trust if the higher-power partner continually sacrifices their interests for those of the household. More empirical research is required to determine the size and direction of this (potential) mechanism on trust levels.

As discussed in our previous chapters, several studies have already documented the associations between early marriage and low levels of education, labour force participation, poor mental health, and participation in household decision-making. Using Demographic and Health Survey (DHS) data from Nigeria, Solanke (2015) identifies a significant relationship between age at first marriage and women's empowerment, with a younger age at marriage (ages 15 to 19) associated with low levels of empowerment. Here, empowerment was measured using education levels and women's autonomy in household decisions, specifically, women's response to questions: "who has the final say on own health care, purchase of large items, and visit to friends and relatives?" (Solanke, 2015). Early marriage is thus an appropriate setting to test for differences in observed levels of intrahousehold trust and reciprocity, given the unequal power dynamics between spouses.

3.3 Experimental Design

Ethics Statement: Experimental design and procedures - including the verbal consent process - were checked and approved by the International Development Ethics Committee Chair at the University of East Anglia, UEA (Granted: 11/08/2018) and Makerere University School of Social Sciences Research Ethics Committee, MAKSS REC (Granted: 20/09/2018).

3.3.1 Sample Selection and Fieldwork Implementation

In selecting the sample for the research project, we employed a multi-stage stratified sampling strategy, described in greater detail in Chapter 2 of this thesis. These methods allowed us to gather a representative sample of the married population in the selected research site.

Two sub-counties - Buhugu and Bukise - were purposely selected for reasons of accessibility and safety. From a compiled list of 101 village, 20 villages were randomly selected for study. Our procedure then employed an initial census in the selected villages, where information on the household head and their spouses were elicited, including the age at which they married. This information allowed us to allocate households to our "early" and "later" marriage stratifications. The early marriage stratification contains households where the wife married *below* the age of

18. The later marriage stratification contains those households where the wife married 18+. However, strict eligibility criterion had to be met for the household to participate in the research project.

First, the household must self-identify as "married" and both husband and wife should be cohabiting at the point of research. Eligible spouses must not have been married before; current marriages should be their first and only. Widows and divorcees were not eligible to participate. Finally, households must not be in a polygynous arrangement; the husband's wife should be his one and only wife. Households that met these criteria would then qualify for random selection.

For each village, a master list of households was compiled by early and late strata. For selection to be proportional to the national average (49% of women in Uganda marry below the age of 18[2] we assign a 50/50 split to each stratum. Up to 12 households were randomly selected in each village; 6 households (randomly) from each stratum. Stratums with fewer than 6 eligible households were fully sampled.

Where there was a moderate risk of subject contamination through information leakages, villages close geographically had their experimental sessions held on consecutive days; neighbouring villages were combined into one experimental session to avoid obvious cross-contamination. Consultations with the local chairpersons responsible for each sub-county confirmed that between-village contamination was unlikely to occur for our sample.

Attrition between recruitment and experimental sessions was very low (less than 4%). Where a participant declined, severe illness and prior work commitments were cited. Anticipating this, we modestly over-sampled and thus replacement was not necessary. Attrition between experimental sessions and individual surveys was also very low (less than 3%), and mainly attributable to seasonal migration. We are left with a final sample size of 294 participants, split equally between men and women.

3.3.2 The Trust Game

Data on trust and reciprocity were generated by asking each experimental subject to participate in a series of "Investment Games" (Berg, Dickhaut and McCabe, 1995) - more colloquially referred to as the "Trust Game" in the experimental literature.

In our experiment, participants were assigned to the first-mover role of Sender, s and allocated an endowment, e. Each Sender is asked how much of their endowment they would like to keep for themselves, and how much they would like to send to their assigned partner, whom we call the Receiver, r. Senders have the option to keep zero (send all), or send zero (keep all). Players in the designated Receiver role will subsequently receive 3 times the amount sent. Both Sender and Receiver are aware of this multiplier.

[2]DHS Uganda 2016.

Let the amount sent be x_s; the amount kept by the Sender is, therefore, their endowment e, less the amount sent, $e - x_s$. The Receiver (second-mover) is then asked to choose the amount to return, r_r from the $3x_s$, where 3 is the multiplier. The Receiver can choose to return or keep zero.

For illustrative purposes, let us assume that Sender, s has an initial endowment e, of 8,000 Shillings; all play is conducted in 1,000 Shilling notes[3]. Thus, Sender s must choose $x_s \in e$, where $x_s = \{0, 1000, 2000, 3000, 4000, 5000, 6000, 7000, 8000\}$. The choice of x_s by the Sender determines the Γx_s sub-game, in which the Receiver must choose the amount to return $r_r \in 3x_s$, where $3x_s = \{0, 1000, 2000, 3000, \ldots, 24000\}$, which satisfies $0 \leq r_r(3x_s) \leq 3x_s$.

From the outset, all participants are made aware that initial endowments, e can vary between a maximum of 8,000 Ugandan Shillings, and a minimum of 0 (zero amount); the amount they receive is randomly determined. However, the probability of receiving an endowment other than the maximum amount (8,000 Ugandan Shillings) is not known by subjects. Figure 3.2 illustrates the complete game tree for our Trust Game.

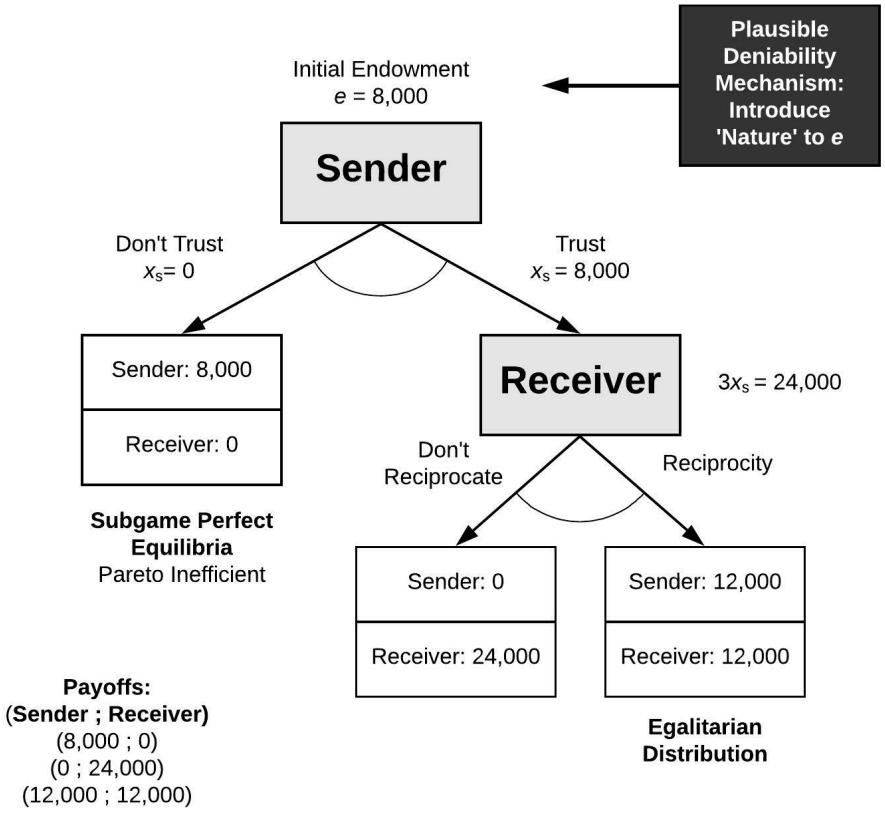

Figure 3.2: Game Tree for Trust Game

[3]The exchange rate at the time of the experimental workshops was (an average) of 3,680 Ugandan Shillings per 1 US dollar.

Based on the core design features of the Trust Game, the following outcomes are obtained:

$\left(\frac{x_s}{e}\right)_s^g$ is the proportion of the endowment that the Sender s of gender g transfers to their partner.

$\left(\frac{r_r}{3x_s}\right)_r^g$ is the proportion of the multiplied sum that the Receiver r of gender g transfers back to their partner.

The pay-offs associated with each role are the following:

$$Sender(x_s, r_r) = (e - x_s) + r_r \tag{3.1}$$

and

$$Receiver(x_s, r_r) = 3x_s - r_r \tag{3.2}$$

The Nash Equilibrium with egotistic (or selfish) preferences predicts a zero transfer from the Sender $x_s = 0$, as the best response of the Receiver is to keep the entire multiplied sum (self-interested subjects will prefer more money to less). Anticipating this move, the Sender decides to keep the entirety of their initial endowment. Conversely, the socially optimum, household-earning maximising strategy is for the Sender to transfer their entire endowment due to the 3 multiplier ($3x_s = 3e$). Under the assumptions of the unitary model, the Receivers response is redundant; irrespective of their choice, the outcome is efficient. Transfers between spouses do not change the equilibrium allocations due to resource sharing or income pooling (Lundberg and Pollak, 1993). With a non-unitary approach, the egotistic preferences model is Pareto-inferior; collectively, the household earns e (the endowment) when they could have earnt $3e$. Therefore, control over intrahousehold decision-making is crucial, as there can be significant efficiency losses.

The framework we have adopted in our modified version of Berg et al. (1995)'s game is consistent with broad conceptual notions of trust and reciprocity. Aligned with Rousseau et al. (1998)'s psychological definition of trust, the Game's sequential nature harmonises the mixed-motive nature of what one considers to be a trustful act; expecting the other party to honour exhibited trust, while simultaneously exposing oneself to the vulnerability of exploitation. Conditional upon the Sender's actions, the Receiver must decide whether and how much to reciprocate exhibited trust. The Receiver can either pursue their dominant strategy (resulting in a loss to the Sender) or reciprocate to achieve a joint maximum shared by both players (McCabe et al., 2003, p.267)[4].

[4]It is worth noting that we do not focus on Matthew Rabin's concept of 'reciprocal kindness' (1993), due to its' paradoxical nature in explaining trust and trustworthiness (for more information,

3.3.3 Game Procedures

Due to the relatively low levels of education and high illiteracy rates of our sample, the experimental procedures for our modified version of Berg et al. (1995)'s Trust Game must be adapted from those originally applied to the undergraduate students from the University of Minnesota, USA. We have thus decided to adopt procedures similar to Henrich (2000), Barr (2003), and Ashraf (2009) that are more suitable for our rural Ugandan context.

Before entering the field, a detailed script of experimental instructions were developed in English. The script was later adapted and evolved in Lugisu (the local language of all the surrounding communities) in a roundtable discussion with the experimental team and project leads. In a pilot study, the translated script was tested and later modified, adding clarification where needed[5]. English translations of Trust Game scripts are replicated in their entirety in Appendices A and B.

After piloting the proposed experimental design, it was decided that the experimental script for the Game should be split into two components; each component would reflect the separate decisions required from Sender and Receiver. This decision was taken for both logistical reasons (as we required participants to play both roles), and to ease participant understanding. The latter rationale came from studying the pedagogy of instructing individuals with low literacy skills (LLS). An important area of research within the Medical Sciences examines how health professionals should effectively deliver instructions to patients with LLS. One recommendation is to instruct patients in small increments to allow for process and comprehension. Specifically, each idea or topic should be taught one step at a time; instructions should be "broken down into segments or [individual] components. Breaks should [also] be provided at the end of each segment/component to provide time for review, feedback, and questions" (Cowan, 2004, p. 283). Thus, the experimental team felt justified in adopting a well-structured, sequential procedure reflecting the individual components (first and second moves) of the Trust Game. This structure is illustrated in Figure 3.3, and assumed in each experimental workshop.

Each script for Sender and Receiver contained three components: a detailed and repetitive description of the Game; a set of examples and questions demonstrating how different combination of decisions yield particular pay-offs for each player[6] ; and - for Receivers only - a general description of what their partner (the Sender) was asked to decide, with numerical examples. One set of examples were used for all Senders, and another set for all Receivers. Examples and questions were designed

please consult Isoni and Sugden (2019)). Instead, trust and trustworthiness are understood as reciprocal cooperation; they are cooperative moves in creating mutual benefit/gains. Mutual gains from the exchange are measure relative to the subgame perfect equilibria. Thus, to exhibit reciprocity in our Trust Game context, the Receiver must not play their dominant strategy.

[5]Please note that data from the pilot has not been included in the final analysis.

[6]Examples were addressed to the room by the enumerator delivering the script, while questions were asked of each participant individually and in private to test their understanding of the instructions.

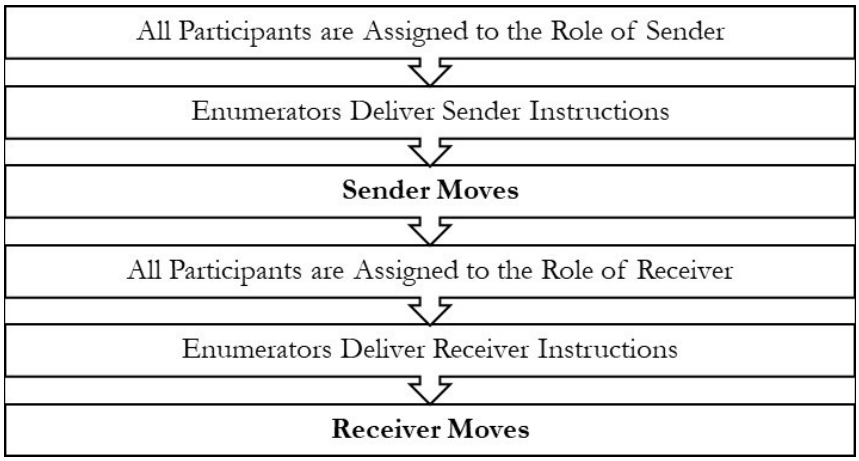

Figure 3.3: Sequential structure for Trust Game

to demonstrate the Game's core features while minimising the extent to which a player may be led to behave in a certain way.

In all experimental sessions, the two scripts were closely adhered to. Where participants had questions or required clarification, the relevant part of the script was repeated by the enumerators. Individuals unable to demonstrate a core understanding of the Game were allowed to play, but their decisions have been omitted from the final analysis. We distinguished participants based on their 'understanding' by asking research assistants to fill in an "Understanding Card" (see Appendix C). This card indicates whether each participant correctly answered the two control questions and asked whether the participant understood the instructions sufficiently; the latter asked for the research assistant's opinion.

Upon the advisement of our Field Partner, we only used note denominations in experimental workshops; specifically, the 1,000 Ugandan Shilling note pictured in Figure 3.4. At the time of fieldwork, the average conversion from US Dollar (USD) to Ugandan Shilling (UGX): 1 USD = 3693.515 UGX. 8,000 Ugandan Shillings was approximately 2.17 US dollars, equivalent to an estimated one to two days' wages of an agricultural labourer. The maximum one participant could earn from the game is 24,000 Ugandan Shillings, which is equivalent to one week's worth of wages.

Figure 3.4: 1,000 Ugandan Shilling Note

While coins do exist in the Ugandan currency (1, 2, 5, 10, 50, 100, 200, 500 denominations), they are widely looked down upon due to their low value and the

impracticality of carrying them in large quantities. Despite the obvious benefit of increasing the number of strategies players could employ, we feared the presence of coins might affect play due to the inherent bias against them.

All experimental workshops were held in primary or nursery schools[7]; given the nature and layout of the locations, it was relatively straightforward to arrange the following set-up depicted in Figure 3.5 on page 3-14. Once the introductory remarks had concluded, men and women were separated into each experimental room (Room A and Room B) with the same gender Enumerator and Moderators. Individual seating was provided, and participants were asked to turn and face the wall when making decisions. At the beginning of each treatment, participants received two large, unsealed brown envelopes (see Figure 3.5); one labelled "Keep" and one labelled "Send". In the Sender role, "Keep" envelopes contained initial endowments, while "Send" envelopes were empty. In the Receiver role, "Keep" envelopes contained the multiplied sum sent by the Sender, while "Send" envelopes were again empty.

Separating Rooms A and B was a private room designated for data recording. One member of the recording team inputted all data into an MS Excel spreadsheet. The second recording team member was in charge of all envelopes; the primary investigative lead was the only member of the experimental team authorised to remove, count and replace money in envelopes. The hallway connecting the three rooms was constantly monitored by a male member of the experimental team. Participants were made aware of his presence to reassure them of security and that no deception was taking place; specifically, no envelopes were tampered with, and enumerators did not – at any point – look inside envelopes, remaining "blind" to participant decisions.

3.3.4 Plausible Deniability

Our experimental design calls for instances of player non-anonymity; in one of our treatments, the playing partner's precise identity is known to the participant. We thus modify the Trust Game's structure to decrease the ease with which precise game-play or strategy could be deduced. Such modifications were necessary for two highly interrelated reasons; the first concerns the accurate interpretation of results in a non-anonymous setting given new-found accountability considerations. The second reason concerns the personal safety and protection of vulnerable human subjects.

At its most intrinsic level, experimental games are designed to elicit a participant's intuition about the "right way" to behave in an interaction. In cases where a subject knows their playing partner's precise identity, we assume they use their knowledge

[7]Total of six different locations; Bumatofu Primary School, New Life Nursery School, Nalugugu Primary School, Nandago Primary School, St. Francis Primary School, and Gadigadi Primary School. We wish to extend our sincerest thanks to the Headmasters of each respective school for permission to use their premises.

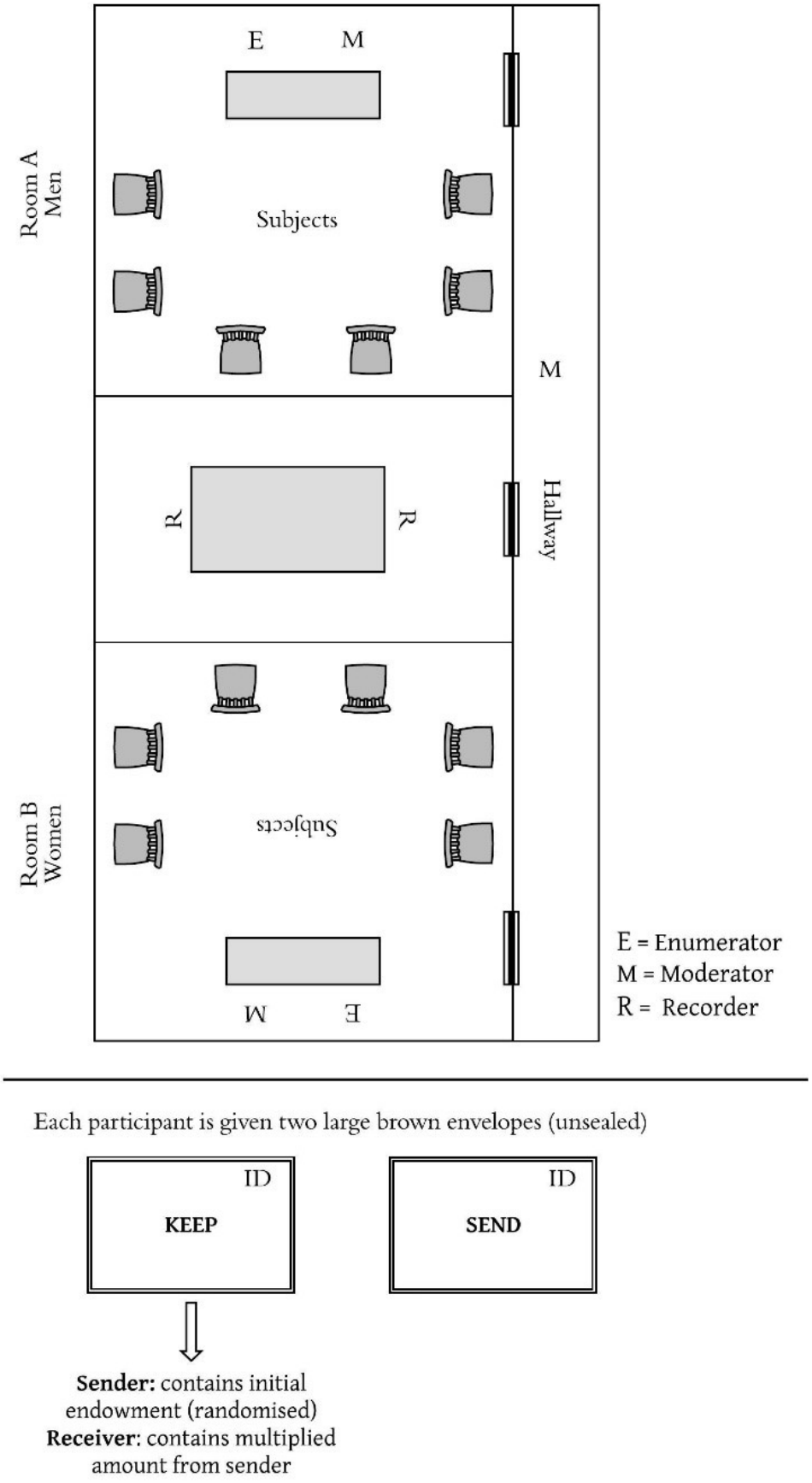

Figure 3.5: Experimental Setup

of that person to assist in making their final decision. For example, if a wife knows that her husband typically exhibits selfish behaviour in the home and is unlikely to be trustworthy, the rational thing would be to keep the initial endowment for herself. However, without a guaranteed protective veil of anonymity, participants can now be held accountable for their decisions. Consequently, they may alter their behaviour accordingly to appear more compliant or "trusting".

In a non-anonymous setting, behaviour in the lab is guaranteed to be part of a broader "game" that participants have with their partners. This "game", or rather, the interpersonal dynamics[8] is not something that researchers are privy to. Furthermore, one must consider the genuine possibility of retaliation; in other words, a continuation of the game well after the workshop has concluded (and outside the confines of the lab). For example, if a wife is not fully trusting in the experiment, her in-game behaviour could lead to retaliation by her husband upon return to their private residence. In a context with high rates of physical violence against women by their husbands/partners (please see Table 3.1 below), we must adhere strict ethical considerations to protect this vulnerable group.

Table 3.1: Women's Experience of Domestic Violence

Variable	**Bagisu**	**Uganda**
Experienced any emotional violence by husband/partner	33.33%	41.68%
Experienced any less severe violence by husband/partner	42.09%	40.31%
Experienced any severe violence by husband/partner	19.22%	21.02%
Experienced any sexual violence by husband/partner	21.90%	22.69%

Data Source: Demographic and Health Surveys (DHS) Dataset, 2016 Uganda; Individual Women's Data – Individual Recode (IR)

We thus developed strict "Plausible Deniability" features into our game design. Plausible deniability here refers to each participant's ability to deny knowledge or responsibility for any decisions they make throughout the game. Deniability claims are conceivably legitimate due to the lack of traceable evidence that would confirm any in-game decision. The first component to our plausible deniability mechanism allows for a range of possible Sender endowments. Participants are informed that they could receive an initial endowment ranging from 0 (zero) Ugandan Shillings, to a maximum of 8,000 Ugandan Shillings, in 1,000 Shilling increments. Informing all participants that the game accommodates a range of possible endowments, in turn, allows participants to contribute significantly less than their initial endowment, while claiming to have contributed more if later questioned by their partner.

As discussed, initial endowments must be sufficiently large to ensure participants' thoughtful and deliberate consideration over Sending decisions. At the same time, plausible deniability must be assured. To harmonise these interests, we assigned

[8]The term "interpersonal dynamics" here refers to how individuals cope and/or deal with different situations and scenarios given personal feelings and behavioural tendencies towards a specific person.

probabilities to the range of endowments. For each treatment, we assigned a 95% probability of receiving a "full" endowment of 8,000 Ugandan Shillings and a 5% probability of receiving a "low" endowment; this "low" endowment ranged from 0 to 7,000 Ugandan Shillings (precise amounts were randomised with each treatment). The range of possible endowments was made common knowledge to all participants; however, the probabilities associated with each were not public knowledge.

The second component of our plausible deniability mechanism involves "random payment"; due to methodological considerations and possible spillover effects, we discuss this procedure in greater length in Appendix D. Briefly, this procedure ensured that participants were paid for only one of their decisions taken throughout the day, and this payment was determined via a lottery system. Participants were not informed which decision they were paid for, so a partner could plausibly deny their in-game decisions.

To summarise, participants' strategies and the actions' anonymity were guaranteed. Participants were read a consent document that stated that their names would be anonymised so that no decisions could be traced to them directly. Participants were also informed at the beginning of each treatment that no one – not even enumerators and moderators – knew how much they received as an endowment. Participants were assured that decisions were private and that they would be paid *before* reuniting with their spouse. Individual earnings would be disclosed in envelopes that were discreetly concealed.

Further information on specific game design features, including playing both roles, random payment, strategy method and double-blind procedures, are described in Appendix D on page 3-62.

3.3.5 Treatments

A within-subject design was used to expose each married participant to two treatments, with each treatment representing a different playing partner in the Trust Game. Participants were asked to play both roles in the Trust Game two times, each time reflecting one of the assigned treatments. In their assigned role (Sender or Receiver), participants were individually informed with whom they were playing.

Treatment 1 (T1) we designate as the **Intrahousehold Game**, where every husband (wife) plays with their wife (husband). We have two complete Intrahousehold Trust Games for each married individual, as we ask husbands (wives) to switch roles after play.

Treatment 2 (T2) we designate as the **Interhousehold Game**, where every male (female) plays with a female (male) from another household in the same village. Precise identities of the playing partner were not revealed, only their gender. We have two complete Interhousehold Trust Games for each participant.

By implementing a stranger counterfactual in T2, we should determine whether observable differences in T1 behaviour are owing to an effect of the marriage institution, rather than the selection of less trusting, or less reciprocal people into our age at first marriage stratifications.

Participants were told their playing partner's precise identity at the start of T1 (the *Intrahousehold Treatment*). In T2 (the *Interhousehold Treatment*), participants were informed that they were playing with a "man" or "woman" in the same workshop. Hence, participants in the interhousehold treatment knew that they were playing with an adult from another household, but did not know their playing partner's precise identity - only their gender. Had we revealed the exact identities in T2, both reputational factors and characteristics of the playing pairs' relationship, unknown to us, would affect sending decisions. This procedure was repeated for every workshop; at no point were participants deceived regarding whom they were paired with.

The order of treatments was randomised with each workshop to control for potential order effects. No feedback was given between treatments. Participants received no indication that husbands and wives would play together until the start of Treatment 1. From the outset, participants were informed that their final earnings would be determined via a lottery, corresponding to only one of their decisions taken that day. In combination, these design details minimised the likelihood that participants played each treatment in the Trust Game as a portfolio, rather than a series of separate interactions (the latter we sought to encourage).

3.4 Data and Descriptive Statistics

Table 3.2 contains summary statistics on individual and household characteristics for the experimental sample, by gender and by our marriage stratifications: Early and Later. Data was collected via individual surveys administered after the experimental workshops. Men and women were questioned at the same time in their home, in separate rooms with the same gendered enumerator. Below each statistic, standard deviations are reported in brackets.

The sample of participants used here is the same as in Chapter 2 of this thesis, where we also present summary statistics for men and women but not grouped by marriage stratification. From Table 2.1 of Chapter 2, we concluded that our mean experimental sample is not too different from the Bagisu or Ugandan national averages in observable characteristics[9]. Table 2.1 on page 2-17 contains further details. Here we will discuss key differences by marriage stratification.

Overall, households are remarkably similar in both size and number of children. This similarity contradicts the profile of early marriage we generated from the DHS data in Chapter 1 (Table 1.2 on page 1-20) as the women in our sample appear to have the same level of achieved fertility, irrespective of whether she married as a

[9]Using data from the Ugandan DHS, 2016.

Table 3.2: Summary Statistics by Gender and Marriage Stratification

Variable	**Mean (Standard Deviation)**			
	Early Marriage (N=148)		Later Marriage (N=146)	
	Male	*Female*	*Male*	*Female*
Age	39.77 (14.55)	33.27 (13.94)	39.60 (12.74)	35.29 (11.48)
Number of Children	3.77 (2.37)		4.01 (2.42)	
Household Size	6.27 (2.20)		6.63 (2.68)	
Years of Education	6.91 (3.18)	5.31 (2.81)	7.81 (3.14)	6.33 (3.47)
Bagisu Ethnicity	0.96 (0.20)	0.95 (0.23)	1.00 (0.00)	0.93 (0.25)
Works on Household Farm	0.84 (0.37)	0.93 (0.25)	0.83 (0.38)	0.85 (0.36)
Self-Employed	0.41 (0.49)	0.27 (0.45)	0.40 (0.49)	0.32 (0.47)
Wealth Index*	-0.07 (1.54)	-0.46 (1.39)	0.06 (1.49)	-0.49 (1.35)
Gender Index*	-0.92 (0.84)	0.86 (0.70)	-0.92 (0.91)	0.85 (0.73)
Church of Uganda	0.43 (0.50)	0.46 (0.50)	0.44 (0.50)	0.33 (0.47)
Age at First Marriage	22.11 (4.74)	15.58 (2.01)	24.97 (6.28)	21.26 (4.31)
Age Difference With Spouse	6.93 (4.12)		4.95 (4.41)	
Years Married	17.64 (13.97)	17.73 (14.39)	14.59 (10.81)	14.08 (10.93)

* Please see Appendices D and E of Chapter 2 for a full description of the construction of these indices.

child or not.

Both men and women in a later marriage arrangement have, on average, one year of additional education, with the anticipated gender disparity of men averaging more years than women. Again, most of our sample are of Bagisu ethnicity, and occupations are primarily household farm-based. Interestingly, we observe fewer women engaged in self-employment activities in an early marriage arrangement than later; however, this statistical difference is not significant. Wealth indices remain largely unchanged between the marriage stratifications. We also observe a similar pattern of men possibly overinflating their assets given the large differences between male and female means.

A higher proportion of women marry early within the church of Uganda – the largest religious group represented in our sample – 46% compared with 33% (a one-sided t-test confirms this difference at the 10% significance level). The average age at marriage for those women married as a child was 15 years, and 21 years for those married over the legal threshold. Age differences are larger in early marriage households, averaging almost seven years compared with five. Years married are higher in our early marriage stratification – a somewhat unsurprising result given that average ages in our sample are similar.

Typically, women in Uganda are portrayed as having low levels of control and decision-making authority in the household. This phenomenon is perhaps best illustrated by the targeted policy and development programs currently in place to increase female decision-making power in agricultural households (see, for example, "Uganda Vision 2040", which calls for men and women to be treated as "equal partners in development right from the household to the Country-level" (The Republic of Uganda, 2013, p. 96-97)). The degree to which women have authority in areas of money-management is considered to indicate their level of empowerment (Alkire et al., 2013).

From the psychological literature, we believe that power in household decision-making likely affects trust levels between spouses. We thus devised questions to elicit the division of money management in the household, the summary statistics of which are presented in Table 3.3 on page 3-20. Participation in decision-making is usually measured by explicitly examining *'who'* makes a specific decision; for example, by posing the question "in general, who keeps the money in your household?". Given the uncertainty over the precise distribution of power in "joint" decision-making, we instead focus on the response "separate finances", which implies a level of individual control (or autonomy) in household money management. This will remain a core assumption throughout the analysis.

To complement this data, we also investigate how key household purchases are distributed between husband and wife. In particular, we look at the purchasing of staple foods, clothing and human capital investments, namely the payment of school fees and medical expenses. These statistics are presented in Table 3.3. We believe that what participants transfer in-game depend (in-part) on expectations of what they believe their spouse will do with their earnings. Expectations are formed

Table 3.3: Household Finances and Purchases

Variable	**Mean**		**Test for Equality of Means**	
	Male (N=147)	**Female** (N=147)	**t-stat**	**p-value**
Separate Decision Making for Household Finances	0.14 (0.35)	0.30 (0.46)	-3.28	0.001
Household Head Pays for School Fees	0.82 (0.39)	0.66 (0.47)	2.99	0.003
Household Head Pays for Medical Expenses	0.82 (0.39)	0.77 (0.42)	0.93	0.355
Wife Purchases Cooking Oils and Spices	0.51 (0.50)	0.58 (0.50)	-1.17	0.243
Wife Purchases Clothing for Children	0.12 (0.32)	0.17 (0.38)	-1.407	0.161
Wife Purchases Clothing for Male Household Members	0.08 (0.26)	0.14 (0.34)	-1.689	0.092
Wife Purchases Clothing for Female Household Members	0.27 (0.45)	0.32 (0.47)	-0.823	0.411

based on prior experience of household purchases. Because spouses' utilities are interdependent via household goods, we hypothesise that the spouse who assumes responsibility for the goods' purchase will be sent more from their spouse.

When posing these questions to the household, previous studies and field reports have found that spouses frequently report differing perceptions of how specific household decisions are taken. Disagreements suggest gendered differences in perceptions of the decision-making process. Indeed, we find some statistically significant differences in the responses between men and women, as illustrated by the t-stat and associated p-values in Table 3.3. The overwhelming majority of household heads in our sample are male (99%), and the discrepancy between male and female reporting is intriguing. For example, 82% of men claim that the household head is responsible for the payment of school fees, while 66% of women report that the household head pays this. While only speculative, we feel this may indicate men's "impression management" (Jackson, 2009). Men may wish to impart on the enumerator the distinct impression that they contribute more to their child's development than they actually do. Subsequently, they may be reluctant to admit that they receive support for this expense (from the wife or other sources).

We similarly examine spousal responses, decomposed by early and later marriage stratifications; male responses are reported in Table 3.4 and female responses in Table 3.5. Differences in response are almost entirely insignificant, except for the male response to school and medical fees. 88% of males in early marriage households respond that they are responsible for the payment of these 'big expenditures', while in later marriage households, 75% of men claim responsibility. Upon closer examination, more men respond that *both spouses* assume responsibility for large expenditures in households where the bride married later.

Table 3.4: Early Marriage: Household Finances and Purchases (Male Response)

Male Response	**Mean (Standard Deviation)**		**Test for Equality of Means**	
	Early Marriage	**Later Marriage**	**t-stat**	**p-value**
Separate Decision Making for Household Finances	0.11 (0.31)	0.18 (0.39)	1.21	0.2282
Household Head Pays for School Fees	0.88 (0.33)	0.75 (0.43)	-1.97	0.0509
Household Head Pays for Medical Expenses	0.88 (0.33)	0.75 (0.43)	-1.97	0.0509
Wife Purchases Cooking Oils and Spices	0.49 (0.50)	0.53 (0.50)	0.58	0.5656
Wife Purchases Clothing for Children	0.15 (0.36)	0.08 0.28)	-1.26	0.2104
Wife Purchases Clothing for Male Household Members	0.07 (0.25)	0.08 (0.28)	0.31	0.7559
Wife Purchases Clothing for Female Household Members	0.28 (0.45)	0.26 (0.44)	-0.32	0.7508

Table 3.5: Early Marriage: Household Finances and Purchases (Female Response)

Female Response	**Mean (Standard Deviation)**		**Test for Equality of Means**	
	Early Marriage	**Later Marriage**	**t-stat**	**p-value**
Separate Decision Making for Household Finances	0.32 (0.47)	0.28 (0.45)	-0.56	0.5794
Household Head Pays for School Fees	0.60 (0.49)	0.73 (0.45)	1.60	0.1127
Household Head Pays for Medical Expenses	0.75 (0.44)	0.80 (0.40)	0.76	0.4475
Wife Purchases Cooking Oils and Spices	0.57 (0.50)	0.58 (0.50)	0.12	0.9031
Wife Purchases Clothing for Children	0.16 (0.37)	0.19 (0.39)	0.37	0.7116
Wife Purchases Clothing for Male Household Members	0.11 (0.32)	0.16 (0.37)	0.91	0.3664
Wife Purchases Clothing for Female Household Members	0.32 (0.47)	0.31 (0.47)	-0.08	0.9399

The following is a description of the study variables employed in forthcoming regression analysis:

Table 3.6: Study Variables*

Variable	Description
Trust	Proportion sent [log ratio]
Response	Proportional response [log ratio]
Intrahousehold Game (*T1*)	Treatment 1; where every husband (wife) plays with his (her) wife (husband) [dummy]
Interhousehold Game (*T2*)	Treatment 2; where every male (female) plays with a female (male) from another household [dummy]
Endowment	Participant's initial endowment when playing the role of Sender in Ugandan Shillings
Received	Participant's multiplied sum received from the Sender in Ugandan Shillings
Early Marriage	Household is in an early marriage arrangement (female married below the age of 18) [dummy]
Finances	Participant declares household has separate decision-making for household finances [dummy]
School Fees	Household head pays for school fees [dummy]
Medical Expenses	Household head pays for medical expenses [dummy]
Oils and Spices	Wife purchases cooking oils and spices for household consumption [dummy]
Children Clothing	Wife purchases clothing for children of the household [dummy]
Male Clothing	Wife purchases clothing for male members of the household [dummy]
Female Clothing	Wife purchases clothing for female members of the household [dummy]
Gender	Participant's gender [dummy]
Age	Participant's age in years
Bagisu	Whether the participant belongs to the Bagisu ethnic group [dummy]
Church of Uganda	Whether the participant affiliates themselves with the Church of Uganda [dummy]
Self-Employed	Participant runs a business/is self-employed other than farming [dummy]
Education	Participant's years of completed formal education in years
Education (*category*):	*No Education, (Some) Primary, Graduated Primary, (Some) Secondary, and Higher Education*
Household Size	Number of people currently living with/in participant's residence
Male Children	Number of male children under the age of 18 currently living in the participant's household
Female Children	Number of female children under the age of 18 currently living in the participant's household
Wealth Index	Participant's calculated wealth index based on household assets
Gender Index	Participant's calculated gender index based on gender equal beliefs
Age Difference	Participant's age difference with spouse
Marriage Length	Years married with spouse [log form]
Order of Rounds (T1 First)	Intrahousehold game (T1) was played before Interhousehold game (T2) in experimental session [dummy]
Received Help	Participant received help in experimental session [dummy]

*Full descriptive statistics of all explanatory variables (by gender) are displayed in Appendix D.1, pages 3-68 and 3-69.

3.5 Estimation Strategy

The use of the regression methodology allows us to control for alternative contextual factors that likely influence our studied behaviours. This methodology also allows us to maximise our econometric tests' statistical power by employing all the available data gathered in the field.

To evaluate the observed behavioural patterns formally, we deploy a series of empirical regression models to address the leading question of this chapter – the influence of early marriage on intrapersonal social behaviours – which shares the following common linear structure:

$$y_i = \boldsymbol{X}_i\boldsymbol{\beta} + u_i \tag{3.3}$$

where y_i is the proportion shared (as either Sender or Receiver) as the dependent variable, and $\boldsymbol{X}_i$ includes key explanatory variables and the control variables.

In an experimental setting with married couples, one can only capture a small snapshot of a more complex, dynamic and continuous intrahousehold game. Each spouse has some prior knowledge of their partner's behaviour due to repeated interaction. This repeated interaction (or perhaps conflict) informs individual beliefs about how their partner will respond in-game.

Relative to the stranger counterfactual in treatment 2, we assume three key differences when examining monetary transfers in the Trust Game with married couples. First, we must assume that in-game decisions depend on expectations of how spouses will distribute or spend their earnings post-game (private retention, or for the benefit of the household). Second, even in the absence of altruism or caring preferences, spouses' utilities are interdependent via household goods. Finally, we assume that monetary transfers in the Game depend on prior management experience (or autonomy) of household finances. Because we do not observe spousal distribution or expenditures post-experiment, we rely heavily on our survey data; specifically, how key household purchases are distributed between husband and wife (according to each spouse), self-declared household control over finances, and finally, individual characteristics and household compositions.

3.5.1 Sender Behaviour

We begin by investigating the impact that early female marriage has on the amount transferred by the Sender. Our first behavioural variable generated from the Game, proportion sent ($Trust$), is regressed upon a dummy that takes the value one if individual i lives in an early marriage household and zero if otherwise (EM_{ih}). To control for village heterogeneity, we employ a fixed-effect model throughout, which is represented by δ_v.

Our base model estimates the proportion of the endowment (x_s/e) that is transferred by individual i, of gender g in treatment round t:

$$Trust_{igt} = \alpha_i + \gamma EM_{ih} + \boldsymbol{X}_{it}\beta + \sum_{v=1}^{13} \delta_v + u_{it} \tag{3.4}$$

Given the widespread acknowledgement for early marriages' interaction with education (see, for example, Field and Ambrus (2008)) we, in turn, interact early marriage with education dummies in subsequent specifications[10]. These education dummies are represented by $Education_i$, a categorical variable comprising of the five self-constructed education categories; each category enters the regression as a bivariate variable, with "No/very low education" becoming the reference category. We estimate the following model:

$$Trust_{igt} = \alpha_i + \gamma EM_{ih} + \varphi Education_i + \beta_1 EM_{ih} * Education_i + \boldsymbol{X}_{it}\beta + \sum_{v=1}^{13} \delta_v + u_{it} \tag{3.5}$$

where the parameter β_1 measures the interaction between early marriage and education levels.

3.5.2 Receiver Behaviour

To measure reciprocity, we use the ratio between the amount sent back to the first mover (i.e. to the Sender), and the amount originally sent to the second mover (the Receiver)[11]. Many researchers use this proportional response ratio, including Berg et al. (1995), Camerer (2003) and Barr (2003)[12].

[10] These dummies were constructed from the data to ensure equal distribution across the categories. Throughout, "Primary" and "Secondary" variables indicate *some level* of this education attained; the variable "Graduated Primary School" has been generated to indicate that a participant successfully completed primary school but advanced no further in their education. Due to the low number of participants in the "Upper Secondary" band, lower and upper have been merged into one "Secondary" school variable. Very few participants have "No Education"; therefore, "No Education" and low levels of primary education (P1 and P2) have been combined.

[11] An alternative to this ratio is to use the actual monetary response (controlling for the received amount) in an estimation strategy. However, one must be wary of drawing strong inferences about reciprocating behaviour from the actual monetary response. The amount sent and monetary response are likely to be correlated, simply due to the mathematics of the Game. The same, however, is not true for the proportional response; the upper bound of the set of actual responses from which the second player (the Receiver) can choose is directly proportional to the amount sent by the first player (the Sender). The upper bound of the set of proportional responses from which the second player can choose is constant at three, which is unrelated to the proportion sent by the first player.

[12] In some cases, researchers have used the ratio of the amount sent back, and the *multiplied sum* sent to the Receiver; the original ratio is just three times this ratio (using the multiplied sum), consequently the same measure with identical properties.

The proportional response lends itself to straightforward interpretation. For example, a proportional response of 0 corresponds to self-interest money maximisation. A proportional response of 1 corresponds to what one could designate as "pure reciprocity", that is, returning exactly what was sent. A proportional response of 1.5 corresponds to what one could designate as "pure sharing", that is, dividing the total money received (i.e. the Receivers' wealth) equally between the two players. A proportional response of 3 corresponds to "pure altruism," that is, returning the entire multiplied sum. Furthermore, the proportional response excludes cases of zero trust. Trust is the denominator of the ratio and is thus undefined when a zero-sum is sent. Conceptually, we feel this is appropriate as it reflects a core facet of reciprocity; one cannot exhibit it when no trust has been forthcoming. In other words, reciprocity necessitates a mutual exchange. The ratio r_r/x_s is thus bound by zero and three, provided that the amount sent originally is greater than zero, $x_s > 0$.

Potential mechanisms influencing Receiver behaviour vary from those directly attributable to the Sender. Senders, required to move first in the Game, experience uncertainty over how much they may (or may not) receive in return. Receivers, meanwhile, already know the decision that the Sender has taken. Therefore, strategic behaviour and game-play are not strictly necessary in the Receiver role, as no response is required for the subject they are paired with. Unlike the Sender, the Receiver does not face any direct cost by choosing to keep the money sent to them, as there is no pecuniary advantage to sharing.

To examine the mechanisms motivating Receiver behaviour between spouses, we estimate the following:

Where $x_s > 0$,

$$Reciprocity_{igt} = \alpha_i + \gamma EM_{ih} + \boldsymbol{X}_{i,t}\beta + \sum_{v=1}^{13} \delta_v + u_{i,t} \tag{3.6}$$

Where $Reciprocity_{igt} = r_r/x_s$ is the proportional response of participant i, of gender g in a given treatment t; a decision taken twice by each participant, under different circumstances, during the experiment. Each situation reflects one of the two treatments the participant is exposed to, and is randomised with each experimental workshop. Similar to Sender behaviour, we will also examine the effect of education on Receiver behaviour.

3.5.2.1 Log Transformation

While pleasing graphically, using raw ratios as dependent variables can be problematic from an econometric standpoint. Kronmal (1993) discusses the consequences of using a single ratio as a dependent variable in multiple regression

analysis[13], and concludes that ratios can lead to incorrect or misleading inferences. He recommends that, where possible, raw ratios should be avoided in regression analysis. Consequently, there is a strong argument for taking the log form of the dependent ratio. There are several reasons why natural logarithms are used so much in applied work. First, using the log of a variable leads to coefficients with appealing interpretations, and one can be ignorant regarding the units of measurement of variables taking a logarithmic form. This is because the slope coefficients are invariant to re-scaling. Second, when $y > 0$ (y representing the dependent variable), models using $log(y)$ often satisfy the Classic Linear Model (CLM) assumptions more closely than models using the level of y. Strictly positive variables often have conditional distributions that are heteroskedastic or skewed; taking the log can mitigate both problems. Moreover, taking the logarithm usually compresses the distribution of the variable. This makes the estimate less sensitive to outliers.

For the separate dependent variables of Trust and Reciprocity, integers are non-negative but can take the value of zero (i.e. one can send a zero amount; one can return zero). For regression analysis, the recommendation of Wooldridge (2009, p.192) has been adopted, and the dependent variables are of the form $log(1 + y)$. Technically $log(1 + y)$ cannot be normally distributed, although it might be less heteroskedastic than y. Nevertheless, using $log(1 + y))$ and then interpreting the estimates as if the variable were $log(y)$, is acceptable with the disclaimer that the data on y should contain relatively few zeros. Figures 3.6 and 3.7 both plot the raw ratio distributions, and the distributions log-ratio transformation for proportions sent, and the proportional response.

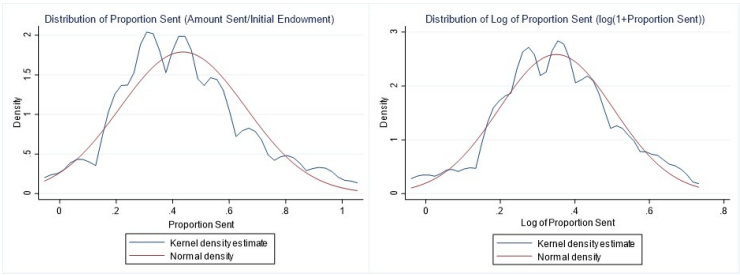

Figure 3.6: Raw Ratio and Log-ratio Distributions for Proportion Sent

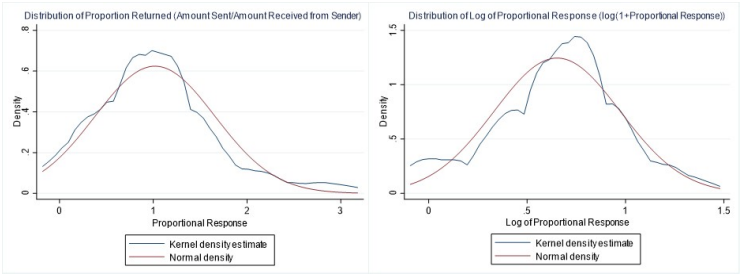

Figure 3.7: Raw Ratio and Log-ratio Distributions for Proportional Response

[13]Please see Kronmal's full 1993 paper for econometric proof.

3.6 Results and Discussion

3.6.1 Main Experimental Outcomes

Spouses in our sample do not attain the efficient, household earnings maximising outcome, as less than 3% of participants send their entire endowment. Total household earnings (calculated as the sum of Sender and Receivers' final earnings) average at 14,500 Ugandan Shillings. Where Senders received the maximum endowment of 8,000 Ugandan Shillings, household earnings averaged slightly higher at almost 15,000 Ugandan Shillings; this constitutes 62.5% of maximum potential earnings. As a proportion of total household earnings (which equals money kept by the Sender + money received back + money kept by the Receiver), Senders earn 57%, while Receivers earn 43%; this difference is highly statistically significant[14]. These results immediately indicate that both the unitary and collective household models can be rejected for our Ugandan sample.

Descriptive and test statistics of the main experimental outcomes - organised by role and gender - are reported in Table 3.7 on page 3-29. Senders transfer on average 3,360 Ugandan Shillings, which is equivalent to 44% of their initial endowments[15]. Receivers, on average, return 34% of the multiplied amount they receive. The equivalent proportional response would be to return 30%; on average, the Sender is earning interest on their "investment". Only 4% of spouses in the Sender role and 9% of spouses in the Receiver role chose to send a zero-sum to their partner; less than 2% return the entire amount they receive. The distribution of proportions sent (x_s) by first movers (both husband and wife) are depicted in Figure 3.8.

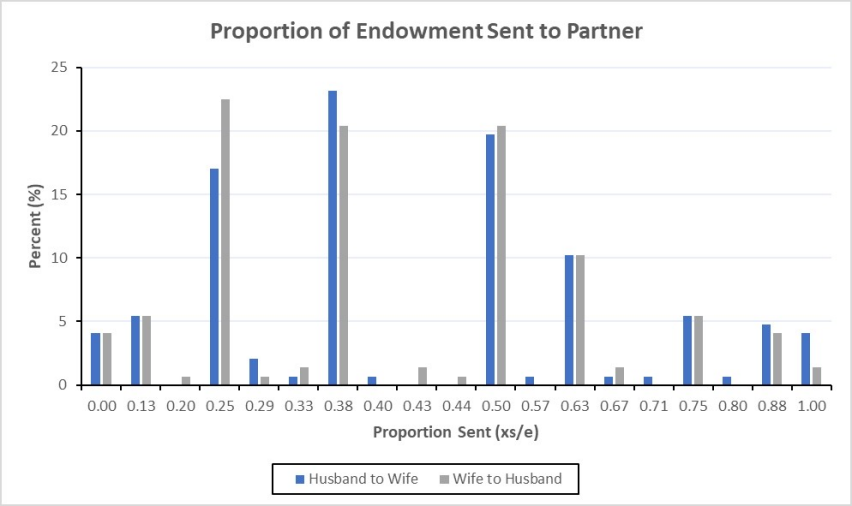

Figure 3.8: Distribution of Proportions Sent to Partner in Treatment 1

[14] t-statistic = 10.12 (p-value = 0.0000).

[15] Where participants receive the maximum possible endowment of 8,000 Ugandan Shillings, the amount sent averages slightly higher at 3,480 Ugandan Shillings, but proportionally remains the same at 44%.

On average, when playing with their spouse, women send 42% and return 30%; men send 45% and return 37%. Wives appear to send (as a proportion of their initial endowment) an average of 3% points less than husbands; however, this difference between husband and wife sending behaviour is not statistically significant. When assigned to the Receiver role, wives return (as a proportion of the multiplied amount received) an average of 7% less than their husbands, and this difference is statistically significant; women appear to exhibit less reciprocity to their spouses than men. An illustration of these mean differences for the intrahousehold treatment can be found in Figure 3.9.

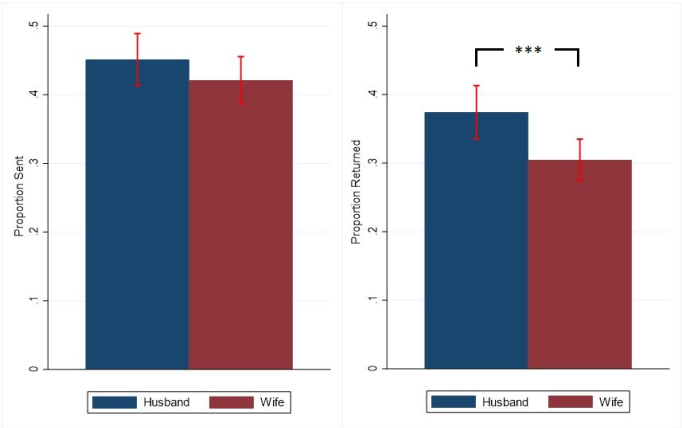

Figure 3.9: Mean Differences by Gender, Treatment 1
*** = statistically different at the 1% level. *Notes:* Red vertical whiskers are 95% confidence intervals, generated using a linear regression of contribution rates on gender. The test result indicated by the horizontal bracket at the top of the panel is derived from the same regression.

For intrahousehold play, a potential explanation for observed behaviour could be a general 50/50 sharing rule between spouses. While some players may adopt a 50/50 strategy, we can reject this hypothesis for the mean sample, as the average proportion sent for both men and women is significantly larger than the proportion returned[16], and neither proportion (sent or returned) is statistically equal to 50%[17]. Alternatively, spouses could be exhibiting inequality aversion, which led them to equate individual final earnings. We can also reject this hypothesis, but only when women are in the designated Sender role. Where women are Senders, women earn, on average, 8,000 Ugandan Shillings. Men, as the Receiver, earn less at around 6,200 Ugandan Shillings. This difference is highly statistically significant[18]. However, when roles are switched, men as Senders earn on average 7,400 Ugandan Shillings, and women earn 7,370. We do not have enough evidence to reject the inequality aversion hypothesis when men are assigned to the role of Sender as the p-value is very large (t-statistic = 0.21, p-value = 0.8346).

Figure 3.10 shows the distribution of the proportional responses (r_r) made by 141

[16]Men: t-statistic = 2.79 (p-value = 0.0056). Women: t-statistic= 4.97 (p-value = 0.0000)
[17]Men: Sender t-statistic = -2.53 (p-value = 0.0124). Receiver: t-statistic= -6.35 (p-value = 0.0000). Women: Sender t-statistic = -4.5 (p-value = 0.0000). Receiver: t-statistic= -12.66 (p-value = 0.0000).
[18]t-statistic = 4.2125 (p-value = 0.0000).

Table 3.7: Treatment 1: Intrahousehold Outcomes

		Inter-Spousal Transfers	
		Sender [a]	Receiver [a]
Number of Players			
	Husbands	147	141
	Wives	147	141
Sub-Game Perfect Equilibrium Plays; Pareto Inefficient Outcome (Proportion)			
	Husbands	0.04	-
	Wives	0.04	-
Total Earnings [b]			
	Husbands	7429	6238
		[206.82]	[356.70]
	Wives	7993	7340
		[215.32]	[369.30]
Amount Transferred to Spouse [b]			
	Husbands	3490	3603
		[150.60]	[237.75]
	Wives	3238	3262
		[138.33]	[244.21]
Proportion Transferred to Spouse			
	Husbands	0.45	0.37
		[0.02]	[0.02]
	Wives	0.42	0.30
		[0.02]	[0.02]
Mean Tests for Differences of Husband vs Wife [c]			
	Husband - Wife (Amount)	251.70	340.43
		(0.2193)	(0.3187)
	Husband - Wife (Proportion)	0.03	0.07***
		(0.2474)	(0.0059)

[a] *Standard error in brackets*
[b] *Reported in Ugandan Shillings (UGX): 1 USD = 3693.515 UGX at the time of fieldwork*
[c] *p-values in parentheses; *** p<.01*

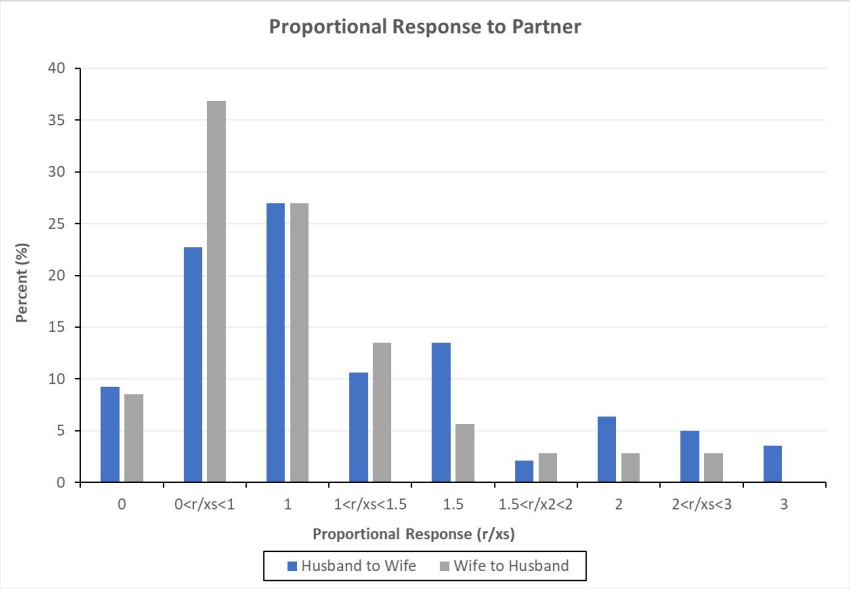

Figure 3.10: Condensed Distribution of Proportional Responses in Treatment 1

husbands to their wives, whom received a positive, tripled sum, $3x_s$. The same graph similarly shows the distribution of proportional responses from 141 wives to their husbands. Interestingly, 6 men and 6 women were sent a zero-sum from their spouse in the first move. Of these 12 participants, one male and one female belonged to the same household (that is, we have one household in the dataset that sent zero); the remaining 10 participants belong to different households and from different villages.

Theoretically, for a Receiver to exhibit reciprocity, it is required that they send back to the Sender as much as the Sender sent forward. Based on this logic, regardless of the amount sent, a return ratio of 1 thus signals reciprocity. For both spouses, we do appear to have a distinct mode at 1, which we designate the "Pure Reciprocity" ratio. This value is a possible focal point for spouses[19]. Using the least complicated fairness heuristic, some Receivers simply split what they have received in half (that is, the response ratio is 1.5). There is also some evidence supporting a more sophisticated fairness heuristic whereby players split evenly the surplus generated by the Sender's Trust plus the amount initially sent to them, returning two-thirds of the amount received. Overwhelmingly, however, participants are observed to have returned the amount initially sent to them, keeping the interest earned for themselves.

From Figure 3.10, we observe multiple responses falling below the threshold we call "Pure Reciprocity" (that is, $r_r/x_s < 1$). However, like Ciriolo (2007), equality of final pay-offs should rightly be considered a sufficient condition for reciprocity. That is, a minimum level of reciprocity may occur even when the amount sent back by the Receiver is strictly smaller than the amount sent forward by the Sender, as long as the "equal division" constraint is satisfied (assumed pay-off equality). Indeed, inequality-averse trustees do not reciprocate by equal sharing, but rather consider the amount the Sender keeps in their decision to reciprocate. For example, where

[19]Whether modal values serve as focal points for participants, or whether these precise values are associated with behavioural norms is subject to continued debate and investigation; see *inter alias*, the works of Robert Sugden.

initial endowments are assumed to be 8,000, the equal division return ratio is equal to 0 for values of the amount sent equal or below 2,000. When a sender sends 2,000, they keep 6,000. Hence a maximally inequality-averse recipient receiving three times the amount sent (6,000) would send back 0 to generate pay-off equality (6,000, 6,000)[20].

Overall, in terms of final earnings, women fare remarkably well; for every 1,000 Ugandan Shillings sent, they receive back an average of 2,500 Ugandan Shillings. Furthermore, a higher proportion of women are rewarded for "trusting" their husband than vice versa; this reward is in the form of higher final earnings as a Sender (their moving first), as illustrated in Table 3.8. "Trust Rewarded" refers to cases where the participant received back a greater sum than what they sent. "Trust Punished" refers to cases where the participant received back a lesser sum than what they sent.

Table 3.8: Final Earnings for Husbands and Wives in Sender Role*

	Trust Rewarded	Trust Punished
Male	10,371	5,833
	(2,602)	(1,330)
No. of Observations	35	55
Female	10,473	5,619
	(1,913)	(1,464)
No. of Observations	60	42

Notes: *Where endowments were the maximum possible amount; 8000 Ugandan Shillings. Standard deviation in parentheses.

We similarly examine the final earnings of husband and wife, decomposed by marriage stratification in Table 3.9. Again, we observe a higher proportion of women 'rewarded' for trusting their husbands (particularly those women married as a child), while more men are 'punished' for their trust. However, differences between genders and across the early and later marriage stratifications are not significant.

Table 3.9: Final Earnings for Husbands and Wives in Sender Role*

	Early Marriage		**Later Marriage**	
	Trust Rewarded	**Trust Punished**	**Trust Rewarded**	**Trust Punished**
Male	10,833	5,867	9,882	5,800
	(3,417)	(1,137)	(1,219)	(1,518)
No. of Observations	18	30	17	30
Female	10,296	5,667	10,643	5,583
	(1,660)	(1,138)	(2,147)	(1,692)
No. of Observations	27	18	28	24

Notes: *Where endowments were the maximum possible amount; 8000 Ugandan Shillings. Standard deviation in parentheses.

[20]We record eight observations where Sender and Receiver play this precise strategy.

In Appendices E and F, we conduct further mean testing and closely examine distribution across roles and genders, further corroborating what we have already discussed. First, we cannot differentiate between the sending behaviour of husbands and wives in the intrahousehold game; both appear to send very similar amounts. Second, for the response, we have evidence to suggest that the proportions returned are statistically different across gender, with wives returning significantly less than their husbands. Finally, when examining differences in sending and returning behaviour within couples, we obtain very clear evidence that husbands and wives respond proportionately to the first mover, with husbands more likely to reciprocate proportionately to the trust a wife exhibits first. However, when husbands move first, wives significantly return less; women are not as forthcoming in their reciprocity as men are in their trust.

Our experimental design allows us to directly compare the spousal behaviour observed in our intrahousehold treatment relative to a stranger counterfactual. For treatment 2, only 1% of participants chose to send their entire endowment to their playing partner, while almost 10% opt to send zero. The proportion of men who opt for the Pareto inefficient outcome is 15% and for women less at 5%. Descriptive and test statistics of the main experimental outcomes for treatment 2 are reported in Table 3.10. The results from the interhousehold Uganda sample are similar to those of Berg et al. (1995), and Barr (2003), whereby 10% or less of first players send zero. Given these similarities, and the similarities of subjects' average behaviour in Castilla (2015)'s paper, make us confident that misunderstanding is not driving our results.

In terms of positive sending behaviour, men and women appear to exhibit remarkably similar behaviour to one another. This is clear from the left-hand graph in Figure 3.11. Similar to treatment 1, we find no significant difference between male and female behaviour (albeit, a small average proportion was sent in treatment 2). In the Receiver role, women transfer 7% less than men back to their partner, and this difference is highly statistically significant. On average, when playing with an anonymous male, women send 32% and return 26%; for men, they send 31% to their anonymous female playing partner and return a higher proportion of 34%. For both treatments, the evidence thus far suggests that women exhibit less reciprocity than men.

Table 3.10: Treatment 2: Interhousehold Outcomes

		Interhousehold Transfers	
		Sender [a]	Receiver [a]
Number of Players			
	Men	147	139
	Women	147	127
Sub-Game Perfect Equilibrium Plays; Pareto Inefficient Outcome (Proportion)			
	Men	0.15	-
	Women	0.05	-
Total Earnings [b]			
	Men	7095 [159.89]	4830 [331.66]
	Women	7633 [181.14]	5449 [362.38]
Amount Transferred to Partner [b]			
	Men	2381 [141.99]	2403 [186.53]
	Women	2422 [128.04]	2126 [167.69]
Proportion Transferred to Partner			
	Men	0.31 [0.02]	0.34 [0.02]
	Women	0.32 [0.02]	0.26 [0.02]
Mean Tests for Differences of Men vs Women [b]			
	Men - Women (Amount)	-40.816 (0.8311)	276.893 (0.2739)
	Men - Women (Proportion)	-0.003 (0.9022)	0.08*** (0.0098)

[a] *Standard error in brackets*
[b] *Reported in Ugandan Shillings (UGX): 1 USD = 3693.515 UGX at the time of fieldwork*
[c] *p-values in parentheses; *** p<.01*

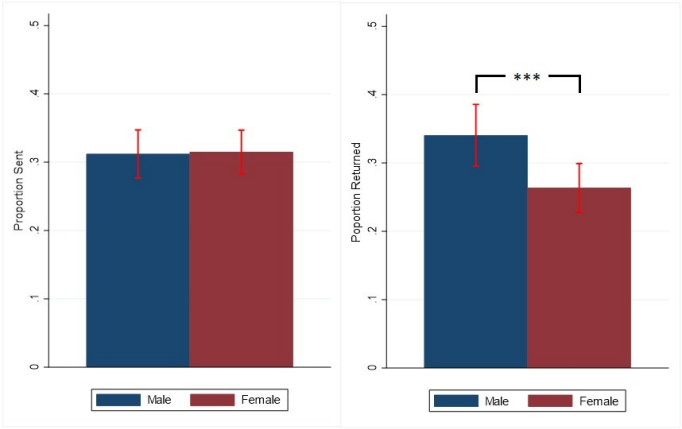

Figure 3.11: Mean Differences by Gender, Treatment 2
*** = statistically different at the 1% level. *Notes:* Red vertical whiskers are 95% confidence intervals, generated using a linear regression of contribution rates on gender. The test result indicated by the horizontal bracket at the top of the panel is derived from the same regression.

Between treatments 1 and 2, there are clear and significant differences in Sending behaviour; men transfer 13.8% more, and women transfer 10.7% more when paired with their spouse. Interestingly, we do not observe the same strong results with returning behaviour. While men do return 3.3% more when playing with their spouse than a female stranger, this result is not significant. For women, we observe a 4% difference between treatments, but this result is only weakly significant and quite a small fraction. Marriage, *per se*, is not entirely driving our reciprocity results, so much so that men do not differentiate in their reciprocity when interacting with their wife, or with their female neighbour.

Table 3.11: Mean Testing for Differences Between Treatments

	Men *(T1-T2)*	**Women** *(T1-T2)*
Proportion Sent	0.138***	0.107***
	(0.026)	(0.024)
Proportion Returned	0.033	0.040*
	(0.030)	(0.023)

Standard errors are in parentheses
*** p<.01, ** p<.05, * p<.1

3.6.2 Early Marriage, Trust and Reciprocity

Our analysis now moves to regression methodology. We estimate equations 3.4 and 3.6 (from pages 3-24 and 3-25) using the two behavioural variables generated from treatment 1 and 2 of the Trust Game: log of proportion sent by first-movers (Trust) and log of the proportional response by second-movers (Reciprocity)[21].

[21]We take the coefficients for proportions sent and returned out of log form when discussing results from regression analysis.

Throughout, results are presented in three panels: Panel A presents the distributions of proportions sent (Trust or Reciprocity) for the whole sample. Panel B focuses on the male sub-sample, and Panel C focuses on the female sub-sample.

Trust results are presented in Table 3.12 with column (1) presenting intrahousehold and column (2), interhousehold coefficients. For both treatments, early marriage households are less 'trusting' than households where the bride married as a legally defined adult. However, this difference is not significant for the full sample. Dividing the sample into male and female behaviour, we find that women who marry as children exhibit less trust towards their male spouse. Taking the female coefficient out of log form, women married below 18 trust their husbands 5.7% less than their adult counterfactuals. Men similarly exhibit less trust towards their wife, whom they married when she was a child; however, this result is small in magnitude, with the standard error exceeding the male coefficient. For the interhousehold treatment, estimates for the whole sample and for the female sample are not significant. However, estimates suggest that men who marry children are less trusting of women than those men who marry an adult female (approximately 6%).

Looking now to second-mover behaviour, regression results for Reciprocity are presented in columns (3) and (4) of Table 3.12. With no controls in the model, we find inconclusive evidence for early marriage, by both gender and treatment. With the exception of the male response in the interhousehold treatment, the size of the coefficients are small in comparison to their standard errors. Based on this evidence, we cannot say definitively what direction the early marriage mechanism is operating for intra- and interhousehold reciprocity.

Next, we investigate whether the differences described in the preceding section are owing to sub-sample variations in the participants' experiences during the experimental sessions or individual characteristics. Table 3.13 presents fixed-effects regression results with an extensive list of socioeconomic and experimental controls included in the model. Column (1) presents the intrahousehold Trust result, and column (2) present Trust results from the interhousehold treatment.

With controls included in the model, the coefficient for wives' trust increases in statistical significance (and the robust standard error decreases); women married below 18 transfer approximately 5.9% less than women married about 18. This difference is statistically significant at the 5% level. Similarly, we observe a negative coefficient for women in the interhousehold treatment; early marriage women transfer 4.2% less to a stranger counterfactual than those women married later *ceteris paribus*. The drop in magnitude and statistical significance from 5 to 10% implies that the effect of early marriage is more substantial in the household, albeit not confined to it. Overall, however, our results suggest that women married below 18 have a generalised propensity to exhibit less trust towards men. This conclusion adds weight to our earlier intuition that women's early relationship experience - derived from marriage - has a spillover effect onto other male members of her community.

Table 3.12: Trust, Reciprocity and Early Marriage: Fixed-Effects Model with No Controls

	Trust [a]		Reciprocity [b]	
	Intrahousehold Treatment (1)	Interhousehold Treatment (2)	Intrahousehold Treatment (3)	Interhousehold Treatment (4)
Panel A. Whole Sample				
Early Marriage	-0.033	-0.035	-0.006	-0.047
	(0.023)	(0.021)	(0.036)	(0.052)
Observations	294	294	282	266
Panel B. Male Sample				
Early Marriage	-0.009	-0.062*	0.001	-0.107
	(0.029)	(0.032)	(0.069)	(0.080)
Observations	147	147	141	139
Panel C. Female Sample				
Early Marriage	-0.055*	-0.007	-0.018	0.010
	(0.028)	(0.026)	(0.061)	(0.052)
Observations	147	147	141	127
Controls	No	No	No	No
Village Fixed-Effects	Yes	Yes	Yes	Yes

Robust standard errors are in parentheses, *** p<.01, ** p<.05, * p<.1
Notes: [a] Dependent Variable: log of proportion sent (log (1 + proportion sent)), where proportion sent = amount sent / initial endowment.
[b] Dependent Variable: log of proportional response (log (1 + proportional response)), where proportional response = amount sent / amount received from Sender.
In Panel A, the explanatory variable of interest is early marriage for the full sample of men and women; Panel B uses early female marriage for the male sub-sample (husband only first mover); and similarly, Panel C uses early female marriage for the female sub-sample (wife only first mover). This sequence is followed throughout, with all standard errors and p-values adjusted to account for inter-dependence within villages.

Similarly, for the interhousehold treatment, we observe that men who married a girl child transfer approximately 7.9% less in the stranger treatment that those men who married an adult bride. This result is statistically significant at the 5% level, and isolated purely to the interhousehold treatment. Running the fixed-effects regression on the whole sample (and controlling for gender), we find that early marriage households appear less trusting to strangers of the opposite sex by approximately 5.7%, and this result is highly statistically significant and robust to the inclusion of controls. This result was unexpected, and we cannot definitively say why such a strong result exists for the interhousehold treatment. We can only speculate that, since early marriage is associated with worse *ex-post* outcomes, early marriage households prefer the security of retained funds. While we control for household wealth - and find no significant effects - it is clear from the current modelling that early marriage is capturing something unique about trust for those of the opposite gender.

Table 3.13: Trust, Reciprocity and Early Marriage: Fixed-Effects Model with Controls

	Trust [a]		**Reciprocity** [b]	
	Intrahousehold Treatment	Interhousehold Treatment	Intrahousehold Treatment	Interhousehold Treatment
	(1)	(2)	(3)	(4)
Panel A. Whole Sample				
Early Marriage	-0.031	-0.059***	-0.048	-0.108
	(0.020)	(0.018)	(0.036)	(0.072)
Observations	256	256	244	230
Panel B. Male Sample†				
Early Marriage	-0.007	-0.082**	-0.028	-0.163
	(0.034)	(0.032)	(0.067)	(0.098)
Observations	118	118	112	112
Panel C. Female Sample†				
Early Marriage	-0.061**	-0.043*	-0.050	-0.034
	(0.023)	(0.022)	(0.066)	(0.072)
Observations	138	138	132	118
Controls	Yes	Yes	Yes	Yes
Village Fixed-Effects	Yes	Yes	Yes	Yes

Robust standard errors are in parentheses, *** p<.01, ** p<.05, * p<.1
Notes: [a] Dependent Variable: log of proportion sent (log (1 + proportion sent)), where proportion sent = amount sent / initial endowment.
[b] Dependent Variable: log of proportional response (log (1 + proportional response)), where proportional response = amount sent / amount received from Sender.
In Panel A, the explanatory variable of interest is early marriage for the full sample of men and women; Panel B uses early female marriage for the male sub-sample (husband only first mover); and similarly, Panel C uses early female marriage for the female sub-sample (wife only first mover). This sequence is followed throughout, with all standard errors and p-values adjusted to account for inter-dependence within villages.
† Full tables with regression coefficients for all control variables can be found in Appendix H on page 3-78

For Reciprocity, results are similarly reported in Table 3.13, columns (3) and (4) for the intrahousehold and interhousehold treatments. Where the bride married as a child, households exhibit less Reciprocity when playing an intrahousehold game *ceteris paribus*. Across all panels and for both treatments, early marriage appears to have a negative correlation to proportions sent in game. None of the coefficients, however, appear significant.

As a robustness check and to account for possible outliers in the exploratory analysis conducted in Table 3.13, we drop those observations where the age at first marriage exceeds 30 years for our sample of women. Given the unusual pattern of women marrying over 30 years of age in our sample, we chose this threshold for outlier analysis. A condensed version of results are presented in Table 3.14, divided into male and female sub-samples. Full tables with regression coefficients for all control variables can be found in Appendix H, pages 3-80 and 3-81.

Table 3.14: Outlier Analysis: Trust, Reciprocity and Early Marriage

	Trust				Reciprocity			
	Intrahousehold Treatment		Interhousehold Treatment		Intrahousehold Treatment		Interhousehold Treatment	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Male Sample								
Early Marriage	-0.009	0.011	-0.076**	-0.077**	-0.008	0.002	-0.060	-0.073
	(0.031)	(0.034)	(0.031)	(0.030)	(0.035)	(0.047)	(0.042)	(0.050)
Observations	143	121	143	121	137	115	136	116
Female Sample								
Early Marriage	-0.060*	-0.069***	-0.009	-0.048**	-0.010	-0.031	0.010	-0.010
	(0.028)	(0.021)	(0.027)	(0.021)	(0.027)	(0.034)	(0.020)	(0.031)
Observations	143	136	143	136	137	130	123	116
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Village Fixed-Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors are in parentheses, *** p<.01, ** p<.05, * p<.1

Outlier analysis confirms the negative effect of early marriage on trust behaviours; for women in the intrahousehold treatment, the coefficient for early marriage increases to 6.7%, and statistical significance is now at the 1% level[22]. For the male sample, intrahousehold results remain insignificant. In the interhousehold treatment, early marriage coefficients are again robust to outlier analysis, maintaining strong statistical significance for both male and female samples. There is still a trend in which women send less of their endowment to their husbands than to a stranger male counterfactual (6.7% less vs 4.7%). It is clear that women prefer the security of retained funds, but much more so when paired with their husbands. As in our initial exploratory analysis, results for reciprocity are insignificant throughout.

The final part to our estimation strategy involves estimating variations of equation 3.5 from page 3-24. By interacting early marriage with education, we are able to examine any heterogeneity within our sample regarding the nature of early marriage across the different educational levels. We report the coefficients on the early marriage variable and the interaction terms in Table 3.15 for Trust, and Table 3.16 for Reciprocity. For proportions sent, there is no differential early marriage gap between the increasing levels of education on trust behaviours for husbands and wives. In other words, the effect of early marriage on trust is the same among the education dummies alike. Similarly, we do not receive significant coefficients for the interacted early marriage and education dummies for returned proportions. The exception to this rule is for the husband intrahousehold sample and the interaction between early marriage and secondary education.

[22]Standard error = 0.021

Table 3.15: Trust, Early Marriage and Education Interactions

Trust	Husband Sample		Wife Sample	
Variables	**Intrahousehold**	**Interhousehold**	**Intrahousehold**	**Interhousehold**
	(1)	**(2)**	**(3)**	**(4)**
Early Marriage	0.014	-0.040	-0.098*	-0.046
	(0.068)	(0.096)	(0.045)	(0.042)
Some Primary	0.131**	0.013	0.031	0.116**
	(0.044)	(0.099)	(0.044)	(0.044)
Graduated Primary	0.106*	0.077	0.036	0.067
	(0.055)	(0.089)	(0.042)	(0.088)
Some Secondary	0.138***	0.012	0.083	0.041
	(0.042)	(0.102)	(0.057)	(0.058)
Tertiary	0.241*	-0.134	0.075	0.002
	(0.113)	(0.105)	(0.184)	(0.088)
EM*No Education	0.135	0.093	-0.005	0.106
	(0.119)	(0.156)	(0.076)	(0.076)
EM*Some Primary	-0.064	-0.032	0.072	-0.032
	(0.071)	(0.126)	(0.056)	(0.068)
EM*Graduated Primary	0.029	-0.083	0.027	-0.008
	(0.070)	(0.127)	(0.055)	(0.066)
EM*Some Secondary	-0.053	-0.053		
	(0.142)	(0.081)		
Observations	118	118	138	138
Controls	Yes	Yes	Yes	Yes
Village Fixed-Effects	Yes	Yes	Yes	Yes

Robust standard errors are in parentheses, *** p<.01, ** p<.05, * p<.1
Dependent Variable: log of proportion sent.

Table 3.16: Reciprocity, Early Marriage and Education Interactions

Reciprocity	Husband Sample		Wife Sample	
Variables	**Intrahousehold**	**Interhousehold**	**Intrahousehold**	**Interhousehold**
	(1)	**(2)**	**(3)**	**(4)**
Early Marriage	0.285	-0.295	0.200*	-0.089
	(0.184)	(0.317)	(0.103)	(0.129)
Some Primary	0.365***	0.295*	0.148	0.110
	(0.113)	(0.143)	(0.108)	(0.119)
Graduated Primary	0.310*	0.249*	-0.086	-0.213
	(0.171)	(0.128)	(0.131)	(0.182)
Some Secondary	0.496***	0.391**	-0.064	0.178
	(0.107)	(0.169)	(0.100)	(0.109)
Tertiary	0.056	0.247	0.193	0.126
	(0.222)	(0.342)	(0.273)	(0.164)
EM*No Education	0.346	0.504	-0.291	0.085
	(0.278)	(0.251)	(0.205)	(0.157)
EM*Some Primary	-0.271	0.271	-0.316	0.025
	(0.261)	(0.303)	(0.164)	(0.143)
EM*Graduated Primary	-0.227	0.183	-0.337	0.237
	(0.219)	(0.385)	(0.288)	(0.255)
EM*Some Secondary	-0.590**	-0.107		
	(0.218)	(0.398)		
Observations	112	112	132	118
Controls	Yes	Yes	Yes	Yes
Village Fixed-Effects	Yes	Yes	Yes	Yes

Robust standard errors are in parentheses, *** p<.01, ** p<.05, * p<.1
Dependent Variable: log of proportional response.

3.6.3 Gender Differences in Household

When evaluating the experimental evidence on gender differences in the Trust Game, results consistently indicate that women send less and return more (see, for example, Ashraf et al. (2006); Chaudhuri and Gangadharan (2007); Buchan et al. (2008); and Croson and Gneezy (2009)). It is clear, however, that the sample selection of this early literature is drawn exclusively from a university student population. Such sampling limits the results' generalisability, particularly if one wishes to extrapolate results to a lab-in-the-field, developing context. While by no means conclusive, for experiments implemented in populations other than students, women appear to send and return less than men (Schechter (2007); Bellemare and Kröger (2007); Castilla (2015)). These results are more consistent with our findings, and here we speculate several reasons why this may be the case.

Married couples engage in repeated daily interactions, which can be interpreted as their own unique 'game'. The experimental setting can be viewed, therefore, as just another round of this game. Consequently, women may send and return less to their husbands and receive more from them due to the ascribed gender roles within traditional households. Social norms regulate these gender roles and make it difficult for women to access resources. Women, therefore, may be unaccustomed to having access to their own money and so reluctant to give up what they have. Indeed, Barr (2003) found anecdotal evidence of this in her sample of women from rural Zimbabwe, who similarly exhibited less reciprocity in an experimental setting.

Traditional societies often clearly define individual household responsibilities (Deschênes et al., 2020). Broadly, women take charge of catering to daily needs (such as maintaining daily food supply), which require small yet frequent expenses. The husband's financial obligations include lodging, and assuming costs associated with healthcare and education. While variations exist in the division of tasks, this general pattern is fairly consistent across African societies, and the Bagisu are no exception. It may be customary, therefore, for husbands to give their wives an allowance for small expenses[23]. In some instances, however, the wife may have to ask for money for each specific item/need they may have. In the latter case, the opportunity for private retention likely encourages women to hold onto what money they receive. This might explain why income concealment is so common among women in developing countries, who frequently take advantage of asymmetric information for private gain (see, for example, Hoel (2015), Iversen et al. (2011) and Castilla (2019)). For the remainder of this section, we will examine some of the mechanisms driving the observed differences in sharing across genders. This investigation simultaneously contributes to a broader discussion on whether behaviour in the lab reflects the real-life circumstances of households.

Extensive means testing on our intrahousehold data supports a rejection of a unitary household model. Most participants retain money as individuals, forgoing the multiplier effect and reducing the amount earned from sending. Other

[23]It is worth noting that some compensation may occur outside the lab, which may crowd out other intrahousehold transfers.

researchers have found similar results in other developing countries, and there is increasing experimental evidence confirming that households do not maximise aggregate pay-off. Individually, it is clear that spouses pursue both separate and joint interests within the household. This conclusion aligns itself with Amartya Sen's model of cooperative conflicts, whereby Jackson (2013) surmises that households are "not unitary but internally divided by gendered interests and decision-making" (p.43).

Kandiyoti (1998) states that gender relations of women are highly variable over a life course and in different subject positions within the household. As Jackson (2013) describes: "women have multiple identities, and a familial sense of well-being may be high as mothers... [and] low as wives, in relation to husbands" (p.34). Identities change as parents and children age, and household expenditures similarly change (for example, paying school fees). By not sharing her endowment (in either role), wives could have a more familial sense of well-being; they retain what money they possess for household public goods. Therefore, categorising this private retention with a broad generalisation such as "self-interest" would be misleading. Disaggregating intrahousehold roles is key to moving beyond such behavioural generalisations.

From the survey data, it is clear that our sample of men and women follow traditional roles in the household, and are likely focal points for the division of responsibilities. Given the association with women's care for household members and men with provisioning, this may well induce men to act generously in line with ideals of competent adult masculinities (Jackson, 2013, p.14). Allocation to either Sender or Receiver role may trigger norms of male provisioning and female caring[24]. Private retentions may appear more obviously "selfish" to husbands, given their advance knowledge that the recipient is their wife whom, for them, is synonymous with household welfare.

Using the available survey data, we examine gender-specific mechanisms that drive the observed differences in sharing across genders. In Chapter 2 of this thesis, we demonstrated correlations between intrahousehold behaviour in the lab and self-declared behaviour of spouses. We thus feel confident in the crossover and consistency of our two data sources: experimental and survey. Using variants of Equations 3.4 and 3.6, we estimate the linear relationship between our behavioural variables of Trust and Reciprocity, and those variables pertaining to household money management.

Results for Trust behaviours are presented in Tables 3.17 and 3.18; the sample has been split, and we estimate variants of our model for men and women separately for ease of interpretation. Column (1) contains the results from regressing the log of the proportion sent on dummy variable for separate control of household finances. Column (2) includes variables for human capital investments made by the head of the household. In column (3), we add indicators for wife purchases of staple foods and clothing for household members. In column (4), we add our control variables for the individual, and in column (5), we add household composition and characteristic

[24]However, due to the plausible deniability mechanism, women may well conceal any retentions for personal use rather than for the household.

Table 3.17: Trust and Household Money Management: Husband Sample

Variables	**Husband**				
	(1)	(2)	(3)	(4)	(5)
Early Marriage	-0.012	-0.014	-0.010	-0.002	-0.017
	(0.030)	(0.028)	(0.030)	(0.034)	(0.034)
Separate Decision Making for Household Finances	-0.061	-0.065	-0.068	-0.091*	-0.129**
	(0.040)	(0.043)	(0.043)	(0.042)	(0.051)
Household Head Pays for School Fees		0.028	0.020	0.044	0.052
		(0.064)	(0.067)	(0.052)	(0.056)
Household Head Pays for Medical Expenses		-0.007	-0.004	0.010	0.011
		(0.048)	(0.048)	(0.034)	(0.027)
Wife Purchases Cooking Oils and Spices			-0.004	0.005	0.021
			(0.025)	(0.028)	(0.029)
Wife Purchases Clothing for Children			-0.039	-0.038	-0.030
			(0.071)	(0.072)	(0.066)
Wife Purchases Clothing for Male Household Members			-0.019	-0.013	-0.038
			(0.036)	(0.034)	(0.038)
Wife Purchases Clothing for Female Household Members			0.004	-0.009	-0.009
			(0.041)	(0.045)	(0.046)
Observations	147	147	146	133	123
R-Squared	0.019	0.022	0.031	0.106	0.194
Controls					
Individual Characteristics	N	N	N	Y	Y
Household Composition and Characteristics	N	N	N	N	Y
Village Fixed-Effects	Y	Y	Y	Y	Y

Robust standard errors are in parentheses. *** p<.01, ** p<.05, * p<.1

variables. This sequence is followed for men and women in their respective tables.

From Tables 3.17 and 3.18, we observe that separate decision-making for household finances correlates negatively with proportions sent in the Trust Game. This result is highly statistically significant for men, and the point estimate increases after including an extensive set of control variables accommodating both individual and household characteristics. Compared with joint decision-making, husbands transfer 13.8% less to their wives when there is separate decision-making for household finances, and this result is significant at the 5% level using model (5). One possible explanation for this result (and why this variable is not significant in men's observed second-mover behaviour) could be due to the strong masculine identities of Bagisu men. Examining the anthropological literature of Heald (1998) and Jackson (2013), male reputations are clearly tied to the perceived running of the household. Historically, all household wealth, including land, cattle, and monetary income from cash-cropping or wage-employment, "is at the absolute disposal of the husband" (Heald, 1998, p. 98). With this mindset, men may perceive the initial endowment as theirs and are accustomed to keeping income for themselves. For men, loss aversion may play a decisive role as they perceive the initial endowment as a private good. However, our study cannot confirm this finding; a broader sample frame where we directly compare the Bagisu and non-Bagisu identities could help substantiate this claim.

For women, separate decision-making is not significant; however, we observe some

Table 3.18: Trust and Household Money Management: Wife Sample

Variables	**Wives**				
	(1)	(2)	(3)	(4)	(5)
Early Marriage	-0.054*	-0.051	-0.056**	-0.047**	-0.031*
	(0.029)	(0.029)	(0.023)	(0.016)	(0.017)
Separate Decision Making for Household Finances	-0.024	-0.024	-0.038	-0.042	-0.050
	(0.029)	(0.031)	(0.026)	(0.028)	(0.030)
Household Head Pays for School Fees		0.002	-0.018	-0.016	-0.001
		(0.028)	(0.024)	(0.023)	(0.030)
Household Head Pays for Medical Expenses		0.006	0.016	0.015	-0.004
		(0.036)	(0.035)	(0.037)	(0.038)
Wife Purchases Cooking Oils and Spices			-0.071***	-0.072***	-0.064**
			(0.019)	(0.018)	(0.023)
Wife Purchases Clothing for Children			-0.054	-0.047	-0.053
			(0.043)	(0.042)	(0.036)
Wife Purchases Clothing for Male Household Members			0.045	0.044	0.039
			(0.054)	(0.048)	(0.042)
Wife Purchases Clothing for Female Household Members			0.059**	0.051*	0.070**
			(0.025)	(0.024)	(0.028)
Observations	147	142	136	136	131
R-Squared	0.042	0.039	0.110	0.140	0.175
Controls					
Individual Characteristics	N	N	N	Y	Y
Household Composition and Characteristics	N	N	N	N	Y
Village Fixed-Effects	Y	Y	Y	Y	Y

Notes: Robust standard errors are in parentheses. *** p<.01, ** p<.05, * p<.1

Table 3.19: Reciprocity and Household Money Management: Husband Sample

Variables	**Husband**				
	(1)	(2)	(3)	(4)	(5)
Early Marriage	-0.001	0.001	-0.011	-0.004	-0.020
	(0.069)	(0.067)	(0.069)	(0.067)	(0.062)
Separate Decision Making for Household Finances	-0.030	-0.031	-0.024	-0.116	-0.123
	(0.092)	(0.089)	(0.086)	(0.077)	(0.071)
Household Head Pays for School Fees		0.030	0.071	0.143	0.164
		(0.149)	(0.140)	(0.149)	(0.150)
Household Head Pays for Medical Expenses		-0.049	-0.069	-0.070	-0.070
		(0.147)	(0.153)	(0.126)	(0.132)
Wife Purchases Cooking Oils and Spices			0.059	0.129**	0.133**
			(0.045)	(0.045)	(0.057)
Wife Purchases Clothing for Children			0.176	0.158	0.221*
			(0.154)	(0.117)	(0.104)
Wife Purchases Clothing for Male Household Members			0.137	0.132	0.073
			(0.165)	(0.204)	(0.176)
Wife Purchases Clothing for Female Household Members			-0.067	-0.115	-0.136
			(0.100)	(0.104)	(0.118)
Observations	141	141	140	127	117
R-Squared	0.001	0.003	0.053	0.156	0.178
Controls					
Individual Characteristics	N	N	N	Y	Y
Household Composition and Characteristics	N	N	N	N	Y
Village Fixed-Effects	Y	Y	Y	Y	Y

Robust standard errors are in parentheses. *** p<.01, ** p<.05, * p<.1

Table 3.20: Reciprocity and Household Money Management: Wife Sample

Variables	**Wives**				
	(1)	(2)	(3)	(4)	(5)
Early Marriage	-0.020	-0.027	-0.028	-0.024	-0.020
	(0.063)	(0.057)	(0.062)	(0.064)	(0.068)
Separate Decision Making for Household Finances	0.025	0.019	-0.001	0.007	-0.018
	(0.049)	(0.057)	(0.063)	(0.062)	(0.066)
Household Head Pays for School Fees		0.027	-0.000	-0.002	-0.001
		(0.061)	(0.055)	(0.060)	(0.071)
Household Head Pays for Medical Expenses		-0.041	-0.031	-0.017	-0.020
		(0.070)	(0.082)	(0.084)	(0.104)
Wife Purchases Cooking Oils and Spices			-0.161***	-0.161***	-0.146**
			(0.046)	(0.050)	(0.057)
Wife Purchases Clothing for Children			-0.065	-0.066	-0.065
			(0.058)	(0.064)	(0.065)
Wife Purchases Clothing for Male Household Members			-0.032	-0.042	-0.036
			(0.095)	(0.098)	(0.082)
Wife Purchases Clothing for Female Household Members			0.079	0.075	0.091
			(0.072)	(0.083)	(0.087)
Observations	141	136	130	130	125
R-Squared	0.003	0.006	0.084	0.089	0.092
Controls					
Individual Characteristics	N	N	N	Y	Y
Household Composition and Characteristics	N	N	N	N	Y
Village Fixed-Effects	Y	Y	Y	Y	Y

Robust standard errors are in parentheses. *** p<.01, ** p<.05, * p<.1

interesting results when examining the dummy coefficients for women's responsibility for purchasing household necessities. Wives who buy spices and cooking oils for household consumption are less likely to send money to their husbands by 6.6%. This result is robust to the inclusion of control variables, only dropping slightly in significance after controlling for household characteristics and composition. Similarly, wives purchasing clothing for children correlates negatively to the proportions sent by women. While this clothing coefficient is not significant, our findings broadly align with Jackson (2013), insofar as women assume responsibility for household welfare. These women prefer the security of retained funds, as they will likely go on to make small yet frequent expenses catering to daily household needs.

Substantial weight is added to this finding when examining men's Reciprocity in the Trust Game, the results of which are presented in Table 3.19. The amount transferred back to wives is large and statistically significant for purchasing cooking oils and spices and purchasing children's clothing. For women's Reciprocity in Table 3.20, women again transfer less to their husbands if they are responsible for buying oils and spices for the household (15.7% less), which is significantly larger than their behaviour in the first move. The only difference is that, for the second move, the wife has received funds from her husband (she has no endowment herself). This may well induce her to behave in ways akin to her familiar role, as she has effectively received an 'allowance' (*per se*) directly from her husband.

Next, we explore early marriage and household financial management correlations

to determine whether these interactions help further explain intrahousehold contributions. For proportions sent in column 1 of Table 3.21, men are invariant to early marriages' interaction with household financial management, as throughout interactions are insignificant. Irrespective of the wife's age at first marriage, men transfer approximately 13.4% less if there is a separate household financial arrangement between spouses.

A highly statistically significant interaction exists between medical expenses and early marriage for women, presented in column (2) of Table 3.21. Those women married under 18 transfer approximately 25% more of their initial endowment compared to those women that marry later. Given that medical payments can be substantial (and frequent, given the high malaria risk in this region of Uganda), we believe that this result indicates women's dependence on men for large, essential household expenditures. For women married before the age of 18, this is particularly relevant; not only are men more likely to assume the cost of this expense (see Table 3.4, where differences between the marriage stratifications are statistically significant), but low age at first marriage is conducive to lower earning capacity. Child brides not only have fewer years of education at their disposal but, in general, are less likely to be self-employed (see Table 3.2) and, therefore, unlikely to have independent earnings. It is doubtful she can assume whole or joint responsibility for such a considerable expense, thus transferring more to her husband.

Earlier, we posed the argument that private retention of funds implied a sense of familial well-being for women. Based on the evidence we've gathered, we contend that this is still true for small household costs (such as oils and spices). For large expenses and for those women with low earning capacity (proxied by early marriage), the direction of familial well-being is to give more money to her husband if he assumes medical expenses for the household. Further investigation, bolstered by qualitative interviews, could be revealing and help guide future research in this area.

Of course, gaps remain in our understanding of trust and gendered household mechanisms. For example, explaining the significant and positive impact on proportions sent for those women who purchase clothing for female household members (Table 3.18 on page 3-43) would, at this point, be entirely speculative. Follow-up questions, such as 'do wives receive regular clothing allowances from their husbands?' and 'do wives receive clothing as a gift from husbands or other household members?' would complement this line of inquiry. Such knowledge gaps demonstrate that more work is required in this field, and claims necessitate further experimental evidence on intrahousehold trust. Clearly, women prefer the security of retained money when they are responsible for purchasing staple foods; however, disentangling trust from loss aversion is not easy. Understanding individual and collective loss aversion would undoubtedly complement the trust data, but was beyond the scope of this thesis. Nonetheless, we feel that we have obtained suggestive evidence that first-mover behaviour in the Trust Game - although far from predictable using contextual variables - roughly mirrors analogous real-life household behaviour.

Table 3.21: Early Marriage and Household Money Management

Variables	**Trust**		**Reciprocity**	
	Husband	**Wife**	**Husband**	**Wife**
	(1)	(2)	(3)	(4)
Early Marriage (EM)	0.031	-0.193***	0.082	-0.054
	(0.079)	(0.047)	(0.118)	(0.079)
Separate Decision Making for Household Finances	-0.144**	-0.093**	-0.055	-0.082
	(0.050)	(0.042)	(0.055)	(0.048)
Household Head Pays for School Fees	0.053	0.038	0.084	-0.005
	(0.088)	(0.055)	(0.074)	(0.040)
Household Head Pays for Medical Expenses	0.020	-0.129*	-0.005	-0.027
	(0.061)	(0.060)	(0.096)	(0.064)
Wife Purchases Cooking Oils and Spices	0.034	-0.063*	0.078	-0.082
	(0.047)	(0.036)	(0.082)	(0.057)
Wife Purchases Clothing for Children	-0.089	-0.121*	0.169	-0.010
	(0.096)	(0.058)	(0.120)	(0.057)
Wife Purchases Clothing for Male Household Members	-0.035	0.124	0.126	0.037
	(0.063)	(0.075)	(0.112)	(0.064)
Wife Purchases Clothing for Female Household Members	-0.017	0.032	-0.126	0.046
	(0.068)	(0.024)	(0.084)	(0.050)
EM*Separate Decision Making	0.082	0.006	-0.014	0.136
	(0.091)	(0.054)	(0.089)	(0.075)
EM*School Fees	-0.044	-0.067	-0.018	0.021
	(0.096)	(0.063)	(0.092)	(0.039)
EM*Medical Expenses	0.014	0.225**	-0.067	-0.012
	(0.073)	(0.086)	(0.131)	(0.080)
EM*Oils and Spices	-0.027	-0.050	-0.036	0.029
	(0.060)	(0.056)	(0.123)	(0.065)
EM*Clothing for Children	0.176	0.172	-0.137	0.001
	(0.127)	(0.090)	(0.261)	(0.103)
EM*Clothing for Males	-0.107	-0.115	-0.048	-0.107
	(0.097)	(0.100)	(0.158)	(0.154)
EM*Clothing for Females	-0.007	0.041	0.104	-0.034
	(0.087)	(0.052)	(0.084)	(0.070)
Observations	123	130	117	124
R-squared	0.236	0.275	0.212	0.183
Controls				
Individual Characteristics	Y	Y	Y	Y
Household Composition and Characteristics	Y	Y	Y	Y
Village Fixed-Effects	Y	Y	Y	Y

Robust standard errors are in parentheses. *** p<.01, ** p<.05, * p<.1

3.7 Discussion and Concluding Remarks

The importance of trust to both household economic activity and interpersonal relationships is much remarked, but the channels through which trust helps to increase household efficiency are still imperfectly understood. In this study, we identify early marriage as a channel through which trust and reciprocity can affect efficiency levels in the household.

Using sampling methods to obtain an equal representation of households where the bride married under age 18 and households where the bride married over 18, we generate directly comparable measures of the extent to which spouses exhibit trust and reciprocity with one another. Using a within-subject design, we employ a modified version of Berg et al. (1995)'s Investment Game to assess differences between early marriage and later marriage, and whether effects are isolated to the household by introducing a stranger counterfactual.

Overall, we find evidence that women married as children exhibit less trust to their husbands, as proportions sent are almost 6% lower than those women married over 18. This result is significant at the 5% level and robust to the inclusion of socioeconomic and demographic control variables, and robust to outlier analysis. We do not, however, observe an effect of early marriage on women's reciprocity. Given that first-mover behaviour determines the overall net benefit to the household (in so far as transferring her full endowment would triple the amount sent), our results imply a severe efficiency loss for the early marriage household. Furthermore, in a series of interactions between early marriage and education, we find that the slopes of the linear regression line between proportions send and early marriage are not significantly different for increasing education levels. The negative effect of early marriage on trust is the same across educational stratifications.

Throughout, coefficients for the interhousehold treatments have been monitored alongside coefficients for the interhousehold treatment. When investigating differences between intra- and inter-household trust, we find weak evidence suggesting that women married under age 18 send less to men from other households. Similarly, men who marry a bride that was under 18 exhibit significantly less trust to women from different households. We do not, however, observe any significant behaviour from men in our intrahousehold treatment.

Using concepts from (Bowlby, 1969), and Erikson (1963) on attachment and psychosocial development, and the interplay between trust, reciprocity and reputation for cooperating from Ostrom (2003), we find some evidence suggesting that early marriages form the psychological foundation for women's trusting behaviour with men. Cultural and institutional variables (which also have a distinct bearing on marital age) affect women's trusting behaviour. Further, these structural variables influence her expectations of how other's will behave. In non-anonymous or semi-anonymous settings, women can use the knowledge of their partner (either her husband or a male from another household) to

strategically determine the best option for both herself and her family.

Early female marriage is typically associated with low levels of participation in household decisions making. Unequal power dynamics influence cooperation between spouses. In the previous chapter, we identified a highly statistically significant correlation between increased age at marriage and increased intrahousehold cooperation for the same sample of households used in this chapters' investigation. As Ostrom (2003) states, a decrease in cooperation - due to a lower age at marriage - can lead to a "downward cascade" in trust behaviours, and our results appear to corroborate her intuition.

In addition to the early marriage literature, our study also contributes to the intrahousehold literature on gender differences in Trust Games. Here we identify four key findings: (1) We are unable to differentiate between the trusting behaviour of husbands and wives in the intrahousehold games, as both appear to send very similar amounts. For reciprocity, however, we observe that wives return significantly less than their husbands. (2) We reject a general 50/50 sharing hypothesis, as neither proportions sent or returned are statistically equal to 50%. We also reject the hypothesis for inequality aversion when wives are assigned to the Sender role and husbands to the Reciever Role. (3) Our results are inconsistent with the assumption of Pareto efficiency in household decision-making. Spouses in our sample do not attain the efficient household outcome, as less than 3% of spouses send their entire endowment. Final earnings average at 15,000 Ugandan Shillings, which constituted approximately 63% of maximum potential earnings. Finally (4), we find that women send less and receive more from their husbands when they are responsible for the purchase of oils and spices for household consumption.

This latter finding does bring into question whether the Trust Game is capturing pure indicators of intrahousehold trust and reciprocity; a frequently levied critique against the Berg et al. (1995) game (see, for example, Alós-Ferrer and Farolfi (2019)). Due to confounds with social preference, the game itself may be overestimating trusting behaviours. While we reject the 50/50 sharing and inequality aversion hypotheses, we are unable to reject the possibility of alternative, pro-social mechanisms, as this was beyond the scope of this thesis. Nonetheless, we do feel that we have captured an authentic dimension of trust and reciprocity in the lab.

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Appendix A: Trust Game Script for Sender Role

Research Assistants: all instructions in [**BOLD AND IN CAPITAL LETTERS**] please read to yourself.

[THE FOLLOWING INSTRUCTIONS SHOULD BE GIVEN TO ALL SUBJECTS SIMULTANEOUSLY WHILE THEY ARE SEATED IN THE EXPERIMENTAL ROOM.]

"■Welcome! Please make yourselves comfortable, and if you have a mobile phone we would appreciate if you could you please turn it off."

"In this portion of today's workshop, you will be playing with three different people; we will inform you before the start of each round who exactly you are playing with. In one game you will be playing with your [**READ AS APPROPRIATE**]: husband / wife; in another game you will be playing with a [**READ AS APPROPRIATE, ALWAYS OPPOSITE GENDER**]: man / woman who you do not know, and in another game, you will be playing with a [**READ AS APPROPRIATE, ALWAYS OPPOSITE GENDER**] man / woman who is either older, younger or of a similar age to you."

"At the very beginning of each round, you will receive 8000 shillings in an envelope. However, there is a chance that you receive an amount other than 8000 shillings; for example, you could receive anything between 0, 1000, 2000, 3000, 4000, 5000, 6000, and 7000. Whatever amount you receive, that money is yours."

"Now, for each person that we ask you to play with, you must decide how much of that money to keep for yourself, and how much you would like to send to the person you are paired with."

"Whatever amount you send to the person you are paired with will be tripled before reaching them."

"Therefore, if the initial amount of money you receive is 5,000 shillings and you decide to send 1,000 shillings to the person you are paired with, then they receive 3,000 shillings (remember, we multiply the amount you send by 3). If you send 2,000 shillings, the person you are paired with will receive 6,000 shillings. If you send zero shillings, the person you are paired with receives zero shillings."

"Later, after you have made your decision, the person you are paired with must then decide how much to give back to you from the tripled amount. The amount they send back to you is not multiplied. The person you are paired with has the option to send you zero."

"So, if you send 1,000 shillings to the person you are paired with, they receive 3,000 shillings in an envelope. The person you are paired with could decide to keep the 3,000 shillings for themselves and send you zero shillings. They could decide to split the 3,000 equally between you both, so you receive half of the 3,000 shillings. Or,

the person you are paired with could decide to send you more than half. If they split the money or send you more, this could mean that you make more money that you would have if you kept all the money for yourself."

"Let's look at some examples:"

"You may receive 8,000 shillings in your envelope." "You may decide to send 5,000 shillings to the person you are paired with and keep 3,000 for yourself." "The 5,000 shillings you may send to the person you are paired with will be tripled becoming 15,000 shillings."

- "If the person you are paired with decides to keep the money, you will receive 0 shillings back, and they will keep 15,000 shillings. You will lose the money you shared and have only what you originally kept for yourself which is 3,000 shillings."

- "If the person you are paired with decides to share the money equally, you will receive 7,500 shillings and the person you are paired with will keep 7,500 shillings. In total, you now have 10,500 shillings."

"Let's look at another example:"

"This time, you may receive 6,000 shillings in your envelope." "You may decide to send 2,000 shillings to the person you are paired with and keep 4,000 for yourself." "The 2,000 you may send to the person you are paired with will be tripled becoming 6,000 shillings."

- If the person you are paired with decides to keep the money, you may receive 0 shillings back, and they will keep 6,000 shillings. You will lose the money you shared and have only what you originally kept for yourself which is 4,000 shillings.

- If the person you are paired with decides to share the money equally, you may receive 3,000 shillings and the person you are paired with will keep 3,000 shillings. In total, you now have 7,000 shillings.

"What we have given you here are just examples. You should be free to make your own decisions."

"If you have any questions, please ask us now." **[PAUSE FOR ANY QUESTIONS FROM THE GENERAL AUDIENCE. ADDRESS THE ANSWERS TO THESE QUESTIONS TO THE AUDIENCE. IF NECESSARY, CLARIFY THE INSTRUCTIONS. REFRAIN FROM**

GIVING ANY ANSWERS THAT MAY INFLUENCE THEIR DECISIONS].

"If you would like to talk to us privately for clarification on the instructions or for any issue relating to this game, please raise your hand and we will come and talk to you individually and in private. Please do not be afraid to ask, we are here to help you. "

"Now we are going to come around the room and ask you individually some questions to see if you understood the instructions."

[RESEARCH ASSISTANTS MUST ASK PARTICIPANTS INDIVIDUALLY THESE TWO CONTROL QUESTIONS; SPLIT THIS TASK BETWEEN THE TWO OF YOU. MAKE SURE YOU CANNOT BE OVERHEARD BY OTHER PARTICIPANTS. IF NECESSARY, YOU AND THE PARTICIPANT SHOULD MOVE TO A DIFFERENT PART OF THE ROOM/OUTSIDE, SO YOU CANNOT BE OVERHEARD. MARK ON THE UNDERSTANDING CARDS PROVIDED IF THE PARTICIPANT CORRECTLY OR INCORRECTLY ANSWERED CONTROL QUESTION 1 AND CONTROL QUESTION 2. IF THE PARTICIPANT GAVE A WRONG ANSWER FOR AT LEAST ONE OF THE QUESTIONS, ASK HIM/HER WHAT WAS NOT CLEAR. ANSWER THEIR QUESTIONS AS CLEARLY AND ACCURATELY AS POSSIBLE. IF NECESSARY, CLARIFY THE INSTRUCTIONS; BUT NOT MORE THAN ONCE. FINALLY, PLEASE ANSWER WHETHER YOU THINK THE PARTICIPANT UNDERSTOOD THE INSTRUCTIONS WELL. MAKE SURE THAT EACH PARTICIPANT HAS BEEN ASKED THESE CONTROL QUESTIONS. PLEASE KEEP THESE UNDERSTANDING CARDS FOR THE NEXT GAME.]

Control Question 1

"In your envelope, you have 6,000 shillings. You decide to keep 2,000 shillings for yourself and give 4,000 shillings to the person you are paired with."

"If the person you are paired with decides to keep to money, how much do you earn in total? [2,000]"

"If the person you are paired with decides to send you all the money, how much do you earn in total? [14,000]"

"If the person you are paired with decides to split the money equally, how much do you earn in total? [8,000]"

Control Question 2

"In your envelope, you have 8,000 shillings. You decide to keep 6,000 shillings for

yourself and give 2,000 shillings to the person you are paired with."

"If the person you are paired with decides to send you all the money, how much do you earn in total? [12,000]"

"If the person you are paired with decides to keep the money, how much money do you earn in total? [6,000]"

"If the person you are paired with decides to split the money equally, how much do you earn in total? [9,000]"

[THE WORKSHOP ORGANISER WILL INFORM YOU OF THE ORDER OF ROUNDS. THE ORDER OF ROUNDS WILL CHANGE WITH EACH WORKSHOP SO PLEASE MAKE SURE YOU UNDERSTAND THE ORDER, SO YOU CAN TELL PARTICIPANTS THE CORRECT INFORMATION]

"Now, we are going to each give you two envelopes. One is empty and marked "SEND", and one contain an amount of money; only you know how much you have in this envelope, but it could be anything from 0 to 8000 shillings. This envelope is marked "KEEP". Please do not open your envelopes until we tell you to do so." **[HAND OUT ENVELOPES; AT THIS POINT, INFORM PARTICIPANTS INDIVIDUALLY WHO THEY ARE PLAYING WITH IN THIS ROUND; THEIR SPOUSE, STRANGER, OR STRANGER WITH AGE REVEALED. WAIT FOR EVERYONE TO RECEIVE THEIR ENVELOPES]**

"Now, please open your envelope and count how much money is inside." **[WAIT FOR ALL PARTICIPANTS TO OPEN THEIR ENVELOPE AND COUNT HOW MUCH THEY HAVE INSIDE. IF THEY NEED HELP COUNTING, PLEASE HELP THEM DISCREETLY]**

"Now please take out from the envelope the amount that you would like to send to the person you are paired with and place this money in the envelope marked "SEND". Again, please remember that the person you are paired with will receive three times the amount you have placed in this envelope. The amount left in your original envelope is the amount that you would like to keep for yourself. This envelope is marked "KEEP"."

"Please take this decision freely as we will not be seeing the decisions you make. We are going to turn our heads around while you take this decision. We will not open your envelopes. The workshop organiser in the next room will open the envelope and triple the amount in it. Also, please make sure that your neighbour cannot see your decision."

"The game ends for you once you have handed the envelopes to us."

[COLLECT ALL ENVELOPES AT THE SAME TIME. MAKE SURE

EVERYONE HAS FINISHED TAKING THEIR DECISION BEFORE COLLECTING THESE ENVELOPES. WHEN YOU HAVE COLLECTED ALL ENVELOPES, PLEASE ARRANGE ENVELOPES IN NUMERICAL ORDER (BY ID) AND PLACE THEM IN THE FOLDER. HAND THIS FOLDER TO THE WORKSHOP ORGANISER IN THEIR ROOM. ONLY LEAVE THE ROOM WHEN YOU HAVE ALL ENVELOPES. ONE RESEARCH ASSISTANT SHOULD REMAIN IN THE ROOM AT ALL TIMES.]

Appendix B: Trust Game Script for Receiver Role

Research Assistants: all instructions in [**BOLD AND IN CAPITAL LETTERS**] please read to yourself.

[THE FOLLOWING INSTRUCTIONS SHOULD BE GIVEN TO ALL SUBJECTS SIMULTANEOUSLY WHILE THEY ARE SEATED IN THE EXPERIMENTAL ROOM.]

"Earlier, we gave the person that you were paired with an amount of money that could have been anything between 0 and 8,000 shillings."

"We then asked the person you were paired with to make a decision; we asked them how much they would like to keep for themselves, and how much to send to you. You should know that the person you were paired with had the option to send you zero and keep everything for themselves."

"The person you were paired with was informed that any amount of money they sent to you would be tripled. We also informed them that you would make a decision about how much of the money you would return to them. You may of course decide to return zero."

"So, in this part of the game, you are going to receive whatever the person you were paired with sent you. We do not know how much is in your envelope. Whatever amount you receive in your envelope, that money is yours. It is up to you to decide what you would like to do with your money."

"Let's look at an example:" "Let's assume that in the envelope you receive from the person you were paired with, there is 3000 shillings. This means that before the Workshop Organiser tripled the amount sent, the person you were paired with sent you 1000 shillings."

"Now, it is your freedom to decide what you would like to do with this money. You may keep and/or send any amount that you would like. For example, you may decide to keep all the 3000 shillings and send nothing; or you may decide to send all the 3000 shillings to the person you are paired with. You may decide to divide the 3000 equally between you and the person you are paired with, so in this example you would keep 1500 shillings and you send 1500 shillings. Of course, you may decide to keep some money for yourself and send more to the person you are paired with, or you could send the person you are paired with some money, and you keep more for yourself."

"These are just examples of what you could do; nobody here is telling you what you should do. You are free to make your own decisions and there are no right or wrong answers."

"If you have any questions, please ask us now." [**PAUSE FOR ANY QUESTIONS FROM THE GENERAL AUDIENCE. ADDRESS THE**

ANSWERS TO THESE QUESTIONS TO THE AUDIENCE].

"If you would like to talk to us privately for clarification on the instructions or for any issue relating to this game, please raise your hand and we will come and talk to you individually and in private. Please do not be afraid to ask, we are here to help you."

[THE WORKSHOP ORGANISER WILL INFORM YOU OF THE ORDER OF ROUNDS. THE ORDER OF ROUNDS WILL CHANGE WITH EACH WORKSHOP SO PLEASE MAKE SURE YOU UNDERSTAND THE ORDER, SO YOU CAN TELL PARTICIPANTS THE CORRECT INFORMATION]

"Now, we are going to each give you two envelopes. One, is empty and marked "SEND" and one contains the tripled amount of what the person you were paired with sent you. This envelope is marked "KEEP". Please do not open these envelopes until we till you to do so."

[HAND OUT ENVELOPES; AT THIS POINT, INFORM PARTICIPANTS INDIVIDUALLY WHO SENT THEM THEIR ENVELOPE; THEIR SPOUSE, STRANGER, OR STRANGER WITH AGE REVEALED. WAIT FOR EVERYONE TO RECEIVE THEIR ENVELOPE BEFORE PROCEEDING]

"Now, please open your envelope. Count how much money is inside and make an estimate of how much the person you were paired with must have set you originally. We are going to come around the room and talk to you one by one to assist you with this."

[IT IS IMPORTANT THAT YOU MAKE SURE THAT ALL PARTICIPANTS FULLY UNDERSTAND HOW MUCH THEY HAVE THEY HAVE IN THEIR ENVELOPE, AND HOW MUCH THE PERSON THEY WERE PAIRED WITH SENT ORIGINALLY, BEFORE THE MONEY WAS TRIPLED. IF THE PARTICIPANT RECEIVED A LOT OF HELP, PLEASE INDICATE THIS ON YOUR UNDERSTANDING CARDS NEXT TO THE PARTICIPANTS' ID WITH A "Y" IN THE RELEVANT BOX. IF A PARTICIPANT DID NOT RECEIVE MUCH HELP, PLEASE MARK THE RELEVANT BOX WITH A "N".]

"Now please take out from the envelope the amount that you would like to send to the person you were paired with, and place this in the envelope marked "SEND". Please remember that any amount you place in this envelope will not be multiplied. The amount left in your original envelope is the amount that you would like to keep for yourself. This envelope is marked "KEEP"."

"If you require assistance, please raise your hand and we will come to you."

"Please remember that this is a personal decision and please make sure that your neighbour cannot see your decision."

"The game ends for you once you have handed the envelope to us."

[COLLECT ALL ENVELOPES AT THE SAME TIME. MAKE SURE EVERYONE HAS FINISHED TAKING THEIR DECISION BEFORE COLLECTING THESE ENVELOPES. WHEN YOU HAVE COLLECTED ALL ENVELOPES, PLEASE ARRANGE ENVELOPES IN NUMERICAL ORDER (BY ID) AND PLACE THEM IN THE FOLDER. HAND THIS FOLDER TO THE WORKSHOP ORGANISER IN THEIR ROOM. ONLY LEAVE THE ROOM WHEN YOU HAVE ALL ENVELOPES. ONE RESEARCH ASSISTANT SHOULD REMAIN IN THE ROOM AT ALL TIMES.]

Appendix C: Understanding Cards

DO NOT LET PARTICIPANTS SEE THIS UNDERSTANDING CARD

Participant Number	Trust Game: Correct answer? Yes = Y No = N — Control Question 1	Trust Game: Control Question 2	Trust Game: Do you thing the participant understood the instructions well? Y/N?	Trust Game: Did the participant receive a lot of help (counting money, making their decision etc.)? Y/N	Public Goods Game: Correct answer? Yes = Y No = N — Control Question 1	Public Goods Game: Control Question 2	Public Goods Game: Do you thing the participant understood the instructions well? Y/N?	Public Goods Game: Did the participant receive a lot of help (counting money, making their decision etc.)? Y/N
1 H1								
1 H2								
1 H3								
1 H4								
1 H5								
1 H6								
1 H7								
1 H8								
1 H9								
1 H10								
1 H11								
1 H12								
1 H13								
1 H14								
1 H15								
1 H16								

Figure 3.12: Understanding Card for Male Participants

DO NOT LET PARTICIPANTS SEE THIS UNDERSTANDING CARD

Participant Number	Trust Game: Correct answer? Yes = Y No = N — Control Question 1	Trust Game: Control Question 2	Trust Game: Do you thing the participant understood the instructions well? Y/N?	Trust Game: Did the participant receive a lot of help (counting money, making their decision etc.)? Y/N	Public Goods Game: Correct answer? Yes = Y No = N — Control Question 1	Public Goods Game: Control Question 2	Public Goods Game: Do you thing the participant understood the instructions well? Y/N?	Public Goods Game: Did the participant receive a lot of help (counting money, making their decision etc.)? Y/N
2 H1								
2 H2								
2 H3								
2 H4								
2 H5								
2 H6								
2 H7								
2 H8								
2 H9								
2 H10								
2 H11								
2 H12								
2 H13								
2 H14								
2 H15								
2 H16								

Figure 3.13: Understanding Card for Female Participants

Appendix D: Other Design Features

Our two dependent variables are the proportions of the endowment sent, relative to the participants' initial endowment - this is our measure of "trust", and the response ratio, expressed as a proportion of what was sent to the Receiver before multiplication - this is our measure of "reciprocity". It is clear from the relevant experimental literature that methodological variations across Trust Game have the potential to systematically influence the Senders' expectations or willingness to expose themselves to the vulnerable position of "trusting" their respective partner, and the extent to which Receivers' reciprocate exhibited trust. Here we will describe each of these variables in turn, explaining their potential for impacting observed behaviour in the lab using evidence from existing literature and address the measures we have taken to mitigate their impact on our results.

Both Roles

Our research interest in intrahousehold behaviour necessitates the collection of the same data from both household members; we therefore require our participants to play both the role of Sender and Receiver. While this approach offers the obvious advantage of collecting more testable observations on fewer subjects, there are possible implications for adopting this procedure. Indeed, Johnson and Mislin (2011) warn that investigators frequently ask participants to play both roles without reference to the possible systematic effects this method may have on trust behaviour.

Burks, Carpenter and Verhoogen (2003) specifically examine the effect of subjects playing both roles in a trust game. The authors implement a standard version of Berg et al. (1995)'s Investment Game, in which participants were randomly assigned to three treatments; control, two-role no-prior-knowledge, and two-role prior-knowledge. From their data, Burks et al. (2003) concluded that playing both roles reduces both trust and reciprocity[25] and attribute this finding to the "reduced responsibility" hypothesis. This hypothesis states that experimental subjects feel less obligation to their partner in the two-role protocols, as they know that their playing partner will have more than one opportunity to earn money in the Game. Subjects send and return less because the self-interest motivation overrides fairness motivations when asked to play both roles. An alternative suggestion to the "reduced responsibility" hypothesis could be that two-role play cues players to follow norms associated with competitive game-playing. Under this norm paradigm, one could consider it fair - rather than selfish - to compete aggressively by sending and returning less (Burks et al., 2003, p.210).

In their global meta-analysis of Trust Games, Johnson and Mislin (2011) similarly found evidence that two-role play has a negative impact on Reciprocity, but not for Trust behaviours. We refer to the Burks, Carpenter and Verhoogen (2003)

[25]Results also appear robust after controlling for demographic variables; the "negative effect of prior knowledge of playing both roles appears... robust, even after controlling for [an] inherent disposition toward trusting and trustworthy behaviour" (Burks et al., 2003, p.207)

study to explain this result. Using the Wilcoxon test statistic, the authors first conclude that their control treatment protocol elicits behaviour similar to that in the original Investment Game (Berg et al., 1995), but only for sending behaviour. Second, Burks et al. (2003) observed that the distribution of amounts sent in the "no-prior knowledge" treatment is similar to the control treatment distribution, and statistical tests and robust OLS regression later confirm this observation. For Receivers, however, the differences in fractions returned across treatments are highly significant[26] , with a negative coefficient for both prior and no-prior-knowledge treatments (albeit a larger, negative coefficient for the prior-knowledge group).

Given these results, we feel that engaging participants in a two-role trust game with no-prior-knowledge will not affect trusting behaviour; our participants are blind to the fact that they will be asked to repeat the Game, this time their role reversed. Of course, when informed they are playing the Receiver role, participants are no longer ignorant to the fact that they are playing both roles[27].This awareness may well induce the "reduced responsibility" hypothesis, but arguably to a lesser extent than if they were to play with complete, prior knowledge. We feel that this line of reasoning is reflected in Burks et al. (2003) reciprocity results, but not mentioned explicitly in their discussion.

The instructions for our modified version of the Trust Game are reproduced in their entirety in Appendix A and B. Instructions were purposely designed to be delivered in a two-step sequential manner, with all participants playing their role simultaneously (first Sender, then Receiver). At no point in the instructions do we mention that players will later be asked to switch roles; in other words, participants had no prior knowledge that they would be playing both roles in Trust Game. We are confident that two-role play does not impact trust behaviour, but we cannot eliminate the possibility of an effect for Reciprocity. This notwithstanding, we must stress that our experimental design is **internally consistent**; all male and female subjects played their respective role of Sender and Receiver simultaneously, albeit in different rooms. It is not our intention to conduct a comparative study with another paper, whereby we compare trust levels with another country or another sub-set of the Ugandan population. We are simply interested in examining the differences in, and between, tested households.

Random Payment

Arguably, the "traditional" and "conservative" approach in experiments with multiple decisions is to pay for the outcome from every decision made (Charness et al., 2016, p.141); this approach is sometimes referred to as the 'pay-all' method. An alternative approach would be to pay participants based on only one of the decisions they took in-game, determined randomly at the end of the session; this is

[26]The difference between the control treatment and the no-prior-knowledge treatments is significant at the 5% level; the difference between no-prior knowledge and prior knowledge is significant at the 5% level; the difference between the control treatment and the prior knowledge treatment is highly statistically significant at the 1% level.

[27]"...[participants] are not told that they will play the returner role until after the sender decision has been made" (Burks et al., 2003, p.198)

referred to as the 'pay-one' approach. There are associated challenges and benefits to both approaches, and relative advantage changes depending on the geographical context and laboratory setting.

Unlike Berg et al. (1995)'s original game, we decided that our version should involve random, rather than guaranteed, payments to subjects. Two methodological considerations drove this decision; first, we felt that random payment would complement our "Plausible Deniability" procedure, discussed earlier. Post-game, and with a 'pay-all' approach, there is a possibility (albeit slim) that a player could deduce what their partner had sent them in-game. This raises serious concerns regarding the possibility of retaliation, which the experimental team were adamant to avoid. Random payment, on the other hand, provides the participant with an opportunity to deny – with reasonable plausibility – that the final payment their husband/wife received was not a consequence of their (the partner's) decision, but from another decision taken that day.

The second reason why random payment has a relative advantage over a pay-all approach in our context stems from one of the core features of our design which provides Senders with large initial endowments. By providing the equivalent of one-to-two day's wages (with an opportunity to earn more via the decisions they are asked to take), we hope to provide a large enough incentive to prompt subjects to engage with - and carefully deliberate - each decision they face, as well as providing sufficient strategy choice for each player. Alongside considerations of spiralling experimental costs with a 'pay-all' approach, we felt that a multi-decision experiment where subjects earn money for a single, randomly-selected decision would eliminate the opportunity for wealth and portfolio effects (Bardsley et al., 2020).

Cubitt et al. (2001) stress that if random payments are incorporated into the experimental design, then it is imperative that subjects understand the random procedure one has adopted. We thus devoted a large proportion of the introductory remarks to explaining how final payments would be determined and demonstrating what the lottery system looked like. Subjects were made aware that they were to engage in a series of separate interactions, with each task (or interaction) assigned a number and an equal possibility of being randomly selected as their final payment.

Bottom (1998) argues that it is important to acknowledge the additional risk introduced to an experimental game by choosing a random payment procedure. A participant's final pay-out not only depends on whether their respective counterpart in each round is trustworthy, but is further expounded by an unrelated lottery. This 'additional risk' could make the average Sender less willing to pass money to their counterpart. However, evidence from the literature is encouraging, as there appears little to no behavioural differences between the two methods. Bolle (1990), in an early experimental exposition of "reward structures", found that the use of randomised payments versus payments for all subjects does not systematically affect behaviour in-game. More recent studies (in particular Beaud and Willinger (2015);Charness et al. (2016) and Clot et al. (2018)) arrive at similar

conclusions and provide a general recommendation that, while in some cases the pay-one procedure may "distort behaviour", in the majority of cases random payments are either equal to ("or sometimes superior to") pay-all methods (Charness et al., 2016, p.149).

Strategy Method

Prior to entering the field, it was the intention of the experimental team to implement a strategy method for the Receiver. This procedure would ask each participant to indicate how much they would return to their partner for each conceivable amount passed initially by the Sender. Such data collection would provide more information on reciprocity by obtaining a full reaction function for each Receiver.

The strategy method is a commonplace feature of many experimental designs. A comprehensive survey of past literature by Brandts and Charness (2011), which examines 29 datasets spanning 1993 to 2010, deliberate the strategy verses direct-response method. The authors conclude that, while more research is required, they hope that their review dispels the "impression that the strategy method inevitably yields results that differ significantly from results gathered using the traditional direct-response method" (Brandts and Charness, 2011, p.395).

In areas characterised by low levels of education and high illiteracy rates[28], one could compromise the understanding of the Game if the strategy method were to be included. Using the strategy method to elicit responses requires the participant to think in an unconventional way. People do not naturally think in terms of strategies; it may be hard for subjects to employ the necessary cognitive resources to address how they would respond to every conceivable situation. Posing hypotheticals likely alters the subject's perception of the Game, and the participant would consequently process their decisions differently from how they would under normal (non-laboratory) circumstances. It is much easier to think about what one will do given the situation one finds themselves in.

After piloting the experimental design, it was decided that the direct-response method is more appropriate given our context. Therefore, we asked our participants to indicate how much they would like to return or keep for themselves, based on the actual sum of money sent to them by their partner (albeit multiplied). In the pilot study, it was concluded that the strategy method compromised the understanding of the Trust Game; this was reflected in the in data and the main reason why pilot data cannot be included in the analysis. Furthermore, as pointed out by several experimental team members, the actual possession and handling of money is more analogous to real-world, money-handling situations. In other words, the direct-response method would elicit a more authentic response from participants than if one were to pose a hypothetical.

Double Blind

[28] 22% of our final sample were "completely illiterate", and 32% acknowledge "difficulty" in their ability to read and write.

The double-blind procedure ensures that neither the participants nor the experimental team (including the project lead) can trace decisions back to the individuals that made them. This method "protect[s] any observed results from being attributed to reputation, collusion, or threat of punishment" (Berg et al., 1995, p.127). In other words, the double-blind procedure in Berg et al. (1995) mitigated the possibility that participants merely exhibited trust to build or protect their reputation as a generous, agreeable individual – both with fellow members of their community and with the experimental team. Documented behaviour would thus be motivated by an expectation of some future pay-off, in addition to (or instead of) trust in their partner[29].

Despite every effort being taken to implement a legitimate double-blind procedure for our version of the Trust Game, this practice was not feasible for the Receiver component of the Game. The need to ensure player understanding was too crucial, and so the following was relayed to participants:

> *"Now, please open your envelope. Count how much money is inside and make an estimate of how much the person you were paired with must have set you originally. We are going to come around the room and talk to you one by one to assist you with this."*
>
> — Excerpt from Trust Game Script for Receiver Role (Appendix B)

Potential subject-experimenter effects must, therefore, be considered[30], albeit localised to the Receiver role. For example, there is a possibility that the relatively large response rates (expressed as a proportion of the amount sent) reflect the presence of such effects in our Ugandan experiment. When compared with the US undergraduate students observed by Berg et al. (1995) whose mean response rate is 0.89, our response rate for participants in Treatment 2 (interhousehold treatment) is slightly higher at 0.91; for Treatment 1 (intrahousehold treatment) the mean response is 1.02. Barr (2003)'s response rate is much higher at 1.28, and similarly acknowledges the lack of a double-blind procedure for Zimbabwean participants[31].

To minimise the impact of potential subject-experimenter effects, great care was taken to follow identical assistance procedures with each participant that requested help. Consequently, we acknowledge that different experimenter effects could have

[29]It is stressed in the introductory remarks that no project/s were going to come to this area due to the research being conducted that day. Participants were asked to keep this in mind when taking decisions.

[30]Previous studies give mixed results on whether subject-experimenter anonymity affects behaviour. It is difficult therefore to isolate its' overall impact (see Hoffman et al. (1994) for the first paper to directly address the impact of subject-experimenter anonymity and find that it does have an effect; Roth (1995) reviews several studies that find no effect). Barmettler et al. (2012) investigate whether the presence of double-anonymity leads to a systematic change in prosocial behaviour in three laboratory experiments. The authors find that the variation of anonymity does not significantly affect behaviour in the dictator, ultimatum or trust games.

[31]We must remember, of course, that the respective authors are each playing with different subject pools, different geographical contexts, and with slight variations to the overall structure of the Trust Game.

biased the results for the men and women who requested said help. Pre-empting this bias, we asked research assistants to discreetly record when a participant asked for a significant amount of help (specifically counting money and helping them understand how much was initially sent to them, prior to multiplication)[32]. The following prompt (to assistants only) was included in the script for the Receiver component of the Trust game:

> *"It is important that you make sure that all participants fully understand how much they have in their envelope, and how much the person they were paired with sent originally before the money was tripled. If the participant received a lot of help, please indicate this on your understanding cards next to the participants' ID with a "Y" in the relevant box. If a participant did not receive much help, please mark the relevant box with an "N"."*
>
> — Excerpt from Trust Game Script for Receiver Role (Appendix B)

Male and female Understanding Cards can be found in Appendix C. At no point were participants aware of this card, nor were they aware that receiving help was being monitored. In training, it was stressed to research assistants the necessity of being discreet when marking cards, and that cards should at no point, be seen by participants. With this data, we employ econometric methods ex-post to test and control for potential subject-enumerator bias.

[32]70 participants were documented as receiving assistance from research team; 21 male and 49 female.

D.1 Descriptive Statistics for Explanatory Variables

Table 3.22: Full Male Descriptive Statistics

Male Sample					
Variable	**Observations**	**Mean**	**Standard Deviation**	**Min.**	**Max.**
Early Marriage	147	0.503	0.502	0	1
Finances	147	0.143	0.351	0	1
School Fees	147	0.816	0.389	0	1
Medical Expenses	147	0.816	0.389	0	1
Oils and Spices	147	0.510	0.502	0	1
Children Clothing	147	0.116	0.321	0	1
Male Clothing	146	0.075	0.265	0	1
Female Clothing	147	0.272	0.447	0	1
Age	147	39.687	13.635	18	81
Bagisu	147	0.980	0.142	0	1
Church of Uganda	147	0.435	0.498	0	1
Self-Employed	147	0.401	0.492	0	1
Education (category):					
No Education	137	0.058	0.235	0	1
Some Primary	137	0.350	0.479	0	1
Graduated Primary	137	0.226	0.420	0	1
Some Secondary	137	0.299	0.460	0	1
Tertiary	137	0.066	0.249	0	1
Household Size	147	6.449	2.453	2	14
Male Children	147	1.918	1.611	0	6
Female Children	147	1.973	1.535	0	7
Wealth Index	136	-0.003	1.507	-3.715	5.409
Gender Index	144	-0.918	0.875	-3.198	1.642
Age Difference	147	5.946	4.366	0	18
Marriage Length	147	2.431	0.924	0.000	4.078
Order of Rounds	147	0.327	0.471	0	1
Received Help	147	0.150	0.358	0	1

Table 3.23: Full Female Descriptive Statistics

Female Sample					
Variable	**Observations**	**Mean**	**Standard Deviation**	**Min.**	**Max.**
Early Marriage	147	0.510	0.502	0.000	1.000
Finances	147	0.299	0.460	0.000	1.000
School Fees	143	0.664	0.474	0.000	1.000
Medical Expenses	145	0.772	0.421	0.000	1.000
Oils and Spices	147	0.578	0.496	0.000	1.000
Children Clothing	144	0.174	0.380	0.000	1.000
Male Clothing	139	0.137	0.345	0.000	1.000
Female Clothing	139	0.317	0.467	0.000	1.000
Age	147	34.272	12.773	17.000	75.000
Bagisu	146	0.938	0.241	0.000	1.000
Church of Uganda	147	0.395	0.490	0.000	1.000
Self-Employed	147	0.293	0.456	0.000	1.000
Education (category):					
No Education	147	0.156	0.365	0.000	1.000
Some Primary	147	0.469	0.501	0.000	1.000
Graduated Primary	147	0.156	0.365	0.000	1.000
Some Secondary	147	0.197	0.399	0.000	1.000
Tertiary	147	0.020	0.142	0.000	1.000
Household Size	147	6.503	2.555	2.000	14.000
Male Children	147	1.918	1.611	0.000	6.000
Female Children	147	1.973	1.535	0.000	7.000
Wealth Index	141	-0.472	1.364	-3.408	3.080
Gender Index	147	0.853	0.710	-1.226	1.642
Age Difference	147	5.946	4.366	0.000	18.000
Marriage Length	147	2.395	0.945	0.000	4.078
Order of Rounds	147	0.327	0.471	0	1
Received Help	145	0.331	0.472	0.000	1.000

Appendix E: First Mover Behaviour; Sender

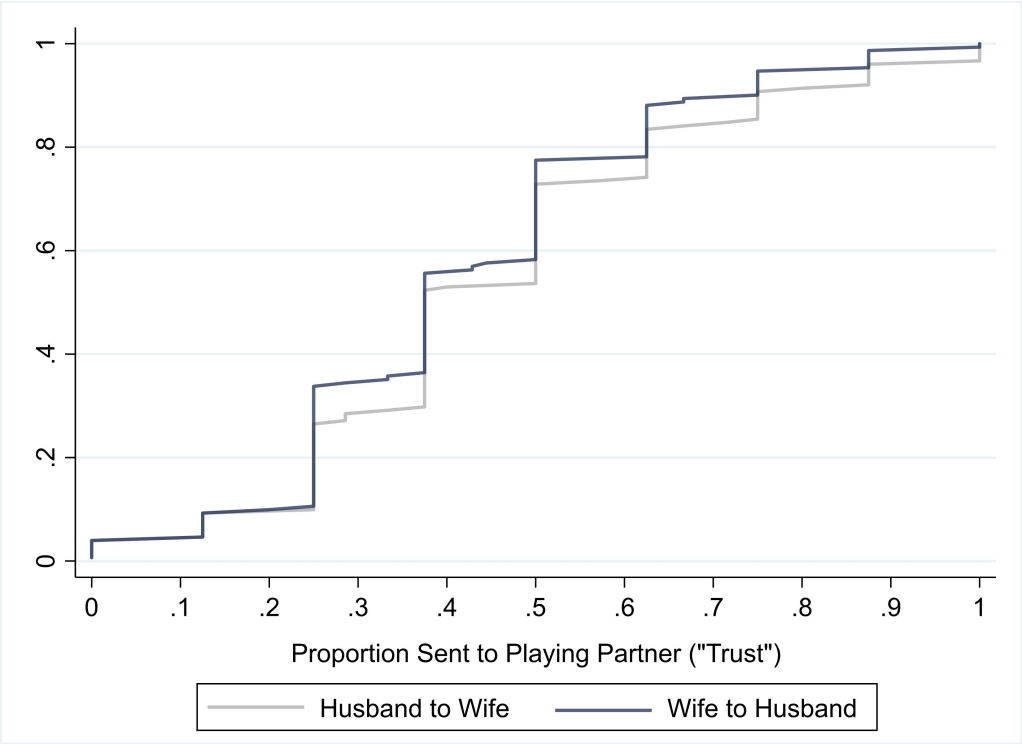

Figure 3.14: Cumulative Distribution Function for "Senders", by Gender in Treatment 1

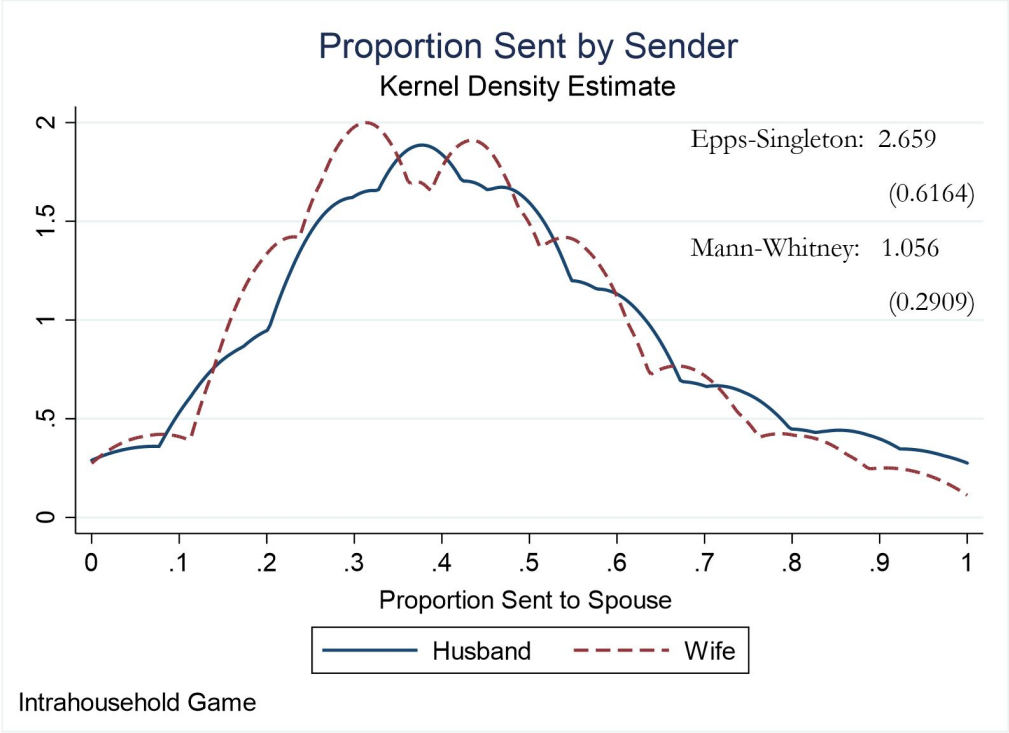

Figure 3.15: Estimated Probability Density Function for "Senders", by Gender in Treatment 1 with Epps-Singleton and Mann-Whitney test statistics (p-values in parentheses)

The results from the Epps-Singleton and Mann-Whitney test statistics in Figure 3.18 are further complemented from additional mean testing (between husband and wife behaviour), the results of which are presented in Table 3.25 below.

Table 3.24: Proportion Sent: Mean Testing Between Genders in Treatment 1

Mean Tests for Differences between Husband and Wife	
Levene's t-test for equality of variance (p-value)	0.318
t-test for equality of mean, equal variance assumed (p-value)	0.247
t-test for equality of mean investments, equal variance not assumed (p-value)*	0.247

*Using Welch's approximation.

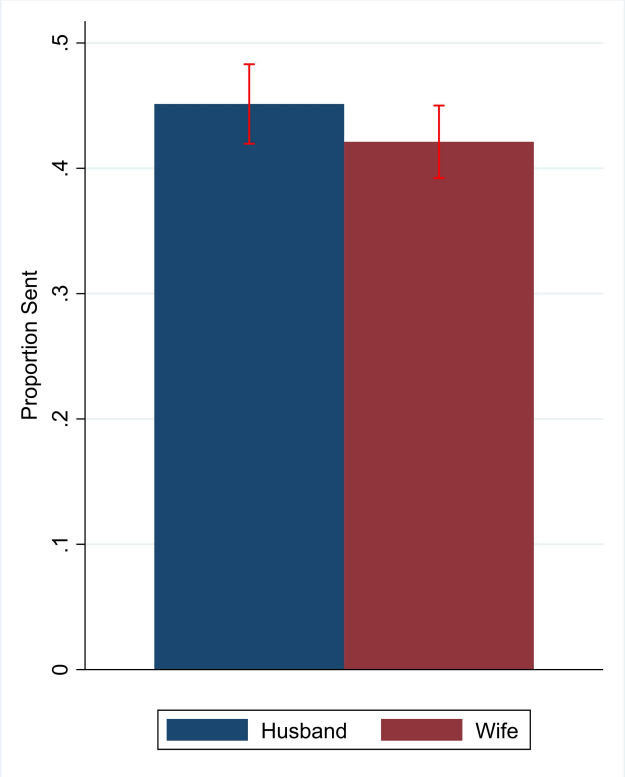

Figure 3.16: Proportion Sent: Mean Differences by Gender, Treatment 1

For husbands, the mean proportion sent to their spouse is 0.45 (with a standard deviation of 0.23); wives send a mean proportion of 0.42 (standard deviation of 0.21). Mean difference in sending behaviour between husbands and wives is not statistically significant.

From our extensive testing, we conlcude that for the proportions sent in Treatment 1, we are unable to differentiate between the first mover behaviour of husbands and wives; we do not have enough evidence to reject the null that the distribution functions underlying the two samples (i.e. for husbands and for wives) are identical.

Appendix F: Second Mover Behaviour; Receiver

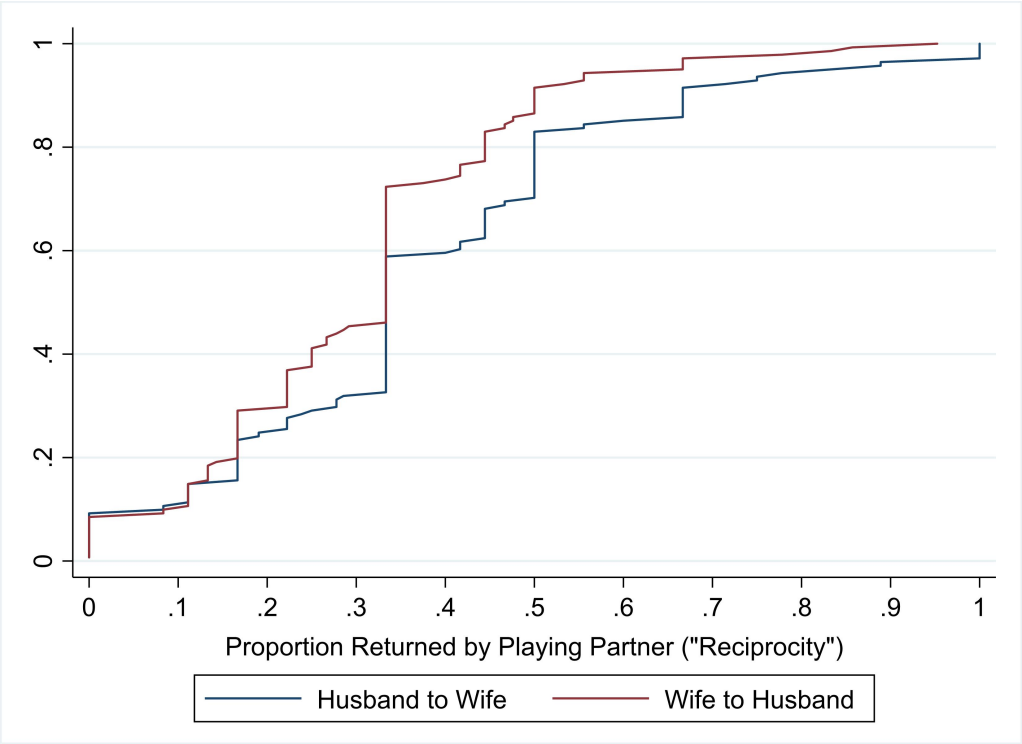

Figure 3.17: Cumulative Distribution Function for "Receivers", by Gender in Treatment 1

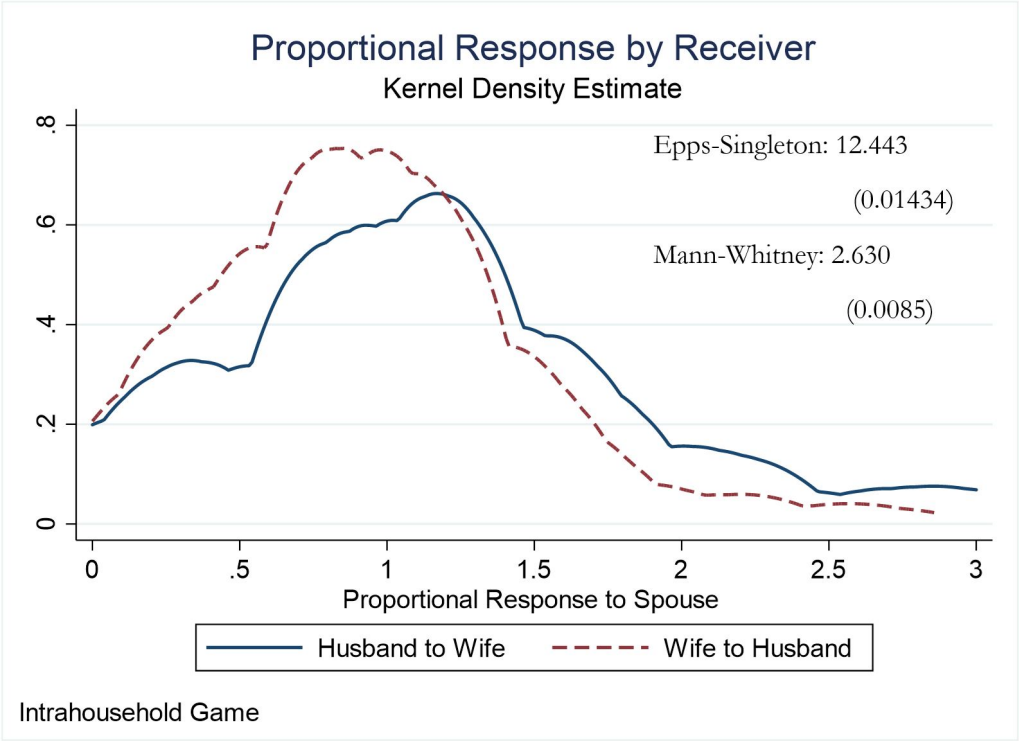

Figure 3.18: Estimated Probability Density Function for "Receivers", by Gender in Treatment 1 with Epps-Singleton and Mann-Whitney test statistics (p-values in parentheses)

For the response, when comparing husband and wife behaviour using the Epps-Singleton test, we can reject the null hypothesis at the 5% level (p=0.01135). We have evidence to suggest that the kernel density distributions of the proportion returned are statistically different across genders, with wives returning less than their husbands. This finding is confirmed by the two-sided rank-sum test (the Mann-Whitney test), which similarly reveals a significant difference between the behaviour of men and women, this time at the 1% level. The results from additional means testing are presented in the table below:

Table 3.25: Proportional Response: Mean Testing Between Genders in Treatment 1

Mean Tests for Differences between Husband and Wife	
Levene's t-test for equality of variance (p-value)	0.012
t-test for equality of mean, equal variance assumed (p-value)	0.006
t-test for equality of mean investments, equal variance not assumed (p-value)*	0.006

*Using Welch's approximation.

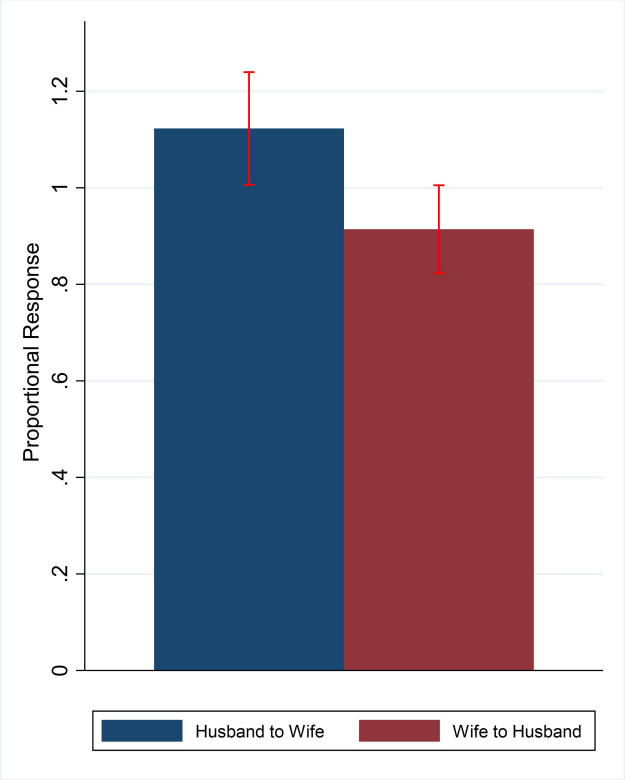

Figure 3.19: Proportional Response: Mean Differences by Gender, Treatment 1

For husbands, the mean proportional response is 1.13, and for wives is slightly less 0.91. The difference between husbands and wives is statistically significant at the 1% significant level.

Next, we examine results of differences in sending and returning behaviour within couples.

Table 3.26: Descriptive Reaction Function of Husbands to Wives

Amount Sent by Wife (Multiplied)	Amount Returned by Husband												
	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	12000	15000
0	6	0	0	0	0	0	0	0	0	0	0	0	0
3000	0	7	2	2	0	0	0	0	0	0	0	0	0
6000	6	3	12	10	5	0	2	0	0	0	0	0	0
9000	0	5	3	9	9	1	2	1	2	0	0	0	0
12000	2	2	8	1	3	3	8	0	0	2	1	0	0
15000	3	0	0	0	0	6	1	2	0	1	1	0	1
18000	1	0	1	0	1	3	0	0	0	1	1	0	0
21000	1	0	0	0	2	1	1	0	0	0	0	0	1
24000	0	0	0	0	0	0	0	0	0	0	0	1	0

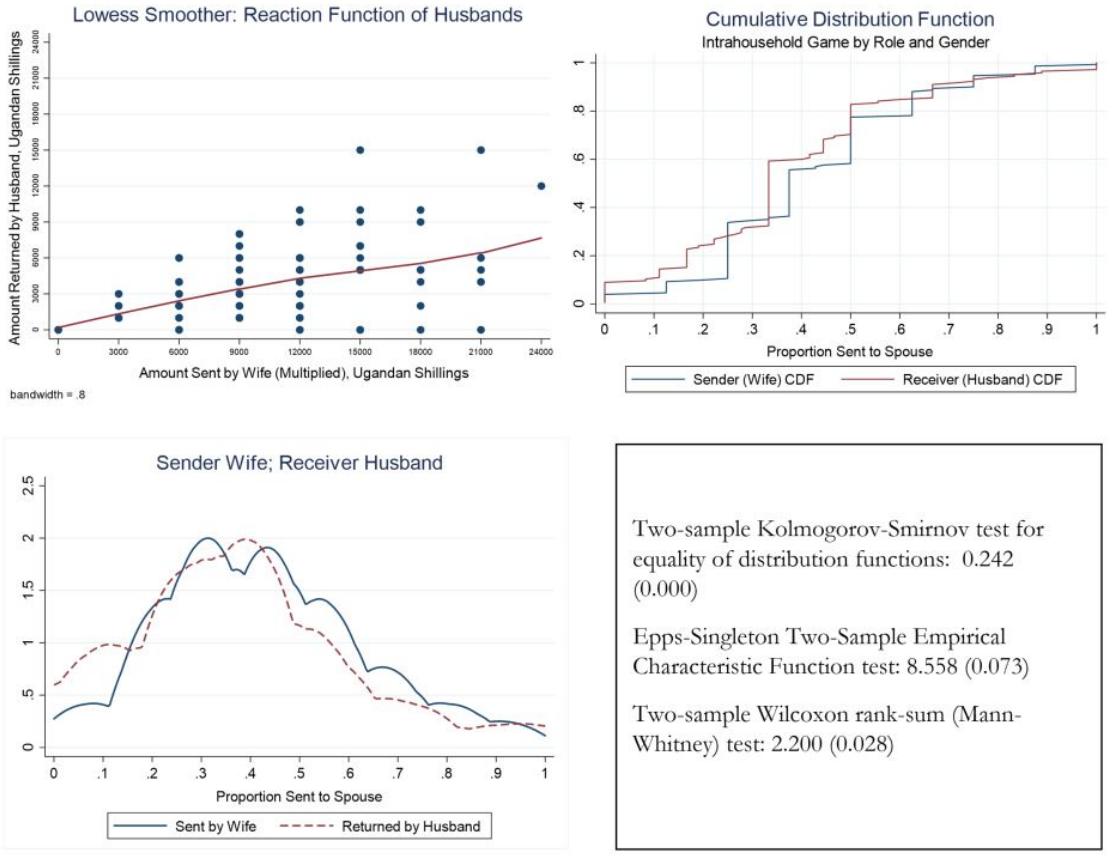

Figure 3.20: Graphics for Sender Wife and Receiver Husband

Top Left: Locally weighted regression of amount returned by husband on amount sent by wife, in Ugandan Shillings.
Top Right: Cumulative Distribution Function: Wife Sender, Husband Receiver.
Bottom Left: Kernel Density Estimation for Wife Sender and Husband Receiver.
Bottom Right: Distributional test statistics (p-values in parentheses).

Table 3.27: Descriptive Reaction Function of Wives to Husbands

Amount Sent by Husband (Multiplied)	Amount Returned by Wife												
	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	18000	20000
0	6	0	0	0	0	0	0	0	0	0	0	0	0
3000	0	7	1	0	0	0	0	0	0	0	0	0	0
6000	2	6	17	6	1	1	0	0	0	0	0	0	0
9000	4	3	10	4	9	3	0	1	0	0	0	0	0
12000	4	2	7	5	5	3	2	0	2	0	0	0	0
15000	1	0	5	0	3	3	1	2	1	0	0	0	0
18000	0	0	4	0	1	1	2	0	0	0	0	0	0
21000	1	0	0	1	0	0	1	0	0	0	2	1	1
24000	0	0	0	0	1	0	1	1	0	1	1	0	0

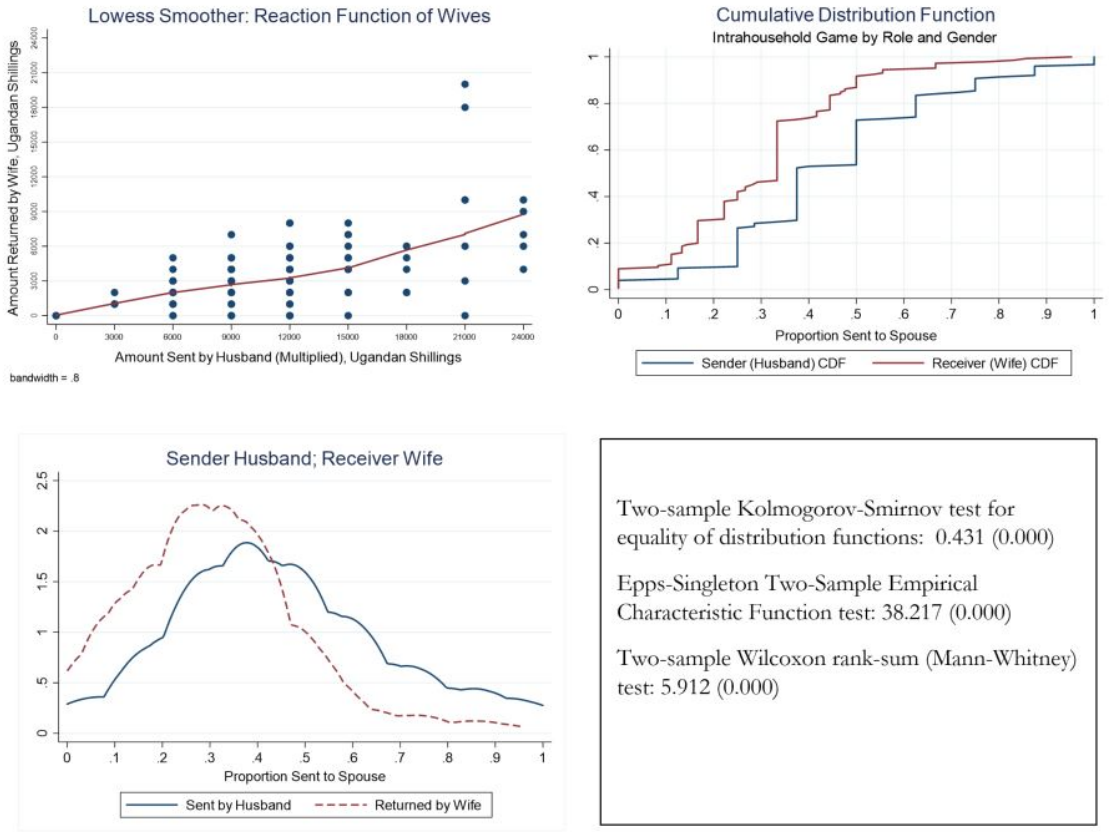

Figure 3.21: Graphics for Sender Husband and Receiver Wife

Top Left: Locally weighted regression of amount returned by wife on amount sent by husband, in Ugandan Shillings.
Top Right: Cumulative Distribution Function: Husband Sender, Wife Receiver.
Bottom Left: Kernel Density Estimation for Husband Sender and Wife Receiver.
Bottom Right: Distributional test statistics (p-values in parentheses).

In Figures 3.20 and 3.21, we present results of the differences in sending and returning behaviour within couples. Graphically, it is quite clear that husbands and wives respond proportionally to the first mover. From Figure 3.20 we observe that the husband's Cumulative Distribution Function (CDF) as the Receiver remains close (with some overlap) to the wife's CDF as the Sender; this trend indicates that husbands are more likely to reciprocate proportionally to the Trust that a wife exhibits first. Figure 3.20 similarly depicts the kernel densities for wives in the Sender role and husbands in the Receiver role. The ES test does find a difference in the two-sample distributions, but we can only reject the null at the 10% level (p-value = 0.073). However, when roles are switched, the ES test finds a (highly) statistically significant difference between the distributions of sending and returning behaviour from husbands and wives, respectively, with a p-value of 0.000. Women very clearly return less money to their husbands, which is corroborated by both the Mann-Whitney test statistic and from the CDF in Figure 3.21; the women's CDF as the Receiver is shifted to the left of men's CDF as the Sender, indicating that women are not as forthcoming in their reciprocity as men are in their Trust.

Appendix G: Interhousehold Experimental Results

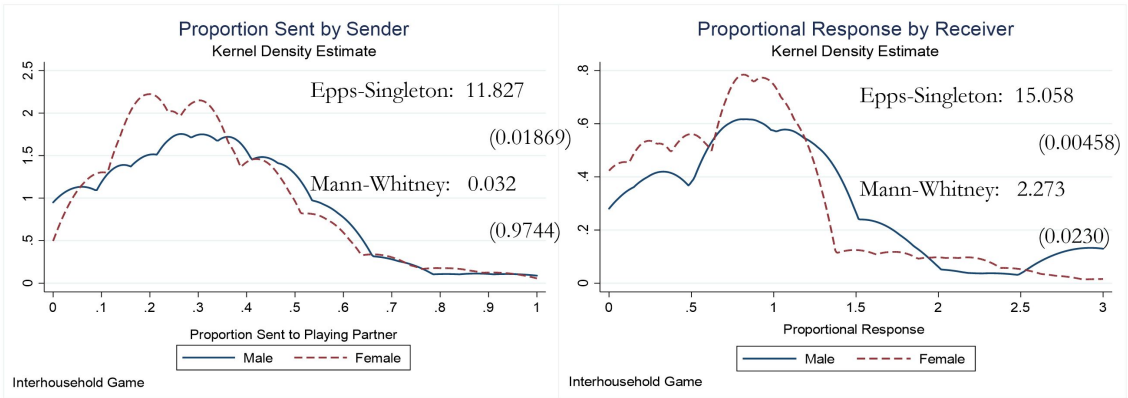

Figure 3.22: Estimated Probability Density Function by Gender and Role in Treatment 2 with Epps-Singleton and Mann-Whitney test statistics (p-values in parentheses)

Left: Proportions Sent, *Right*: Proportional Response

An Epps-Singleton test indicates that the difference in the distributions is significant at the 0.01 level for both Sender and Receiver behaviour. The Mann-Whitney result is significant for Receiver behaviour, but not for Sender (test statistic is very small at 0.032).

Table 3.28: Mean Testing Between Genders in Treatment 2

Mean Tests for Differences between Men and Women	**Sender**	**Receiver**
Levene's t-test for equality of variance (p-value)	0.193	0.063
t-test for equality of mean, equal variance assumed (p-value)	0.902	0.0098
t-test for equality of mean investments, equal variance not assumed (p-value)*	0.902	0.0090

*Using Welch's approximation.

Appendix H: Additional Regression Tables

Table 3.29: Intrahousehold Trust and Reciprocity: Full Model with Controls

	Husband Sample		**Wife Sample**	
Variables	**Trust** [a]	**Reciprocity** [b]	**Trust** [a]	**Reciprocity** [b]
	(1)	(2)	(3)	(4)
Early Marriage	-0.007	-0.028	-0.061**	-0.050
	(0.034)	(0.067)	(0.023)	(0.066)
Age	-0.001	0.002	-0.002	-0.003
	(0.002)	(0.008)	(0.003)	(0.005)
Some Primary	-0.008	-0.119	0.070*	0.133**
	(0.064)	(0.185)	(0.033)	(0.060)
Graduated Primary	0.018	-0.151	0.050	-0.130
	(0.083)	(0.196)	(0.045)	(0.105)
Some Secondary	0.010	-0.132	0.084	0.066
	(0.076)	(0.173)	(0.065)	(0.087)
Tertiary	0.121	-0.364	0.101	0.240
	(0.132)	(0.262)	(0.175)	(0.234)
Household Size	-0.002	0.008	-0.003	-0.017
	(0.005)	(0.025)	(0.014)	(0.014)
Wealth Index	0.012	0.028	0.006	0.005
	(0.013)	(0.026)	(0.013)	(0.026)
Gender Index	0.018	0.097	-0.021	0.024
	(0.022)	(0.060)	(0.013)	(0.036)
Age Difference with Spouse	0.001	-0.006	-0.001	0.006
	(0.004)	(0.012)	(0.004)	(0.008)
Male Children	0.003	-0.016	0.006	-0.006
	(0.013)	(0.023)	(0.012)	(0.026)
Female Children	0.006	0.013	-0.011	0.031*
	(0.009)	(0.027)	(0.014)	(0.017)
Bagisu	0.155	-0.020	0.035	0.010
	(0.104)	(0.233)	(0.087)	(0.120)
Church of Uganda	-0.023	-0.030	-0.016	-0.022
	(0.031)	(0.056)	(0.028)	(0.052)
Self-Employed	-0.012	0.009	-0.028	-0.045
	(0.034)	(0.085)	(0.038)	(0.058)
Marriage Length	-0.013	-0.028	0.035	0.081
	(0.026)	(0.106)	(0.044)	(0.059)
Constant	0.497	1.050**	0.367***	0.657***
	(0.288)	(0.356)	(0.068)	(0.128)
Observations	118	112	138	132
R^2	0.153	0.146	0.117	0.165
Village Fixed-Effects	Y	Y	Y	Y

Robust standard errors are in parentheses, *** p<.01, ** p<.05, * p<.1

Notes: [a] Dependent Variable: log of proportion sent (log (1 + proportion sent)), where proportion sent = amount sent / initial endowment.

[b] Dependent Variable: log of proportional response (log (1 + proportional response)), where proportional response = amount sent / amount received from Sender.

Standard errors and p-values adjusted to account for inter-dependence within villages.

Table 3.30: Interhousehold Trust and Reciprocity: Full Model with Controls

	Husband Sample		**Wife Sample**	
Variables	**Trust** [a]	**Reciprocity** [b]	**Trust** [a]	**Reciprocity** [b]
	(1)	(2)	(3)	(4)
Early Marriage	-0.082**	-0.163	-0.043*	-0.034
	(0.032)	(0.098)	(0.022)	(0.072)
Age	0.004***	0.005	-0.004*	0.002
	(0.001)	(0.007)	(0.002)	(0.004)
Some Primary	-0.080*	0.141	0.048	0.081
	(0.042)	(0.163)	(0.029)	(0.079)
Graduated Primary	-0.038	0.039	0.012	-0.091
	(0.066)	(0.208)	(0.074)	(0.110)
Some Secondary	-0.088	0.056	-0.007	0.149
	(0.081)	(0.250)	(0.059)	(0.083)
Tertiary	-0.214***	-0.076	-0.058	0.138
	(0.063)	(0.311)	(0.080)	(0.161)
Household Size	0.008	0.015	0.003	-0.025
	(0.010)	(0.014)	(0.007)	(0.025)
Wealth Index	-0.003	-0.016	-0.009	0.026
	(0.014)	(0.043)	(0.014)	(0.044)
Gender Index	0.023	-0.023	-0.014	0.072**
	(0.016)	(0.055)	(0.022)	(0.033)
Age Difference with Spouse	-0.001	0.002	0.001	0.019**
	(0.004)	(0.005)	(0.003)	(0.007)
Male Children	-0.000	-0.009	-0.006	-0.001
	(0.014)	(0.027)	(0.008)	(0.034)
Female Children	0.016**	0.005	-0.010	-0.006
	(0.007)	(0.027)	(0.011)	(0.031)
Bagisu	0.004	0.044	-0.030	0.035
	(0.025)	(0.090)	(0.042)	(0.099)
Church of Uganda	0.019	0.479	0.070	0.109
	(0.071)	(0.310)	(0.066)	(0.111)
Self-Employed	-0.014	0.039	-0.010	-0.162
	(0.031)	(0.102)	(0.045)	(0.098)
Marriage Length	-0.081***	-0.063	0.065***	0.125*
	(0.025)	(0.088)	(0.021)	(0.068)
Constant	0.603***	0.059	0.373***	0.116
	(0.171)	(0.507)	(0.089)	(0.174)
Observations	118	112	138	118
R^2	0.268	0.130	0.116	0.267
Village Fixed-Effects	Y	Y	Y	Y

Robust standard errors are in parentheses, *** p<.01, ** p<.05, * p<.1

Notes: [a] Dependent Variable: log of proportion sent (log (1 + proportion sent)), where proportion sent = amount sent / initial endowment.

[b] Dependent Variable: log of proportional response (log (1 + proportional response)), where proportional response = amount sent / amount received from Sender.

Standard errors and p-values adjusted to account for inter-dependence within villages.

Table 3.31: Outlier Analysis: Intrahousehold Treatment

	Husband Sample		**Wife Sample**	
Variables	**Trust**	**Reciprocity**	**Trust**	**Reciprocity**
	(1)	(2)	(3)	(4)
Early Marriage	0.011	0.002	-0.069***	-0.031
	(0.034)	(0.047)	(0.021)	(0.034)
Age	0.001	0.003	-0.002	-0.003
	(0.002)	(0.003)	(0.002)	(0.002)
Some Primary	-0.020	-0.036	0.060*	0.028
	(0.054)	(0.086)	(0.033)	(0.025)
Graduated Primary	0.053	-0.029	0.050	-0.069
	(0.063)	(0.094)	(0.046)	(0.052)
Some Secondary	0.055	-0.024	0.072	0.005
	(0.062)	(0.079)	(0.064)	(0.036)
Tertiary	0.193*	-0.119	0.102	0.070
	(0.101)	(0.113)	(0.159)	(0.075)
Household Size	-0.010	-0.002	-0.004	-0.010*
	(0.009)	(0.011)	(0.015)	(0.006)
Wealth Index	0.009	0.016	0.008	0.003
	(0.015)	(0.011)	(0.012)	(0.013)
Gender Index	0.009	0.045	-0.019	0.007
	(0.021)	(0.030)	(0.015)	(0.017)
Age Difference with Spouse	0.002	-0.002	0.000	-0.003
	(0.004)	(0.003)	(0.004)	(0.004)
Male Children	0.003	-0.005	0.003	-0.004
	(0.010)	(0.011)	(0.014)	(0.011)
Female Children	0.004	0.006	-0.013	0.007
	(0.010)	(0.011)	(0.014)	(0.008)
Bagisu	0.199**	0.017	0.028	0.015
	(0.087)	(0.086)	(0.075)	(0.058)
Church of Uganda	-0.029	-0.016	-0.017	-0.006
	(0.031)	(0.035)	(0.024)	(0.024)
Self-Employed	-0.035	-0.007	-0.030	-0.038
	(0.034)	(0.040)	(0.043)	(0.026)
Marriage Length	-0.024	-0.031	0.044	0.064*
	(0.027)	(0.039)	(0.040)	(0.032)
Constant	0.243	0.364**	0.352***	0.251***
	(0.198)	(0.146)	(0.080)	(0.069)
Observations	121	115	136	130
R^2	0.171	0.102	0.114	0.117
Village Fixed-Effects	Y	Y	Y	Y

Robust standard errors are in parentheses, *** p<.01, ** p<.05, * p<.1

Table 3.32: Outlier Analysis: Interhousehold Treatment

	Husband Sample		**Wife Sample**	
Variables	**Trust**	**Reciprocity**	**Trust**	**Reciprocity**
	(1)	(2)	(3)	(4)
Early Marriage	-0.077**	-0.073	-0.048**	-0.010
	(0.030)	(0.050)	(0.021)	(0.031)
Age	0.003**	0.002	-0.005**	0.000
	(0.002)	(0.003)	(0.002)	(0.002)
Some Primary	-0.050	0.082	0.043	0.029
	(0.042)	(0.076)	(0.033)	(0.041)
Graduated Primary	-0.029	0.055	0.006	-0.038
	(0.057)	(0.096)	(0.077)	(0.049)
Some Secondary	-0.061	0.056	-0.015	0.064
	(0.066)	(0.101)	(0.062)	(0.050)
Tertiary	-0.176**	0.039	-0.058	0.103*
	(0.064)	(0.152)	(0.072)	(0.052)
Household Size	0.014	-0.002	0.001	-0.012
	(0.011)	(0.008)	(0.006)	(0.011)
Wealth Index	0.002	-0.006	-0.006	0.015
	(0.012)	(0.019)	(0.014)	(0.022)
Gender Index	0.020	-0.011	-0.015	0.027
	(0.018)	(0.027)	(0.022)	(0.015)
Age Difference with Spouse	-0.001	0.005	-0.002	-0.008***
	(0.004)	(0.003)	(0.003)	(0.002)
Male Children	-0.003	-0.005	-0.007	0.003
	(0.013)	(0.012)	(0.009)	(0.016)
Female Children	0.001	-0.005	-0.013	0.000
	(0.012)	(0.012)	(0.011)	(0.015)
Bagisu	0.077	0.209	0.076	0.052
	(0.076)	(0.144)	(0.064)	(0.043)
Church of Uganda	-0.012	0.010	-0.026	0.018
	(0.032)	(0.039)	(0.038)	(0.042)
Self-Employed	-0.034	0.010	-0.005	-0.066
	(0.036)	(0.053)	(0.047)	(0.050)
Marriage Length	-0.077***	-0.025	0.079***	0.055
	(0.024)	(0.039)	(0.025)	(0.039)
Constant	0.287**	0.007	0.225**	0.036
	(0.118)	(0.210)	(0.078)	(0.066)
Observations	121	116	136	116
R^2	0.183	0.085	0.097	0.207
Village Fixed-Effects	Y	Y	Y	Y

Robust standard errors are in parentheses, *** p<.01, ** p<.05, * p<.1