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## Spending or saving? Female empowerment and financial decisions in a matrilineal society

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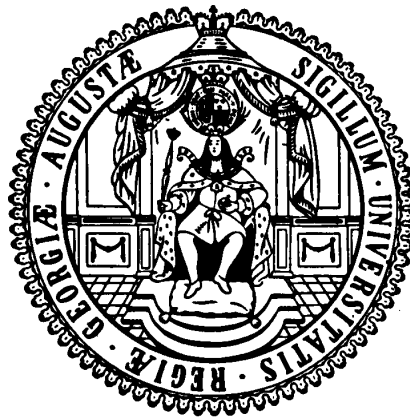
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# **Courant Research Centre**

## **‘Poverty, Equity and Growth in Developing and Transition Countries: Statistical Methods and Empirical Analysis’**

**Georg-August-Universität Göttingen**  
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Discussion Papers

**No. 268**

**Spending or Saving? Female empowerment and financial decisions in a matrilineal society**

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# Spending or Saving? Female empowerment and financial decisions in a matrilineal society

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## Abstract

This paper looks at household consumption and financial decisions made in a matrilineal society where women are traditionally the household financial managers. This culture was strongly altered by the British in the mid-19th century through Christian missionaries who proclaimed that the role of the household manager is ascribed to men and not to women. Using self-collected data of 650 individuals from the matrilineal state of Meghalaya, India, and exploring household's distance to the historical Protestant base in Cherrapunji, we find evidence that household where women are empowered spend more on welfare enhancing goods, such as food, but are less likely to have savings left at the end of the month. Our paper contributes to the literature by investigating how a historical shift in female empowerment, mostly driven by cultural norms, can have long-term effects on financial decisions.

*JEL-Classification:* I3, O1, R20, Z1.

*Keywords:* female empowerment, matrilineality, culture, savings, India, Protestant missions

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# 1 Introduction

Female empowerment has become an important goal in the field of development economics in the past decades. With the inclusion of gender equality as one of the Sustainable Development Goals (SDGs) in the year 2000, increasing effort has been directed to the reduction of discrimination and promotion of gender equality both at private and public spheres. In addition to the belief that empowering women is desirable in its own right, existing evidence shows its indirect effects for children and the society at large (Bobonis, 2009; Ashraf et al., 2010; Doepke and Tertilt, 2018). Duflo (2003) shows that when household economic resources are controlled by women, there is an improvement in children's education, nutrition and an increase in investment in durable goods. In a similar vein, Thomas (1990) provides evidence that when financial resources are controlled by mothers, health outcomes of other household members are improved. Additionally, existing evidence has shown that increasing bargaining power of females reduces household expenditures with alcohol and cigarettes, as these products are more aligned with male's consumption patterns (Rubalcava and Thomas, 2000).

This paper contributes to the literature by looking at household financial decisions in a setting where women are empowered by cultural reasons rather than due to a shift in economic resources. We exploit a historical event, namely the arrival of the Protestant British Missions in the matrilineal state of Meghalaya, India, as a source of exogenous variation in female empowerment. We then test the hypothesis that empowered women make different financial decisions than less empowered women. Using original microdata on financial decisions, sociodemographic characteristics and female empowerment collected in three Khasi districts of Meghalaya (East Khasi Hills, West Khasi Hills and RiBhoi), we provide causal evidence that empowered females spend more on food and nutrition, but this comes at the expense of savings. As pointed out by Doepke and Tertilt (2018), while female empowerment has been associated with higher investments in human capital, its negative effects for capital accumulation can have important implications for long-run economic growth.

The North-Eastern Indian state of Meghalaya is an attractive setting for two main reasons. First, we can exploit the fact that Protestant British Missions expanded slowly in the 19th century from their main bases, Cherrapunji and Shillong, introducing historical variation in female empowerment (Nakane, 1967). Second, Meghalaya’s traditional Khasi culture persisted in many parts of the state and remained mostly unaffected by other exogenous influences (Nakane, 1967; Nongbri, 1993). The Khasis form one of the few matrilineal cultures in the world with women considered to be the household head and inheritance following the mother’s lineage. Men, on the other hand, are responsible for religious, political and farm activities outside of the household (Nongbri, 1993). As girls learn their role already from young-age, they grow up as the textbook examples of empowered females. However, the arrival of the Protestant British Missions exogenously introduced non-matrilineal social values. This historic event is the basis of our identification strategy. More specifically, we use the distance to the former British bases in Cherrapunji and Shillong as instruments to investigate if female empowerment explains household financial decisions.

Our instruments are highly correlated with four indicators of female empowerment. For instance, we provide evidence that households that live further away from Cherrapunji (Shillong) are more likely to have a female household head, report more often having a female who is responsible for short-run and long-run financial decisions and are more likely to have land titles in the name of a women. At the same time, we show that the distances do not influence other observable household characteristics. By including a range of individual and household controls as well as infrastructural variables, we are confident that our results cannot be entirely driven by unobservable characteristics.

Our paper relates to two strands of the literature. First, the papers connecting female empowerment and intra-household decision making and, second, the literature investigating the long-run effects of cultural norms and institutions <sup>1</sup>. In contrast to existing studies that explore the effects of *increases* in female empowerment induced by income transfers

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<sup>1</sup>See, among others, Manser and Brown (1980); Hoddinott and Haddad (1995); Nunn (2008); Becker and Woessmann (2008); Mantovanelli (2013); de Brauw et al. (2014); Duflo (2012); Doepke and Tertilt (2018); Castelló-Climent et al. (2017); Calvi and Mantovanelli (2018); Valencia Caicedo (2018)

(de Mel et al., 2009; Ashraf, 2009), we explore a historical event that caused a *decrease* in female empowerment in a setting where females were empowered by cultural rather than by economic reasons. Additionally, by taking a closer look at the infrastructural developments around the Protestant British Missions, we shed light on a channel through which social values were transmitted over the centuries.

The remainder of this paper proceeds as follows. The next section presents the relevant literature on female empowerment and intra-household decision making and derives our hypotheses. Section 3 describes Khasi culture and British rule. Section 4 presents our data sources. Our empirical methodology is discussed in section 5. The econometric results, robustness checks and transmission channels are discussed in section 6. Section 7 concludes.

## 2 Theoretical background

This section starts by discussing the most important theories on female empowerment and then proceeds to discuss the link between female empowerment and financial decisions in the context of the matrilineal state of Meghalaya. It concludes with hypotheses about the effects of female empowerment on welfare-increasing expenditures and savings.

### 2.1 Intra-household bargaining power

Early economic theory traditionally treated the household as a single unit (Samuelson, 1956; Becker, 1965) with all household members having similar utility functions and similar preferences. In these models, household decisions are Pareto efficient and do not involve a bargaining process. Thus, within the household, the identity of the decision maker is irrelevant. More recently, a number of studies have rejected these unitary models of decision making, replacing them with the so-called non-unitary models (Manser and Brown, 1980; McElroy and Horney, 1981). In non-unitary models, each household member is assumed to have a different utility function and therefore different preferences. A bargaining process takes place within the household and decisions are made according to each member's

bargaining power. In these models, two factors determine household consumption and expenditure decisions: *i) each household member's bargaining power* and *ii) each household member's preferences*. The outcome of these bargaining processes, therefore, depends on who in the household makes the decision.

[Smith et al. \(2010\)](#) study representative data from the United States and find that there is a strong tendency for men to be the household financial managers, which is only lessened in cases where the wife is considerably older and with higher cognitive abilities than the husband. Similarly, [Ashraf \(2009\)](#) provides evidence that increasing women's bargaining power through an increase in income has a significant effect on the outcome of the household financial decision process. The author emphasizes, however, that this effect is dependent on other factors such as information and communication.

The literature investigating intra-household decision making often argues that individual bargaining power depends primarily on the amount of income that each partner contributes to the household. In this sense, a positive income shock to one of the partners would increase his/her bargaining power and shift the outcome of the decision process in his/her favor ([Manser and Brown, 1980](#)). In line with the theory, existing evidence based on observational data has shown that control over resources indeed leads to control over decisions ([Lundberg et al., 1997](#)). One of the main implications of these models, therefore, is that if women receive a positive income shock and become more empowered, financial decisions would shift and align with their preferences.

## 2.2 Preferences

Most of the non-unitary models argue that women have different preferences than men, with female preferences being more aligned with children's welfare. To test this hypothesis, they look at exogenous changes in women's bargaining power to assess its effects on household financial decisions. Using data from Ivory Coast, [Duflo and Udry \(2004\)](#) show that changes in rainfall that benefit traditionally female crops shift household expenditures towards food consumption, which improves child nutrition. Similarly, [Duflo \(2003\)](#) finds

evidence that exogenous increases in pensions to grandmothers raise nutrition of young girls – but not that of boys – in South Africa.

Great part of the existing literature has explored conditional cash transfer programs that, in many countries, target women specifically. [Attanasio and Lechene \(2010\)](#) investigate how the *PROGRESA* program in Mexico affects household expenditures. They argue that the substantial increase in household resources, which would be expected to reduce the budget share spent on food, is counteracted by the increase in female’s bargaining power, which explains the fact that the share spent with food remains constant. All in all, the authors argue that giving the money to women shifts the Engel curve and thus the household budget share spent with food does not decrease.

Also using data from *PROGRESA*, [Rubalcava et al. \(2009\)](#) and [Bobonis \(2009\)](#) provide evidence that money in the hands of women increases investments in children in Mexico. Similar results have been found in Brazil, where the conditional cash transfer program *Bolsa Familia* was associated with an increase in women’s bargaining power and consequently higher investments children’s education, health and durable goods ([de Brauw et al., 2014](#)). Exploiting a program in Macedonia, where the gender of the recipient of the transfer was randomized at the municipality level, [Armand et al. \(2016\)](#) find that cash transfers given to mothers rather than fathers increase the share of food consumption by 4 to 5 percentage points. In a field experiment in the Philippines, [Ashraf et al. \(2010\)](#) randomly provide commitment savings accounts to women and men and find that women’s self-reported bargaining power within the household increases. Moreover, they also find a shift towards female oriented consumption goods. All these papers take their findings as supportive evidence against the unitary-model of the household and as indication that women have different preferences to men. Further, they show that women’s preferences are more in line with welfare increasing expenditures in particular that of children.

From the experimental literature, a large number of studies show that women have different preferences than men (see [Andersen et al. \(2013\)](#) for a summary). Women have been found to be more risk averse ([Dohmen et al., 2011](#); [Eckel and Grossman, 2008](#)), more patient ([Dittrich and Leipold, 2014](#)), more pro-social ([Eckel and Grossman, 1998](#)) and less



trusting (Buchan et al., 2008), although the evidence on trust is mixed. Existing evidence also indicates that men and women have different preferences, with female preferences being more conducive to family welfare. However, it remains unclear what are the short run and long run consequences of empowering women for economic growth. Doepke and Tertilt (2018) present a theoretical model which shows that while empowering women would be expected to increase growth in societies whose economies depend mainly on human capital, the opposite effect would be found in societies that are dependent on the accumulation of physical capital. Using data from *PROGRESA*, the authors show that while cash transfers to women caused an increase in the investment in children, this occurred at the expense of savings, which illustrates well the existing trade off between human capital and physical capital accumulation.

Another open question in the literature refers to women’s preferences and behavior in settings where they *are* fully empowered, *i.e.* for cultural reasons, in contrast to settings where they *become* relatively more empowered through relative income changes. Gneezy et al. (2009), for instance, show that fully empowered females that live in the matrilineal state of Meghalaya are more competitive than less empowered women living in a patrilineal society and as competitive as males living in those cultures. Rink et al. (2019) show that no gender gap in financial literacy exists in the matrilineal societies in India, whereas such a gender gap is a common phenomenon in developing as well as developed countries.

## 2.3 Female empowerment and financial decisions

Some of the recent economic theories relax the assumption that females and males have different innate preferences and explain different financial decisions on the basis of resources controlled by each household member. Doepke and Tertilt (2018), for example, show theoretically that even if women and men value private and public goods (such as children’s human capital) the same way, an increase in female resources would still lead to more spending on children.

They argue against the “preference hypothesis” and assume that it is the specific

role that each spouse plays within the household that explains financial decisions. In their non-cooperative model, each spouse has its own individual budget constraint. Each household consists of a couple, a woman and a man, who both derive utility from a set of public goods in the household. Both have symmetric preferences and the provision of public goods is determined by a Nash equilibrium between the spouses. Each spouse produces public goods, which vary from very to less time intensive, and this has to be combined with the share of labor of the spouse assuming that time and goods inputs cannot be separated between spouses. Both spouses then maximize their utility taking the other spouse's behavior as given. The budget constraint is the given wealth and the time spent on public good production which cannot be spent on labor. They argue that men and women are involved to different extents in the production of public goods.

In countries where labor market wages for women are low compared to men, women would focus on the production of time intensive public goods such as the welfare of children. As a consequence, when resources are transferred to women rather than to men, spending on nutrition and education would increase. At the same time, spending on labor intensive goods and investments would decrease, as these are the goods that men specialize on. In this case, a shift in resources towards women is predicted to cause a decrease in physical investment and so a decrease in business growth. There is also empirical evidence for this model; [de Mel et al. \(2009\)](#) find that a transfer to male small business owners leads to an increase in profits, while the same does not apply to female business owners.

We can transfer this household-specialization model to the Khasis, where women and men have to decide how to spend their household income on different types of public goods (including savings). Traditionally in the Khasi culture, women are responsible for household expenditures and in particular for long-term savings and investment decisions. Although men in the Khasi culture are engaged in the production of labor intensive goods, the final decision about how to spend the household income lies with the female household head. There is nonetheless variation in female empowerment among the Khasis, through the impact of Christianity in Meghalaya that has influenced the Khasi culture in particular the empowerment status of women. Some women are still fully in charge of intra-household

financial decisions while others decide with their husbands or solely the husband decides.

We have the following hypotheses to be tested in the empirical analysis: *(i) Households where women are more empowered make different financial decisions than households where women are less empowered. (ii) Households where women are empowered spend more on the welfare of children than households where women are less empowered. (iii) and save less at the end of the month as savings can be considered as a public good.*

### 3 The Khasis and the British rule

The matrilineal culture found in Meghalaya has been used as a natural experiment in a number of other papers (Gneezy et al., 2003; Filipiak and Walle, 2015; Asiedu and Ibanez, 2014). Filipiak and Walle (2015) show that, unlike in most countries studied so far, women in this part of India are just as financially literate as men. This also applies to their self-reported financial knowledge (Filipiak, 2016). Asiedu and Ibanez (2014) also show that women in Meghalaya are more likely to punish in a public goods game with third party punishment. In this section, we discuss the characteristics of this matrilineal society as well as the historical influence of the Protestant British Missions, which constitute the basis of our identification strategy.

#### 3.1 The Khasis

The Khasis are besides the Garos and the Jaintias one of the main ethnic communities in Meghalaya, a mountainous state in North East India that borders Bangladesh and Assam. After independence, Meghalaya was separated from Assam in 1972. Although it is not known when exactly the three tribes settled in the hills of Meghalaya, they had likely been there centuries before the Indian subcontinent was unified for the first time under the British rule (Gait, 1906; Nolan, 2002; Dalby, 2015). Until today, the Khasis reside predominantly in the Khasi Hill districts in the center of Meghalaya (West Khasi Hills, East Khasi Hills, and Ri Bhoi). The inaccessibility and remoteness of Meghalaya's hills have minimized external cultural influence besides confrontation with the British rule in

the 19<sup>th</sup> century, so that many Khasi traditions have been preserved and an exceptionally large share of Meghalaya's population have conserved their tribal identity (Gait, 1906; Herzog, 2001).

In the Khasis matrilineal culture, women are considered to be the household head and inheritance follows the mother's lineage. The youngest daughter, the *Khaddu*, inherits the largest share of the families property and becomes the household head of the family in the future. She is traditionally seen as the manager of assets and financial resources subject to the advice of an elder man, usually the mother's brother (Herzog, 2001). Men in this society are ascribed to religious, political or farm activities outside the household (Nongbri, 1993).

When analyzing the power relations within the Khasi culture, Herzog (2001) emphasizes that there is a symmetry of power between men and women, with a clear division of roles over the different spheres of life. Until today, this power balance is reflected with different social indicators. Meghalaya is amongst the Indian states with the highest sex ratio: 989 females per 1000 males, according to the Census of India 2011, resembling that of developed countries. This sex ratio stands out in a nation which is otherwise known for its large share of "missing women" (Sen, 1992). In fact, Klasen and Wink (2003) update the estimates for the number of missing women in developing countries and find that, despite some improvements, India has the largest share of missing women in South Asia today. Also, the overall literacy rate in Meghalaya is very high in comparison with other Indian states: 73 percent for females and 76 percent for males (IIPS, 2014). Thus, the Khasi culture provides a natural testing ground for investigating household consumption and expenditure patterns of empowered women who learn this role from early childhood.

### 3.2 The British rule

The British influence in India started in 1600 under Elisabeth I. The expansion towards the North-East of India ended with the victory of the First Burmese War (1826) that led to the annexation of the province of Assam - from which Meghalaya was part of until

India's independence in 1972 (Paxton, 1999). Being considered "savage", "barbarous" and "primitive" tribes [...] due to their inadequacy of dress, war-like habits, most Khasi siemships remained nominally independent under the British (Chaube, 1999).

However, already in 1833 a Serampore missionary school opened in Cherrapunji where also the British administration of Assam settled at first. In 1841, the Serampore Mission was replaced by the Welsh Presbyterian Mission which introduced the Roman script and put more emphasis on proselytization (Chaube, 1999). The rapid progress of Christianization in the Empire was mainly driven by the work of Welsh and Baptist Missions which were active among the hill tribes in Assam, especially the Khasis (Risley et al., 1909). Education and other social services were almost entirely left to the Church who also administered most of the schools at that time. The exceptional presence and proselytizing efforts of Christian missionaries explains why today much of the Khasis have become Christians. For instance, in our sample more than 95 percent of the individuals are Christians.

Overall, the British rule had a far-reaching cultural impact on the matrilineal Khasi society. Especially the fact that both administrative units and educational system addressed predominantly males, challenged the existing matrilineal rule. The matrilineal system of inheritance from the Khasis was hardly compatible with the property inheritance laws introduced by the British, who also introduced their type of marriage as an institution (Chaube, 1999). Hence, although the matrilineal traditions remain widely intact today, the patriarchal influence of British rule has induced considerable cultural change among the Khasis. The continuum between conservation and assimilation is summarized in the *Dictionary of Language* (Dalby, 2015):

*[...] Yet Shillong, in the temperate Khasi hills, had made an ideal provincial capital for all of British Assam. There was also early interest in Khasi speakers on the part of Welsh Presbyterian missionaries, who devised a Latin orthography for Khasi in 1842, on the basis of the dialect of Cherrapunji, which preceded Shillong as a radiating point for British influence. The missionaries also introduced primary and secondary education and founded a theological seminary. Thus, though politically independent, Khasi speakers in*

*fact underwent significant English speaking cultural and linguistic influence.*<sup>2</sup>

Cherrapunji and Shillong were the main hubs of Christian Missionaries among the Khasis. In our main specification, therefore, we use the distance to Cherrapunji (Shillong) as instruments for female empowerment, exploiting the fact that proximity to the Missions is related to the degree of historical exposure to the British Protestant values. As Shillong is the capital of the state of Meghalaya, arguing for the exclusion restriction of our instrument is less straightforward. However, as it will be discussed in the next section, we employ the distance to Cherrapunji as our main instrumental variable and show several strategies to reduce concerns with the excludability of our instruments. Overall, the results using both distances point out to the same direction.

## 4 Data and descriptive statistics

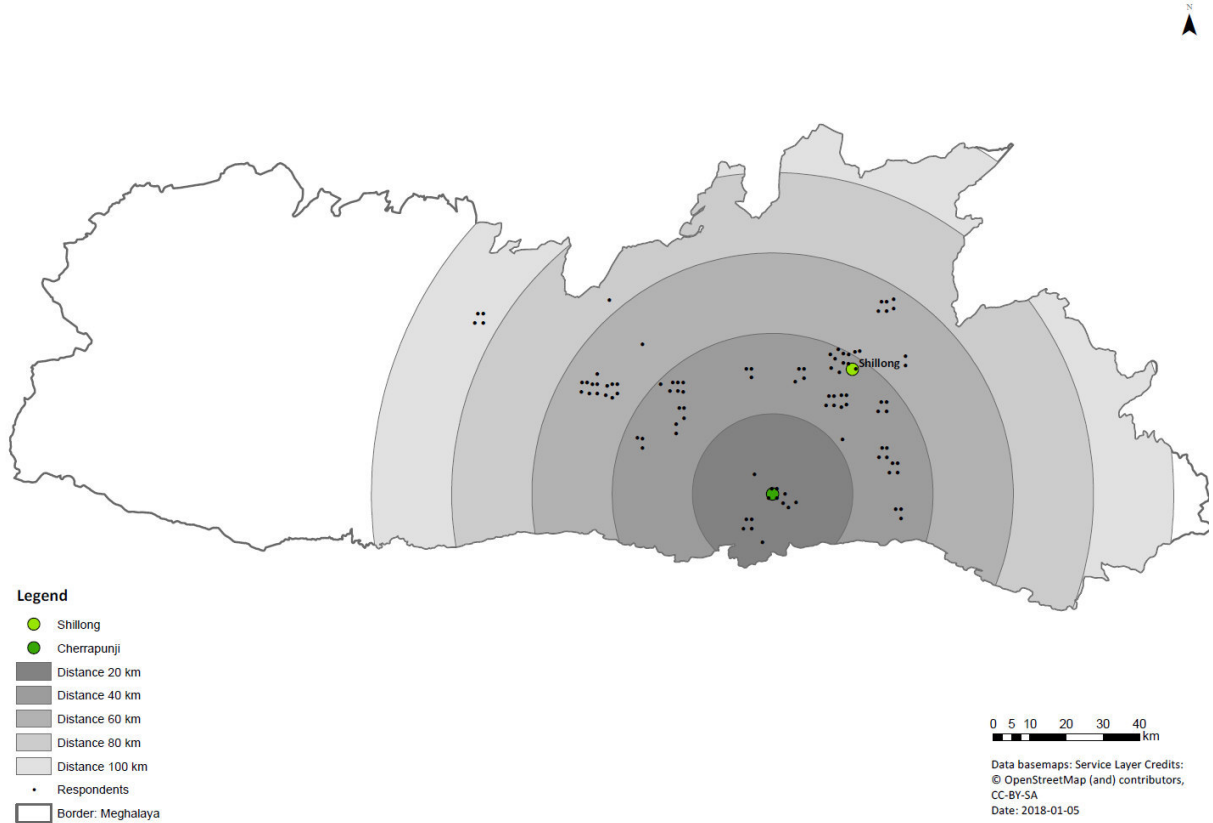
### 4.1 Data sources

We use two data sources in our empirical analysis. First, microdata on financial decisions, sociodemographic characteristics and female empowerment was collected for the special purpose of this study in the three Khasi districts of Meghalaya (East Khasi Hills, West Khasi Hills, and RiBhoi) and, second, the Village and Town Census of India of 2011 which contains information on infrastructural characteristics at the village and town level. For the self-collected data, interviews took place between May and June of 2015 in randomly selected villages. We did a listing of households based on local Census Data, and randomly selected 650 households. Field teams visited the households on different days and at different times of the day. If one household was not accessible, we visited the nearest neighbor. The interviewers chose one adult income earning member for the interview. The first one was selected by throwing a dice. If for instance 2, 4 or 6 was thrown, a women

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<sup>2</sup>The source also mentions the influence on the Garos and Jaintas, who are also matrilineal societies. *“When they are first heard of in historical records, in the 16th century, Khasi speakers already made up twenty-five chiefdoms, which persisted through British times into the period of Indian independence. Jaintia came under British rule in the 1850s, but the other Khasi chiefdoms remained nominally independent, and as such were transferred to the suzerainty of the Governor of Assam in 1947 as the United Khasi-Jaintia Hills District, later to be joined with the Garo Hills in the state of Meghalaya.”*

**Figure 1:** Location of interviewed villages in Meghalaya and the distance to Cherrapunji



Own elaboration based on the location of the villages in which the interviews took place and the distance radius to the former British base in Cherrapunji.

was selected, otherwise a male household member was selected for the interview. The gender of the next respondent was then switched e.g. from males to females and so forth. Overall, the dataset is representative of the Khasi population in East Khasi Hills, West Khasi Hills, and Ri Bhoi with a population of about 1.5 million in total, according to the 2011 Indian Census. Figure 1 shows the location of the villages in which the interviews took place as well as the distance of the villages to the former British base in Cherrapunji.

## 4.2 Measurement of variables

### Dependent variables

In order to measure financial decisions, different outcome variables are employed. First, *savings* are considered, where the respondent was asked: Do you have savings left at the end of the month? The variable takes value of one if the respondent answers with

*yes* and zero otherwise.<sup>3</sup> Second, the respondent is asked about the household monthly expenditures with *i) food and groceries, ii) education, and iii) temptation goods*. Although our main interest lies in understanding the effect of female empowerment on savings, we use the other expenditure variables to shed light on the investment and consumption decisions.<sup>4</sup>

## Explanatory variables

To measure female decision power in the household, we consider four different variables: *short financial decisions female* takes value one if the respondent states that a female is responsible for taking short-term financial decisions in the household and zero otherwise, *long financial decisions female* takes value one if a woman is responsible for long-term financial decisions and is zero if the respondent answers that a man is responsible for them, *femalehh* takes value one if a woman is household head and is zero if a man is the household head and *femlandtitle* takes value one if the land title is on the name of a female household member and zero otherwise.

We consider, furthermore, information on risk attitude, competitiveness, self-confidence with financial matters and gambling behavior. Risk behavior was measured using a standard lottery question.<sup>5</sup> Since other personal characteristics can influence investment as well as savings behavior, we also account for *gambling behavior* which is often ascribed to men. This is captured by the number of tries the respondent needs to finish a simple but financially incentivized memory game. We also take into account time preferences of the respondent using the question: “Suppose you have the option to receive 100 INR today or 150 INR three days later. It is sure that you will get the money. What would be your choice?” The variable *shortpreferences* takes on the value one if the respondent opts for the first option. In addition, we consider a substantial number of variables reflecting

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<sup>3</sup>We also asked the individuals the exact amount that they saved, however this variable is missing for most of the respondents.

<sup>4</sup>Expenditures with temptation goods comprise the sum of monthly expenditures with consumption goods such as cigarettes, coffee, etc

<sup>5</sup>Competitiveness is self-assessed by asking the respondent “Suppose you are asked to toss a small ball into a small bin 10 feet away. You will have 10 opportunities to toss the ball. How many successful tosses do you think you will make?”



socioeconomic characteristics as controls such as age, education and income.

In addition to the household and individual controls, we make use of the Village and Town Census of India of 2011 to control for infrastructural and sociodemographic characteristics of the villages, such as total population and road accessibility. The variable *total population* measures the number of inhabitants in each village or town, as measured in 2011 and the variable *road access* takes value one if the respondent lives in a village or town that had access to a major district road in 2011 and zero otherwise.<sup>6</sup> Additionally, in our instrumental variable specification, we make use of the zipcodes of the respondents to calculate the distance to the former British base in Cherrapunji and the distance to the second most important Protestant base in the capital, Shillong. The variables *far from Cherrapunji* and *far from Shillong* equal to one if the village where the respondent was living is farther than the average distance and zero otherwise.<sup>7</sup>

### 4.3 Descriptive statistics

To illustrate the relationship between female empowerment and distance to the former British base, we present the distribution of our four indicators of female empowerment depending on whether the individuals are living farther or closer to Cherrapunji (above or below the mean of 68 kilometers). As it can be seen in Figure 2, more than 60 percent of households who have a female household head, 55 percent of households in which the land titles are in the name of a women, 58 percent of households in which a female is responsible for long-term financial decisions and 50 percent of households in which a female is responsible for short-term financial decisions live far from Cherrapunji. Although these figures are simply correlational, they already illustrate the relationship between the distance to the historical British base and the matrilineal values.

In order to see whether households also differ in financial decisions depending on their distance to the former British base, Table 1 shows the group differences in savings and

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<sup>6</sup>To make the Village and Town Census of India compatible, we code the variable *road access* one if the village had access to a major district road using question *MajorDistrictRoadStatusA1* and if a town is closer than 10 kilometers to a major district road using question *DistrictHQRoadDistancein*.

<sup>7</sup>In the robustness checks, we also show the results using the continuous measure of the distance variable.

**Figure 2:** Female empowerment and distance to Cherrapunji



The figure shows the distribution of the four female empowerment variables depending on the distance to Cherrapunji. The bars on the right hand side reflect the share of empowered women living far from Cherrapunji and the bars on the left hand side reflect the share of empowered women living close to Cherrapunji.

expenditures with food and groceries, education and temptation goods for households living close or far from Cherrapunji. In Panel A, the group differences are calculated using the whole sample, while in Panel B, the group differences are calculated restricting the sample to female respondents. Panel A reveals that households who live geographically far from Cherrapunji spend on average less on temptation goods and savings and more with education and food. This however, does not seem to be explained by differences in household's average income.

Table 2 reports summary statistics for all explanatory variables. From the table, we see that approximately 49 percent of the households state that a female is responsible for short-term financial decisions, 53 percent of females are responsible for long-term financial decisions, 10 percent of the households state that the female is the household head and around 69 percent of the land titles are in a women's name. As for the demographic

**Table 1:** Savings and expenditures depending on the distance to Cherrapunji*Panel A: Male and female respondents*

	<i>km &lt; mean</i>		<i>km &gt; mean</i>		<i>Difference</i>	
	mean	sd	mean	sd	b	t
Savings	0.43	0.50	0.37	0.48	0.07	1.69
Food Expenditure	4294.39	2488.26	4661.10	2309.45	-366.71	-1.93
Education expenditure	2175.66	2405.23	2728.98	6518.47	-553.33	-1.24
Temptation goods	680.25	750.14	618.58	756.03	61.68	0.97
<i>N</i>	338		303		641	

*Panel B: Female respondents*

	<i>km &lt; mean</i>		<i>km &gt; mean</i>		<i>Difference</i>	
	mean	sd	mean	sd	b	t
Savings	0.37	0.49	0.37	0.48	0.01	0.11
Food Expenditure	4291.62	2367.50	4445.08	2074.07	-153.46	-0.63
Education expenditure	2172.67	2272.13	2675.49	6416.26	-502.82	-0.85
Temptation goods	740.91	882.55	644.16	752.47	96.75	1.02
<i>N</i>	179		160		339	

composition of the sample, the table shows that around 53 percent of the respondents are female, respondents are on average 29 years old and have on average 2 children. The household average monthly income is 9228 INR, which corresponds to approximately USD 132, and the average education level is 5, which corresponds to middle school. Among the variables reflecting the respondents personality traits, Table 2 shows that 91 percent of the sample respondents are rather risk averse, 65 percent can be considered as being competitive and 57 percent have short term preferences.<sup>8</sup>

<sup>8</sup>**Risk-aversion** is measured as a lottery question where the respondent was asked : “Suppose you have 1000 INR with you, which you want to invest. I am giving you three choices in which you can make this investment as follows: *Choice 1:* In this choice, after one year your 1000 INR may grow up to 2000 INR, or you may lose some of the money and get back only 500 INR. *Choice 2:* In this choice after one year your money may grow up to 1200 INR, or you may lose some of the money and get back 800 INR. *Choice 3:* In this choice, after one year your money will grow to 1050 INR, and you do not lose your deposit at all. Which one would you choose? The variable risk averse takes on the value one if the respondent opts for option 3 and is zero otherwise”. **Self-confidence** is measured by the question : “Suppose you are asked to toss a small ball into a small bin 10 feet away. You will have 10 opportunities to toss the ball. How many successful tosses do you think you will make?” The variable takes on the value one if the respondent states that he or she will make more than 5 successful tosses. **Competitiveness** is measured by the question : “If you play a game is it important for you to win?” the respondent can choose between the following answers: 1. I absolutely have to win 2. I very much like to win 3. I’ll be happy if I win 4. I do not care if I win. The variable competitiveness takes on the value one if the respondent opts for the first and second answer and is zero otherwise. The variable **financial self-assessment** is measured by the question *emph:* “Would you say that you perform well on financial and economic problems (for example when paying bills by yourself) ?” The variable takes on the value one if the respondent says yes and is zero otherwise.

**Table 2:** Summary statistics explanatory variables

	mean	sd	min	max
Female head	0.10	0.29	0.00	1.00
Female land title	0.69	0.46	0.00	1.00
Short financial decisions female	0.49	0.50	0.00	1.00
Long financial decisions female	0.53	0.50	0.00	1.00
Savings	0.40	0.49	0.00	1.00
Far from Cherrapunji	0.47	0.50	0.00	1.00
Far from Shillong	0.35	0.48	0.00	1.00
RoadAccess	0.69	0.46	0.00	1.00
Total population	50603.97	56773.47	0.00	143229.00
Temptation goods	648.76	753.12	50.00	6000.00
Education expenditures	2454.02	4927.26	50.00	50000.00
Food Expenditure	4467.73	2410.50	5.00	15000.00
Female	0.53	0.50	0.00	1.00
Age	29.05	10.21	15.00	60.00
Squared age	948.33	706.63	225.00	3600.00
Married	0.52	0.50	0.00	1.00
Number of children	2.25	1.89	0.00	11.00
Education	5.49	2.19	1.00	11.00
Own land	0.65	0.48	0.00	1.00
Income	9228.16	7271.95	2.00	60000.00
Computations	0.75	0.43	0.00	1.00
Knows interest rate	0.83	0.37	0.00	1.00
Knows bank deposit	0.65	0.48	0.00	1.00
Self confidence	0.53	0.50	0.00	1.00
Risk aversion	0.91	0.28	0.00	1.00
Memory game	15.70	4.61	7.00	36.00
Short preferences	0.57	0.50	0.00	1.00
Competitive	0.65	0.48	0.00	1.00
<i>N</i>	641			

## 5 Methodology

In order to analyze if female empowerment affects financial decisions conditional on observable characteristics, such as the level of education, income and other demographic variables, we first estimate a linear probability model. Our baseline regression equation is written as:

$$Financialdecision_{ihv} = \beta_0 + \beta_1 Empowerment_h + \delta_1 X_{ih} + \theta_1 V_v + \epsilon_i \quad (1)$$

Where the subscripts  $i$ ,  $h$  and  $v$  in Equation (1) denote individual, household and village, respectively. Our main measure of household financial decisions is *savings*. However, to investigate the underlying channels, we also use the other expenditure variables as alternative outcomes *i.e.* *education expenditure*, *food expenditure* and *temptation goods*. Our main explanatory variables are the four measures of female empowerment, which are regressed separately: *short financial decisions female*, *long financial decisions female*, *femalehh* and *femlandtitle*.  $X$  is a vector of individual characteristics including age, age squared, a dummy for whether the individual is married, a dummy for whether the respondent is female, number of children, education level, a dummy for whether the individual owns land, income and indicator variables for financial literacy, personality traits and access to financial institutions.  $V$  includes control variables at the village level, such as village or town population.

As female empowerment is most likely endogenous to other unobserved household and individual characteristics, in a second step, we make use of an instrumental variable that exploits the distance to the former British base in Cherrapunji (or Shillong) as a source of historical variation in female empowerment. We estimate the model using a two stage least square estimation *2SLS*.

$$\widehat{Empowerment}_{ihv} = \alpha_0 + \alpha_1 Distance_v + \phi_1 X_{ih} + \zeta_1 V_v + \mu_i \quad (2)$$

$$Financialdecision_{ihv} = \zeta_0 + \zeta_1 \widehat{Empowerment}_{ihv} + \eta_1 X_{ih} + \rho_1 V_v + \iota_i \quad (3)$$

Where Equations (2) and (3) show the first stage and the second stage, respectively. Our main instrumental variable *far from Cherrapunji* is a dummy which equals one if the household lives in a village which is above the mean distance of 68 kilometers and zero otherwise. Alternatively, we use the distance to Shillong, the second location of Protestant Missions in Meghalaya, as an instrument for female empowerment.<sup>9</sup>

Two main assumptions underly our IV estimator. First, the closer the Khasis live to Cherrapunji or Shillong, the more they have been exposed to (the legacies of) male-centered decision making structures of the British and the less likely they stick to their matrilineal Khasi tradition. Consequently, we expect that females are more empowered when they live far away from these two towns, while it should be the other way around for households who live close to these two places. Second, the distance to Cherrapunji and Shillong only affects expenditure decisions through female empowerment. While we can test directly for the relevance of our instruments using the first stage regressions, arguing for the exclusion restriction requires more effort. In what follows, we discuss our strategies to reduce concerns with the excludability of our instruments.

There are two main threats to our identification strategy: First, there is a possibility that Protestant Missions affected financial decisions through channels other than female empowerment. Second, the fact that the location of the British Protestant Missions might not have been random raises the question of whether the results are driven by other omitted variables that persisted over time. To reduce these concerns, we consider a number of aspects: (1) We explore variation within the state of Meghalaya, which consists in a relatively homogeneous environment, both in terms of social norms, geographic conditions and institutional characteristics; (2) To ensure that our results are not driven by alternative channels, we control for a wide range of individual and household level covariates as well as village characteristics; (3) Several papers discuss the possibility that there was a positive selection of Mission locations, in terms of economic development (Mantovanelli, 2014; Jedwab et al., 2018). However, if this were the case, we would expect to find more

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<sup>9</sup>We also report the results of the regressions using both instruments in the same specification and the continuous distance variables.

gender equality around the Protestant Missions, as there is a well documented association between economic development and gender equality. Differently from many papers that found positive long-term effects of Christian Missions on economic outcomes, (Becker and Woessmann, 2008; Nunn et al., 2014; Mantovanelli, 2014; Calvi and Mantovanelli, 2018; Valencia Caicedo, 2018) in the case of Meghalaya, proximity to the British Mission is associated with the dilution of matrilineal values, which ended up causing a reduction in female empowerment. All in all, a positive selection in Mission locations would make it less likely that we would find significant results; (4) Although we are not able to control for potential migration movements such as Khasis moving from other parts of the state to Cherrapunji, we know that family boundaries and matrilocality are strong elements of Khasi culture and family members typically stay geographically close. Thus, it is not likely that migratory movements would drive completely our results.

Our identification strategy relates to a growing literature that investigates the effects of proximity to historical institutions on contemporaneous outcomes (Becker and Woessmann, 2009; Castelló-Climent et al., 2017; Calvi and Mantovanelli, 2018; Mantovanelli, 2013, 2014; Valencia Caicedo, 2018). More precisely, it follows the well-known examples of Becker and Woessmann (2009) and Nunn (2008), who also use the degree of historical exposure (approximated by distance) to investigate how they shape long-term economic development.

## 6 Results

In our econometric specification, we run a linear probability model to predict the probability that households have savings left at the end of the month. Additionally, we investigate the underlying channels that could explain the differences in savings patterns across households. More specifically, we investigate whether female empowerment affects expenditures with food and groceries, education and temptation goods using an instrumental variable. The main hypothesis behind these regressions is that females make different economic and financial decisions than men, particularly with respect to welfare enhancing goods. We

**Table 3:** Female empowerment and savings: linear probability model

	Savings at the end of the month			
	(1)	(2)	(3)	(4)
Short financial decisions female	-0.0875* (0.0512)			
Long financial decisions female		-0.0652 (0.0507)		
Female head			-0.1385** (0.0643)	
Female land title				-0.0387 (0.0382)
Number of Observations	624	624	624	624
Adjusted R-squared	0.036	0.033	0.035	0.030
Controls	✓	✓	✓	✓

*Notes:* Robust standard errors clustered at the village level in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . In each column, one measure of female empowerment is used. In column (1) a dummy for whether a female is responsible for short-term financial decisions, in column (2) a dummy for whether a female is responsible for long-term financial decisions, in column (3) a dummy for whether a female is the household head and in column (4) a dummy for whether the land title is in the name of a female. The control variables are included in all the regressions.

start by presenting the results from the linear probability model and then proceed with the instrumental variable results.

## 6.1 Main results

### Female empowerment and savings

Table 3 shows the estimation results of Model (1), in which savings is the outcome variable. Columns (1) to (4) show the results using the four different indicators of female empowerment. Although one should refrain from making any causal interpretations, the results indicate a negative correlation between female empowerment and savings. For instance, column (1) shows that households in which a female is responsible for short-term financial decisions are 8.7 percentage points less likely to have savings left at the end of the month. Similarly, column (3) indicates that having a female as the household head decreases the probability of having savings by the end of the month by 13.8 percentage points. The results using the other two female empowerment variables *i.e. long term financial decisions female* and *female land title* are also negative, but statistically insignificant.

Table 4 presents the results of the second stage specified in Equation (3). *Distance to*



**Table 4:** Female empowerment and savings: instrumental variable

	Savings at the end of the month			
	(1)	(2)	(3)	(4)
Short financial decisions female	-0.6371*** (0.1581)			
Long financial decisions female		-0.5686*** (0.1460)		
Female head			-4.5729 (2.8159)	
Female land title				-1.1855*** (0.4204)
Number of Observations	624	624	624	624
Kleibergen-Paap weak identification F-statistic	27.570	30.934	1.886	15.017
Controls	✓	✓	✓	✓

*Notes:* Robust standard errors clustered at the village level in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . In each column, one measure of female empowerment is used. In column (1) a dummy for whether a female is responsible for short-term financial decisions, in column (2) a dummy for whether a female is responsible for long-term financial decisions, in column (3) a dummy for whether a female is the household head and in column (4) a dummy for whether the land title is in the name of a female. The instrumental variable used is a dummy variable measuring if the households reside in a village that is far from Cherrapunji (>68km) or not. The control variables are included in all the regressions.

*Cherrapunji* is used as an instrument for each of the four indicators of female empowerment. As it can be seen in Table 4, apart from *female head*, all other female empowerment coefficients are negative and highly significant. For instance, in column (1) we estimate that households in which a female is responsible for short-term financial decisions are, on average, 63.7 percentage points less likely to have savings at the end of the month. Also, households in which a female is responsible for long-term financial decisions are, on average, 56.8 percentage points less likely to have savings at the end of the month. The results hold even after controlling for a wide range of individual and household controls, personality traits and access to financial institutions. Tables 4 and A3 reveal that the instrument is relevant for *short financial decisions female*, *long financial decisions female* and *female land title* as shown by the Kleibergen-Paap statistics and the F-statistics well above the conventional standards.<sup>1011</sup>

In what follows, we present the results of the regressions using both distance variables *i.e.*

<sup>10</sup>In the Appendix we also show the regression results using the continuous distance measure as our instrument. The results also point out to the same direction, although the relevance of the instrument is much smaller. Our hypothesis is that since we calculated the distance using the zipcodes of the households, there is probably more measurement error in the continuous variable, while this is not the case for the binary distance variable

<sup>11</sup>Tables A2 and A3, in the Appendix, show, respectively, the full table including all estimated covariates and the first stage results of the Two-Stage least squares (2SLS)

**Table 5:** Female empowerment and savings: instrumental variables distance to Cherrapunji and distance to Shillong

	Savings at the end of the month			
	(1)	(2)	(3)	(4)
Short financial decisions female	-0.7491*** (0.1313)			
Long financial decisions female		-0.6927*** (0.1191)		
Female head			-5.5601 (3.4486)	
Female land title				-1.5017*** (0.3805)
Number of Observations	624	624	624	624
Kleibergen-Paap weak identification F-statistic	15.244	17.062	1.427	7.501
Controls	✓	✓	✓	✓

*Notes:* Robust standard errors clustered at the village level in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . In each column, one measure of female empowerment is used. In column (1) a dummy for whether a female is responsible for short-term financial decisions, in column (2) a dummy for whether a female is responsible for long-term financial decisions, in column (3) a dummy for whether a female is the household head and in column (4) a dummy for whether the land title is in the name of a female. The instrumental variables used are a dummy variable measuring if the households reside in a village that is far from Cherrapunji (>68km) or not and an instrumental variable that measures if the households live far from Shillong (>32km) or not. The control variables are included in all the regressions.

*distance to Cherrapunji* and *distance to Shillong* as instruments for female empowerment, considering that Shillong was the second main hub for Christian missionaries in Meghalaya. Similar to the previous results, we find that female empowerment decreases the probability of having savings left at the end of the month. The results presented in columns (1), (2) and (4) are not only statistically significant, but also economically meaningful.

Overall, our results indicate that households where females are responsible for economic and financial decisions by culture and where this role is learned from early childhood are less likely to have savings left at the end of the month. We argue that our instrument allows us to deal with the endogeneity problem arising from reversed causality and omitted variable bias. What is noticeable from Tables 3, 4 and 5 is that not accounting for endogeneity in female empowerment would lead to a severe underestimation of the effects of female empowerment on financial decisions. As a next step, we investigate how female empowerment affects consumption decisions, as this possibly explains the verified differences in saving patterns.

**Table 6:** Female empowerment and food expenditure: instrumental variable

	Food expenditure			
	(1)	(2)	(3)	(4)
Short financial decisions female	2834.47*** (1052.20)			
Long financial decisions female		2529.73*** (910.00)		
Female head			20343.50 (16000.15)	
Female land title				5274.00** (2539.93)
Number of Observations	624	624	624	624
Kleibergen-Paap weak identification F-statistic	27.570	30.934	1.886	15.017
Controls	✓	✓	✓	✓

*Notes:* Robust standard errors clustered at the village level in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . In each column, one measure of female empowerment is used. In column (1) a dummy for whether a female is responsible for short-term financial decisions, in column (2) a dummy for whether a female is responsible for long-term financial decisions, in column (3) a dummy for whether a female is the household head and in column (4) a dummy for whether the land title is in the name of a female. The instrumental variable used is a dummy variable measuring if the households reside in a village that is far from Cherrapunji (>68km) or not. The control variables are included in all the regressions.

## Female empowerment and consumption decisions

We now turn to the investigation of possible underlying channels that could explain the observed differences in investment decisions. Our main objective is to assess if empowered females save less due to differences in consumption expenditures *i.e.* with food and groceries, education and temptation goods. In all estimations, we use the distance to Cherrapunji as the instrumental variable for the different measures of female empowerment. Table 6 shows that female empowerment is associated with higher expenditure with food and groceries and the effect is highly significant. We estimate that in households where the female is responsible for short-term and long-term financial decisions, expenditure with food is on average 2834 INR and 2529 INR higher. Having land titles in the name of a woman increases the expenditures with food and groceries by 5274 INR on average.

In terms of other consumption goods, we do not find evidence of differential expenditure patterns in case females are responsible for financial decisions, as it can be seen in Tables 7 and 8. For educational expenditures, the coefficients are in line with what we would expect – higher education expenditure for households in which females have higher decision power. Although the estimated coefficients are large, they are estimated very imprecisely. For expenditures with temptation goods the coefficients are positive, although much smaller

**Table 7:** Female empowerment and education expenditure: instrumental variable

	Education expenditures			
	(1)	(2)	(3)	(4)
Short financial decisions female	3384.98 (2591.00)			
Long financial decisions female		2977.89 (2270.46)		
Female head			48595.89 (81646.54)	
Female land title				5809.21 (4135.27)
Number of Observations	477	477	477	477
Kleibergen-Paap weak identification F-statistic	22.440	23.415	0.419	11.721
Controls	✓	✓	✓	✓

*Notes:* Robust standard errors clustered at the village level in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . In each column, one measure of female empowerment is used. In column (1) a dummy for whether a female is responsible for short-term financial decisions, in column (2) a dummy for whether a female is responsible for long-term financial decisions, in column (3) a dummy for whether a female is the household head and in column (4) a dummy for whether the land title is in the name of a female. The instrumental variable used is a dummy variable measuring if the households reside in a village that is far from Cherrapunji (>68km) or not. The control variables are included in all the regressions.

in magnitude.

Overall, the results presented in this section corroborate the hypothesis that empowered females make different financial and expenditure decisions. For instance, we provide evidence that households where females are more empowered have lower probability of having savings left at the end of the month and higher expenditures with food and groceries. Our results are in line with [Doepke and Tertilt \(2018\)](#) who find evidence that cash transfers to women caused an increase in welfare enhancing goods at the expense of savings. As highlighted by the authors, this might have important implications for long-term economic growth, especially considering the role of human and physical capital in a country's productive structure.

## 6.2 Robustness checks

In this section, we present robustness checks to test whether the results presented before hold to alternative specifications. First, we use an alternative measure of distance as our instrument for female empowerment. Instead of relying on a dummy variable, we now use the continuous distance to Cherrapunji as the instrumental variable. The results are presented in Table [A4](#). The results are qualitatively similar, although the relevance of the

**Table 8:** Female empowerment and temptation goods expenditure: instrumental variable

	Temptatioin goods expenditures			
	(1)	(2)	(3)	(4)
Short financial decisions female	36.80 (332.25)			
Long financial decisions female		32.58 (294.24)		
Female head			381.23 (3261.72)	
Female land title				75.54 (674.79)
Number of Observations	551	551	551	551
Kleibergen-Paap weak identification F-statistic	25.467	28.941	0.794	11.374
Controls	✓	✓	✓	✓

*Notes:* Robust standard errors clustered at the village level in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . In each column, one measure of female empowerment is used. In column (1) a dummy for whether a female is responsible for short-term financial decisions, in column (2) a dummy for whether a female is responsible for long-term financial decisions, in column (3) a dummy for whether a female is the household head and in column (4) a dummy for whether the land title is in the name of a female. The instrumental variable used is a dummy variable measuring if the households reside in a village that is far from Cherrapunji (>68km) or not. The control variables are included in all the regressions.

instrument is much lower, as seen by the Kleinbergen-Paap statistics. Second, we control for the occupation of the individuals, considering that this might explain how much the income varies over the month, and with which uncertainty – which is likely affecting how much individuals can save. Controlling for the occupation makes the results even larger in magnitude and more significant, as it can be seen in Table A12. Third, we implement a set of alternative controls, including a variable that measures whether the individuals have access to microcredit and mobile banking and one dummy variable that measures whether the spouse earns income. Again, the results are similar to the results presented in our main specification, as it can be seen in Table A13.

### 6.3 Transmission channel

In this section, we investigate the role of infrastructural development as a potential transmission channel that could explain the diffusion of values of the Protestant British Missions in Meghalaya. Figures A1 and A2 from the Constable’s Hand Atlas of India (1893) show, respectively, the location of all Christian Missions in India, as of 1893, and the availability of railways, telegraphs and navigable canals in the country during the same period. What is noticeable from the second map is that, already in 1893, Shillong

and Cherrapunji, the main hubs of Protestant Missions in Meghalaya, were connected via the telegraph, and railways were being constructed around Cherrapunji. Our hypothesis is that the subsequent infrastructural development around those centers facilitated the diffusion of values in nearby locations, while locations that were farther away remained more isolated from those cultural influences.

We test this hypothesis using current road accessibility data from the Village and Town Census of India of 2011. First, we regress our four measures of female empowerment on road accessibility. We control for a set of individual and household characteristics that most likely determine female empowerment such as age, squared age, a dummy for whether the respondent is married, number of children, education level, a dummy for whether the respondent owns land, income, a dummy for whether the respondent is female and a dummy for whether the individual has access to media (as measured by access to newspapers).

Table 9 shows the results. As it can be seen in columns (1) to (4), access to roads has a negative and statistically significant effect on female empowerment. We estimate that households that live in a village that has access to a major district road have approximately 23 percentage points lower probability of having a female responsible for short-term financial decisions, 28 percentage points lower probability of having a female responsible for long-term financial decisions, 11 percentage points lower probability of having a female as a household head and 17 percentage points lower probability of having land titles in the name of a woman. At first, these results appear to be counter-intuitive as one would expect access to infrastructure to be positively associated with gender equality. In the context of Meghalaya, however, the results are in line with the hypothesis that being far from Cherrapunji and the subsequent infrastructural development contributed for the preservation of the traditional Khasi values and matrilineal social norms. Although one should refrain from making causal interpretations of the results presented in Table 9, they are in line with the idea that infrastructural development is a potential channel explaining the diffusion of social values around the Protestant Missions.

In a second exercise, we use the road accessibility variable as an alternative instrument

**Table 9:** Female empowerment and road accessibility

	Female empowerment			
	(1)	(2)	(3)	(4)
Road access	-0.2320*** (0.0795)	-0.2859*** (0.0797)	-0.1115*** (0.0258)	-0.1780*** (0.0289)
Age	0.0242 (0.0146)	0.0156 (0.0127)	0.0272*** (0.0091)	-0.0291** (0.0121)
Squared age	-0.0003* (0.0002)	-0.0002 (0.0002)	-0.0002 (0.0001)	0.0003* (0.0002)
Married	-0.3600*** (0.0484)	-0.3320*** (0.0284)	-0.2180*** (0.0425)	-0.0639* (0.0327)
Number of children	-0.0484*** (0.0114)	-0.0437** (0.0172)	-0.0130*** (0.0036)	-0.0206** (0.0094)
Education	0.0008 (0.0247)	0.0111 (0.0217)	-0.0074 (0.0086)	0.0154*** (0.0050)
Own land	-0.1906** (0.0715)	-0.1565** (0.0672)	-0.0248 (0.0191)	0.1645** (0.0589)
Income	0.0000 (0.0000)	0.0000 (0.0000)	-0.0000 (0.0000)	0.0000 (0.0000)
Female	0.1064** (0.0490)	0.0609 (0.0542)	0.1947*** (0.0458)	0.1502*** (0.0336)
Newspaper	0.0297 (0.0352)	0.0477 (0.0450)	-0.0314* (0.0176)	0.0691** (0.0296)
$N$	506	506	506	506
$R^2$	0.219	0.187	0.283	0.174
adj. $R^2$	0.178	0.145	0.246	0.131

*Notes:* Robust standard errors clustered at the village level in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . In each column, one measure of female empowerment is used. In column (1) a dummy for whether a female is responsible for short-term financial decisions, in column (2) a dummy for whether a female is responsible for long-term financial decisions, in column (3) a dummy for whether a female is the household head and in column (4) a dummy for whether the land title is in the name of a female.

for female empowerment to investigate its effects on household financial decisions. The results are presented in Table 10. As it can be seen in columns (1), (2) and (4), road accessibility is a good predictor for female empowerment, as seen by the high Kleibergen-Paap statistics. Although the results should be interpreted with caution, as road accessibility could also be determined by unobserved factors other than the establishment of the British mission in Cherrapunji, they indicate that the transmission of values through infrastructural development is a plausible channel. All in all, the results presented in this section corroborate the hypothesis that, in the context of Meghalaya, the establishment of Protestant British Missions and subsequent infrastructural developments were associated a shift in traditional matrilineal values.

**Table 10:** Female empowerment and savings: instrumental variable road accessibility

	Savings at the end of the month			
	(1)	(2)	(3)	(4)
Short financial decisions female	-0.6995** (0.2816)			
Long financial decisions female		-0.6611*** (0.2387)		
Female head			-2.9867 (1.9295)	
Female land title				-1.1278*** (0.3981)
Number of Observations	506	506	506	506
Kleibergen-Paap weak identification F-statistic	27.138	25.943	4.649	20.760
Controls	✓	✓	✓	✓

*Notes:* Robust standard errors clustered at the village level in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . In each column, one measure of female empowerment is used. In column (1) a dummy for whether a female is responsible for short-term financial decisions, in column (2) a dummy for whether a female is responsible for long-term financial decisions, in column (3) a dummy for whether a female is the household head and in column (4) a dummy for whether the land title is in the name of a female. We use road accessibility as an instrument for female empowerment. The control variables are included in all the regressions.

## 7 Discussion and conclusion

This study provides new empirical evidence on the effect of female empowerment on household financial decisions. By exploring a historical shift in social values caused by the arrival of Protestant British Missions in the matrilineal state of Meghalaya, we are able to identify the causal effect of female empowerment on intra-household investment and consumption decisions. While most of the existing literature focused on the effects of *increasing* female's intra-household bargaining power via income transfers, the financial behavior of *culturally* empowered females has been relatively overlooked.

Using new data on female empowerment and financial decisions and implementing a novel identification strategy, our results show that empowered women spend more on welfare-enhancing goods, such as food and groceries, but this comes at the expense of savings. Our results are in line with [Doepke and Tertilt \(2018\)](#) who show that in settings where labor market wages for women are low as compared to men, women focus on the investment of time intensive public goods, such as the welfare of children, and this comes the expense of lower physical capital accumulation. As discussed by the authors, this trade-off between human capital investment and capital accumulation can have important implications for long-run economic growth. As documented in the new endogenous growth



theory, capital accumulation is a crucial factor explaining country’s long-run economic growth.

Similarly to other existing studies in developing countries, we provide evidence that, once females are in charge of financial decisions, household savings tend to be lower (see, for instance, [Dupas and Robinson \(2013\)](#); [Karlan and Linden \(2014\)](#)). It remains an open question if lower savings are a result of demand side or supply side constraints. As discussed by [Steinert et al. \(2018\)](#), savings tools are often missing or discredited in developing countries, which could prevent individuals from saving. Therefore, although not in the scope of this paper, understanding the reasons why females save less would be the first step for the elaboration of effective policies to tackle the issue.

In addition to the contribution to the literature on intra-household financial decisions, our paper also adds to the studies investigating the long-run effects of historical institutions on economic development. While great part of the existing papers document positive effects of Christian Missionaries for economic development ([Becker and Woessmann, 2008](#); [Nunn et al., 2014](#); [Mantovanelli, 2014](#); [Calvi and Mantovanelli, 2018](#); [Valencia Caicedo, 2018](#)), we show that, in Meghalaya, proximity to the Protestant British Missions was associated with the dilution of matrilineal values and a decrease in female empowerment. More interestingly, we hypothesize that the modernizing infrastructural developments around the British base consisted in a channel for diffusion of Christian values, which plausibly explains the negative association between current road accessibility and female empowerment in Meghalaya.

All in all, our instrumental variable results show that fully empowered females invest more on welfare increasing goods, such as food and nutrition, but save less. By including a range of individual and household controls, discussing the plausibility of a positive selection in Protestant Mission locations and discussing other potential transmission channels using official data we are confident that our results cannot be entirely driven by omitted variable bias or alternative explanations.

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# Appendix

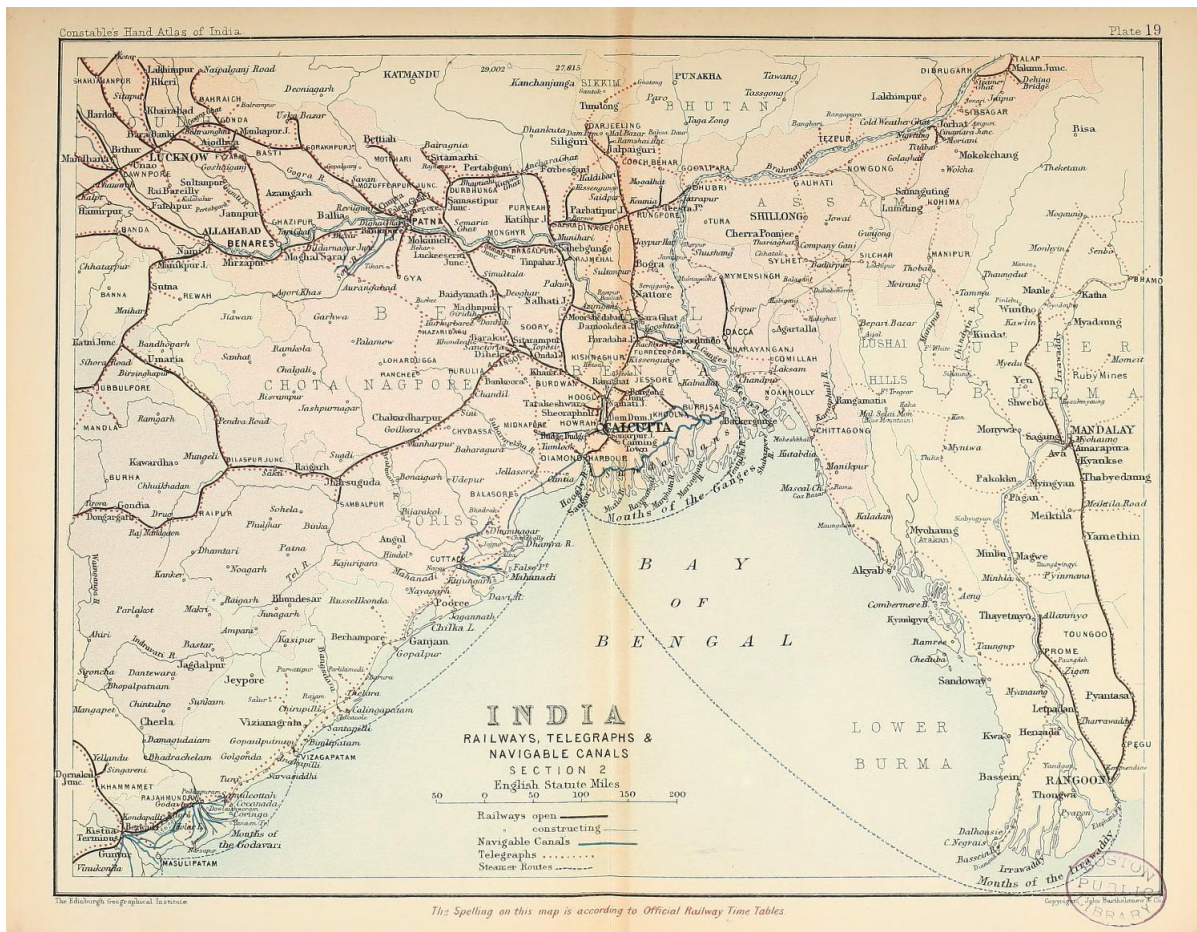


**Figure A1: Location of Christian Mission Stations in India (1893)**



The figure shows location of Christian Missions in India as of 1893.

**Figure A2: Existing Infrastructure in India in 1893 Constable's Hand Atlas of India (1893)**



The figure shows the availability of railways, telegraphs and navigable canals in India in 1893 from the Constable's Hand Atlas of India (1893).

**Table A1:** Female empowerment and savings: linear probability model

	Savings at the end of the month			
	(1)	(2)	(3)	(4)
Short financial decisions female	-0.0875* (0.0512)			
Long financial decisions female		-0.0652 (0.0507)		
Female head			-0.1385** (0.0643)	
Female land title				-0.0387 (0.0382)
Female	-0.0359 (0.0446)	-0.0393 (0.0453)	-0.0180 (0.0491)	-0.0386 (0.0469)
Age	0.0203 (0.0137)	0.0201 (0.0135)	0.0215 (0.0138)	0.0171 (0.0128)
Squared age	-0.0003* (0.0002)	-0.0003* (0.0002)	-0.0003 (0.0002)	-0.0003 (0.0002)
Married	-0.0627 (0.0505)	-0.0540 (0.0544)	-0.0574 (0.0553)	-0.0374 (0.0510)
Number of children	-0.0259** (0.0105)	-0.0256** (0.0108)	-0.0252** (0.0118)	-0.0243* (0.0119)
Education	0.0014 (0.0096)	0.0007 (0.0091)	-0.0003 (0.0086)	0.0005 (0.0084)
Own land	0.0940 (0.0647)	0.0951 (0.0617)	0.0953* (0.0549)	0.1109* (0.0588)
Income	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
Computations	0.0983 (0.0683)	0.0935 (0.0660)	0.0941 (0.0664)	0.0973 (0.0654)
Knows interest rate	0.0044 (0.1100)	0.0126 (0.1037)	0.0138 (0.1055)	0.0194 (0.0986)
Knows bank deposit	0.0311 (0.0623)	0.0299 (0.0606)	0.0281 (0.0646)	0.0202 (0.0650)
Bank account	-0.0178 (0.0411)	-0.0170 (0.0414)	-0.0093 (0.0412)	-0.0150 (0.0406)
Risk aversion	0.0776* (0.0430)	0.0736 (0.0456)	0.0703 (0.0444)	0.0708 (0.0424)
Memory game	-0.0082* (0.0044)	-0.0085* (0.0043)	-0.0079* (0.0045)	-0.0081* (0.0046)
Short preferences	0.0366 (0.0422)	0.0328 (0.0416)	0.0394 (0.0420)	0.0327 (0.0432)
Competitive	0.0618 (0.0379)	0.0646* (0.0377)	0.0659* (0.0373)	0.0617 (0.0374)
Total population	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
Number of Observations	624	624	624	624
Adjusted R-squared	0.036	0.033	0.035	0.030

*Notes:* Robust standard errors clustered at the village level in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . In each column, one measure of female empowerment is used. In column (1) a dummy for whether a female is responsible for short-term financial decisions, in column (2) a dummy for whether a female is responsible for long-term financial decisions, in column (3) a dummy for whether a female is the household head and in column (4) a dummy for whether the land title is in the name of a female.



**Table A2:** Female empowerment and savings: instrumental variable

	Savings at the end of the month			
	(1)	(2)	(3)	(4)
Short financial decisions female	-0.6371*** (0.1581)			
Long financial decisions female		-0.5686*** (0.1460)		
Female head			-4.5729 (2.8159)	
Female land title				-1.1855*** (0.4204)
Female	0.0122 (0.0412)	-0.0063 (0.0444)	0.8015* (0.4260)	0.1102** (0.0545)
Age	0.0348* (0.0202)	0.0364** (0.0152)	0.1337* (0.0762)	-0.0085 (0.0198)
Squared age	-0.0005** (0.0003)	-0.0005*** (0.0002)	-0.0013 (0.0008)	0.0000 (0.0003)
Married	-0.2365*** (0.0712)	-0.2007*** (0.0661)	-0.7744 (0.4883)	-0.1086 (0.0820)
Number of children	-0.0383*** (0.0123)	-0.0385*** (0.0088)	-0.0658*** (0.0216)	-0.0355* (0.0182)
Education	0.0074 (0.0163)	0.0022 (0.0132)	-0.0263 (0.0337)	0.0009 (0.0093)
Own land	0.0573 (0.1036)	0.0589 (0.0755)	-0.0491 (0.1718)	0.4391*** (0.1312)
Income	0.0000 (0.0000)	0.0000 (0.0000)	-0.0000 (0.0000)	0.0000 (0.0000)
Computations	0.0816 (0.0749)	0.0363 (0.0764)	-0.1243 (0.1454)	-0.0101 (0.0848)
Knows interest rate	-0.0860 (0.1236)	-0.0352 (0.1024)	-0.1482 (0.3722)	0.0371 (0.0849)
Knows bank deposit	0.1122* (0.0599)	0.1203* (0.0663)	0.3473* (0.1978)	0.0793 (0.0699)
Bank account	-0.0184 (0.0505)	-0.0117 (0.0555)	0.2622 (0.1992)	0.0652 (0.0602)
Risk aversion	0.1455*** (0.0420)	0.1270* (0.0697)	0.1839 (0.1312)	0.1899*** (0.0630)
Memory game	-0.0089** (0.0036)	-0.0115*** (0.0034)	-0.0002 (0.0099)	-0.0068 (0.0051)
Short preferences	0.0469 (0.0414)	0.0158 (0.0409)	0.1828** (0.0878)	-0.0326 (0.0402)
Competitive	0.0511 (0.0485)	0.0730 (0.0523)	0.1432 (0.0910)	0.0082 (0.0677)
Total population	0.0000 (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)	0.0000 (0.0000)
Number of Observations	624	624	624	624
Kleibergen-Paap weak identification F-statistic	27.570	30.934	1.886	15.017

*Notes:* Robust standard errors clustered at the village level in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . In each column, one measure of female empowerment is used. In column (1) a dummy for whether a female is responsible for short-term financial decisions, in column (2) a dummy for whether a female is responsible for long-term financial decisions, in column (3) a dummy for whether a female is the household head and in column (4) a dummy for whether the land title is in the name of a female. The instrumental variable used is a dummy variable measuring if the households reside in a village that is far from Cherrapunji (>68km) or not.

**Table A3:** Female empowerment and savings: first stage instrumental variable

	Female empowerment			
	(1)	(2)	(3)	(4)
Far from Cherrapunji	0.4175*** (0.0958)	0.4678*** (0.0882)	0.0582 (0.0393)	0.2244*** (0.0439)
Female	0.0900*** (0.0319)	0.0682** (0.0331)	0.1851*** (0.0419)	0.1310*** (0.0310)
Age	0.0296** (0.0125)	0.0361*** (0.0099)	0.0257** (0.0111)	-0.0206 (0.0124)
Squared age	-0.0004** (0.0002)	-0.0005*** (0.0001)	-0.0002 (0.0002)	0.0002 (0.0002)
Married	-0.3477*** (0.0458)	-0.3268*** (0.0401)	-0.1661** (0.0612)	-0.0790** (0.0334)
Number of children	-0.0228 (0.0194)	-0.0260 (0.0158)	-0.0092*** (0.0026)	-0.0099 (0.0093)
Education	0.0065 (0.0154)	-0.0019 (0.0077)	-0.0065 (0.0093)	-0.0020 (0.0052)
Own land	-0.0670 (0.0786)	-0.0724 (0.0474)	-0.0326 (0.0348)	0.2860*** (0.0651)
Income	0.0000 (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)
Computations	0.0086 (0.0399)	-0.0702 (0.0464)	-0.0439*** (0.0151)	-0.0728** (0.0309)
Knows interest rate	-0.1125* (0.0625)	-0.0367 (0.0323)	-0.0293 (0.0603)	0.0434 (0.0713)
Knows bank deposit	0.1029** (0.0499)	0.1294** (0.0607)	0.0657*** (0.0132)	0.0275 (0.0270)
Bank account	-0.0185 (0.0303)	-0.0088 (0.0487)	0.0588*** (0.0177)	0.0606*** (0.0173)
Risk aversion	0.0942 (0.0654)	0.0731 (0.0581)	0.0215 (0.0269)	0.0881** (0.0333)
Memory game	0.0021 (0.0050)	-0.0021 (0.0050)	0.0022 (0.0020)	0.0029 (0.0025)
Short preferences	0.0489 (0.0484)	0.0002 (0.0437)	0.0365 (0.0315)	-0.0407* (0.0210)
Competitive	-0.0254 (0.0388)	0.0101 (0.0526)	0.0166 (0.0164)	-0.0498 (0.0393)
Total population	0.0000*** (0.0000)	0.0000*** (0.0000)	-0.0000 (0.0000)	0.0000*** (0.0000)
Number of Observations	624	624	624	624
F-statistics	18.990	28.157	2.193	26.160

*Notes:* Robust standard errors clustered at the village level in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . In each column, one measure of female empowerment is used. In column (1) a dummy for whether a female is responsible for short-term financial decisions, in column (2) a dummy for whether a female is responsible for long-term financial decisions, in column (3) a dummy for whether a female is the household head and in column (4) a dummy for whether the land title is in the name of a female. The instrumental variable used is a dummy variable measuring if the households reside in a village that is far from Cherrapunji (>68km) or not.

**Table A4:** Female empowerment and savings: continuous instrumental variable

	Savings at the end of the month			
	(1)	(2)	(3)	(4)
Short financial decisions female	-1.2549* (0.6568)			
Long financial decisions female		-1.0923*** (0.4239)		
Female head			-8.0727 (10.1973)	
Female land title				-1.7656 (1.0808)
Female	0.0664 (0.0902)	0.0280 (0.0708)	1.4483 (1.7558)	0.1855 (0.1655)
Age	0.0511** (0.0206)	0.0535*** (0.0194)	0.2222 (0.2504)	-0.0214 (0.0349)
Squared age	-0.0007*** (0.0003)	-0.0007*** (0.0003)	-0.0021 (0.0023)	0.0002 (0.0005)
Married	-0.4318** (0.2148)	-0.3533*** (0.1199)	-1.3402 (1.6284)	-0.1445 (0.1153)
Number of children	-0.0523*** (0.0129)	-0.0520*** (0.0088)	-0.0978 (0.0899)	-0.0411* (0.0213)
Education	0.0141 (0.0256)	0.0038 (0.0176)	-0.0468 (0.0669)	0.0011 (0.0114)
Own land	0.0161 (0.1279)	0.0212 (0.0872)	-0.1630 (0.4772)	0.6052* (0.3521)
Income	0.0000 (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)
Computations	0.0629 (0.0963)	-0.0233 (0.1189)	-0.2968 (0.4860)	-0.0645 (0.1357)
Knows interest rate	-0.1876 (0.1689)	-0.0849 (0.1020)	-0.2760 (0.7735)	0.0460 (0.1025)
Knows bank deposit	0.2034 (0.1604)	0.2143 (0.1534)	0.5991 (0.7100)	0.1092 (0.0995)
Bank account	-0.0191 (0.0653)	-0.0061 (0.0755)	0.4765 (0.6618)	0.1058 (0.0945)
Risk aversion	0.2219* (0.1267)	0.1826** (0.0916)	0.2735 (0.2882)	0.2502** (0.1183)
Memory game	-0.0096** (0.0046)	-0.0145** (0.0058)	0.0058 (0.0233)	-0.0062 (0.0056)
Short preferences	0.0585 (0.0593)	-0.0018 (0.0654)	0.2959 (0.3076)	-0.0656 (0.0889)
Competitive	0.0391 (0.0660)	0.0818 (0.0848)	0.2043 (0.2044)	-0.0188 (0.0949)
Total population	0.0000 (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)	0.0000 (0.0000)
Number of Observations	624	624	624	624
Kleibergen-Paap weak identification F-statistic	4.355	6.094	0.630	4.866

Notes: Robust standard errors clustered at the village level in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . In each column, one measure of female empowerment is used. In column (1) a dummy for whether a female is responsible for short-term financial decisions, in column (2) a dummy for whether a female is responsible for long-term financial decisions, in column (3) a dummy for whether a female is the household head and in column (4) a dummy for whether the land title is in the name of a female. The instrumental variable used is a variable measuring the distance to Cherrapunji (>68km) or not.

**Table A5:** Female empowerment and savings: instrumental variables distance to Cherrapunji and distance to Shillong

	Savings at the end of the month			
	(1)	(2)	(3)	(4)
Short financial decisions female	-0.7491*** (0.1313)			
Long financial decisions female		-0.6927*** (0.1191)		
Female head			-5.5601 (3.4486)	
Female land title				-1.5017*** (0.3805)
Female	0.0221 (0.0462)	0.0018 (0.0493)	0.9840** (0.4794)	0.1512* (0.0775)
Age	0.0377* (0.0200)	0.0405*** (0.0145)	0.1586* (0.0835)	-0.0155 (0.0246)
Squared age	-0.0006** (0.0003)	-0.0006*** (0.0002)	-0.0015* (0.0009)	0.0001 (0.0004)
Married	-0.2719*** (0.0591)	-0.2369*** (0.0530)	-0.9340 (0.5738)	-0.1282 (0.0892)
Education	0.0086 (0.0178)	0.0026 (0.0142)	-0.0321 (0.0368)	0.0011 (0.0103)
Own land	0.0499 (0.1091)	0.0500 (0.0773)	-0.0812 (0.2248)	0.5296*** (0.1503)
Income	0.0000 (0.0000)	0.0000 (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)
Computations	0.0783 (0.0776)	0.0222 (0.0820)	-0.1730 (0.1772)	-0.0397 (0.0919)
Knows interest rate	-0.1044 (0.1257)	-0.0470 (0.1014)	-0.1843 (0.4551)	0.0420 (0.0931)
Knows bank deposit	0.1287* (0.0700)	0.1425* (0.0812)	0.4183* (0.2236)	0.0956 (0.0831)
Bank account	-0.0185 (0.0530)	-0.0103 (0.0600)	0.3227 (0.2383)	0.0873 (0.0588)
Risk aversion	0.1593*** (0.0487)	0.1402* (0.0737)	0.2092 (0.1432)	0.2228*** (0.0545)
Memory game	-0.0090** (0.0037)	-0.0122*** (0.0038)	0.0015 (0.0124)	-0.0065 (0.0053)
Short preferences	0.0490 (0.0429)	0.0116 (0.0455)	0.2147*** (0.0789)	-0.0506 (0.0480)
Competitive	0.0489 (0.0516)	0.0751 (0.0591)	0.1604 (0.1098)	-0.0065 (0.0741)
Total population	0.0000 (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)	0.0000 (0.0000)
Number of Observations	624	624	624	624
Kleibergen-Paap weak identification F-statistic	15.244	17.062	1.427	7.501

*Notes:* Robust standard errors clustered at the village level in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . In each column, one measure of female empowerment is used. In column (1) a dummy for whether a female is responsible for short-term financial decisions, in column (2) a dummy for whether a female is responsible for long-term financial decisions, in column (3) a dummy for whether a female is the household head and in column (4) a dummy for whether the land title is in the name of a female. The instrumental variables used are a dummy variable measuring if the households reside in a village that is far from Cherrapunji (>68km) or not and an instrumental variable that measures if the households live far from Shillong (>32km) or not.

**Table A6:** Female empowerment and food expenditure: instrumental variable

	Food expenditure			
	(1)	(2)	(3)	(4)
Short financial decisions female	2834.47*** (1052.20)			
Long financial decisions female		2529.73*** (910.00)		
Female head			20343.50 (16000.15)	
Female land title				5274.00** (2539.93)
Female	-384.45** (192.77)	-301.79* (177.38)	-3895.83 (2630.05)	-820.27** (409.26)
Age	-69.30 (50.77)	-76.64 (56.98)	-509.16 (369.05)	123.18 (100.50)
Squared age	1.02 (0.68)	1.05 (0.74)	4.43 (3.65)	-1.39 (1.41)
Married	878.54** (396.54)	719.59* (387.30)	3271.54 (2387.67)	309.47 (437.40)
Number of children	127.90** (58.50)	128.91* (74.48)	250.13 (179.24)	115.39 (117.12)
Education	-45.86 (94.88)	-22.80 (70.83)	103.91 (185.49)	-17.14 (88.36)
Own land	480.68** (198.39)	473.80** (222.41)	953.99 (1162.44)	-1217.83 (811.87)
Income	0.17*** (0.04)	0.17*** (0.04)	0.21*** (0.05)	0.18*** (0.04)
Computations	-160.81 (162.48)	40.96 (217.19)	755.59 (861.08)	247.44 (270.08)
Knows interest rate	397.07* (231.31)	171.11 (189.07)	673.90 (1511.56)	-150.37 (498.72)
Knows bank deposit	360.23 (231.09)	324.39 (235.96)	-685.43 (1027.95)	506.73** (225.87)
Bank account	223.68 (136.95)	193.73 (153.42)	-1024.72 (1093.23)	-148.22 (257.11)
Risk aversion	175.22 (238.23)	257.29 (311.65)	4.46 (568.81)	-22.36 (299.29)
Memory game	-12.61 (16.45)	-1.19 (14.29)	-51.14 (57.00)	-21.83 (15.76)
Short preferences	-662.20*** (240.34)	-524.00** (216.93)	-1266.72* (650.48)	-308.77 (268.25)
Competitive	-47.55 (157.96)	-145.05 (197.24)	-457.44 (449.17)	143.20 (300.76)
Total population	0.00* (0.00)	0.00*** (0.00)	0.02 (0.01)	0.00 (0.00)
Number of Observations	624	624	624	624
Kleibergen-Paap weak identification F-statistic	27.570	30.934	1.886	15.017

*Notes:* Robust standard errors clustered at the village level in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . In each column, one measure of female empowerment is used. In column (1) a dummy for whether a female is responsible for short-term financial decisions, in column (2) a dummy for whether a female is responsible for long-term financial decisions, in column (3) a dummy for whether a female is the household head and in column (4) a dummy for whether the land title is in the name of a female.



**Table A7:** Female empowerment and food expenditure: first stage instrumental variable

	First stage			
	(1)	(2)	(3)	(4)
Female	0.0900*** (0.0319)	0.0682** (0.0331)	0.1851*** (0.0419)	0.1310*** (0.0310)
Age	0.0296** (0.0125)	0.0361*** (0.0099)	0.0257** (0.0111)	-0.0206 (0.0124)
Squared age	-0.0004** (0.0002)	-0.0005*** (0.0001)	-0.0002 (0.0002)	0.0002 (0.0002)
Married	-0.3477*** (0.0458)	-0.3268*** (0.0401)	-0.1661** (0.0612)	-0.0790** (0.0334)
Number of children	-0.0228 (0.0194)	-0.0260 (0.0158)	-0.0092*** (0.0026)	-0.0099 (0.0093)
Education	0.0065 (0.0154)	-0.0019 (0.0077)	-0.0065 (0.0093)	-0.0020 (0.0052)
Own land	-0.0670 (0.0786)	-0.0724 (0.0474)	-0.0326 (0.0348)	0.2860*** (0.0651)
Income	0.0000 (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)
Computations	0.0086 (0.0399)	-0.0702 (0.0464)	-0.0439*** (0.0151)	-0.0728** (0.0309)
Knows interest rate	-0.1125* (0.0625)	-0.0367 (0.0323)	-0.0293 (0.0603)	0.0434 (0.0713)
Knows bank deposit	0.1029** (0.0499)	0.1294** (0.0607)	0.0657*** (0.0132)	0.0275 (0.0270)
Bank account	-0.0185 (0.0303)	-0.0088 (0.0487)	0.0588*** (0.0177)	0.0606*** (0.0173)
Risk aversion	0.0942 (0.0654)	0.0731 (0.0581)	0.0215 (0.0269)	0.0881** (0.0333)
Memory game	0.0021 (0.0050)	-0.0021 (0.0050)	0.0022 (0.0020)	0.0029 (0.0025)
Short preferences	0.0489 (0.0484)	0.0002 (0.0437)	0.0365 (0.0315)	-0.0407* (0.0210)
Competitive	-0.0254 (0.0388)	0.0101 (0.0526)	0.0166 (0.0164)	-0.0498 (0.0393)
Total population	0.0000*** (0.0000)	0.0000*** (0.0000)	-0.0000 (0.0000)	0.0000*** (0.0000)
Far from Cherrapunji	0.4175*** (0.0958)	0.4678*** (0.0882)	0.0582 (0.0393)	0.2244*** (0.0439)
Number of Observations	624	624	624	624
F-statistics	18.990	28.157	2.193	26.160

*Notes:* Robust standard errors clustered at the village level in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . In each column, one measure of female empowerment is used. In column (1) a dummy for whether a female is responsible for short-term financial decisions, in column (2) a dummy for whether a female is responsible for long-term financial decisions, in column (3) a dummy for whether a female is the household head and in column (4) a dummy for whether the land title is in the name of a female.

**Table A8:** Female empowerment and education expenditure: instrumental variable

	Education expenditure			
	(1)	(2)	(3)	(4)
Short financial decisions female	3384.98 (2591.00)			
Long financial decisions female		2977.89 (2270.46)		
Female head			48595.89 (81646.54)	
Female land title				5809.21 (4135.27)
Female	5.88 (391.51)	108.92 (342.45)	-8173.68 (13082.73)	-586.42 (748.03)
Age	-338.43** (163.22)	-334.19** (144.91)	-1445.31 (1925.20)	-69.79 (105.99)
Squared age	4.98** (2.21)	4.82** (1.94)	13.04 (14.74)	1.56 (1.35)
Married	1307.75 (1056.71)	1049.39 (886.57)	9396.48 (15196.23)	324.79 (322.02)
Number of children	407.53* (208.10)	403.27** (197.85)	643.28 (699.82)	406.36*** (132.97)
Education	364.25*** (115.81)	381.62*** (135.32)	1053.56 (885.29)	423.95*** (148.92)
Own land	-1165.82 (775.75)	-1258.68* (717.77)	671.03 (4245.72)	-2900.83** (1441.11)
Income	0.37*** (0.12)	0.38*** (0.12)	0.47** (0.21)	0.38*** (0.12)
Computations	-10.74 (318.29)	119.53 (340.73)	3239.22 (5847.85)	354.21 (516.49)
Knows interest rate	963.67* (566.22)	769.21 (498.12)	1627.17 (4648.79)	358.16 (364.81)
Knows bank deposit	-1189.02 (810.25)	-1244.10 (849.07)	-4170.02 (6100.20)	-947.79* (546.10)
Bank account	-17.06 (338.26)	-108.76 (334.08)	-3895.39 (6591.16)	-252.18 (323.99)
Risk aversion	-1087.03*** (363.19)	-1072.09*** (300.61)	-2482.73 (2198.60)	-1263.54** (502.12)
Memory game	47.32 (33.04)	58.11 (36.72)	-27.85 (167.09)	46.88 (28.97)
Short preferences	-26.35 (431.71)	99.31 (412.87)	-740.86 (1836.71)	385.80 (489.00)
Competitive	422.53 (380.01)	284.55 (313.28)	-348.82 (1397.55)	752.11 (591.35)
Total population	-0.01*** (0.00)	-0.01*** (0.00)	0.01 (0.05)	-0.01*** (0.00)
Number of Observations	477	477	477	477
Kleibergen-Paap weak identification F-statistic	22.440	23.415	0.419	11.721

Notes: Robust standard errors clustered at the village level in parentheses.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

**Table A9:** Female empowerment and education expenditure: first stage instrumental variable

	First stage			
	(1)	(2)	(3)	(4)
Far from Cherrapunji	0.38*** (0.09)	0.43*** (0.09)	0.03 (0.04)	0.22*** (0.06)
Female	0.07** (0.03)	0.05* (0.03)	0.17*** (0.04)	0.14*** (0.03)
Age	0.03* (0.02)	0.03*** (0.01)	0.02*** (0.01)	-0.03*** (0.01)
Squared age	-0.00** (0.00)	-0.00** (0.00)	-0.00** (0.00)	0.00** (0.00)
Married	-0.36*** (0.05)	-0.32*** (0.07)	-0.19*** (0.05)	-0.04 (0.04)
Number of children	-0.02 (0.02)	-0.02 (0.02)	-0.01 (0.00)	-0.01 (0.01)
Education	-0.01 (0.02)	-0.01 (0.01)	-0.01 (0.01)	-0.01** (0.01)
Own land	-0.07 (0.08)	-0.04 (0.06)	-0.04 (0.03)	0.26*** (0.07)
Income	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
Computations	-0.01 (0.07)	-0.06 (0.06)	-0.07*** (0.02)	-0.07** (0.03)
Knows interest rate	-0.09 (0.07)	-0.03 (0.05)	-0.02 (0.07)	0.05 (0.08)
Knows bank deposit	0.18** (0.07)	0.22** (0.08)	0.07*** (0.02)	0.06* (0.03)
Bank account	-0.05 (0.04)	-0.03 (0.06)	0.08*** (0.02)	0.01 (0.03)
Risk aversion	0.04 (0.06)	0.04 (0.08)	0.03 (0.02)	0.05 (0.06)
Memory game	0.00 (0.00)	-0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Short preferences	0.06 (0.05)	0.03 (0.04)	0.02 (0.04)	-0.03* (0.02)
Competitive	-0.02 (0.05)	0.03 (0.06)	0.01 (0.02)	-0.07 (0.04)
Total population	0.00** (0.00)	0.00** (0.00)	-0.00 (0.00)	0.00* (0.00)
Number of Observations	477	477	477	477
F-statistics	16.901	24.283	0.463	15.555

Notes: Robust standard errors clustered at the village level in parentheses.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

**Table A10:** Female empowerment and temptation goods expenditure: instrumental variable

	Temptation goods expenditure			
	(1)	(2)	(3)	(4)
Short financial decisions female	36.80 (332.25)			
Long financial decisions female		32.58 (294.24)		
Female head			381.23 (3261.72)	
Female land title				75.54 (674.79)
Female	94.12 (64.59)	95.27* (57.40)	33.20 (568.57)	88.50 (106.36)
Age	25.36 (20.31)	25.30 (20.61)	17.48 (70.66)	27.90 (30.05)
Squared age	-0.38 (0.27)	-0.39 (0.28)	-0.32 (0.63)	-0.42 (0.39)
Married	-36.60 (85.97)	-39.25 (70.19)	-0.75 (367.25)	-44.19 (58.11)
Number of children	7.18 (10.75)	7.19 (10.92)	8.04 (16.17)	6.53 (9.44)
Education	-28.29 (24.96)	-27.91 (23.31)	-24.48 (25.59)	-28.32 (25.46)
Own land	-14.19 (84.97)	-14.40 (84.59)	-3.34 (144.29)	-39.60 (208.65)
Income	0.04*** (0.01)	0.04*** (0.01)	0.04*** (0.01)	0.04*** (0.01)
Computations	6.93 (56.16)	9.23 (64.44)	27.81 (198.16)	11.80 (77.00)
Knows interest rate	19.30 (109.94)	15.94 (86.98)	18.37 (95.61)	11.95 (66.62)
Knows bank deposit	-56.35 (126.74)	-56.77 (130.17)	-75.53 (277.33)	-55.86 (123.83)
Bank account	138.11** (69.87)	137.50** (65.43)	113.91 (165.20)	133.18*** (48.17)
Risk aversion	83.41 (76.75)	84.99 (72.10)	85.78 (74.18)	80.15 (92.55)
Memory game	-3.08 (3.22)	-2.93 (3.32)	-3.66 (6.47)	-3.20 (3.67)
Short preferences	-24.98 (45.76)	-23.43 (42.23)	-30.02 (74.16)	-18.54 (57.23)
Competitive	-13.28 (60.04)	-14.92 (51.75)	-21.52 (56.76)	-8.60 (91.58)
Total population	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Number of Observations	551	551	551	551
Kleibergen-Paap weak identification F-statistic	25.467	28.941	0.794	11.374

Notes: Robust standard errors clustered at the village level in parentheses.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

**Table A11:** Female empowerment and temptation goods expenditure: instrumental variable

	First stage			
	(1)	(2)	(3)	(4)
Far from Cherrapunji	0.41*** (0.10)	0.47*** (0.09)	0.04 (0.04)	0.20*** (0.04)
Female	0.10*** (0.03)	0.07*** (0.03)	0.17*** (0.04)	0.12*** (0.03)
Age	0.03** (0.01)	0.04*** (0.01)	0.02** (0.01)	-0.02 (0.01)
Squared age	-0.00*** (0.00)	-0.00*** (0.00)	-0.00 (0.00)	0.00 (0.00)
Married	-0.34*** (0.04)	-0.31*** (0.04)	-0.13** (0.06)	-0.07* (0.04)
Number of children	-0.02 (0.02)	-0.03 (0.02)	-0.00* (0.00)	-0.00 (0.01)
Education	0.00 (0.02)	-0.01 (0.01)	-0.01 (0.01)	0.00 (0.01)
Own land	-0.07 (0.08)	-0.07 (0.05)	-0.03 (0.04)	0.30*** (0.06)
Income	0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
Computations	0.02 (0.05)	-0.05 (0.05)	-0.05*** (0.01)	-0.06* (0.03)
Knows interest rate	-0.11 (0.07)	-0.03 (0.04)	-0.01 (0.07)	0.04 (0.07)
Knows bank deposit	0.13** (0.05)	0.16** (0.07)	0.06*** (0.02)	0.06 (0.03)
Bank account	-0.05 (0.03)	-0.04 (0.05)	0.06*** (0.02)	0.04* (0.02)
Risk aversion	0.11 (0.07)	0.08 (0.06)	0.00 (0.03)	0.10*** (0.03)
Memory game	0.00 (0.00)	-0.00 (0.01)	0.00 (0.00)	0.00 (0.00)
Short preferences	0.04 (0.05)	-0.00 (0.05)	0.02 (0.03)	-0.07*** (0.02)
Competitive	-0.03 (0.04)	0.02 (0.05)	0.02 (0.02)	-0.08* (0.04)
Total population	0.00** (0.00)	0.00** (0.00)	-0.00 (0.00)	0.00** (0.00)
Number of Observations	551	551	551	551
F-statistics	16.071	25.195	0.845	23.024

Notes: Robust standard errors clustered at the village level in parentheses.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

**Table A12:** Female empowerment and savings: instrumental variable controlling for occupation

	Savings at the end of the month			
	(1)	(2)	(3)	(4)
Short savings female	-0.7582*** (0.1781)			
Long savings female		-0.6565*** (0.1530)		
Female head			-5.9896 (4.2316)	
Female land title				-1.2583*** (0.4017)
Female	0.0601* (0.0328)	0.0399 (0.0396)	1.0829 (0.6599)	0.1588*** (0.0496)
Age	0.0110 (0.0175)	0.0155 (0.0144)	0.1062 (0.0794)	-0.0392** (0.0192)
Squared age	-0.0003 (0.0002)	-0.0003 (0.0002)	-0.0008 (0.0009)	0.0004 (0.0003)
Married	-0.3847*** (0.0871)	-0.3200*** (0.0729)	-1.1679* (0.6822)	-0.1706** (0.0758)
Number of children	-0.0364*** (0.0104)	-0.0365*** (0.0066)	-0.0711** (0.0304)	-0.0319 (0.0211)
Education	0.0036 (0.0155)	-0.0033 (0.0137)	-0.0207 (0.0480)	0.0093 (0.0109)
Own land	0.0160 (0.0938)	0.0204 (0.0624)	-0.1524 (0.2803)	0.4070*** (0.1239)
Income	0.0000 (0.0000)	0.0000 (0.0000)	-0.0000 (0.0000)	0.0000 (0.0000)
Computations	0.0551 (0.0678)	0.0067 (0.0706)	-0.1897 (0.1790)	-0.0246 (0.0853)
Knows interest rate	-0.1223 (0.1127)	-0.0626 (0.0946)	-0.2324 (0.4639)	-0.0083 (0.0754)
Knows bank deposit	0.0995* (0.0582)	0.1108* (0.0658)	0.3980 (0.2738)	0.0712 (0.0618)
Bank account	0.0001 (0.0467)	0.0057 (0.0521)	0.4287 (0.3481)	0.0867* (0.0482)
Risk aversion	0.1597*** (0.0407)	0.1174 (0.0777)	0.1802 (0.1946)	0.1871*** (0.0702)
Memory game	-0.0091** (0.0037)	-0.0111*** (0.0037)	0.0003 (0.0127)	-0.0060 (0.0056)
Short preferences	0.0457 (0.0306)	0.0088 (0.0358)	0.2615* (0.1510)	-0.0436 (0.0374)
Competitive	0.0369 (0.0478)	0.0633 (0.0521)	0.1692 (0.1242)	-0.0034 (0.0672)
Total population	0.0000 (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)	0.0000 (0.0000)
Salaried employee private sector	-0.3827*** (0.1043)	-0.2701*** (0.0786)	-0.3205 (0.4194)	-0.0730 (0.1314)
Small business owner	-0.1763* (0.1062)	-0.1300 (0.0802)	-0.1100 (0.1956)	0.1322 (0.1272)
Self-employed (Private sector <5 employees)	0.4573** (0.1854)	0.3729* (0.1967)	-0.4552 (0.6427)	0.4713* (0.2798)
Self-employed (Private sector >5 employees)	-0.3411** (0.1462)	-0.9554*** (0.1264)	-1.7586* (0.9771)	-0.9970*** (0.1824)
Farmer	-0.4351*** (0.1442)	-0.3455*** (0.0810)	-0.2171 (0.5789)	-0.1688 (0.1854)
Unskilled worker	-0.7637*** (0.1582)	-0.7129*** (0.0818)	-1.3551** (0.5664)	-0.7243** (0.3111)
Wage agricultural labor	-0.3172*** (0.1005)	-0.2476* (0.1395)	-0.2877 (0.6980)	-0.1288 (0.1424)
Non agricultural labor	-0.4734*** (0.1215)	-0.4019*** (0.1006)	-0.1837 (0.5970)	-0.1154 (0.1319)
Construction worker	-0.2274 (0.1788)	-0.1360 (0.1553)	-0.1361 (0.5495)	-0.0767 (0.1123)
No occupation	-0.4267** (0.1751)	-0.4022*** (0.1298)	-0.1904 (0.6257)	-0.3458* (0.1878)
Student	-0.6812*** (0.1186)	-0.5594*** (0.0846)	-0.9382*** (0.2971)	-0.4197*** (0.1234)
Others	-0.1661 (0.1666)	-0.0041 (0.1444)	-0.3272 (0.4231)	-0.1818 (0.2370)
Number of Observations	624	624	624	624
Kleibergen-Paap weak identification F-statistic	$\chi^2_{25}$ 25.097	29.482	1.260	15.562

Notes: Robust standard errors clustered at the village level in parentheses.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

**Table A13:** Female empowerment and savings: instrumental variable with alternative controls

	Savings at the end of the month			
	(1)	(2)	(3)	(4)
Short savings female	-0.6323*** (0.1604)			
Long savings female		-0.5624*** (0.1509)		
Female head			-4.5959* (2.5596)	
Female land title				-1.1959*** (0.4308)
Female	-0.0074 (0.0530)	-0.0157 (0.0553)	0.8118** (0.4014)	0.1045* (0.0591)
Age	0.0328* (0.0176)	0.0359*** (0.0133)	0.1328* (0.0745)	-0.0083 (0.0185)
Squared age	-0.0005** (0.0002)	-0.0005*** (0.0002)	-0.0013 (0.0008)	0.0000 (0.0003)
Married	-0.2854*** (0.1012)	-0.2208** (0.0990)	-0.7635 (0.4938)	-0.1302 (0.0960)
Number of children	-0.0375*** (0.0122)	-0.0368*** (0.0087)	-0.0701*** (0.0232)	-0.0337** (0.0157)
Education	0.0053 (0.0168)	0.0011 (0.0134)	-0.0227 (0.0351)	-0.0027 (0.0098)
Own land	0.0649 (0.0994)	0.0628 (0.0725)	-0.0585 (0.1673)	0.4512*** (0.1352)
Income	0.0000 (0.0000)	0.0000 (0.0000)	-0.0000 (0.0000)	0.0000 (0.0000)
Spouse earns income	0.0923 (0.0835)	0.0443 (0.0867)	-0.0366 (0.2088)	0.0400 (0.0793)
Bank account	-0.0084 (0.0478)	0.0007 (0.0527)	0.2343 (0.1820)	0.0816 (0.0635)
Mobile banking	0.0972* (0.0544)	0.0231 (0.0544)	-0.1139 (0.1284)	0.1658 (0.1126)
Microcredit	-0.1324* (0.0742)	-0.1567* (0.0862)	0.3811 (0.3683)	-0.2141** (0.0903)
Computations	0.0690 (0.0728)	0.0248 (0.0773)	-0.0957 (0.1165)	-0.0303 (0.0833)
Knows interest rate	-0.0799 (0.1157)	-0.0369 (0.0924)	-0.1346 (0.3556)	0.0319 (0.0809)
Knows bank deposit	0.1090* (0.0592)	0.1173* (0.0652)	0.3540* (0.1896)	0.0758 (0.0681)
Risk aversion	0.1518*** (0.0484)	0.1293* (0.0702)	0.1708 (0.1343)	0.2061*** (0.0711)
Memory game	-0.0089** (0.0037)	-0.0116*** (0.0036)	0.0005 (0.0096)	-0.0071 (0.0053)
Short preferences	0.0521 (0.0427)	0.0203 (0.0424)	0.1717* (0.0886)	-0.0241 (0.0434)
Competitive	0.0522 (0.0501)	0.0760 (0.0549)	0.1359 (0.0910)	0.0105 (0.0689)
Total population	0.0000 (0.0000)	-0.0000 (0.0000)	-0.0000 (0.0000)	0.0000 (0.0000)
Number of Observations	624	624	624	624
Kleibergen-Paap weak identification F-statistic	29.369	32.206	2.206	14.472

Notes: Robust standard errors clustered at the village level in parentheses.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .