

# Polygyny, Child Education, Health and Labour: Theory and Evidence from Mali

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# Polygyny, Child Education, Health and Labour: Theory and Evidence from Mali *

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**Abstract**

In this paper, we use the Demographic and Health Survey conducted in Mali to compare children in polygynous families and their counterparts in monogamous families. We also analyse the link between the mothers' order of marriage and their children's outcomes. We finally propose a theoretical model to rationalise our findings. Our results show that children in polygynous families are less enrolled in school, progress less at school and do less domestic household work compared to children from monogamous families. For polygynous families, we found that educational enrolment and progress of children of the first wife are higher than that of children of the second and subsequent wives. Moreover, weight-for-height and body mass index are both lower for children of first wives compared to children of second and subsequent wives. Children of first wives work more at home compared to children of second and subsequent wives. Our theoretical model predicts that if fathers discriminate against their first wives and if effort at school is positively correlated to the father's discrimination, then, on average, children of first wives will perform better at school but will consume less and will have a lower health outcomes compared to children of second wives.

Keywords: Family structure, Polygyny, Education, Health, Child labour, Mali.

JEL Classification: I14, J13, O12, O15.

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# 1 Introduction

Polygyny is a family structure in which men have multiple wives. It is legally practised in about 850 societies around the world (Hartung et al., 1982; Elbedour et al., 2002). However, little research in the economic literature has focused on the link between polygyny and children's outcomes. To our knowledge, no economic research has addressed the links between wives order in polygynous families and their children's outcomes. An economic analysis is necessary to understand the possible channels that drive the results and to provide policy recommendations.

The consequences of polygyny on children have been mostly discussed in the psychology and anthropology literature, usually with few observations (Strassmann, 1997; Sellen, 1999; Gibson & Mace, 2007; Omariba & Boyle, 2007; Lawson & Uggla, 2014; Strassmann, 2017; Uggla et al., 2017). Even in the psychology and anthropology literature, however, only a few studies have explored whether the effect of polygyny on children's outcomes depends on the mother's marriage order.

The effect of polygyny on children may strongly depends on the country studied. As pointed out by Elbedour et al. (2002), the function polygyny serves and the values the society attaches to polygyny determine the impact of polygyny on children. The cultural context and differences in cultural groups within a specific country may have an impact on the link between polygyny and children's outcomes. In Mali, approximately 40 percent of married women are in a polygynous union (Tertilt, 2005). To our knowledge, no studies have explored whether polygyny affects children's education and health or child labour in Mali. In particular, no study has focused on the link between a wife's marriage order and her children's outcomes in that country.

In this paper, we use the most recent Demographic and Health Survey (DHS) conducted in Mali in 2012-2013 to assess the link between polygyny and children's outcomes. We also analyse the link between the mother's order of marriage and her children's outcomes. Our focus is on three important dimensions of child outcomes: education, health and child labor. We use two indicators to measure child education outcomes: school enrollment and schooling-for-age (SAGE). We measure children's health status by weight-for-height and body mass index (BMI). We finally use three indicators to measure child labor: domestic household work status, work for family members status and work status outside the household. We also propose a theoretical and structural model to understand the possible mechanisms that drive our results.

Our empirical analysis shows that children in polygynous families are less likely to be enrolled in and to progress at school compared to their counterparts in monogamous families. Surprisingly, children in polygynous families also do less domestic household work compared to children from monogamous families. We also found that educational enrolment and progress are higher for children of first wives compared to children of second and subsequent wives. However, weight-for-height and BMI are both lower for children of first wives compared to children of second and subsequent wives. Additionally, children of first wives do more household work compared

to children of second and subsequent wives. In terms of time working outside the household, we found no significant differences between children of first wives and children of second and subsequent wives.

Our proposed model predicts that if the father discriminates against the first wife and if children's efforts at school are positively correlated to negative discrimination, then, on average, children of first wives will have better performance at school but will consume less and will have a lower health index compared to children of second wives. Understanding the discrepancies in children's outcomes and the possible channels that drive those results are relevant for policymakers when trying to provide solutions.

The rest of the paper is organised as follows. Section 2 presents a brief review of the psychology and anthropology literature that partly helps to build the intuition of our theoretical model. Section 3 presents the data used in our analysis. The empirical strategy is presented in section 4. In section 5, we present the results of our comparison of polygyny and monogamy. Results from children's outcome differences related to the mother's order of marriage are presented in section 6. Section 7 provides a discussion of our empirical results. The structural model is presented in section 8. Section 9 concludes.

# 2 Polygyny and Children's Outcomes: A Brief Review

## 2.1 Why Polygyny ?

One factor that may encourage a preference for polygyny is the number of children, especially in regions with a high mortality rate (Elbedour et al., 2002). In his study concerning Ghana, Klomegah (1997) observed that having many children contributes to the economic prosperity of the whole family.

Religion is also correlated to the choice of polygyny. Peterson (1999) and Klomegah (1997) observe in Niger and in Ghana, respectively, that Muslim individuals are more likely to prefer a polygynous family structure than adherents of other religions.

Education can also be associated with polygyny, but the effect strongly depends on gender and on the country chosen for analysis (Elbedour et al., 2002). Al-Krenawi (2001) and Peterson (1999) found no relationship between wives' education and their membership in polygynous families in Bedouin-Arab communities in Israel and in Niger, respectively. In contrast, Klomegah (1997) observed in Ghana that less-educated wives tend to be associated with polygynous families. Al-Krenawi & Lightman (2000) showed in a Bedouin-Arab community in Israel that the level of education of fathers in polygynous families was lower than that of fathers in monogamous families. Gage-Brandon (1992) also observed a similar result for fathers in Nigeria.

It is less likely for wives in polygynous families to work outside the household. In Ghana, Agadjanian & Ezeh (2000) found that the number of wives in polygynous families who work

outside the house is lower than that of monogamous families. In Bedouin-Arab communities, Al-Krenawi & Lightman (2000) found that almost no wives from polygynous families work outside the household.

### 2.2 Polygyny, Risk Factors and Children's Outcomes

Many risk factors can affect child outcomes in polygynous families. For example, children in polygynous families are more likely to witness conflicts and jealousy compared to children in monogamous families (Al-Krenawi, 1998; Elbedour et al., 2007). Those conflicts and jealousy can have a very negative impact on children's school achievements (Emery & O'Leary, 1982; Katz & Gottman, 1991) and aggression (Rutter, 1975; Cummings et al., 1984).

It is important to note that unhappiness of women in polygynous families may also have a negative impact on children. First wives (senior wives) are in general unhappier than second and subsequent wives. Using data from Ethiopia, Gibson & Mace (2007) found that the success of polygynously married women depends on their order of marriage. Husbands often discriminate against senior wives in terms of affection and redistribution of income inside the household. Discrimination among wives and children can lead to huge inequalities in children's outcomes. Discrimination can be explained by the age of senior wives compared to second and subsequent wives: Younger wives may be viewed by the husband as more attractive (Chrisler & Ghiz, 1993; Hurd, 2000). Discrimination usually manifests as a lack of affection and lower transfer of income for senior wives and their children. In many polygynous families, the father leaves his senior wife and her children. Paternal absence can lead to poor academic outcomes (Hetherington & Stanley-Hagan, 1986) and issues associated with income.

Polygynous families generally produce more children. Furthermore, women in polygynous families are less likely to work outside the home. It is therefore not surprising that the average income per person in polygynous families is less than that in monogamous families. Low income is usually associated with unhappiness, low education for children (Conger et al., 1997; Duncan et al., 1998), parental intolerance (Elder Jr et al., 1995; Duncan & Brooks-Gunn, 2000), health problems in children (Bradley et al., 1994; Hanson et al., 1996; Seccombe, 2000) and depression in children (Takeuchi et al., 1991).

## 3 Data

We use the 2012-2013 DHS conducted in Mali. The DHS is a national representative household survey that provides information on population, education, health and nutrition. About 30,000 households are surveyed. The DHS database contains information on household characteristics, such as marital status, the number of wives and the order of marriage of each wife in the household. The DHS database also contains information on children's characteristics, such as age, gender,

level of schooling and school attendance, and information on parental characteristics, such as age, education, ethnicity and religion. Our analysis focuses on children aged 0-14.

For education, we use children's enrolment at school as an indicator. We also use the SAGE of Psacharopoulos & Yang (1991) to measure progress at school. The indicator normalises the year of schooling by the difference between the child's age and the normal schooling entry age. In Mali, the normal schooling entry age is 6. As an example, under normal progression, a 9-year-old child will have 3 years of schooling; in that case, the indicator will be 100. An indicator below 100 indicates low progression. The indicator captures children who have repeated their class and those who enter school late.[1] The smaller the SAGE indicator, the lower the progression of the student at school.

$$\text{Progression=SAGE} = \frac{\text{Years of schooling}}{\text{Age-6}} \times 100 \tag{1}$$

For child health, we use the ratio of weight and height (weight-for-height) and the BMI, the ratio of weight in kilograms and height in metres squared, of each child.

We use three indicators to measure child labour. The first indicates whether the child performed domestic household work. The second indicates whether the child worked for a family member, and the third indicator provides information on whether the child worked for someone outside the household.

The controls used in the regressions with DHS data from Mali are the sex of the head of the family, the number of children in the family, the location of the household, the age of the child, the age squared of the child, the sex of the child, the age of the mother, the mother's education, the father's education, the religion of the family and the ethnicity group of the family.

Table 1 compares family and child characteristics of different types of families: monogamous, polygynous first wife and polygynous second and subsequent wives. Monogamous families have a lower average number of children and are younger and more educated than polygamous families. They are also more likely to live in Bamako.

Table 2 reports a summary of descriptive statistics for all dependent variables with respect to different types of families. Children in monogamous families are more likely to be enrolled in school and have normal academic progress compared to children in polygamous families. Children raised in monogamous families and children of first wives from polygynous families work more than children of second and subsequent wives, regardless of the type of work. The table also shows that children of first wives from polygamous families are in worse health than children from monogamous families and children of second and subsequent wives.

[1] The same indicator is also used in Ballón et al. (2018).

# 4 Empirical Strategy

We estimate two different models. In equation (2), we compare children in monogamous families with those in polygynous families. For child education, health and labour indicators, we estimate the following linear model:

$$Y_i = \alpha + \beta_1 Polygyny_i + \beta_2 X_i + \varepsilon_i, \tag{2}$$

where $Y_i$ represents the outcome considered for child $i$ . The term $Polygyny_i$ is a dummy variable taking the value of 1 if child $i$ belongs to a polygynous family and 0 otherwise. The term $X_i$ is a vector of socio-economic control variables, and $\varepsilon_i$ is an error term.

If $\beta_1$ is statistically significant, children who are part of a polygynous family differ from children in monogamous families for the measure studied.

For polygynous families, we also estimate equation (3), where we measure the difference, in terms of children's outcomes, between children of first wives and children of second and subsequent wives. For education, health and child labour indicators, we estimate the following linear model:

$$Y_i = \alpha + \beta_R WiveOrder_i + \beta_X X_i + \eta_i \tag{3}$$

where $Y_i$ still represents the outcome indicator for child $i$. The term $WiveOrder_i$ takes the value of 0 if child $i$ was born in a monogamous family, 1 if $i$ is a child of the first wife in a polygynous family and 2 if $i$ is a child of a second or subsequent wife. $X_i$ is a vector of socio-economic control variables, and $\eta_i$ is an error term.

If $\beta_R$ is statistically significant, then children from the wife of the rank considered differ from children in monogamous families for the measure studied.

All statistical analyses are weighted using sample weights provided by the DHS.

Results comparing children from polygynous families with their counterparts from monogamous families are presented in section 5. Section 6 analyses the differences between children related to their mother's order of marriage in polygynous families.

# 5 Result 1: Polygyny versus Monogamy

## 5.1 Children's Education and Polygyny

Table 3 presents the estimates of equation 2 when the variables of interest are the child's enrolment (column I and II) and progression in school (column III and IV), with and without the control variables.

### 5.1.1 Children's Enrolment and Polygyny

Column (I) of table 3 shows that being a child in a polygynous family reduces the likelihood of being enrolled in school by 8.8 percentage points compared to children in monogamous families. Column (II) of table 3 controls for child and parental characteristics. Interestingly, our conclusion is not altered.

In addition, for male children, the likelihood of being enrolled in school is 4.6 percentage points higher compared to that of female children. We also find that having a man as head of the family reduces the likelihood of children being enrolled in school by 5.8 percentage points. Column (II) of table 3 shows that when the household is in Bamako, the probability of children being enrolled in school increases by 26 percentage points. Education of the parents also has a positive impact on school enrolment. As shown in column (II) of table 3, each additional year of schooling for mothers increases the likelihood of children being enrolled by 1.5 percentage points, and each additional year of schooling for fathers increases the likelihood by 2.7 percentage points. Being Muslim decreases the likelihood of children being enrolled by 5.5 percentage points in comparison to other religious affiliations. Finally, being in a specific ethnic group may also have an impact on school enrolment for children. Column (II) of table 3 shows that being part of the Bambara ethnic group increases the likelihood of being enrolled by 4.5 percentage points.

### 5.1.2 Children's Progression in School and Polygyny

Column (III) of table 3 shows that being a child in a polygynous family reduces the education progression indicator by 10.6 units compared to children in monogamous families. Column (IV) of table 3 controls for other socio-economic variables. Our conclusion is not altered.

Column (IV) also reports that being male increases the progression indicator for children by 3.2, but having a man as head of the family reduces the progression indicator by 7.7. Column (IV) of table 3 shows that having a house located in Bamako increases the progression indicator for children by 28 in comparison to school enrolment when the house is located outside of Bamako. Education of the parents also has a positive impact on progression at school. As shown in column (IV) of table 3, each additional year of schooling for mothers increases the progression indicator of children by 1.9, and each additional year of schooling for fathers increases the progression indicator by 3.9. Being affiliated with the Muslim faith decreases the progression indicator for children by 7.6. Finally, being in a specific ethnic group does not have a significant impact on the progression indicator for children.

## 5.2 Children's Health and Polygynous Families

To compare the health of children from polygynous families to that of children from monogamous families, we use weight-for-height and BMI, or weight-for-squared-height. Table 4 shows that in

terms of weight, children in polygynous families do not differ from those in monogamous families. We also found that the number of children in the family has an impact on weight-for-height and BMI; an additional child increases both indicators by 2.2 and 2.5, respectively.

## 5.3 Child Labour and Polygynous Families

Table 5 presents the estimates of model 2 when the variable of interest is children's labour.

### 5.3.1 Child Works in the Domestic Household

Column (II) of table 5 presents the results obtained after controlling for household, child and parent characteristics. Being a child in a polygynous family reduces the likelihood of doing domestic household work by 2.3 percentage points compared to that of a child in a monogamous family. The reason may be that there is less household work to do when there are many people at home.

Column II shows that an additional child in the family reduces the likelihood of doing domestic household work by 0.5 percentage points. Moreover, being male reduces the likelihood of doing domestic household work by 20.9 percentage points. Finally, parents' education also has a positive impact on reducing children's domestic household work: An additional year of schooling for fathers reduces the likelihood of children doing domestic household work by 0.9 percentage points.

### 5.3.2 Child Works for Another Family Member

Column (IV) of table 5 presents the results obtained regarding work done for a family member, after controlling for other characteristics. Being a child in a polygynous family does not have any impact on the likelihood of working for another family member compared to that of a child from a monogamous family.

As shown in column (IV), one additional year of schooling for parents reduced the likelihood of the child working for another family member by approximately 0.5 percentage points. Column (IV) of table 5 shows that being part of the Bambara ethnic group increases the likelihood of working for another family member by 1.7 percentage points compared to that of other ethnic groups.

### 5.3.3 Children Work for Someone Outside the Household

Column (VI) of table 5 presents the results obtained for work done by children for someone outside the household, after controlling for other characteristics. As shown, being a child in a polygynous family does not have any impact on the likelihood of working for someone outside the household compared to results obtained for children from monogamous families.

However, the location of the household and the ethnic group of the family play a significant role. Being located in the big city of Bamako reduces the likelihood of children working for someone

outside the household by 2.3 percentage points compared to that of other cities and villages. Column (IV) also shows that being part of the Bambara ethnic group increases the likelihood of working for someone outside the household by 2.2 percentage points compared to that of other ethnic groups.

# 6 Result 2 : Mother's Order of Marriage and Children's Outcomes

## 6.1 Children's Enrolment, Children's Progression and Their Mother's Order of Marriage

Table 6 presents the estimates of equation 3 when the variables of interest are children's enrolment (column I and II) and progression in school (column III and IV).

### 6.1.1 Children's Enrolment and Their Mother's Order of Marriage

Column (I) of table 6 shows that being a child of the first wife in a polygynous family reduces the likelihood of being enrolled in school by 8 percentage points compared to that of children from monogamous families. The reduction is 9.8 percentage points for children of second wives. We also observed that the reduction is greater for children of second and subsequent wives compared to those of first wives in polygynous families.

Column (II) of table 6 controls for other household, child and parent characteristics. We still observe a similar result: The reduction is 2.6 percentage points in the case of the first wife and 3.6 percentage points in the case of the second or subsequent wife.

### 6.1.2 Children's Progression in School and Their Mother's Order of Marriage

Column (III) of table 6 shows that being a child of the first wife in a polygynous family reduces school progression by 9.5 units compared to that of a child from a monogamous family. The reduction is 11.8 units for children of second and subsequent wives. The reduction is thus greater for children of second and subsequent wives compared to those of the first wife in polygynous families.

Column (IV) of table 6 controls for other household, child and parent characteristics. We obtain a similar result. After controlling for other characteristics, the reduction decreases to 2.7 units in the case of the first wife and to 5.7 units in the case of the second and subsequent wives.

## 6.2 Weight-for-height, BMI and Mother's Order of Marriage

Table 7 presents the estimates of equation 3 when the variables of interest are weight-for-height and BMI.

Column (II) of table 7 presents our statistics after controlling for other characteristics. We find that being a child of the first wife in a polygynous family reduces the weight-for-height indicator by 12.7 units compared to that of a child in a monogamous family. The coefficient is not significant for children of second and subsequent wives compared to children in monogamous families. The reduction is thus greater for children of the first wife compared to those of the second and subsequent wives.

Column (IV) of table 7 confirms the previous findings when we use the BMI indicator. After controlling for other characteristics, our result shows that being a child of the first wife in a polygynous family reduces the BMI by 13 units compared to that of a child in a monogamous family. Once again, the reduction is not significant for children of second and subsequent wives compared to children in monogamous families. The reduction in BMI is therefore greater for children of first wives compared to those of second and subsequent wives.

## 6.3 Children's Labour and Their Mother's Order of Marriage

Table 8 presents the estimates of equation 3 when the variable of interest is children's labour.

### 6.3.1 Children's Work in the Domestic Household and Their Mother's Order of Marriage

Column (I) of table 8 shows that being a child of the second and subsequent wives reduces the likelihood of working in the domestic household by 2.7 percentage points compared to that of children in monogamous families. The coefficient is not statistically significant for children of first wives compared to that of children in monogamous families. The reduction is greater for children of second and subsequent wives compared to those of first wives.

Column (II) of table 8 presents the outcomes of interest after controlling for other characteristics. Our results remain similar. Indeed, being a child of second and subsequent wives now reduces the likelihood of working in the domestic household by 3.2 percentage points compared to that of children in monogamous families. The coefficient is still not significant for children of first wives compared to that of children in monogamous families. The reduction remains greater for children of the second and subsequent wives compared to those of the first wife in polygynous families.

### 6.3.2 Children's Work for Another Family Member and Their Mother's Order of Marriage

Column (III) of table 8 shows that being a child of a first wife in a polygynous family increases the likelihood of working for another family member by 5.4 percentage points compared to that of children in monogamous families. The change in the likelihood is not statistically significant for children of second and subsequent wives compared to that of children in monogamous families. The increases are greater for children of first wives than for children of second and subsequent wives.

Column (IV) shows that being a child of the first wife in a polygynous family now increases the likelihood of working for another family member by 2.7 percentage points compared to that of children in monogamous families. The change remains statistically nonsignificant for children of the second and subsequent wives compared to that of children in monogamous families. After controlling for other characteristics, the increase in the likelihood of working for another family member remains greater for children of first wives compared to children of the second and subsequent wives.

### 6.3.3 Children's Work for Someone Outside the Household and Their Mother's Order of Marriage

Column (V) of table 8 shows that being a child of the second and subsequent wives reduces the likelihood of working for someone outside the household by 1.3 percentage points compared to that of children in monogamous families. The change in the likelihood is not statistically significant for children of the first wife compared to that of children in monogamous families. The decrease is greater for children of second and subsequent wives compared to the decreases observed for children of the first wife in polygynous families.

Column (VI) of table 8 presents the results after controlling for other characteristics. The difference is no longer statistically significant even if the statistic still displays a greater reduction of work outside the household for children of second and subsequent wives compared to children of first wives.

# 7 Summary and Discussion

Our first analysis concerning differences between polygynous and monogamous families provides evidence that children in polygynous families are enrolled in school less often and progress less at school compared to children from monogamous families. For health measures, there are no significant differences between children in polygynous families and children in monogamous families. Our results also indicate that children from polygynous families do less household work than children in monogamous families; this specific result may be due to the larger number of children reducing

the average household work. There is no difference between polygyny and monogamy in terms of working for another family member or working for someone outside the household.

The lower performance in education for polygynous families can be explained by their lower average income compared to that in monogamous families (Conger et al., 1997; Duncan et al., 1998). Because polygynous families generally contain more women and more children, the average income is lower. Education of children, especially women's education, becomes less of a priority than some other important issues, such as health (Omariba & Boyle, 2007; Tenikue & Verheyden, 2010). Many families may have difficulties in buying essential school supplies for their children. The lack of differences between polygynous and monogamous families in terms of health may be due to the priority that families give to health.

In our second econometric analysis regarding the link between the order of marriage of mothers and their children's outcomes, we report that the school enrolment and progression of children of first wives are greater than that of children of the second and subsequent wives. Health indicators, however, are lower for children of first wives compared to children of second and subsequent wives. Additionally, children of first wives work more at home compared to children of second and subsequent wives. We found no significant differences between children of the first wife and those of the second and subsequent wives in terms of time working outside the household.

The fact the children of first (senior) wives perform better in school could be related to their experience advantage compared to children of second and subsequent wives. That experience advantage may lead first wives to prioritise the education of their children. Note that second and subsequent wives are usually younger than their husband. That age disparity may lead to a gender hierarchy, with the man being more experienced than the woman. Being close, in an emotional sense, to their husband in general may cause women to have less interest in their children's education, leading second and subsequent wives to neglect the education of their children. Moreover, the negative discrimination faced by the first wife may lead her to prioritise the future of her children through their education.

The lower health indicators for children of first wives compared to children of second and subsequent wives can be explained by discrimination against the first (senior) wife and her children when the father redistributes the aggregate income of the family. Low income is usually associated with health issues (Sachs & McArthur, 2005). It is well known that first wives usually face discrimination in polygynous families, in part because they are older than second and subsequent wives (Chrisler & Ghiz, 1993; Hurd, 2000). The same discrimination can also explain the fact that children of first wives work more at home compared to other children.

# 8 The model

To rationalise our findings, we propose a polygyny model that helps to understand the possible channels that drive our results.[2] For simplicity, our environment is a representative polygynous family with two wives, one husband and children from both wives. Because we are not assessing the impact of the number of children per wife, we will assume that both wives have the same number of children, normalised to one.

The representative husband is endowed with exogenous income and uses it to pay for services from his wives. Such income, for example, may represent a cash transfer from the government. The husband then maximises his utility function by choosing remunerated services from each of his wives, subject to his budget constraint. Additional to the exogenous income, the husband has the responsibility of redistributing goods produced at home by his children.

Both wives gain their income from services provided to their husband. Each wife then maximises her utility function by choosing the consumption and the home production of her children, subject to the budget constraint.

## 8.1 The Problem of the Husband

The representative husband maximises his utility function by choosing the number of services provided by each of his two wives, subject to his budget constraints. The representative husband is endowed with an exogenous income ($y$) and manages the household production of his children. This follows the idea that housework done by children contributes to the economic prosperity of the family, [3] and children's production at home is managed by the father for the benefit of the whole family, regardless of who produces it (Klomegah, 1997). The problem of the representative husband is presented as:

$$\max_{S_{w1},S_{w2}} S_{w1}^{\gamma} S_{w2}^{1-\gamma}$$

subject to the constraint:

$$p_s S_{w1} + p_s S_{w2} = y + \rho(l_1 + l_2),$$

where $S_{w1}$ is the number of services from the first wife; $S_{w2}$ is the number of services from the second wife; and $\gamma \in (0 \quad 1)$, is a parameter that describes the weight that the husband associates

[2] Using simple models helps to avoid numerical methods (see for example Mao Takongmo, 2017), and preserves the understanding of the main channels and intuitions that drive the results.

[3] The household production of any child serves the whole family, including step-brothers and step-sisters.

with services provided by the first (senior) wife in his utility function. $\gamma$ is less than $\frac{1}{2}$ if the husband associates less value with services provided by the first (senior) wife and is equal to $\frac{1}{2}$ if the husband associates the same value with services provided by his wives, regardless of the order of marriage. $y$ is an exogenous income, and $\rho(l_1 + l_2)$ is the total production of the children. $\rho$ represents the productivity of children (in terms of production per hour). $l_1$ and $l_2$ are the number of hours of housework done by children of the first and the second wife, respectively. Each wife is responsible for choosing the number of hours her children work at home. The quantity $\rho(l_1 + l_2)$ is thus the endogenous production of children that the father transfers to his wives. One unit of a wife's services to her husband is remunerated at $p_s$. The price $p_s$ is exogenous.

**Solving the Husband's Problem**

The Lagrangian function associated with the father's problem can be written as :

$$\mathscr{L} = S_{w1}^{\gamma} S_{w2}^{1-\gamma} + \lambda \left( y + \rho(l_1 + l_2) - (p_s S_{w1} + p_s S_{w2}) \right).$$

The first order condition with respect to $S_{w1}$ is:

$$\frac{\partial \mathscr{L}}{\partial S_{w1}} = \gamma S_{w1}^{\gamma-1} S_{w2}^{1-\gamma} - \lambda p_s = 0. \tag{4}$$

And the first order condition with respect to $S_{w2}$ is:

$$\frac{\partial \mathscr{L}}{\partial S_{w2}} = (1-\gamma) S_{w1}^{\gamma} S_{w2}^{-\gamma} - \lambda p_s = 0. \tag{5}$$

Finally, the first order condition with respect to $\lambda$ is:

$$p_s S_{w1} + p_s S_{w2} = y + \rho(l_1 + l_2) \tag{6}$$

Using equations 4 and 5, we have:

$$S_{w2} = \frac{1-\gamma}{\gamma} S_{w1}. \tag{7}$$

Replacing equation 7 in equation 6 leads to

$$S_{w1} = \frac{\gamma}{p_s} \left( y + \rho(l_1 + l_2) \right) \tag{8}$$

and

$$S_{w2} = \frac{1-\gamma}{p_s}\left(y + \rho(l_1 + l_2)\right). \tag{9}$$

## 8.2 The Problem of the First (Senior) Wife

The representative first wife receives her income from services that she provides to her husband. She uses that income to pay for her children's consumption. Education is free, but children need time to go to school to receive their education. Each child is endowed with one normalised unit of time. In one part of their time, children go to school $(1 - l_1)$. The remaining part of their time is used for housework $(l_1)$. One hour of housework produces $\rho$. The total production of children of the first wife is redistributed to the whole family by the father.

The representative first wife maximises her utility function by choosing the number of hours her children work at home $(l_1)$ and her children's consumption $(C_1)$, subject to the budget constraint. The problem of a representative first wife is:

$$\max_{C_1, l_1} C_1^{\mu_1}(1 - l_1)^{1-\mu_1}$$

subject to the constraint:

$$p_c C_1 = p_s S_{w1} = \gamma\left(y + \rho(l_1 + l_2)\right),$$

where $\mu_1$ represents the geometric weight that the first wife associates with the consumption of her children.

### Solving the First Wife's Problem

The Lagrangian function associated with the first wife's problem can be written as:

$$\mathscr{L} = C_1^{\mu_1}(1 - l_1)^{1-\mu_1} + \lambda\left[\gamma\left(y + \rho(l_1 + l_2)\right) - p_c C_1\right]$$

The first order condition with respect to $C_1$ is:

$$\frac{\partial \mathscr{L}}{\partial C_1} = \mu_1 C_1^{\mu_1 - 1}(1 - l_1)^{1-\mu_1} - \lambda p_c = 0. \tag{10}$$

The first order condition with respect to $l_1$ is:

$$\frac{\partial \mathscr{L}}{\partial l_1} = -(1-\mu_1)C_1^{\mu_1}(1-l_1)^{-\mu_1} + \lambda\gamma\rho = 0. \tag{11}$$

And the first order condition with respect to $\lambda$ is:

$$p_c C_1 = \gamma\left(y + \rho(l_1 + l_2)\right). \tag{12}$$

Using equations 10 and 11 leads to:

$$p_c C_1 = \frac{\mu_1\gamma\rho(1-l_1)}{1-\mu_1}. \tag{13}$$

Using equation 13 and 12 leads to:

$$l_1 = \mu_1 - \frac{1-\mu_1}{\rho}\left(y + \rho l_2\right) \tag{14}$$

and

$$C_1 = \frac{\gamma\mu_1}{p_c}\left(\rho + y + \rho l_2\right). \tag{15}$$

## 8.3 The Problem of the Second (Junior) Wife

The second wife also receives her income from services provided to her husband. She also uses that income to pay for her children's consumption. One part of the children's time is dedicated to school $(1-l_2)$, and the remaining part $(l_2)$ is used for housework.

The representative second wife maximises her utility function by choosing the number of hours her children work at home ( $l_2$) and the consumption of her children $(C_2)$, subject to the budget constraint. The problem of the representative second wife is:

$$\max_{C_2, l_2} C_2^{\mu_2}(1-l_2)^{1-\mu_2},$$

subject to the constraint:

$$p_c C_2 = p_s S_{w2} = (1-\gamma)\left(y + \rho(l_1 + l_2)\right).$$

where $\mu_2$ represents the geometric weight that the second wife associates with the consumption of her children.

**Solving the Second Wife's Problem**

The Lagrangian function associated with the second wife's problem can be written as:

$$\mathscr{L} = C_2^{\mu_2}(1-l_2)^{1-\mu_2} + \lambda\left[(1-\gamma)\left(y+\rho(l_1+l_2)\right) - p_c C_2\right].$$

The first order condition with respect to $C_2$ is:

$$\frac{\partial \mathscr{L}}{\partial C_2} = \mu_2 C_2^{\mu_2-1}(1-l_2)^{1-\mu_2} - \lambda p_c = 0. \tag{16}$$

The first order condition with respect to $l_2$ is:

$$\frac{\partial \mathscr{L}}{\partial l_2} = -(1-\mu_2)C_2^{\mu_2}(1-l_2)^{-\mu_2} + \lambda(1-\gamma)\rho = 0. \tag{17}$$

And finally, the first order condition with respect to $\lambda$ is:

$$p_c C_2 = (1-\gamma)\left(y+\rho(l_1+l_2)\right). \tag{18}$$

Using equations 16 and 17 leads to:

$$p_c C_2 = \frac{\mu_2(1-\gamma)\rho(1-l_2)}{1-\mu_2}. \tag{19}$$

Using equations 18 and 19 leads to:

$$l_2 = \mu_2 - \frac{1-\mu_2}{\rho}\left(y+\rho l_1\right) \tag{20}$$

and

$$C_2 = \frac{(1-\gamma)\mu_2}{p_c}\left(\rho+y+\rho l_1\right). \tag{21}$$

## 8.4 The general solution

**Theorem 1.** *The optimal choice of economic agents in our model is:*

$$l_1 = \frac{\mu_1-\mu_2(1-\mu_1)}{\mu_1+\mu_2(1-\mu_1)} - \frac{y}{\rho}\frac{\mu_2(1-\mu_1)}{\mu_1+\mu_2(1-\mu_1)} \tag{22}$$

$$l_2 = \frac{\mu_2-\mu_1(1-\mu_2)}{\mu_2+\mu_1(1-\mu_2)} - \frac{y}{\rho}\frac{\mu_1(1-\mu_2)}{\mu_2+\mu_1(1-\mu_2)} \tag{23}$$

$$C_1 = \frac{\gamma\mu_1\mu_2}{p_c\left[\mu_2+\mu_1(1-\mu_2)\right]}\left(2\rho+y\right) \tag{24}$$

$$C_2 = \frac{(1-\gamma)\mu_1\mu_2}{p_c\left[\mu_1 + \mu_2(1-\mu_1)\right]}(2\rho + y) \tag{25}$$

*where* $l_1$ and $l_2$ are the optimal number of hours of work done at home by children of the first and second wife, respectively. $C_1$ and $C_2$ are the optimal consumption for children of the first and second wife, respectively.

*Proof.* Using equation 14 and 20 leads to the following system of equations:

$$\begin{cases} l_1 = \mu_1 - \frac{1-\mu_1}{\rho}(y + \rho l_2) \\ l_2 = \mu_2 - \frac{1-\mu_2}{\rho}(y + \rho l_1) \end{cases}$$

with the solutions $l_1 = \frac{\mu_1 - \mu_2(1-\mu_1)}{\mu_1 + \mu_2(1-\mu_1)} - \frac{y}{\rho}\frac{\mu_2(1-\mu_1)}{\mu_1+\mu_2(1-\mu_1)}$ and $l_2 = \frac{\mu_2 - \mu_1(1-\mu_2)}{\mu_2+\mu_1(1-\mu_2)} - \frac{y}{\rho}\frac{\mu_1(1-\mu_2)}{\mu_2+\mu_1(1-\mu_2)}$.

By replacing 22 and 23 in 15 and 21, we obtain $C_1 = \frac{\gamma\mu_1\mu_2}{p_c[\mu_2+\mu_1(1-\mu_2)]}(2\rho + y)$ and $C_2 = \frac{(1-\gamma)\mu_1\mu_2}{p_c[\mu_1+\mu_2(1-\mu_1)]}(2\rho + y)$. □

## 8.5 The Health and Education Index

### 8.5.1 The Health Index

The health indicator is assumed to be an increasing function of children's consumption. Malnutrition (including protein-energy malnutrition and micronutrient deficiencies) is the main cause of diseases in developing countries (Müller & Krawinkel, 2005). Malnutrition increases susceptibility to and severity of infections and therefore death from diseases (Murray & Lopez, 1997; Black, 2003; Brabin & Coulter, 2003; Müller & Krawinkel, 2005; Silbersdorff et al., 2018). Low income is one of the causes of malnutrition (Sachs & McArthur, 2005) and has a causal relationship with health (Backlund et al., 1996; Ettner, 1996; McDonough et al., 1997; Ecob & Smith, 1999; Marmot, 2002; Case, 2004; Frijters et al., 2005; Lindahl, 2005; Kawachi et al., 2010; Kuehnle, 2014; Cesarini et al., 2016; Haeck et al., 2018; Lebihan & Mao Takongmo, 2018).

For simplicity, the health indicator for child $i$ can be written by assumption as:

$$Health_i = \frac{C_i - C_{min}}{C_{max} - C_{min}} + \frac{\eta_i - \eta_{min}}{\eta_{max} - \eta_{min}}, \tag{26}$$

where $C_i$ is the consumption of child $i$, $C_{min}$ is the minimum consumption and $C_{max}$ is the maximum consumption. $\frac{C_i - C_{min}}{C_{max} - C_{min}}$ is such that the highest consumption by a child implies a value of 1, and the lowest consumption implies a value of 0 (Lebihan et al., 2018; Todaro & Smith, 2015). $\eta_i$ is an error term and represents all factors other than consumption that can affect the health condition. Following Lebihan et al. (2018), $\eta_{min}$ is the worst negative shock that can affect the child, and $\eta_{max}$ is the best positive impact on health. As in Lebihan et al. (2018), we assume that $\eta_i$ is a realisation from the uniform distribution with the support $[\eta_{min} \quad \eta_{max}] = [-1 \quad 1]$. If $\eta_i < 0$, the

shock will negatively affect health. If $\eta_i > 0$, health will be positively affected by the shock. A null shock will have no impact on health.

**Theorem 2.** *Under the assumptions presented in this model, the following results hold:*

*(a) If $\gamma < \frac{1}{2}$, then the consumption and the expected health index of children of the first (senior) wife will be lower than that of children of the second wife.*

*(b) If $\gamma = \frac{1}{2}$, then the consumption and the expected health index of children of the first (senior) wife will be equal to that of children of the second wife.*

*(c) If $\mu_1 > \mu_2$, then children of the first (senior) wife will work more at home than children of the second wife.*

*(d) If $\mu_1 = \mu_2$, all children will work the same number of hours regardless of the marriage order of their mother.*

*Proof.* **Proof of (a) and (b) :**

From equation 24 and 25 of the first theorem, we have:

$$C_1 = \frac{\gamma\mu_1\mu_2}{p_c\left[\mu_2 + \mu_1(1-\mu_2)\right]}(2\rho + y) \text{ and } C_2 = \frac{(1-\gamma)\mu_1\mu_2}{p_c\left[\mu_1 + \mu_2(1-\mu_1)\right]}(2\rho + y).$$

Then

$$C_1 = \frac{\gamma}{1-\gamma}C_2$$

$\frac{\gamma}{1-\gamma} < 1$ is equivalent to $\gamma < \frac{1}{2}$

Thus, if $\gamma < \frac{1}{2}$ then $C_1 < C_2$ and

$$\frac{C_1 - C_{min}}{C_{max} - C_{min}} < \frac{C_2 - C_{min}}{C_{max} - C_{min}} \text{ i.e. } \frac{C_1 - C_{min}}{C_{max} - C_{min}} - \frac{C_2 - C_{min}}{C_{max} - C_{min}} < 0$$

$E(Health_1) = \frac{C_1 - C_{min}}{C_{max} - C_{min}} + E\left(\frac{\eta_i - \eta_{min}}{\eta_{max} - \eta_{min}}\right)$ and $E(Health_2) = \frac{C_2 - C_{min}}{C_{max} - C_{min}} + E\left(\frac{\eta_i - \eta_{min}}{\eta_{max} - \eta_{min}}\right)$,

Thus, if $\gamma < \frac{1}{2}$ then

$$E(Health_1) - E(Health_2) = \frac{C_1 - C_{min}}{C_{max} - C_{min}} - \frac{C_2 - C_{min}}{C_{max} - C_{min}} < 0.$$

Thus, if $\gamma < \frac{1}{2}$, then $E(Health_1) < E(Health_2)$.

This result means that if the father associates less value with services provided by the first (senior) wife compared to services provided by the second (junior) wife ($\gamma < \frac{1}{2}$), our model predicts that the consumption and the expected health conditions of children from the first wife will both be lower than that of children of the second wife.

On the other hand if $\gamma = \frac{1}{2}$, then $C_1 = C_2$ and $E(Health_1) = E(Health_2)$. This means that if the father associates the same value with services provided by his wives, regardless of their marriage order, children's consumption and expected health will be the same.

**Proof of (c) and (d) :**

From equation 22 and 23 of the first theorem, we have

$$l_1 = \frac{\mu_1 - \mu_2(1-\mu_1)}{\mu_1 + \mu_2(1-\mu_1)} - \frac{y}{\rho}\frac{\mu_2(1-\mu_1)}{\mu_1 + \mu_2(1-\mu_1)} \text{ and } l_2 = \frac{\mu_2 - \mu_1(1-\mu_2)}{\mu_2 + \mu_1(1-\mu_2)} - \frac{y}{\rho}\frac{\mu_1(1-\mu_2)}{\mu_2 + \mu_1(1-\mu_2)}.$$

Then,

$$l_1 - l_2 = (\mu_1 - \mu_2)\frac{2 + (y/\rho)}{\mu_1 + \mu_2(1-\mu_1)}. \tag{27}$$

$\frac{2+(y/\rho)}{\mu_1+\mu_2(1-\mu_1)} > 0$ because $y, \rho, \mu_1, \mu_2$ are all positive, and $\mu_1$ and $\mu_2$ are less than 1.

Thus, if $\mu_1 > \mu_2$ then $l_1 > l_2$. In other words, if the first wife associates more value with consumption, her children will work more at home.

If $\mu_1 = \mu_2$ from equation 27, $l_1 = l_2$. If both the first and the second wife associate the same value with consumption, children will work the same number of hours at home, regardless of the order of marriage of their mother. □

### 8.5.2 The Education Index

The education indicator for child $i$ is assumed to be positively correlated with time spent in school $(1 - l_i)$ and with the child's effort at school. As pointed out by Terrel Bell, a former Secretary of Education of the United States, "There are three things to remember about education. The first is motivation. The second is motivation. The third is motivation" (Covington, 2000). The quality of student learning and the will to continue learning also depend on motivation (Covington, 2000).

We assume that effort expended at school by child $i$ is negatively related to the share of income his mother receives. It is well known that children who face discrimination are usually more motivated and put in more effort at school than their counterparts (Fuligni, 2001; Perreira et al., 2010). Children who face discrimination view this effort as their duty to their close parents, who support them, in response to the sacrifices their parents make. They feel they must obtain better jobs to help support their close parents in the future (Perreira et al., 2010).

Our education index is a weighted average of time spent at school and an indicator of the child's effort at school (represented by one minus the share of income received by his mother). It is written as:

$$\begin{aligned} Education_i &= \phi\frac{(1-l_i)-(1-l_{max})}{(1-l_{min})-(1-l_{max})} + (1-\phi)\frac{(1-share_i)-(1-share_{max})}{(1-share_{min})-(1-share_{max})} + \frac{v_i - v_{min}}{v_{max} - v_{min}} \\ &= \phi\frac{l_{max} - l_i}{l_{max} - l_{min}} + (1-\phi)\frac{share_{max} - share_i}{share_{max} - share_{min}} + \frac{v_i - v_{min}}{v_{max} - v_{min}} \end{aligned} \tag{28}$$

where $(1 - l_i)$ represents the time spent at school, $l_i$ represents time spent working at home, $l_{min}$ is the minimum number of hours spent working at home and $l_{max}$ the maximum. $share_i$ is the share of income received by the mother of child $i$. $share_{min}$ and $share_{max}$ are the minimum and the maximum share, respectively. By normalising, the unit becomes irrelevant and addition becomes possible. $v_i$ represents any variable that may affect the education of children other than attendance and effort. $v_{min}$ is the worst negative shock and $v_{max}$ the best positive impact on schooling. For simplicity, $v_i$ will be a realisation from the uniform distribution with the support $[v_{min} \quad v_{max}] = [-1 \quad 1]$. $\phi \in (0 \quad 1)$ is the weight.

Note that $l_{min} = 0$ and $share_{min} = 0$. Thus,

$$Education_i \quad = \quad \phi(1 - l_i) + (1 - \phi)(1 - share_i) + \frac{v_i - v_{min}}{v_{max} - v_{min}}. \tag{29}$$

The share of income for the first wife is $\gamma$. Thus, the education index for children of the first (senior) wife is:

$$EducationFistWive_i \quad = \quad \phi(1 - l_1) + (1 - \phi)(1 - \gamma) + \frac{v_i - v_{min}}{v_{max} - v_{min}}. \tag{30}$$

The income share for the second (junior) wife is $(1 - \gamma)$. The education index for children of the second wife is thus

$$EducationSecondWife_i \quad = \quad \phi(1 - l_2) + (1 - \phi)\gamma + \frac{v_i - v_{min}}{v_{max} - v_{min}}. \tag{31}$$

**Theorem 3.** *Under the assumptions presented in this model, the following results hold:*

*(a) If both women associate the same value with consumption (i.e., $\mu_1 = \mu_2$ ), then:*

*- If additional to that the first wife faces discrimination (i.e., $\gamma < \frac{1}{2}$), then children from the first (senior) wife will be expected to be better at school (i.e., $E(EducationFistWive_i) > E(EducationSecondWife_i)$).*

*- If $\mu_1 = \mu_2$ and there is no discrimination between wives, children will be expected to have the same education index.*

*(b) If there is no discrimination (i.e., $\gamma = \frac{1}{2}$), then:*

*- If additional to that, the first wife associates less value with consumption (i.e., $\mu_1 < \mu_2$), then children from the first wife will be expected to perform better at school compared to children of the second wife.*

*- If $\gamma = \frac{1}{2}$ and all wives associate the same value with consumption, their children will be expected to have the same level of education.*

*Proof.* The expected difference in education can be written as:

$$E_{e1} - E_{e2} = E\left(EducationFistWive_i\right) - E\left(EducationSecondWife_i\right)$$

$$\begin{aligned} E_{e1} - E_{e2} &= \phi\left(1 - l_1\right) + \left(1 - \phi\right)\left(1 - \gamma\right) - \left[\phi\left(1 - l_2\right) + \left(1 - \phi\right)\gamma\right] \\ &= \phi\left(l_2 - l_1\right) + \left(1 - \phi\right)\left(1 - 2\gamma\right) \end{aligned}$$

From equation 27 we have $l_1 - l_2 = \left(\mu_1 - \mu_2\right)\frac{2+(y/\rho)}{\mu_1+\mu_2(1-\mu_1)}$, thus

$$E_{e1} - E_{e2} = \phi\left[\left(\mu_2 - \mu_1\right)\frac{2 + (y/\rho)}{\mu_1 + \mu_2(1 - \mu_1)}\right] + \left(1 - \phi\right)\left(1 - 2\gamma\right)$$

**Proof of (a):**

If $\mu_1 = \mu_2$ then $E_{e1} - E_{e2} = \left(1 - \phi\right)\left(1 - 2\gamma\right)$. If additional to that $\gamma < \frac{1}{2}$, then $E_{e1} > E_{e2}$; that is, $E\left(EducationFistWive_i\right) > E\left(EducationSecondWife_i\right)$. In other words, children from the first (senior) wife will be expected to be better at school.

If $\mu_1 = \mu_2$ and there is no discrimination between wives ( $i.e. \gamma = \frac{1}{2}$ ), then $E_{e1} - E_{e2} = \phi\left[\left(\mu_2 - \mu_1\right)\frac{2+(y/\rho)}{\mu_1+\mu_2(1-\mu_1)}\right] + \left(1 - \phi\right)\left(1 - 2\gamma\right) = 0$ and $E_{e1} = E_{e2}$. That means that children will be expected to have the same education index.

**Proof of (b):**

If $\gamma = \frac{1}{2}$, then $E_{e1} - E_{e2} = \phi\left[\left(\mu_2 - \mu_1\right)\frac{2+(y/\rho)}{\mu_1+\mu_2(1-\mu_1)}\right]$.

Because $\frac{2+(y/\rho)}{\mu_1+\mu_2(1-\mu_1)} > 0$, if $\gamma = \frac{1}{2}$ and $\mu_1 < \mu_2$, then $E_{e1} > E_{e2}$ . In this case, the model thus implies that children from the first (senior) wife will be expected to perform better at school compared to children of the second wife.

If $\gamma = \frac{1}{2}$ and all wives associate the same value with consumption (i.e., $\mu_1 = \mu_2$ ), then $E_{e1} - E_{e2} = \phi\left[\left(\mu_2 - \mu_1\right)\frac{2+(y/\rho)}{\mu_1+\mu_2(1-\mu_1)}\right] = 0$, and $E_{e1} = E_{e2}$. In other words, children will be expected to have the same level of education, regardless of the order of marriage of their mother. □

# 9 Conclusion

In this paper, we use the DHS conducted in Mali to compare children in polygynous families with children in monogamous families. We also analyse the link between the order of marriage of mothers and their children's outcomes. Finally, we propose a theoretical model that rationalises our findings. Our empirical analysis provides evidence that children in polygynous families are less enrolled in school, progress less at school and do less domestic household work compared to children from monogamous families. Evidence also shows that the school enrolment and progression

of children of first wives are higher compared to that of children of second and subsequent wives. The weight-for-height and BMI are both lower for children of first wives compared to children of second and subsequent wives. Children of first wives work more at home compared to children of second and subsequent wives, but there are no significant differences between them in terms of time working outside the household. Our model predicts that when fathers discriminate against first wives, children of first wives will, on average, perform better at school if effort at school is positively correlated with discrimination, will consume less and will have a lower health index compared to children of second wives.

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TABLE 1 : Descriptive Statistics for the Control Variables

| Variables | Monogamous | Polygyny First Wife | Polygyny 2nd+ Wife |
|---|---|---|---|
| **Household characteristics** | | | |
| HH head is male | 0.941 | 0.957 | 0.964 |
| Number of children | 3.922 | 6.220 | 6.335 |
| | (1.757) | (2.564) | (2.832) |
| HH is located in Bamako | 0.113 | 0.059 | 0.055 |
| **Child characteristics** | | | |
| Age of child | 5.838 | 6.922 | 5.905 |
| | (4.081) | (4.166) | (4.049) |
| Child is male | 0.511 | 0.518 | 0.526 |
| **Parental characteristics** | | | |
| Mother's age | 31.030 | 34.364 | 32.057 |
| | (7.091) | (6.566) | (7.155) |
| Mother's education (years) | 1.096 | 0.371 | 0.581 |
| | (2.878) | (1.506) | (2.064) |
| Father's education (years) | 1.708 | 0.735 | 0.747 |
| | (3.964) | (2.371) | (2.540) |
| Muslim | 0.909 | 0.936 | 0.949 |
| Ethnic group : Bambara | 0.336 | 0.363 | 0.335 |
| *N* | 14,218 (64.07 %) | 3,829 (17.33 %) | 4,017 (18.60 %) |

Notes : This table displays the weighted summary statistics for children, mothers, fathers and families. The statistics are presented by type of family. Standard deviations for continuous variables are in parentheses.

TABLE 2 : Descriptive Statistics for the Dependent Variables

| Variables | Monogamous (64.07 %) | Polygyny First Wife (17.33 %) | Polygyny 2nd+ Wife (18.60 %) |
|---|---|---|---|
| **Child's Education** | | | |
| Enrolment | 0.541 | 0.462 | 0.443 |
| Progression | 53.832 | 44.305 | 41.967 |
| | (60.917) | (54.721) | (54.640) |
| **Child's Labour** | | | |
| Worked in domestic household | 0.481 | 0.483 | 0.444 |
| Worked for a family member | 0.175 | 0.229 | 0.182 |
| Worked for someone outside household | 0.090 | 0.090 | 0.078 |
| **Child's Health** | | | |
| Weight/Height SD (WHO) | -54.404 | -62.985 | -52.333 |
| | (134.833) | (127.608) | (139.810) |
| BMI SD (WHO) | -39.415 | -46.004 | -36.108 |
| | (138.890) | (132.853) | (143.748) |
| *N* | 14,218 (64.07 %) | 3,829 (17.33 %) | 4,017 (18.60 %) |

Notes : This table displays the weighted summary statistics of dependent variables. The statistics are presented by type of family. Standard deviations for continuous variables are in parentheses.

Table 3: Child's Enrolment and Polygynous families

| | **Sample: All** | | | |
|---|---|---|---|---|
| | Enrolment | | Progression | |
| Variables | I | II | III | IV |
| ***HH characteristics*** | | | | |
| Polygyny | -0.088*** | -0.031*** | -10.612*** | -4.147*** |
| | (0.011) | (0.012) | (1.403) | (1.439) |
| HH head is male | | -0.058** | | -7.759** |
| | | (0.023) | | (3.297) |
| Number of children | | -0.004 | | 0.359 |
| | | (0.002) | | (0.291) |
| HH is located in Bamako | | 0.262*** | | 28.196*** |
| | | (0.012) | | (2.035) |
| ***Child characteristics*** | | | | |
| Age of child | | 0.242*** | | -9.832*** |
| | | (0.017) | | (3.454) |
| Age squared | | -0.011*** | | 0.386** |
| | | (0.001) | | (0.158) |
| Child is male | | 0.046*** | | 3.274** |
| | | (0.010) | | (1.349) |
| ***Parental characteristics*** | | | | |
| Mother's age | | -0.001 | | -0.016 |
| | | (0.001) | | (0.112) |
| Mother's education (years) | | 0.015*** | | 1.931*** |
| | | (0.002) | | (0.362) |
| Father's education (years) | | 0.027*** | | 3.932*** |
| | | (0.001) | | (0.293) |
| Muslim | | -0.055*** | | -7.609*** |
| | | (0.019) | | (2.428) |
| Ethnic group: Bambara | | 0.045*** | | 2.058 |
| | | (0.011) | | (1.384) |
| Constant | 0.541*** | -0.633*** | 53.832*** | 110.221*** |
| | (0.007) | (0.085) | (0.970) | (19.423) |
| Observations | 11,311 | 11,311 | 9,500 | 9,500 |
| R-squared | 0.007 | 0.139 | 0.008 | 0.135 |

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

Table 4: Child's Health Indicators and Polygynous Families I

| | Sample: All | | | |
|---|---|---|---|---|
| | Weight/Height SD (WHO) | | BMI SD (WHO) | |
| Variables | I | II | III | IV |
| ***HH characteristics*** | | | | |
| Polygyny | -2.701 | -7.173 | -1.126 | -7.615 |
| | (4.923) | (5.757) | (5.098) | (5.937) |
| HH head is male | | -1.452 | | -2.918 |
| | | (8.202) | | (8.374) |
| Number of children | | 2.216** | | 2.502** |
| | | (1.020) | | (1.067) |
| HH is located in Bamako | | -12.408* | | -18.000*** |
| | | (6.656) | | (6.932) |
| ***Child characteristics*** | | | | |
| Age of child | | 18.883*** | | 43.776*** |
| | | (5.754) | | (5.706) |
| Age squared | | -1.992 | | -7.176*** |
| | | (1.229) | | (1.239) |
| Child is male | | -4.677 | | 2.395 |
| | | (4.612) | | (4.730) |
| ***Parental characteristics*** | | | | |
| Mother's age | | -0.170 | | -0.229 |
| | | (0.346) | | (0.355) |
| Mother's education (years) | | 1.181 | | 0.625 |
| | | (1.050) | | (1.061) |
| Father's education (years) | | 0.963 | | 0.333 |
| | | (0.743) | | (0.765) |
| Muslim | | 0.232 | | 2.015 |
| | | (8.155) | | (8.437) |
| Ethnic group: Bambara | | -4.551 | | -5.317 |
| | | (4.976) | | (5.082) |
| Constant | -54.404*** | -81.373*** | -39.415*** | -85.546*** |
| | (2.801) | (14.662) | (2.887) | (15.036) |
| Observations | 4,248 | 4,248 | 4,248 | 4,248 |
| R-squared | 0.000 | 0.017 | 0.000 | 0.032 |

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

Table 5: Children's Labour Indicators and Polygynous Families I

| | Sample: All | | | | | |
|---|---|---|---|---|---|---|
| | Domestic household work | | Work for family members | | Work outside the household | |
| Variables | I | II | III | IV | V | VI |
| ***HH characteristics*** | | | | | | |
| Polygyny | -0.009 | -0.023** | 0.031*** | 0.013 | -0.006 | -0.008 |
| | (0.009) | (0.011) | (0.008) | (0.009) | (0.006) | (0.007) |
| HH head is male | | -0.030 | | 0.073*** | | 0.007 |
| | | (0.021) | | (0.014) | | (0.012) |
| Number of children | | -0.005** | | -0.001 | | 0.000 |
| | | (0.002) | | (0.002) | | (0.001) |
| HH is located in Bamako | | -0.055*** | | -0.116*** | | -0.023*** |
| | | (0.014) | | (0.008) | | (0.008) |
| ***Child characteristics*** | | | | | | |
| Age of child | | 0.126*** | | 0.069*** | | 0.024*** |
| | | (0.012) | | (0.010) | | (0.008) |
| Age squared | | -0.004*** | | -0.002*** | | -0.001 |
| | | (0.001) | | (0.001) | | (0.000) |
| Child is male | | -0.209*** | | 0.048*** | | -0.005 |
| | | (0.009) | | (0.008) | | (0.006) |
| ***Parental characteristics*** | | | | | | |
| Mother's age | | -0.000 | | -0.000 | | 0.000 |
| | | (0.001) | | (0.001) | | (0.000) |
| Mother's education (secondary) | | -0.001 | | -0.005*** | | -0.001 |
| | | (0.002) | | (0.001) | | (0.001) |
| Father's education (secondary) | | -0.009*** | | -0.006*** | | 0.002* |
| | | (0.002) | | (0.001) | | (0.001) |
| Muslim | | 0.005 | | -0.018 | | -0.015 |
| | | (0.018) | | (0.015) | | (0.012) |
| Ethnic group: Bambara | | -0.010 | | 0.017** | | 0.022*** |
| | | (0.010) | | (0.008) | | (0.006) |
| Constant | 0.476*** | -0.054 | 0.175*** | -0.308*** | 0.090*** | -0.064* |
| | (0.006) | (0.063) | (0.005) | (0.048) | (0.004) | (0.038) |
| Observations | 12,915 | 12,915 | 12,915 | 12,915 | 12,915 | 12,915 |
| R-squared | 0.000 | 0.111 | 0.002 | 0.080 | 0.000 | 0.017 |

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

Table 6: Children's Enrolment, Children's Progression and Their Mother's Order of Marriage

| | **Sample: All** | | | |
|---|---|---|---|---|
| | Enrolment | | Progression | |
| Variables | I | II | III | IV |
| ***HH characteristics*** | | | | |
| Polygyny: first wife (Ref monogamous) | -0.080*** | -0.026* | -9.528*** | -2.779* |
| | (0.013) | (0.014) | (1.672) | (1.637) |
| Polygyny: 2nd+ wife | -0.098*** | -0.036** | -11.865*** | -5.738*** |
| | (0.014) | (0.014) | (1.800) | (1.859) |
| HH head is male | | -0.058** | | -7.724** |
| | | (0.023) | | (3.297) |
| Number of children | | -0.004 | | 0.365 |
| | | (0.002) | | (0.291) |
| HH is located in Bamako | | 0.262*** | | 28.163*** |
| | | (0.012) | | (2.035) |
| ***Child characteristics*** | | | | |
| Age of child | | 0.242*** | | -9.795*** |
| | | (0.017) | | (3.453) |
| Age squared | | -0.011*** | | 0.383** |
| | | (0.001) | | (0.158) |
| Child is male | | 0.046*** | | 3.294** |
| | | (0.010) | | (1.349) |
| ***Parental characteristics*** | | | | |
| Mother's age | | -0.001 | | -0.021 |
| | | (0.001) | | (0.112) |
| Mother's education (years) | | 0.015*** | | 1.941*** |
| | | (0.002) | | (0.363) |
| Father's education (years) | | 0.027*** | | 3.930*** |
| | | (0.001) | | (0.293) |
| Muslim | | -0.055*** | | -7.537*** |
| | | (0.019) | | (2.431) |
| Ethnic group: Bambara | | 0.045*** | | 1.995 |
| | | (0.011) | | (1.384) |
| Constant | 0.541*** | -0.633*** | 53.832*** | 110.195*** |
| | (0.007) | (0.085) | (0.970) | (19.424) |
| Observations | 11,311 | 11,311 | 9,500 | 9,500 |
| R-squared | 0.008 | 0.139 | 0.008 | 0.135 |

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

Table 7: Children's Health Indicators and Their Mother's Order of Marriage

| | **Sample: All** | | | |
|---|---|---|---|---|
| | Weight/Height SD (WHO) | | BMI SD (WHO) | |
| Variables | I | II | III | IV |
| ***HH characteristics*** | | | | |
| Polygyny: first wife (Ref monogamous) | -8.580 | -12.710* | -6.588 | -13.052* |
| | (6.313) | (6.833) | (6.628) | (7.126) |
| Polygyny: 2nd+ wife | 2.071 | -2.353 | 3.308 | -2.882 |
| | (6.355) | (7.158) | (6.534) | (7.322) |
| HH head is male | | -1.851 | | -3.309 |
| | | (8.225) | | (8.400) |
| Number of kids | | 2.090** | | 2.378** |
| | | (1.023) | | (1.070) |
| HH is located in Bamako | | -12.229* | | -17.825** |
| | | (6.665) | | (6.942) |
| ***Child characteristics*** | | | | |
| Age of child | | 18.927*** | | 43.819*** |
| | | (5.747) | | (5.700) |
| Age squared | | -1.994 | | -7.179*** |
| | | (1.229) | | (1.239) |
| Child is male | | -4.677 | | 2.395 |
| | | (4.610) | | (4.728) |
| ***Parental characteristics*** | | | | |
| Mother's age | | -0.107 | | -0.168 |
| | | (0.347) | | (0.357) |
| Mother's education (years) | | 1.142 | | 0.587 |
| | | (1.052) | | (1.063) |
| Father's education (years) | | 0.963 | | 0.334 |
| | | (0.741) | | (0.764) |
| Muslim | | 0.218 | | 2.002 |
| | | (8.158) | | (8.440) |
| Ethnic group: Bambara | | -4.383 | | -5.152 |
| | | (4.969) | | (5.073) |
| Constant | -54.404*** | -82.418*** | -39.415*** | -86.572*** |
| | (2.801) | (14.647) | (2.888) | (15.022) |
| Observations | 4,248 | 4,248 | 4,248 | 4,248 |
| R-squared | 0.001 | 0.017 | 0.000 | 0.032 |

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

Table 8: Children's Labour and Their Mother's Order of Marriage

| | Sample: All | | | | | |
|---|---|---|---|---|---|---|
| | Domestic household work | | Work for family members | | Work outside the household | |
| Variables | I | II | III | IV | V | VI |
| ***HH characteristics*** | | | | | | |
| Polygyny: first wife (Ref monogamous) | 0.008 | -0.015 | 0.054*** | 0.027** | -0.000 | -0.005 |
| | (0.011) | (0.013) | (0.011) | (0.011) | (0.007) | (0.008) |
| Polygyny: 2nd+ wife | -0.027** | -0.032** | 0.007 | -0.003 | -0.013* | -0.011 |
| | (0.012) | (0.014) | (0.010) | (0.011) | (0.007) | (0.008) |
| HH head is male | | -0.030 | | 0.073*** | | 0.007 |
| | | (0.021) | | (0.014) | | (0.012) |
| Number of children | | -0.005** | | -0.001 | | 0.000 |
| | | (0.002) | | (0.002) | | (0.001) |
| HH is located in Bamako | | -0.055*** | | -0.116*** | | -0.023*** |
| | | (0.014) | | (0.008) | | (0.008) |
| ***Child characteristics*** | | | | | | |
| Age of child | | 0.126*** | | 0.069*** | | 0.024*** |
| | | (0.012) | | (0.010) | | (0.008) |
| Age squared | | -0.004*** | | -0.002*** | | -0.001 |
| | | (0.001) | | (0.001) | | (0.000) |
| Child is male | | -0.209*** | | 0.048*** | | -0.005 |
| | | (0.009) | | (0.008) | | (0.006) |
| ***Parental characteristics*** | | | | | | |
| Mother's age | | -0.001 | | -0.000 | | 0.000 |
| | | (0.001) | | (0.001) | | (0.000) |
| Mother's education (secondary) | | -0.001 | | -0.005*** | | -0.001 |
| | | (0.002) | | (0.001) | | (0.001) |
| Father's education (secondary) | | -0.009*** | | -0.006*** | | 0.002* |
| | | (0.002) | | (0.001) | | (0.001) |
| Muslim | | 0.005 | | -0.018 | | -0.015 |
| | | (0.018) | | (0.015) | | (0.012) |
| Ethnic group: Bambara | | -0.011 | | 0.016** | | 0.022*** |
| | | (0.010) | | (0.008) | | (0.006) |
| Constant | 0.476*** | -0.053 | 0.175*** | -0.307*** | 0.090*** | -0.064* |
| | (0.006) | (0.063) | (0.005) | (0.048) | (0.004) | (0.038) |
| Observations | 12,915 | 12,915 | 12,915 | 12,915 | 12,915 | 12,915 |
| R-squared | 0.001 | 0.111 | 0.003 | 0.081 | 0.000 | 0.017 |

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