MIND THE GAP! THE INFLUENCE OF FAMILY SYSTEMS ON THE GENDER EDUCATION GAP IN DEVELOPING COUNTRIES, 1950–2005

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ABSTRACT

This paper argues that, by shaping everyday attitudes towards women and perceptions of their value and decisions about them, family systems explain part of the difficulty in bridging the gap between men’s and women’s achievement in education. The gap is more pronounced outside the highly industrialized nations, where affordable mass education is not the standard, and gender differences in educational attainment are markedly affected by persisting cultural norms. I test this hypothesis by examining family systems that have had a lasting effect on gender norms. I find evidence that family systems explain gender differences in average years of education in 86 developing and middle-income countries around the globe, for the period 1950 to 2005.

Keywords: gender inequality, education, family systems

JEL Codes: I24, J12, J16, N30

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INTRODUCTION

Many countries aim for gender equality in education but, despite similar levels of economic development, some do better than others. A case in point, often cited, is Sri Lanka, which, despite not having strong economic growth, nevertheless has a fairly high level of gender equality, especially compared to countries with similar or higher national incomes (Sen 1999, 45; Hausmann et al. 2010). In 2010 the Sri Lankan educational system had already been gender equal for 20 years. In contrast, Pakistan recorded a gender ratio in educational attainment of 6 women to 10 men in 2010, a ratio Sri Lanka had achieved as early as 1950 (Barro & Lee 2010). The Sri Lankan accomplishment in educational gender equality is as impressive as Pakistan’s lack thereof is puzzling.

What causes these gendered differences in educational outcomes? This study assesses the effect of family systems on gender equality in education in countries with medium to low levels of development. Previous studies have emphasized the importance of economic growth for promoting gender equality and its strong association with gender equality in education (Marshall 1985; Inglehart & Norris 2003). But economic growth is not sufficient to explain essential gender equality differences between countries, especially the sharp differences found outside the highly developed countries (Dilli et al. 2015). Since North (1981, 1990) emphasized the importance of ideology in the enforcement of property rights and the role of institutions, institutions have become a prevalent explanation of the mechanism of historical heritage. Cultural norms, values and preferences can be seen as informal institutions, encompassing the typically unwritten codes of conduct that underlie and supplement formal rules (North 1990; Folbre 1994). Recent scholarly attention has turned to the role of historical and cultural legacies in determining development outcomes. For instance, a seminal paper by Acemoglu et al. (2001) demonstrates that colonial origin strongly correlates with current economic performance. Alesina et al. (2011) find evidence to support Boserup’s hypothesis that traditional agricultural practices influenced the historical gender division of labour and the evolution and persistence of gender norms.

Culture is an important informal institution, but its long-term effect is hard to measure. The family, however, is a measurable cultural institution, with two marked qualities important for education. First, family characteristics provide information about the underlying rules, norms and preferences regarding women’s appropriate role and behaviour. Within the family, these norms, values and preferences are transmitted from generation to generation, which can make them resilient to change. Second, decisions about how to invest in the children’s education are made by the family, particularly the parents. The family’s willingness to invest in female education will be in part determined by gender preferences inherited from former generations. Further, the size of the family and the extent of its influence may determine how far it will deviate from existing gender norms and how much it will invest in girls.

In a country with a functional education system that is both compulsory and affordable, as in the highly developed countries, we might not expect a large
difference in gender patterns. But where parents face real costs to children’s education, both financially and culturally (deviating from a social norm), gender preferences play a much stronger role. What role do family systems play in gender equality in education outside the highly developed nations? I look at the relation between family systems, marriage patterns and the gender ratio in education to see how different family systems have different effects and to find out whether historical preferences persist and to what extent. I argue that family systems influence the social and economic status of women and shape female bargaining power within the family and thus contribute to households’ everyday attitudes and decisions about investing in female education. Marriage patterns and family systems have been explored extensively for Western Europe and Asia (Lynch 1991; Engelen & Wolf 2005) and to some extent globally (Todd & Garrioch 1985; Todd 1987; Therborn 2004), and their effect on various gender roles has been partly explored as well (Dyson & Moore 1983; Laslett & Brenner 1989; Basu & Das Gupta 2001; De Moor & Van Zanden 2010).

This paper looks at the gender ratio in average years of education and its relation to family characteristics, with specific attention to female agency. Other studies explain gender equality in education in terms of income, female labour force participation and the gender wage gap (Jafarey & Maiti 2015) or religious preferences, regional factors and civil freedom (Dollar & Gatti 1999). To the best of our knowledge, only the paper by Bertocchi and Bozzano (2015) explores the links between family systems and gender equality in education. These authors found that family structure in nineteenth century Italy significantly affected the female to male enrolment ratio in upper primary education. To the best of my knowledge, there are no studies that investigate the links between historical family systems and human capital investment in girls at a global level. This paper provides the first cross-country exploration of the relation between family systems and gender equality in education. By exploring the relation between family indicators such as marriage, inheritance rights and co-residence, it provides insight into the success or failure of countries in achieving gender equality in education over 55 years.

THEORETICAL BACKGROUND

Why the educational gender gap matters

During the past three decades, a large and growing volume of studies has emphasized the instrumental benefits of women’s education. Evidence suggests that gender inequality, by lowering the average level of human capital in education, has a direct negative effect on long-term economic growth (Klasen 2002). Indirectly, gender inequality in education has a negative effect on fertility decline, and on structural

2 Defined as the ability to make meaningful life decisions (Sen 1999; Kabeer 2005; World Bank 2011).
investments since women are marginally represented in policies (King & Hill 1997; Dollar & Gatti 1999; Klasen & Lamanna 2009). General rates of return to education are stronger when women are included, and women benefit individually by receiving larger private returns from labour market participation (Psacharopoulos 1994).

Other gains from female education accrue from the benefits of educating mothers. Maternal education has been found to improve knowledge of healthcare (Barrera 1990) and household efficiency (Rosenzweig & Schultz 1982). Higher levels of maternal education are related to declines in infant mortality (Strauss & Thomas 1995) and are associated with intergenerational improvements in the health, education and the general wellbeing of their children (King et al. 1986; TP Schultz 1988; Strauss & Thomas 1995 Currie & Moretti 2003). Mothers are vital links in the transfer of resources to children. Empirical evidence suggests that women are more likely than men to favour children in their resource allocation behaviour (Thomas 1994; Hoddinott & Haddad 1995; Glick & Sahn 2000; Currie & Moretti 2003; Doss 2012). For example, Handa (1994, 119–137) finds, in a study in Jamaica, that mothers with higher education tend to have higher bargaining power, which results in higher investments in the health and education of the children. Some authors suggest that mothers tend to channel resources specifically to their daughters (Thomas 1994; Glick & Sahn 2000; Currie & Moretti 2003). In short, the benefits of educating girls are manifold and gender equality in education seems to make social and economic sense (World Bank 2011; Fiske 2012). Why then does gender inequality persist in education?

Factors affecting female education

Poverty makes it hard to invest in human capital. To some extent, poverty also explains gender inequality; economic prosperity is strongly associated with gender equality in general (Inglehart & Norris 2003) and with gender equality in education, especially in secondary education (Marshall 1985). A poor family struggling to come out on a small budget may prefer to invest in a son, in anticipation of his future remittances. However, investing in boys rather than girls is not necessarily a rational economic cost-benefit decision; rather, it is likely to be based on normative views of women’s roles, value and earning capacity. As Boserup (1970, 119–121) succinctly notes:

> If a poor country belongs to a culture with a positive attitude to higher education for girls, we find a high proportion of girls among the relatively few adult students. By contrast, if the dominant culture is hostile or indifferent to the higher education of girls, we find few girls among the adult students even if the country is relatively advanced.

Religion is a prominent example of cultural norms restricting female educational attainment, as it imposes gender norms and expectations about suitable social roles for women (Fish 2002). Protestantism is thought to promote investment in the literacy skills of both genders, as reading the Bible is an essential part of the religious experience (Weber 2001; Becker & Woessmann 2009). Norton and Tomal
find strong negative links between female educational attainment and the proportion of Hindus and Muslims in a country. Cooray and Potrafke (2010) find that female educational attainment is heavily influenced by whether a country is predominantly Islamic, especially after removing high-income countries from the equation. Donno and Russett (2004) find that Catholicism shows no significant negative impact on the female-to-male education ratio, whereas Islam does.

Several other hypotheses suggest reasons why female educational participation lags behind male participation, focusing on either supply and demand, or on access to education. In the first place, education needs to be supplied: schools must be built and teachers hired. The state is largely responsible for providing the legal and physical infrastructure needed for schooling and state investments tend to be guided either by ideological motives or by a desire to modernize and industrialize (Benavot & Riddle 1988; Meyer et al. 1992; Friedman 2002; Lindert 2004). The provision of mass education by the state overcomes credit constraints faced by local actors in financing education (Engerman et al. 1998; Galor et al. 2009). With the state making education accessible, free and compulsory, parents find it easier to send their children to school. It seems indisputable that parents want their children to receive education because of seemingly obvious income and social benefits. But opponents of this view stress that the benefits of education are not clear-cut and they argue that without a clear demand for female education, increasing the supply of schooling yields little result (Easterly 2006; Banerjee & Duflo 2011).

A further factor driving the demand for education is labour force participation. Low female labour force participation, leaving the labour force after marriage and the unskilled nature of female labour are various reasons offered to explain why women’s education trails behind men’s. The neoclassical argument asserts that the household, with unified household preferences, applies a division of labour directed at maximizing efficiency and family income (Becker 1964, 1965; TW Schultz 1961, 1974). A ‘natural’ division of labour exists within the household: men have a natural strength advantage, while women specialize in reproduction, child care and related domestic activities (Murdock & Provost 1973). Female domestic specialization, by reducing women’s time in the labour force, makes women’s earnings and job opportunities lower than men’s. This in turn discourages investment in female human capital (Becker 1985, 198). A considerable literature questions this neoclassical view, and other explanations for restricted female labour force participation abound, citing, for example, gender-specific agricultural practices, per capita incomes, industries and cultural beliefs (Folbre 1994; Goldin 1994; Fernández & Fogli 2009; Iversen & Rosenbluth 2010; Alesina et al. 2013). Whatever the root causes, the consequence is that women play a smaller part in the labour market and educational investment in women thus yields lower returns than investment in men.

As the family is the primary locus of decisions about girls’ education, the study of family systems and relationships can shed light on beliefs about the value of women. An abundant literature on household bargaining underlines the importance of the way resources are distributed among family members (Becker &
Lewis 1973; Becker 1991; Hanushek 1992; Agarwal 1997). The members’ relative positions in the distribution are governed by norms and culturally determined gender roles, and these norms and roles in turn create social expectations about women’s entitlements, duties and responsibilities. Human capital investment in women may be hampered by gender roles, when expectations of proper female behaviour rule out women for investment. Powerful legal and institutional factors determining the disposition of household assets, such as family laws regarding property rights and social entitlements, help to perpetuate such norms (Folbre 1986, 1994, 2002).

The resilience of gender norms across generations is a product of cultural transmission and socialization within the family. Vital cultural preferences and social norms, such as family attitudes towards fertility or women’s labour force participation, are passed on through generations as a result of ‘imperfect empathy’ (Bisin & Verdier 2001, 2008), which means that the family wishes to socialize their offspring optimally, yet this ‘optimal’ state is subjectively coloured towards the family’s own cultural experiences and preferences. Family choices about, for example children’s education, marriage partners and place of residence, all contribute to passing on cultural values (Bisin & Verdier 2000, 2008; Cohen-Zada 2006). Families are willing to assume high costs to socialize their children according to their own preferences, and one way they do it is by deciding what kind of education they will receive.

A family system can be defined as ‘a set of beliefs and norms, common practices, and associated sanctions through which kinship and the rights and obligations of particular kin relationships are defined’. It typically defines

what it means to be related by blood, or descent, and by marriage; who should live with whom at which stages of the life course; the social, sexual, and economic rights and obligations of individuals occupying different kin positions in relation to each other; and the division of labour among kin-related individuals. (Mason 2001, 160–161)

Family systems are very stable and may persist over centuries. A growing body of literature looks at how family systems affect current development (Todd & Garrioch 1985; Todd 1987; Basu & Das Gupta 2001; Mason 2001; Therborn 2004; Duranton et al. 2009; Lynch 2011).

A family system classification can be useful to researchers because family systems carry elements of gender systems, such as the appropriate roles for wives and husbands and the preferred sex of children (Basu & Das Gupta 2001). Todd (1987) finds that stronger female authority within the family system is positively correlated with the educational advancement of the next generation. Measuring the impact of various historical institutions on a historical gender equality index, Dilli et al. (2015) find that family systems as an institution have insignificant effects on various elements of gender equality. Our study differs from theirs in using a different classification and concentrating solely on a single outcome, gender equality in education – this may explain why our results differ from theirs. For more information, see the notes to Appendix Table A1.
Family systems can also reveal how far girls exercise choice or agency, in other words, their ability to make meaningful life decisions (Sen 1999; Kabeer 2005; World Bank 2011). In societies where inheritance and marriage rules favour men, for example obliging the woman to live with the husband’s family after marriage, women have little economic independence or agency (Basu & Das Gupta 2001). As I explain further below, if a girl is to participate in education she must also have certain abilities within the family context, such as the ability not to be married at a young age, to own property or to generate her own income. The level of agency women can exercise within the family system is important for investment in their educational careers. For instance, King et al. (1986) observe that in Asia, in areas with lower female agency mothers have the least effect on their daughters completed education (Pakistan), whereas in areas with higher female agency (the Philippines) their effect is much stronger.

FAMILY ORGANIZATION AND GENDERED EDUCATIONAL INVESTMENT

Women’s value and agency in the family

Family systems allow us to understand the gender relations and preferences of many generations ago. Questions to ask are whether these preferences persist, to what extent they persist, and whether family systems have different types of influence. To answer these questions, I look at three features of family systems that could lead to gender inequality: marriage patterns, inheritance structures and domestic organization or co-residence patterns.3

Marriage patterns inform us about the agency women have in whether, when and whom to marry. They thus reflect women's position in their natal household and in the new household they will set up. Key elements are the age at first marriage and the age difference between husband and wife: the spousal age gap. Young married girls may be prevented from taking advantage of education or work opportunities by household responsibilities, pregnancy and child rearing, and social restrictions such as limitation of their mobility (Mathur et al. 2003; Jain & Kurz 2007). On the other hand, being able to delay marriage and the first birth is often strongly correlated with an increase in education and earnings (Goldin & Katz 2000; Pezzini 2005; Field & Ambrus 2008) and can positively influence women's time and resource investment in developing their human capital (Jensen & Thornton 2003). A small spousal age gap to a certain extent reflects equality between a woman and her partner (Casterline et al. 1986) and higher female bargaining power than in family systems where women marry men much older than themselves.

3 Additional features that can be used are preferences for patrilocality, matrilocality, bilocality or neolocality and biological mythology (the child seen as a product of father, mother or both), but lack of data and difficulty in measuring these features prevents us considering them here.
(Lloyd 2005; Carmichael et al. 2011). These factors are related: research shows that women who marry before 18 are more likely to be married to much older men (Mensch 1986; Jain & Kurz 2007). In family systems where women marry when they are past adolescence, and to men of similar age, we may assume that they are more able to make decisions about their human capital development, and that of their children, than women who are married younger and to older men.

The question here is one of direction of causality: do women marry later because their family system allows them to receive more education, or do they receive more education because their family system allows them to marry later? The expansion of girls’ formal schooling is often seen as one of the main influences on family structure and behaviour (Jain & Kurz 2007). However, we could argue that when marriage age is relatively high from the outset, girls are more likely to participate in education. Modernization in the form of industrialization, schooling and increasing employment opportunities for women can provide some departures from traditional gender roles, but this only partly accounts for the way the gender education gap varies from society to society. The decision to delay marriage is not only shaped by current incentives such as human capital accumulation or labour force participation, but also reflects cultural values, even though these values may have emanated from historical economic realities (Lynch 1991). Although age at marriage is likely to be sensitive to the economic environment, marriage patterns also appear to be shaped by other features of family systems.

The second feature I look at is inheritance structure. The ability of women to inherit indicates the strength of female property rights, which in turn are positively related to increases in female educational attainment (Quisumbing & Maluccio 2003; Roy 2011), and the well-being of children. In Nepal, for example, women’s land rights empower women by increasing their control over household decision making, which in turn benefits children’s health (Allendorf 2007). Anthropologists distinguish three basic inheritance types: patrilineal, matrilineal or bilateral. Patrilineal systems, in which men control the productive resources, generally imply weak female bargaining power and a lower economic status for women. This gender imbalance can inhibit a mother’s ability to provide for daughters, resulting in an intergenerational transfer of a lower economic position of women (Cox & Fafchamps 2007, 3767). Matrilineal inheritance seems to suggest some form of female property rights. In reality, however, property is transmitted through males related to the mother and women are prohibited from holding property. However, in this system women are arguably valued more highly than in the patrilineal system, where women do not form such links. Bilateral systems do make it possible for women to inherit and give them a somewhat stronger economic bargaining position, which implies better ability to provide for themselves and their daughters.

Our third feature of interest is domestic organization or co-residence patterns. A family is either nuclear (the conjugal couple and their children) or complex. Complex families include adults other than the conjugal couple. There are three types: extended families, stem families and polygamous families. Domestic
organization’ often refers to what people consider their ideal living arrangement, which does not necessarily reflect the actual arrangement at every stage of life (see for example Karve 1965). This measure is therefore highly normative, and can be used to describe ideal gender roles. The four types of family have different gendered expectations of appropriate female roles within the family, and these expectations in turn influence female human capital investment.

A nuclear family excludes family members other than the conjugal couple from everyday decision-making. A new household is established after marriage and is generally based on the mutual consent of both spouses, thus providing a more solid base for gender equality in household investment decisions, than those families where marriage is not on the basis of such mutual consent. Nuclear families are associated with high age at marriage and thus with a longer period of capital accumulation for women. They are also thought to have a positive influence on female labour force participation, which is positively related to human capital accumulation. And with the emphasis on the conjugal couple, and moving out of the parental home after marriage, the nuclear family supports a stronger agency with respect to parental authority (Richard et al. 1983; Todd 1987; De Moor & Van Zanden 2006).

Extended families consist of more than one married couple, generally three generations including relatives such as grandparents, aunts, uncles and (married) siblings. Cultures with extended families are considered to be typically less egalitarian than those that favour the nuclear family, with hierarchical male-dominated structures and inheritance, weakening the position of the women in the family (Boserup 1970; Alesina et al. 2013). Arranged marriages are especially frequent in extended families, often resulting in young female marriage with a high spousal age gap and a young bride’s outmigration to the husband’s family, weakening her bargaining power (Gupta 1976, 82). In these families, boys are favoured for human capital investment because their remittances flow back directly into the natal home.

In the stem family, one of the children remains at home, under the authority of the parents. The position of women in these families seems similar to that of the extended family. Decision-making involves more relatives than is the case in the nuclear family, and resources must be distributed among more kin. However, age at marriage is generally late in stem families and not all children are subject to parental control, which could have positive effects for the position of women and their human capital investment.

The polygamous family, found mostly in Africa, is one with multiple wives (polygyny) or multiple husbands (polyandry), though the latter is rare. Polygyny is generally considered non-beneficial for female educational investment, as it

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4 Goode (1970 – now textbook modernization theory), saw the ideal type of nuclear family as positively related to industrialization and believed that family patterns around the world would eventually resemble the Western-type nuclear family.
drives up the demand for wives and increases the price men must pay to marry them. This system is only sustainable when population growth is high and men marry women younger than themselves. Investment flows into ‘buying’ wives and ‘selling’ daughters, decreasing capital investment, including that for education (Tertilt 2005, 2006). In addition, women share their husband’s earnings with his other spouses. When fertility per woman remains high, fewer resources are available per child than is the case in other family types, which implies less education investment potential. When son preference is strong, boys will be favoured over girls for human capital investment. However, son preference is not clear-cut in societies with this kind of family. In Africa especially, a woman can have considerable autonomy, even if she lacks economic status, and may run her own household in a separate dwelling (Murdock 1981). Polygamous societies that prize high fertility will focus strongly on daughters (Cox & Fafchamps 2007). However, age at marriage is generally low and inheritance is either patrilineal or matrilineal, never bilateral.

Many of these features of family systems are likely to reinforce one another. For instance, son preference may be exacerbated in the extended family, because large families can divide labour more strictly and concentrate human capital investment on certain children only (Das Gupta 1999; Duranton et al. 2009). This son preference has an impact on educational investment, but also on the provision of food and the division of inheritance (Rosenzweig & Schultz 1982; Greenhalgh 1985; King & Hill 1997). In a patrilineal system where girls marry young and cannot claim inheritance rights, sons are considered the more rational investment choice as the old-age caregivers of the natal household, but in bilateral systems this is not necessarily the case. Todd (1987) argues that women in extended families where their position is favourable (measured by their propensity to inherit, relatively high age at marriage and low spousal age gap) are positively associated with literacy attainment. This links up with research that suggests there is a positive relation between maternal education and investment in the grandchildren’s human capital – the so-called ‘grandmother effect’ (Baizan & Camps 2007; Parker & Short 2009).

Capturing family systems

There is data that enable us to measure marriage patterns between 1950 and 2005. Domestic organization and inheritance are available as historical time-fixed indicators measured around the 1920s. This allows us to measure whether such historical systems still have an impact on the period between 1950 and 2005. By combining the types of domestic organization with inheritance, as a basic indicator of the economic status of women in the family, we can expand the four basic types described above into nine sub-types. Table 1 shows these systems, example countries for each type, and the expected effects of the female to male ratio in each system.

The patrilineal extended family systems of Pakistan and India exemplify the effects of family systems on gender outcomes in education. Here, inheritance
rights (patrilineal) and residence patterns (patrilocal)\(^5\) are weighted in favour of men. Property is transmitted through the male line, implying poor property rights for girls; the fathers and husbands control the family budget. Girls marry young and spousal age gaps are large, leaving little room for female agency in human capital investment decisions. Families have little incentive to invest in daughters’ human capital: girls move to the husband’s home after marriage, cutting off remittances to the natal family. This is not to say that all parents make a harsh cost-benefit analysis. A girl’s marriage offers a viable and culturally accepted ‘exit strategy’, where the young bride will be taken care of by a new family. Nonetheless, this family system is expected to have one of the lowest potentials for gender equality in education.

Figure 1 compares gender gaps in educational attainment for five countries from 1950 to 2005. The large gaps and slow educational development of Pakistan and India are clear. There is some progression towards gender equality, but the curve is not as steep as that of Bangladesh. The other two countries, Brazil and Sri Lanka, examples of the bilateral nuclear family system, do not have steeper convergence curves but they do have higher starting positions for the incorporation of women into education. It is true that mass education thrived much earlier in Latin America than in, for example, India, but Latin American countries also have a high level of female inclusion in education (Frankema 2009; van der Vleuten 2009).

The bilateral nuclear system as it exists in Sri Lanka has a strong development potential for female educational participation because of the strong position it assigns to women in the family (Caldwell 1996). Inheritance is bilateral, the

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Table 1: Overview of family systems

| Family systems       | Countries | Example | Expected effect on female to male ratio in education |
|----------------------|-----------|---------|------------------------------------------------------|
| Patrilineal nuclear  | 12        | Belize  | —                                                   |
| Patrilineal extended | 45        | Pakistan| —                                                   |
| Patrilineal stem     | 4         | Mongolia| —                                                   |
| Patrilineal polygamous| 12       | Uganda  | —                                                   |
| Matrilineal nuclear  | 2         | Cambodia| +                                                   |
| Matrilineal extended | 3         | Ghana   | –                                                   |
| Matrilineal polygamous| 3       | Malawi  | —                                                   |
| Bilateral nuclear    | 18        | Sri Lanka| ++                                                  |
| Bilateral extended   | 5         | Bahrain | +/-                                                 |

Note: the expected effects range from – (very negative) to ++ (very positive). +/- is an ambiguous effect.

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\(^5\) ‘Patrilocality’ refers to the married couple setting up residence in or near the husband’s family’s home.
domestic residence is nuclear and women have access to property, making them less dependent on relatives outside the conjugal couple. In addition, Sri Lankan families historically have a higher age at marriage than families in other countries in South Asia. To show the marriage ages in historical comparison, Table 2 compares Sri Lanka with India and China in the early twentieth century, showing that Sri Lankan female age at marriage was high, well past adolescence. Age at marriage is measured using the singulate mean age at marriage (SMAM – the average years of single life, of those who marry before age 50). Hajnal (1953) created this measure to calculate the mean age at marriage, and more recently it has been used as an indicator of female empowerment (Carmichael 2011; World Bank 2011). The spousal age gap, measured by subtracting female SMAM from male SMAM, has been used as a similar indicator of women’s marginalization within marriage and society (Edlund 1999).

In addition to domestic organization and inheritance, female SMAM and the spousal age gap are further useful as measures of female bargaining power and equality within marriage. Unlike inheritance and domestic residence, data availability allows for the continuous measurement of these indicators throughout the period 1950 to 2005. De Moor and Van Zanden (2006, 2010) developed the ‘girl power index’ (GPI) to combine both indicators by subtracting the spousal age gap from the female age at first marriage. Carmichael et al. (2011) tested this measure against contemporary female empowerment measures such as the Global Gender Gap (World Economic Forum) and the Gender Inequality Index (UN) and found them to correlate very strongly. Figure 2 shows that the GPI also relates strongly to the gender ratio in average years of education.

The above observations suggest hypotheses about the relation between family systems and gendered educational attainment. Late marriage and a low spousal age gap should increase female educational attainment and a higher score on the GPI

**Figure 1:** Gender gaps in educational attainment in five countries, 1950–2005

Note: The gender gap is defined as the ratio of female to male attainment (pop. 15+).

Source: Barro & Lee 2010
should narrow the gender gap in education. Patrilineal inheritance probably widens the gender gap in education and conversely, bilateral inheritance should narrow it. Expectations for matrilineal inheritance fall between the negative and positive ones of the patrilineal and bilateral inheritance types. Complex families are expected to have higher gender inequality in education than nuclear families.

**DATA AND ANALYSIS**

To test these hypotheses, I used an unbalanced panel of 86 countries for which data are available on gender inequality in education, family factors and several socioeconomic controls between 1950 and 2005. I followed the subdivision of Barro and Lee (2012), which considers two broad groups of countries in their dataset: 24 advanced countries and 122 developing countries. The use of other data led to a diminishing of that total number: 21 advanced countries and 86 developing countries. The focus is
on developing countries since they display the most variability in the dependent variable and in age at first marriage. The main dependent variable is the ratio of female to male average years of education and the data are by 5-year intervals. Table A1 in the Appendix provides descriptive statistics for all variables. The analytical framework is a random effects panel regression, allowing for the inclusion of time-invariant individual parameters such as the family system operators. In a random effects model, the unobserved variables are assumed to be uncorrelated with all the observed variables. I preferred the random effects model to a pooled OLS model because it can account for individual heterogeneity and to a fixed effects model because it can account for time-invariant variables vital to my analysis, such as the family systems. I used Newey-West (1987) standard errors clustered on countries to correct for serial correlation in the panel.

The full regression model is specified as follows:

\[ y_{it} = \alpha + \delta_1 X_i + \beta_1 Z_{it-1} + \beta_2 \lambda_{it-1} + \beta_3 \theta_t + \delta_2 \mu_i + \delta_3 \mu_i + \nu_{it} \]

Here \( y_{it} \) refers to the ratio of female to male average years of education in country \( i \) at time \( t \). The parameter \( X_i \) refers to the set of family system dummies, \( Z_{it-1} \) to the GPI, \( \lambda_{it-1} \) to the lagged set of socioeconomic controls and \( \theta_t \) to the religion dummies. All estimated models include year \( (\mu_t) \) and regional \( (\mu_r) \) fixed effects to control for individual change over time and by region unexplained by the model. The \( \nu_{it} \) is an error term, capturing all other omitted factors. Dummies are used for the time-invariant family systems, each with a different combination of domestic organization (nuclear, extended, stem and polygamous) and inheritance

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6 The 86 countries of interest are Afghanistan, Albania, Algeria, Argentina, Armenia, Bangladesh, Benin, Bolivia, Botswana, Brazil, Bulgaria, Burundi, Cambodia, Cameroon, Central African Republic, Chile, China, Colombia, Congo, Croatia, Cuba, Czech Republic, Côte d’Ivoire, Ecuador, Egypt, Estonia, Gambia, Ghana, Guatemala, Honduras, Hungary, India, Indonesia, Iran (Islamic Republic of), Iraq, Israel, Jordan, Kazakhstan, Kenya, Kuwait, Kyrgyzstan, Latvia, Liberia, Lithuania, Malawi, Malaysia, Mali, Mauritania, Mexico, Mongolia, Morocco, Mozambique, Nepal, Niger, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Qatar, Republic of Korea, Republic of Moldova, Romania, Rwanda, Saudi Arabia, Senegal, Sierra Leone, Singapore, Slovakia, Slovenia, South Africa, Sri Lanka, Syrian Arab Republic, Tajikistan, Thailand, Togo, Tunisia, Uganda, Ukraine, United Arab Emirates, United Republic of Tanzania, Uruguay, Venezuela (Bolivarian Republic of), Yemen and Zambia. Although Kuwait, Qatar, United Arab Emirates and Venezuela were high-income countries in 1950, I do include them in this group for a better comparison with the Barro and Lee dataset.

7 A Hausman test showed that a fixed-effects model might have been better, but this model was not an option because the family systems are time-invariant. I used a fixed effects model as a robustness check for the girl power index (GPI).

8 Regions are classified according to the CLIO-Infra OECD classification (Van Zanden et al. 2014). The regions are: East Asia and the Pacific, Latin America and the Caribbean, Middle East and North Africa, South Asia, Sub-Saharan Africa, Advanced Economies, Europe and Central Asia.
practices (patrilineal, matrilineal and bilateral). Both domestic organization and inheritance are classified as dominant when the proportion of the historically practising population exceeds a benchmark level of 20% of the population, otherwise the variable is excluded. The family systems are generalized to the total population. The patrilineal extended system is the reference category, for which I expect the lowest gender ratio in education. Data for these family systems are from a dataset in Rijpma and Carmichael (2016) which brings together data from Todd (1987) and the Murdock-Narodov atlas. These data sources have been used frequently by other authors (Duranton et al. 2009; Alesina et al. 2013; Tur-Prats 2014). The is a continuous measure, consisting of data from Sarah Carmichael’s work on marriage patterns (Carmichael 2011; Carmichael et al. 2011). It is lagged with one period (t-1), as are the other time-variant factors, to account for delays in the effect of the variables. For instance, mother’s bargaining power and subsequent investment possibilities are expected to influence the education of the next generation of girls, and a five-year lag adjusts for this delay.11 This does, however, imply a diminished number of observations.

The economic control variables include (the log) of GDP per capita, the female labour force participation rate (FLFPR) and public expenditure on education, all with a 1-period lag (t-1). The parameter of religion describes religious adherence: Catholic, Protestant, Muslim, Hindu, or other. Following Inglehart and Baker (2000), the religion dummy takes the value of one when a particular religion is dominant and zero otherwise. The benchmark for dominance of adherents was set at 50%. For the highly developed countries, a dummy for Protestant was included as well.12

RESULTS

Model 1 in Table 3 shows the relation between the gender ratio, the various family systems and the full spectrum of control variables. Models 2 to 4 add the marriage patterns, either the GPI (2), solely the age at marriage (3) or the spousal age gap (4). The last model adds a comparison, in which the 21 highly developed countries are also included.13 Table 3 shows that most expectations about the link between women’s value in the family and the gender ratio in education are met. Model 1

9 See notes for Table A1 in the Appendix.
10 Further elaboration on this dataset can be found in the notes to Table A1 in the Appendix.
11 I tested for the robustness of this lag period against using multiple lags and found that the latter yielded similar results. However, because the lag period decreases the number of observations, I selected the shortest lag period.
12 In the set of low to middle developed countries, no country reached the benchmark of 50% for the variable ‘Protestant’.
13 The high income countries are: Australia, Austria, Belgium, Canada, Finland, France, Germany, Greece, Ireland, Italy, Japan, The Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, UK and US.
| MODEL       | (1)       | (2)       | (3)       | (4)       | (5)       |
|-------------|-----------|-----------|-----------|-----------|-----------|
| SAMPLE      |           | Developing and middle-income countries | Incl. high-income countries |
| VARIABLES   |           | Female to male ratio in average years of schooling |                       |
| Patrilineal nuclear | 0.0402    | 0.0101    | 0.0147    | 0.0201    | 0.0857*** |
|             | (0.0444)  | (0.0404)  | (0.0403)  | (0.0426)  | (0.0332)  |
| Patrilineal extended | (Ref.)    | (Ref.)    | (Ref.)    | (Ref.)    | (Ref.)    |
| Patrilineal stem | 0.107     | 0.0830    | 0.0877    | 0.0897    | 0.0748*   |
|             | (0.0693)  | (0.0702)  | (0.0751)  | (0.0652)  | (0.0394)  |
| Patrilineal polygamous | 0.145**   | 0.0776    | 0.114**   | 0.0724    | -0.0789  |
|             | (0.0698)  | (0.0604)  | (0.0560)  | (0.0694)  | (0.0692)  |
| Matrilineal nuclear | 0.154***  | 0.126***  | 0.147***  | 0.117**   | 0.0231    |
|             | (0.0579)  | (0.0426)  | (0.0467)  | (0.0467)  | (0.0553)  |
| Matrilineal extended | -0.0203   | -0.0441   | -0.0172   | -0.0609   | -0.225*** |
|             | (0.0735)  | (0.0714)  | (0.0632)  | (0.0829)  | (0.0788)  |
| Matrilineal polygamous | 0.141**   | 0.108**   | 0.147***  | 0.0821    | -0.0629  |
|             | (0.0600)  | (0.0529)  | (0.0470)  | (0.0641)  | (0.0621)  |
| Bilateral nuclear | 0.142**   | 0.117**   | 0.124**   | 0.122**   | 0.127***  |
|             | (0.0671)  | (0.0572)  | (0.0578)  | (0.0616)  | (0.0330)  |
| Bilateral extended | 0.0548    | 0.0549    | 0.0700    | 0.0388    | 0.0658    |
|             | (0.0923)  | (0.0921)  | (0.0908)  | (0.0936)  | (0.0898)  |
| Bilateral stem | -         | -         | -         | -         | -0.0156   |
|                                      | (t-1)       | (t-1)       | (t-1)       | (t-1)       | (t-1)       |
|--------------------------------------|------------|------------|------------|------------|------------|
| Girl power index (t-1)               | -          | 0.0146***  | -          | -          | 0.00456*   |
|                                      | (0.00307)  |            |            |            | (0.00264)  |
| SMAM (t-1)                           | -          | -          | 0.0215***  | -          | -          |
|                                      |            |            | (0.00469)  |            |            |
| Age gap (t-1)                        | -          | -          | -          | -0.0229*** | -          |
|                                      |            |            |            | (0.00604)  |            |
| Log GDP per capita (t-1)             | 0.0238*    | 0.0260*    | 0.0207     | 0.0303**   | 0.0308**   |
|                                      | (0.0144)   | (0.0149)   | (0.0154)   | (0.0138)   | (0.0131)   |
| FLFP rate (t-1)                      | 5.04e-05   | -7.32e-05  | 1.44e-05   | -0.000106  | 0.000270   |
|                                      | (0.000567) | (0.000542) | (0.000555) | (0.000542) | (0.000393) |
| Public expenditure on education (t-1)| -0.00808*  | -0.0103**  | -0.0104**  | -0.00912** | -0.00600   |
|                                      | (0.00489)  | (0.00431)  | (0.00434)  | (0.00450)  | (0.00457)  |
| Catholic                             | (Ref.)     | (Ref.)     | (Ref.)     | (Ref.)     | (Ref.)     |
| Protestant                           | -          | -          | -          | -          | 0.0648*    |
|                                      |            |            |            |            | (0.0369)   |
| Muslim                               | 0.00289    | 0.0383     | 0.0335     | 0.0264     | -0.103***  |
|                                      | (0.0311)   | (0.0299)   | (0.0309)   | (0.0302)   | (0.0389)   |
| Hindu                                | -0.105     | -0.0674    | -0.0470    | -0.107     | -0.374***  |
|                                      | (0.132)    | (0.128)    | (0.127)    | (0.130)    | (0.0924)   |
| Other                                | 0.0340     | 0.0566**   | 0.0521**   | 0.0507**   | -0.0292    |

(Continued)
Table 3: (Continued)

| MODEL | SAMPLE                  | (1)    | (2)    | (3)    | (4)    | (5)    |
|-------|-------------------------|--------|--------|--------|--------|--------|
|       | Developing and middle-income countries<sup>a</sup> |        |        |        |        |        |
|       | Incl. high-income countries<sup>b</sup>         |        |        |        |        |        |
|       | Female to male ratio in average years of schooling | (0.0259) | (0.0251) | (0.0257) | (0.0258) | (0.0208) |
|       | Constant               | 0.658*** | 0.326*** | 0.158   | 0.671*** | 0.550*** |
|       |                       | (0.132)  | (0.126)  | (0.150) | (0.128) | (0.126) |
|       | Observations           | 435     | 435     | 435     | 435     | 605     |
|       | Number of countries    | 86      | 86      | 86      | 86      | 107     |
|       | Year dummies           | Y       | Y       | Y       | Y       | Y       |
|       | Region dummies<sup>d</sup> | Y     | Y       | Y       | Y       | Y       |

Robust standard errors in parentheses
Standard errors are clustered per country
*** p<0.01, ** p<0.05, * p<0.1

Notes:
<sup>a</sup> 86 countries.
<sup>b</sup> 21 countries.
<sup>c</sup> Within this dataset, the bilateral stem family only exists within the advanced economies.
<sup>d</sup> The regions are East Asia and the Pacific, Latin America and the Caribbean, the Middle East and North Africa, South Asia, sub-Saharan Africa, Europe and Central Asia.
shows a statistically significant correlation between the gender ratio in education and those family systems where the women’s value is high and families are relatively small. Nuclear systems have a more significant positive association with the gender ratio in education than the patrilineal extended family system, but only when women have a say in the transmission of property, in other words, when the nuclear system is combined with bilateral or matrilineal inheritance. The estimates for the matrilineal nuclear and bilateral nuclear family systems are 0.154 and 0.142 respectively, both significant at 1%. The second of these estimates implies that the bilateral nuclear system increases the value of the gender ratio in education by 14.6 percentage points. This is a fairly large increase compared with the mean of the gender ratio in education, which is 0.72 in the sample.

Patrilineal inheritance has no significant effect on female educational participation, but this could be because the baseline category is a patrilineal system as well. Nevertheless, I would have expected the patrilineal nuclear system to perform better than the extended ones, because son preference might be increased by the nature of extended families, as explained above. Matrilineal inheritance has no positive effect on the female to male ratio when the domestic organization type is extended. Surprisingly, matrilineal inheritance does have a positive effect in combination with a polygamous family system. In addition the patrilineal polygamous family system is positive and significant vis-à-vis the patrilineal extended system, though I expected polygamous systems in general to perform similarly or worse. With the inclusion of the GPI in the second model, the effect of the patrilineal extended system becomes more significant than that of the polygamous systems, which could indicate that the influence of these polygamous systems on the gender ratio is driven by differences in age at marriage and spousal age gap. This supports the findings by Tertilt (2005, 2006) that spousal age differences are higher in polygamous than in monogamous systems. In sum, inheritance types that favour women have positive effects in all the models. Nuclear family systems perform better than extended systems, as expected. Polygamous systems seem to have a more positive effect than the extended system, but this is more robustly so in combination with a historically matrilineal inheritance structure. This may also be because girls are valued more highly on the basis of their future fertility (Cox & Fafchamps 2007), or because of (domestic) labour conditions that allow girls to go to school while boys need to work. The reasons for a smaller gender gap in families with a tradition of matrilineal inheritance and a polygamous structure should be analysed in future research.

Turning to the link between the GPI and the educational gender gap, we see that the positive and significant sign of the coefficient supports the hypothesis that later marriage and a smaller spousal age gap are positively associated with the gender ratio in education. In model 2, keeping all control variables equal, a one-point increase in the GPI results in a 1.5 percentage point increase in the gender ratio. When marriage partners are on a more equal footing, i.e., when ‘girl power’ increases, gender equality in education rises as well. Further investigation into the two variables constituting the GPI show that both SMAM and
the age gap have the right positively and negatively significant signs respectively, with somewhat larger coefficients (models 3 and 4). As mentioned earlier, the inclusion of the age gap decreases the effect of the polygamous family system on the gender ratio in education, while the age at marriage does not have this effect. I added model 5 because I wondered whether the inclusion of highly advanced countries would weaken the significance of either of the variables. With the addition of the 21 advanced countries, the GPI is still significant at a 10% level.

Table A2 in the Appendix tests the robustness of these marriage pattern findings by applying alternative estimation methods. The same controls, year and region dummies apply, but for the sake of brevity these are unreported. Models 1 and 2 show the benchmark random effects estimation and a pooled OLS estimation with robust standard errors. The GPI is significant and positive and the two models yield very similar results, providing some confidence in my model specification (Wooldridge 2009, ch. 14). As mentioned earlier (footnote 7), a Hausman test indicated that fixed-effects model might have been better, but this would yield no estimations for my time-invariant family systems. With the GPI now as the main independent variable of interest, I performed a fixed-effects estimation, reported in model 3 in Table A2. Though the coefficient of the GPI is somewhat smaller, it remains robustly significant. Lastly, I recognize that the GPI suffers from an endogeneity problem because high education of women might result in later marriage. I therefore applied a traditional technique of using lags of the GPI as an instrument in the model, using a two-stage least-squares approach. I lagged these variables once, and my model still yielded significant results. I interpret these last models with caution and use them only as a test to check the robustness of my results. Since Angrist and Krueger (2001) have pointed out the mechanical and a-theoretical nature of this traditional choice of instrument, the use of lagged variables as instruments is under heavy debate. All in all though, I find that the GPI is robustly associated with the gender ratio in average years in education.

Some interesting findings appeared in the controls. Surprisingly, expenditures on education were negatively related to the gender ratio in education. The results are similar even when I do not control for income per capita. It must be noted that the data quality of this particular variable is weak, which discourages drawing strong conclusions. Nonetheless, the relative worsening of female education by public spending seems like an unlikely outcome. A possible explanation might be that added public expenditure on education benefits men over women. Regressing the same model on female and male education separately, I found that expenditure had no significant relation to female education, but a small significant and positive (10% level) effect on male education (not reported). When the highly developed countries are included in the analysis, the detrimental effect of public educational spending on the gender ratio disappears. This could indicate two things. First, the effects of educational spending on male instead of female education could be stronger in developing countries because of a gender bias of state institutions. Second, in the period from 1950 onwards, developing countries began their mass education systems, which at first generally included more men.
than women. This feature diminished as mass educational systems matured, as is the case in the developed regions and reflected by the drop in the significance of the coefficient in model 4. Further investigation into this variable might yield some interesting results.

The control variable GDP per capita provides some indication of the resources available for education. The positive sign of the GDP coefficient indicates that as income per capita increases and the constraints of poverty become less severe, gender differences in educational enrolment diminish. The female labour force participation rate showed no significant association with the gender ratio in education. It is difficult to assess the causality direction of the relationship between female labour force participation and female education. Development economists have shown that the effect of education on labour force participation rates is not uniform across years of education and that the relationship may be U-shaped. This means that female gains in education are not always reflected by female gains in income and employment or vice versa (Cameron et al. 2001).

Religious adherence produces some interesting results. Recent studies show that female education is more constrained in a society with a large share of Muslim adherents, and to some extent in one with a large share of Hindu adherents, than it is in a society with a large share of any Christian faith (Norton & Tomal 2009; Cooray & Potrafke 2010). However, when I include regional dummies, I find that the Muslim and Hindu dummy variables are insignificant, while without including regions dummies (not reported), I did obtain a significant coefficient. This implies that the cultural effects are captured by regional differences, not by religious ones.

To compare the effect of the different variables influencing the gender ratio in education, Table A3 in the Appendix shows the standardized coefficients of the full family systems model. The effect of the family system variables is very strong, even stronger than that of income per capita. The matrilineal nuclear family and the bilateral nuclear family both stand out as having a particularly strong association with the gender gap, though the effect of the matrilineal polygamous system is strong as well. The coefficient for the GPI and its comparative effect on the educational gender gap is also stronger than that of income per capita. Though not as large as the effect of the family characteristics, GDP per capita still has a positive effect on the gender ratio in education. In comparison, the coefficient for public expenditure on education is smaller, and still negative. Once again, there are no strong negative effects for the Muslim and Hindu variables.

As a robustness check, I tested the full model again only for the year 2000, for the set of developing countries (Table A4 in the Appendix). The association with the gender gap in education and the GPI remains robustly significant. However, many family systems now lose their significant effect compared to the base category of the patrilineal extended system. The bilateral nuclear system retains its significant effect on the gender ratio in education and the effects of the matrilineal extended system
come out as negative. An F-test ($F(8, 46) = 4.12; P = 0.0009$) performed for all family systems shows that these family systems do have some jointly significant effect on the gender ratio.

Figure 3 illustrates the predictive power of our model, by showing the actual time-series of the gender gap in educational attainment, and the outcome as predicted by our model for five countries. Pakistan, with a patrilineal extended family type, and Brazil and Sri Lanka, both with bilateral nuclear types, seem to fit the model quite well. The actual gender gaps demonstrate somewhat more volatility than the model can pick up, but there seems to be a fair match between the actual and the modelled outcomes. The modelled outcome for India shows the model’s imperfections as well. India is already a weak performer, but the modelled outcome predicts the gender gap to be even larger. Possibly, the prediction missed some important elements adding to Indian-specific gender equality in education, such as caste divisions. Another possible explanation is that there is a marked contrast between the historical demographic patterns of North and South India, and that using the Indian country-average family type as data does not accurately portray reality.

CONCLUSIONS

This study adds to the debate on the determinants and persistence of gender gaps in education and the effects of cultural institutions more broadly. I argue that family systems and female agency are a productive area for inquiry into the roots of gender inequalities and their ongoing persistence. I found robust evidence of the
association between the value placed on women in the family and the gender ratio in education, whether this is via institutional effects of family systems or via marriage patterns associated with high female agency. The family as an institution may thus either limit or increase women’s freedom of choice and life opportunities more than it does men’s, through unequal educational participation. Matrilineal and bilateral family types are strong predictors of equal gender participation in education, especially when they are also the nuclear family type. I found that extended or polygamous families did not necessarily have a negative effect on the gender ratio in education; rather, the ratio depended more on the type of inheritance system the family used.

Historical legacies do not weaken a society’s ability to overcome gender inequalities. Countries across the world are trying to overcome gender barriers in education, improve female labour force participation and, more generally, make women valued as assets to society. Moreover, women are themselves active agents in their struggle towards gender equality in all aspects of life. My study demonstrates that the struggle may be more arduous in some parts of the world than in others, because of differences in the slow-changing cultural institution of the family, and the different ways in which has been organized historically. Strong female agency within the family enables women to make important life decisions, such to invest in their own education and their daughters’. Where both spouses are educated, intergenerational transfer of knowledge benefits. This study provides a well-quantified study with a wide range of international data and indicates that in countries where women lack the capacity to choose, either because they marry into a new family at a young age, or because they lack property rights, it is likely that less will be invested in women’s education than in men’s.

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### Table A1: Descriptive statistics for developing and middle-income countries

| VARIABLES                                      | Obs  | Mean   | Sd    | Min  | Max   | Source                     |
|------------------------------------------------|------|--------|-------|------|-------|----------------------------|
| Ratio of female to male average years of education\(^a\) | 1440 | 0.722  | 0.261 | 0.0254 | 1.455 | Barro & Lee 2010           |
| Nuclear                                        | 1320 | 0.318  | 0.466 | 0     | 1     | Rijpma & Carmichael 2013\(^b\) |
| Extended                                       | 1320 | 0.509  | 0.500 | 0     | 1     |
| Stem                                           | 1320 | 0.036  | 0.187 | 0     | 1     |
| Polygamous                                     | 1320 | 0.155  | 0.155 | 0     | 1     |
| Patrilineal inheritance                        | 1344 | 0.795  | 0.404 | 0     | 1     |
| Matrilineal inheritance                        | 1344 | 0.071  | 0.258 | 0     | 1     |
| Bilateral inheritance                          | 1344 | 0.241  | 0.427 | 0     | 1     |
| Girl power index\(^c\)                         | 901  | 18.07  | 3.942 | 5.05  | 31.81 | Carmichael 2011            |
| Log of GDP per capita                          | 1192 | 7.662  | 0.970 | 5.383 | 10.446| Maddison 2010              |
| Female labour force participation rate          | 823  | 21.59  | 14.942| 0     | 66.3  | ILO 2013                   |
| Expenditure on education                       | 1316 | 2.938  | 1.911 | 0.574 | 14.79 | World Bank 2013            |
| Catholic                                       | 1114 | 0.012  | 0.453 | 0     | 1     | Maoz & Henderson 2013      |
| Protestant                                     | 1114 | 0.288  | 0.107 | 0     | 1     |
| Muslim                                         | 1114 | 0.266  | 0.442 | 0     | 1     |
| Hindu                                          | 1114 | 0.022  | 0.145 | 0     | 1     |

(Continued)
### Table A1: (Continued)

| VARIABLES | Obs | Mean | Sd  | Min | Max | Source |
|-----------|-----|------|-----|-----|-----|--------|
| Other     | 1114| 0.413| 0.493| 0   | 1   | "      |

**Notes:**

- The ratio of female to male average years of education for the proportion of the population of 15 years and older.
- The combined Todd-Murdock dataset contains family characteristics such as marriage and inheritance rules. It combines the strengths of Todd’s work and the Murdock-Narodov atlas as updated and turned into country-level variables by Bolt (Bolt 2012). Todd’s work covers a large set of countries, with Europe being the most detailed, whereas Murdock’s dataset is a significant ethnographic work for Africa. Todd relies heavily on historical work and censuses from the 1970s but also anthropological work with observations for a 400-year period. The extrapolation methods of both Murdock and Todd have been viewed as somewhat extreme, for example taking a single village to account for a region or country. Murdock’s observations centre on 1920, but include observations for the period 1820–1940. For further information on the data, see Rijpma and Carmichael (2016).
- Dilli et al. (2015) also use a classification by Todd to measure the impact of various institutions on a historical gender equality index. Family systems are one of the institutions they investigate, but they find no significant effects of family systems on their historical gender equality index. However, their study differs from ours mainly in the measurement of family systems as it follows Todd (1985), which is geared towards explaining differences in political ideologies and emphasises different family system traits, such as cousin marriage. The family systems classified in our paper are based on Todd (1987), which offers a somewhat simplified system originally designed to explain variation in literacy ratios. This more specific approach, using family systems and a single outcome variable (gender equality in education), may be the reason for the difference in outcomes between the study by Dilli et al. and this study.
- Girl power index = age at marriage minus spousal age gap.
### Table A2: Marriage patterns using different estimation methods, 1950–2005

| VARIABLES                  | MODEL (1) | (2)   | (3)   | (4)   |
|----------------------------|-----------|-------|-------|-------|
|                           | Random effects | Pooled OLS | Fixed effects | 2SLS |
| Patrilineal nuclear       | 0.0101    | 0.00194 | –     | –0.0147 |
|                           | (0.0404)  | (0.0179) |       | (0.0240) |
| Patrilineal extended      | (Ref.)    | (Ref.) | –     | (Ref.) |
| Patrilineal stem          | 0.0830    | 0.0173  | –     | 0.0206  |
|                           | (0.0702)  | (0.0351) |       | (0.0348) |
| Patrilineal polygamous    | 0.0776    | 0.0618  | –     | 0.0341  |
|                           | (0.0604)  | (0.0398) |       | (0.0447) |
| Matrilineal nuclear       | 0.126***  | 0.138*** | –     | 0.0460  |
|                           | (0.0426)  | (0.0317) |       | (0.0468) |
| Matrilineal extended      | –0.0441   | –0.122*** | –     | –0.177*** |
|                           | (0.0714)  | (0.0436) |       | (0.0557) |
| Matrilineal polygamous    | 0.108**   | 0.125*** | –     | 0.0482  |
|                           | (0.0529)  | (0.0410) |       | (0.0575) |
| Bilateral nuclear         | 0.117**   | 0.101*** | –     | 0.0874*** |
|                           | (0.0572)  | (0.0225) |       | (0.0256) |
| Bilateral extended        | 0.0549    | 0.0610  | –     | 0.00866 |
|                           | (0.0921)  | (0.0430) |       | (0.0407) |
| Girl power index (t-1)    | 0.0146**** | 0.0167*** | 0.0117*** | 0.0244*** |
|                           | (0.00307) | (0.00335) | (0.00326) | (0.00303) |
| Constant                  | 0.326***  | –0.292*** | 0.414*** | 0.364*** |
|                           | (0.126)   | (0.102) | (0.117) | (0.0780) |
| Observations              | 435       | 435    | 435   | 373    |
| R-squared                 | 0.755     | 0.574  | 0.729 |
| Number of countries       | 86        | 86     | 86    |

Robust standard errors in parentheses
Standard errors are clustered

*** p<0.01, ** p<0.05, * p<0.1
### Table A3: Standardized coefficients of family systems, 1950–2005

| VARIABLES                              | (1) Female to male ratio in average years of schooling |
|----------------------------------------|--------------------------------------------------------|
| Patrilineal extended (Ref.)            |                                                        |
| Patrilineal nuclear                    | 0.0401                                                 |
|                                        | (0.161)                                                |
| Patrilineal stem                       | 0.330                                                  |
|                                        | (0.280)                                                |
| Patrilineal polygamous                 | 0.309                                                  |
|                                        | (0.240)                                                |
| Matrilineal nuclear                    | 0.500***                                               |
|                                        | (0.169)                                                |
| Matrilineal extended                   | –0.176                                                 |
|                                        | (0.284)                                                |
| Matrilineal polygamous                 | 0.430**                                                |
|                                        | (0.211)                                                |
| Bilateral nuclear                      | 0.466**                                                |
|                                        | (0.227)                                                |
| Bilateral extended                     | 0.219                                                  |
|                                        | (0.366)                                                |
| Girl power index                       | 0.238***                                               |
|                                        | (0.0500)                                               |
| Log GDP per capita                     | 0.114*                                                 |
|                                        | (0.0655)                                               |
| Female labour force Participation rate | –0.00441                                               |
|                                        | (0.0326)                                               |
| Public expenditure on education (t-1)  | –0.0791**                                              |
|                                        | (0.0332)                                               |
| Catholic (Ref.)                        |                                                        |
| Muslim                                 | 0.153                                                  |
|                                        | (0.119)                                                |
| Hindu                                  | –0.268                                                 |
|                                        | (0.508)                                                |
| Other                                  | 0.225**                                                |

(Continued)
Table A3: (Continued)

| VARIABLES          | (1) Female to male ratio in average years of schooling |
|--------------------|-------------------------------------------------------|
| Patrilineal extended | (Ref.)                                                 |
|                    | (0.100)                                                |
| Constant           | 0.0858                                                 |
|                    | (0.205)                                                |
| Observations       | 435                                                    |
| Number of countries | 86                                                     |
Table A4: Family systems for 2000

| VARIABLES                     | Ratio     |
|-------------------------------|-----------|
| Patrilineal nuclear           | 0.0212    |
|                               | (0.0396)  |
| Patrilineal extended          | (Ref.)    |
| Patrilineal stem              | 0.0225    |
|                               | (0.0720)  |
| Patrilineal polygamous        | -0.0522   |
|                               | (0.121)   |
| Matrilineal nuclear           | -0.0632   |
|                               | (0.0538)  |
| Matrilineal extended          | -0.167*** |
|                               | (0.0501)  |
| Matrilineal polygamous        | 0.0107    |
|                               | (0.0858)  |
| Bilateral nuclear             | 0.0814**  |
|                               | (0.0361)  |
| Bilateral extended            | 0.128     |
|                               | (0.0839)  |
| Girl power index              | 0.0198**  |
|                               | (0.00910) |
| Log GDP per capita            | 0.0263    |
|                               | (0.0372)  |
| Female labour force participation rate | 0.00134 |
|                               | (0.00126) |
| Public expenditure on education (t-1) | -0.0219 |
|                               | (0.0179)  |
| Catholic                      | (Ref.)    |
| Muslim                        | -0.128**  |
|                               | (0.0599)  |
| Hindu                         | -0.288*** |
|                               | (Continued) |
Table A4: (Continued)

| VARIABLES  | Ratio     | (1)         |
|------------|-----------|-------------|
|            |           | (0.0800)    |
| Other      | 0.00190   | (0.0345)    |
| Constant   | 0.344     | (0.247)     |
| Observations | 62        |             |
| R-squared  | 0.640     |             |

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1