The Effect of Religious Constraints on Individual Labour Supply.*

Guillermo Cabanillas-Jiménez[1]

[1]Universidad de Alcalá (UAH) & DeReCK, guillermo.cabanillas@uah.es

June 16, 2023

Abstract

We study the effect of religious constraints on individual's labor supply decisions in the context of Ramadan, one of the central pillars of Islam, consisting of an entire lunar month of fasting from sunrise to sunset. Using household panel-data from Malawi for the years 2010, 2013 and 2016. We find that females reallocate their time, from their jobs to household work. For males, we do not find such reallocation of hours, as they increase both, their hours worked at their jobs but also in the household. As a robustness check to our results, we use household data from Bangladesh to support the estimates on the extensive margins, where we do not find any effect on labor force both for females and males or the likelihood of working during Ramadan. These findings show that we need to go beyond general beliefs that labor supply goes down, but individuals keep working at home or more hours overall, when religious constrains appear.

Keywords: Labor Supply, Ramadan, Hours worked, Wooldridge Correction
JEL Classification: C01, C23, C26, C93, J22, J43 and O12.

1 Introduction

Religion plays an important role in human societies. All religions impose rules of behavior, or discipline, that constrain their followers, depending on the degree of strictness of each religion (see Campante-Yanagizawa-Drott, 2015; see also Barro and McCleary, 2003). Religion can also provide behavioral incentives towards

*This paper has benefited from all comments received in internal seminars at given university. The author wants to thank everyone who contributed with their ideas to improve the research quality of the paper. Big thanks to my colleagues forther support and advices along this project. And also a special thanks to another great colleage for her help and tips in this paper which have been extremely helpful.

a certain type of institutions that ultimately shape economic growth. For instance, historically, extensive research (and still inconclusive) has focused on the comparative behavior between Catholics and Protestants over the long run. This is because, according to Max Weber, Protestantism should favor economic development (see, for example, Cantoni 2015, p. 1; Weber 1904/05). Other studies have shown, for example, how specific institutions, like the Spanish Catholic Inquisition, hindered long-term, economic growth and, what is more, the effects are still being felt today in terms of trust (see Drelichman, 2021). It is therefore undeniable that religious practices have an impact on individual behavior and thus, they can affect indirectly (or directly) economic outcomes in different ways: labor supply, productivity, economic growth, trust, etc.

When it comes to Islam, the second-largest religion in the world, there are many arguments that relate it negatively to economic growth (see review by Kuran 2018). For example, at the aggregate level, Campante and Yanagizawa-Drott (2015) analyze the economic effects of Ramadan - a month of fasting, prayer, reflection, and community - on economic growth of all countries around the world. The authors conclude that religious constraints imposed by Ramadan have negative effects on labor markets and economic growth, especially for those countries in which fasting takes longer. This is in line with other studies that also estimate a negative relationship between religious behavior and economic growth (see Barro and McCleary, 2003 and Barro and McCleary, 2006). The problem is that, as Kuran (2018) concludes, when it comes to Islam and economic growth, there are key questions that remain unanswered. This is often the case when micro-level data are scarce. For instance, do men and women respond differently to the Ramadan shock? Do their responses vary differently depending on other variables such as the level of income and education? (see Kuran, 2018)

The main goal of this paper is to contribute to this discussion. We study Malawi, a landlocked country in southeastern Africa, and analyze how the religious constraints imposed by the Ramadan can affect human behavior in the labor supply (allocation of hours) decisions, differentiating between males and females. As van Ewijk (2011) describes, Ramadan is one of the big Five Pillars of Islam and the *Holiest month of Islam*. It lasts for a period of 29-30 days, in which Muslims are not allowed to consume any type of food or drink, nor tobacco, nor have sexual activity from sunrise to sunset (see Çelen, 2015; Odabasi and Argan, 2009). Hence, it is a great case study of religious constraints that can influence the supply of labor and the reallocation of working time.

For this, we use the Life Standard Measurement Survey (LSMS) from Malawi, a household panel-data for the years 2010, 2013 and 2016. This data is unique because it includes surveys taken during the Holy month of Ramadan, and this not something very common among the available World Bank surveys. This dataset also provides a good balance across treatment and control groups, satisfying our identifying assumption and will

allow us to analyze the intensive and the extensive margins. Finally, and in addition to the particularity of the data, which allows us to identify if the individuals were surveyed during Ramadan, Malawi is a great case study as it is in Africa. As Kumar (2018, p. 1352) points out, more research is needed on Muslim behavior in Africa, a continent that is experiencing high rates of population growth, and which allows for the consideration of other factors, such as ethnic differences.

Hence, using data from Malawi we analyze how religious constraints interfere with individuals' allocation of hours worked and the likelihood of being at work or in the labor force. The focus is on how individuals reallocate their time under religious constraints (from work to housework or vice-versa). Hence, the main research question of this paper is *how do religious constraints affect the allocation of labor by individuals in developing countries?* In this case, the Muslim obligation to fast during the month of Ramadan is our religious constraint and the hypothesis we test is that Ramadan affects the allocation of hours worked during this period. In addition, we investigate how household composition influences work time allocation. Another aspect of this paper is the analysis of the extensive margins to examine how Ramadan affects the likelihood of being employed and/or in the labor force.

To test the changes in time reallocation, we use a differences-in-differences estimation method. In addition to the constraints imposed by Ramadan, such as fasting or lack of sexual activity, another important aspect is that it goes in line with the lunar calendar, in other words, every year it takes place in a different period, and it does not have a fixed date, as for example Christmas does for Christians on December 25 (see van Ewijk 2011). This is a key factor since it also allows us to test for seasonal fixed effects in our analysis. However, we also need to consider our identifying assumption, where individuals that are interviewed during the month of Ramadan do not systematically differ, on average, to individuals interviewed in a different period of the year. Thus, using a differences-in-differences estimation method, we can test whether the change in hours worked is because of a shock that has occurred in a given period of the year, which is correlated with the Holy month, or because of Ramadan itself. We proceed with a Heckman model to control for sample selection, as there might be individuals in the sample that decided not to work because of personal reasons or prefer to work in the household. The challenge in this paper is the inclusion of individual fixed effects, which is done by adding the Wooldridge correction to the model, allowing for robust-heteroskedastic standard errors clustered at the village level (see Wooldridge, 1995).

To our knowledge, there is one paper, Schofield (2014), that uses household/individual data to quantify how both labor supply and calories consumed are affected during the Ramadan month in India. By using a combination of a natural experiment and a Randomized Control Trial (RCT), in which the treatment group receives

food rich in calories, Schofield (2014) finds that religious constraints significantly reduce the labor supply due to the low consumption of calories. However, households that belong to the treatment group and increase their calorie intake, do not reduce their hours worked. Differently to our study, we do not use an RCT. Instead, we use a quasi-experiment where we test in detail the religious constraints effects, such as fasting during Ramadan, on labor supply at the individual level and how households adjust the intensive margins of labor when they must adjust to cultural constraints, by performing an intrahousehold analysis on labor supply indicators. Thus, the uniqueness of this paper, to our best knowledge, lies in the fact that we investigate the effects of cultural constraints on labor supply at the individual level, identifying not only the number of hours worked under paid jobs but also hours worked at the household, by testing if there exists any reallocation of time devoted to labor during the Holy month of Ramadan.

The main finding in this paper is that we do not find any evidence at the aggregate level that Ramadan has an impact on labor supply indicators; in other words, we do not observe that individuals that celebrate the Ramadan festivity increase/decrease their hours worked during this period. However, Ramadan creates a reallocation of time for females: specifically, we find that females reallocate their time from hours worked under a paid job to household work, increasing by 0.5 hours their housework and reduce by 2 hours their time under paid jobs. However, for Malawian males that take part in Ramadan, we find a general increase in 2.2 worked hours in total, compared to those that do not celebrate Ramadan. Such results are very important as it proves that individuals in Malawi do not reduce labor supply as economic indicators may tell us, but they do more housework and dedicate more time to family and friends.

We also estimate how family composition in Malawi affects labor supply, as we believe intrahousehold allocation also matters on the number of hours worked: more children at home might lead some household members to dedicate more time to them. This may also be the case when there are elderly people in the household that may need care. However, when we differentiate across gender, we find that for female and male subsamples, household composition matters and affects both subsamples similarly. One relevant fact is that having an additional adult or elderly female in the household leads to negative effects on individuals own labor supply allocation.

Finally, and as a robustness check to our results, we run a similar analysis for Bangladesh (because of data availability). We use the Household Income and Expenditure Survey (HIES) and the Women's Life Choices and Attitudes Survey (WiLCAS). These datasets help us conduct a good robustness check since it provides a good balance across treatment and control groups, satisfying our identifying assumption. The difference is that for Bangladesh we estimate the extensive margins, given that the survey only considers the number of

hours worked per year and not per week. We test the likelihood of working or being in the labor force during the Holy month of Ramadan. However, we do not find any effects for this country either. These findings confirm our previous results, indicating that individuals do not enter or exit the labor force during Ramadan but reallocate their labor time across different types of activities.

The rest of the paper is structured in six further sections. Section 2 gives a brief history of the Ramadan tradition in Malawi. Section 3 gives the background of the labor market in Malawi. In section 4 we describe the dataset we use. Sections 5 and 6 describe the econometric approach and the estimated results from the regressions, respectively. Finally, Section A concludes the paper.

2 Background

Ramadan is the ninth month of the Islamic Calendar, consisting of mandatory fasting from sunrise to sunset. Fasting during the month of Ramadan is one of the big Five Pillars of Islam and Muslims are required to abstain from food, drinks, smoking and sexual activities during the sunlight hours for 29-30 days, depending on the length of the lunar month. As in every country where Ramadan takes place, food after fasting takes a principal role during the Holy month of Ramadan. There are two main meals that Muslims take during Ramadan, a big one during the sunset (*iftar*) and another one before the sunrise (*suhoor*).[1] However, there are some people exempted from fasting during this period: children under 12 years old, elderly people, those that are ill or women in the period of menstruation or that have recently given birth (see Almond and Mazumder, 2011).

Ramadan is also considered a period in which Muslims enhance their self-control, experience a personal growth and spirituality, developing empathy towards those in need and reinforce their connection with God, being mindful of their religious obligations by going to mosques and prayer- houses daily. Moreover, Ramadan is the time where Muslims choose to pay their annual charity tax (*zakat*), which is another pillar of Islam (see Demiroglu et al., 2017). However, the most important event of Ramadan comes at the end of the festivity. It is called *Eid al-Fitr* and consists of a three-day event where families meet together and break the fast. It is the first time after Ramadan when Muslims are allowed to not fast during the day (see Bone, 1982 and Malawi, CultureGrams 2018).

Ramadan fasting can lead to physical and/or psychological issues caused by the fact of fasting and not being allowed to ingest calories or liquids during the day. Medical research has shown that fasting can entail irri-

[1] One might find different names for the sunset and dawn meals in different papers, depending on the language they use.

tability caused by stress, sleep deprivation, headaches, dehydration, physical exhaustion, among other minor health problems but it rarely leads to major health problems (see Leipier and Molla, 2003). This can have effects on individual labor supply. Some studies found that a significant number of people reported fatigue and aversion to work, in addition to a reduction in focus at work during the Holy month (see Afifi, 1997 and Karaagaoglu and Yucecan, 2000). With that, many governments in Muslim countries do formally reduce the number of hours worked during the Holy month of Ramadan by one to three hours allowing workers to start and end their workday earlier (see Demiroglu et al., 2017).

Given that Ramadan follows the lunar calendar instead of the solar one, the period of Ramadan corresponds to a different set of dates on the solar calendar each year. Specifically, Ramadan starts about 11-12 days earlier each year according to the solar calendar (see Göçmen et al., 2004). In that aspect, some countries close to the Equator have the (dis)advantage of having the same number of hours of sunlight along the entire year, whereas countries in the Northern Hemisphere, like Bangladesh, or in the Southern Hemisphere, such as Malawi, have different numbers of sunlight hours during the year. Thus, hours of fasting are not the same in all countries and can differ significantly depending on the location of the country and the season in which Ramadan takes place. Hence, fasting during Ramadan can have a different effect on individuals' labor supply behavior according to whether they live in the Northern or Southern Hemisphere.

Therefore, food and calorie intake also represent one of the most important aspects of Ramadan. Thus, Ramadan meals during sunset and sunrise are rich in calories and carbohydrates (see Shephard, 2012). This is important as individuals need to have energy during the day, as they want to keep their productivity in their jobs.

Hence, with all the restrictions that Ramadan presents, but also with all its opportunities for Muslims to increase their happiness and their social relations, Ramadan seems a good treatment to assess for individual labor supply and observe the implications of religious constraints in the labor market at the individual level.

3 Labor Market Background in Malawi

The agricultural sector is the most important one in the labor market of developing economies or sub-Saharan African countries. The same holds true for Malawi where around 71% of the population in 2019 worked in this sector (see indexmundi, checked on April 2020). Figure 1b shows the importance of the agricultural sector in the Malawian labor market, with a 70-80% share of total labor during the last 20 years.

Members of the household provide most of the agricultural labor in farming in Malawi. Around 60% of the farms in Malawi are small, with a land area less than 0.8 hectares. In contrast, just 0.4% of Malawian farmers operate in farms with an area greater than 4.5 hectares (see Julien et al., 2019). This implies that in large households, some members will typically need to look for work outside the home because of an excess endowment of labor relative to land ownership. When analyzing labor decisions, we need to consider that in developing countries, the head of the household make most of the decisions affecting household members; therefore, we can treat him as the social planner of the family (see Dercon and Krisnan, 2000). This means that if there are too many adult members in a household, the head of the household may employ some members to work on the household land (or farming activities) and send others to look for a job outside the home.

An important issue in sub-Saharan African countries is the investment limitations in irrigation infrastructures, where only 4% of the cropland is irrigated (see Sheahan and Barrett, 2017). As explained in Julien et al. (2019), some constraints are specific to some landowners, and some others are general to everyone. The first ones mainly affect small farms or farmers who produce to subsist. These constraints refer to new technology investments, the use of fertilizers or pesticides, but also to the access to credit markets, which is harder for owners of small lands/farms. Common constraints faced by all farms are climate change and environmental degradation. Each of these constraints affect production and whether directly or indirectly, the labor market.

Regarding the employment gender gap in the Malawian labor market between males and females, according to ILOSTAT in 2019, it increased over the years. In 2019, there was a 10% employment gap between males and females in the Malawian labor market, where the majority of the population is employed in the agricultural sector, where the share of females employed in this sector is greater than the share of employed males (see Figure 1a in the Appendix and Klaveren, 2009). This fact implies that most females are working on their own household land (see Julien et al., 2019). Nonetheless, according to ILOSTAT in 2019, the gender gap across sectors does not report big differences across males and females (see Figure 1 in the Appendix).

4 Data

The dataset we use in this paper comes from the Malawian Integrated Household Panel Survey provided by the Malawi National Statistics Office (NSO). We use Malawian data to analyze how Ramadan affects labor supply outcomes at the intensive and extensive margins. Later we perform a robustness check analysis of the extensive margins only using data from Bangladesh, due to data availability - more precisely we use the Household Income and Expenditure Survey (HIES) and the Women's Life Choices and Attitudes Survey (WiLCAS) - the results are in the appendix of this paper.

The reasons for choosing Malawi as our country of interest are that it has a sizeable population of both Muslims (15%) and non-Muslims and because of the availability of a household panel data survey for which the period of interviews overlaps with the Ramadan period (28% of interviews conducted during the month of Ramadan - see Table 1). Hence, the survey includes a sizeable number of households that we classify as being treated: Muslims interviewed during the Ramadan period.

The data for Malawi constitutes a panel dataset in which individuals are observed in three different years: 2010, 2013 and 2016. The sample is composed of 3231 households randomly selected, of which 15% are Muslim. However, Malawi is a Christian country where, according to the last Population and Housing Census collected in 2018 by the NSO, 83% of the total population follows this religion. In contrast to that, 13.8% of the population is composed of Muslims, most of them living in the southern regions, and 2.1% of its population does not follow any religion.

Therefore, we need to establish those individuals that are part of our treatment group (Muslims interviewed during Ramadan) and those that belong to the control group. To do so, first we need to identify those individuals that are Muslims and those that are not. The other key feature to determine the treated group is the date on which the interview took place. Muslims interviewed during the month of Ramadan belong to the treatment group; the rest of the sample is our control group.

The Malawian Integrated Household Panel Survey provides information about the number of hours the individuals have worked during the previous week to the survey, both in household work and paid jobs. We also have information about their consumption expenditures, gender, age, marital status, number of children they have, whether they live in a rural or urban area, and whether they have attended school, among other socio-demographic variables. Furthermore, we have access to the agricultural data, in which we have information from each household about the area of land they have in hectares (ha.), whether this is of its own property or not (and who has the land rights), their land production and its livestock, among other variables.

This survey also asks individuals about their religion and beliefs, as well as keeping a record of when the interview took place, where it allows us to create a dummy variable ($Islam$) that takes value one if the individual is Muslim and a second one ($Ramadan$), which takes value one if the individual was interviewed during the Ramadan. The identification of the treatment comes by interacting two variables. If the value of the interaction term is equal to one, the individual is part of the treatment group; otherwise, he/she is part of the control group.

Another important addition to this data is the generation of the labor force participation group. This will help us later to control for any potential sample selection when analyzing the intensive margins in the selection equation - discussed later in section 5. In this case, we say that *an individual belongs to the labor force if he/she is actively working or potentially looking for a job*.

Table 1: Summary statistics

Variable	Mean	Std. Dev.
Housework Hours	5.375	10.933
Paid Job Hours	10.106	17.588
Total Hours	15.48	24.157
Proportion Working	0.671	0.47
Labor Force Participation	0.885	0.32
Islam	0.154	0.36
Ramadan	0.284	0.451
Islam × Ramadan	0.059	0.237
Age	22.587	18.072
Male	0.489	0.5
School	0.858	0.349
Urban	0.259	0.438
Household size	5.975	2.385
Land area (ha.)	2.357	9.183
Num. adults	2.355	1.248
Proportion of male children	0.186	0.177
Proportion of female children	0.187	0.177
Proportion of male adults	0.215	0.194
Proportion of female adults	0.227	0.178
Proportion of old males	0.043	0.103
Proportion of old females	0.050	0.103

Source: World Bank Data - Malawian Integrated Household Panel. Summary statistics of all relevant variables that are used for our study.

Table 1 shows the summary statistics of the main variables this paper focuses on. We observe that on average, people work around 5.4 hours per week in the household and 10 hours in their jobs (those who work outside home). However, the standard deviation is almost twice the mean in both cases, meaning that there is lot of variability across individuals on the allocation of working hours, where some individuals might not work, and some others might double the hours worked from the average. Moreover, when observing at the proportion of people working and that belongs to the labor force in our sample, we detect that 67% are working and 88% of the individuals are part of the labor force, meaning that most of our sample that is in their working age is part

of the labor force.[2] This is important, as we have that some individuals in the sample are unemployed and not even looking for a job and, thus, later in the data analysis we need to control for any potential selection bias in labor supply.

Another fact from Table 1 is that only 6% of the sample belongs to the treatment group ($Islam \times Ramadan$). The sample is composed of young people, 22 years old on average, and almost equally divided between males and females: in total there are 49% males and 51% females. We also observe that most of the people have attended school (86%) and live in rural areas (74%). Another important fact is that on average there are two adults per household and the average number of people in each household is six. This means that on average there are around four children per household. Finally, the average land area in the household is 2.4 hectares; however, notice that the standard deviation is almost four times higher than the average. According to Julien et al. (2019), Malawi is characterized by not having big areas of land; more precisely, 60% of the farms are small with an area of less than 0.8 hectares, and only 0.4% of the farms are greater than 4.5 hectares.

Finally, we also show the proportion of children, adults and elder people in the household, by gender. On average, we observe that 36% of the household is composed by children and 9% by elderly people, equally divided by males and females. On the other hand, 45% of the household is composed by adult people, where 22% are males and 23% are females.[3] This data will be useful for later, when we estimate the intrahousehold allocation affecting the labor supply during the Ramadan.

4.1 Balance Tables - Malawi

The idea of showing balance tables and normalized differences, jointly with the orthogonality test instead of the classic t-test for differences across groups, is to check how correlated the main control variables of our study are within those individuals interviewed during the Ramadan month and those that were not and check how balanced the sample is across the groups of interest (see McKenzie, 2017). In words, we analyze whether households that have been interviewed during the month of Ramadan differ systematically from those that were interviewed in other months. The approach used in this mechanism is the one proposed by Imbens and Rubin (2015) in which a *normalized* difference of 0.25 or less would imply a good signal of balanced data. In this case, a *normalized* difference is defined as *the difference between treatment and control groups means, over the square root of half of the sum of the treatment and control group variances* (see McKenzie, 2017). This helps to see

[2] When we analyze the proportion of males and females that are working and in the labor force in our sample, we find that 68% of the females are working and 88% of them belong to the labor force; whereas 67% of males are working and 88% of them are part of the labor force. Such results are in line with the data presented in Figure 1a.

[3] In this case, we assume that children are composed by individuals under 18 years old. Adults are those individuals who are between 18 and 65 years old, and finally the elderly population is that one above 65 years old.

how well distributed the sample across groups is and if there are many differences across them.

Table 2: Balance Summary Statistics - Malawi

	(1) Non-Ramadan Month		(2) Ramadan Month		*t*-test Difference	Normalized difference
Variable	N	Mean/SE	N	Mean/SE	(1)-(2)	(1)-(2)
Islam	12018	0.131	4756	0.210	-0.079***	-0.218
		(0.003)		(0.006)		
Age	12018	22.610	4756	22.528	0.082	0.005
		(0.164)		(0.265)		
Male	12018	0.488	4756	0.492	-0.005	-0.009
		(0.005)		(0.007)		
School	10038	0.864	3946	0.845	0.019***	0.054
		(0.003)		(0.006)		
Urban	12018	0.256	4756	0.266	-0.010	-0.022
		(0.004)		(0.006)		
Num. children	12018	2.283	4756	2.315	-0.032	-0.019
		(0.015)		(0.024)		
Household size	12018	5.961	4756	6.010	-0.049	-0.021
		(0.021)		(0.036)		
Land area (ha.)	10519	2.480	4004	2.033	0.447***	0.049
		(0.102)		(0.067)		
Marital status	12018	4.196	4756	4.195	0.001	0.001
		(0.021)		(0.034)		

Notes: The value displayed for t-tests are the differences in the means across the groups. The normalized difference is understood as the difference between the mean of the treatment group and the mean of the control one, over the square root of half of the sum of the treatment and control group variances (as defined in McKeinze, 2017). Standard errors are heteroskedastic. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. The *F*-test for the joint orthogonality is 16.44 with a corresponding *p*-value equal to 0.000.

According to Table 2, the proportion of Muslims is greater under the treatment group (21% of the individuals that are interviewed under Ramadan are Muslims, whereas only 13% of the ones interviewed under the control group are Muslims) and the size of land is also significantly different across groups. Therefore, the question should be whether this difference in land size is because there is a greater proportion of Muslims in the treatment group or because there are richer individuals in the control group. In order to test that, Table 3 presents the balance summary statistics only for the subsample of Muslims in the dataset.

In this case, when controlling for Muslims only, the panel is well-balanced, and the normalized differences of the land size are not significant anymore. The remaining variables are also balanced except for the area where they live, urban or rural ones. Thus, we can say that our identifying assumption that *individuals interviewed during the month of Ramadan are, on average, identical to those interviewed outside the Ramadan period, in a given year*, is satisfied. Hence, if there are changes in individual labor supply, these should be due to the Ramadan

effect rather than to individual effects or region-year shocks correlated with the selection of fasting in a given year.

Table 3: Balance Summary Statistics for Muslims - Malawi

	(1) Non-Ramadan Month		(2) Ramadan Month		T-test Difference	Normalized difference
Variable	N	Mean/SE	N	Mean/SE	(1)-(2)	(1)-(2)
Age	1577	22.478	998	21.893	0.585	0.031
		(0.473)		(0.594)		
Male	1577	0.502	998	0.500	0.002	0.004
		(0.013)		(0.016)		
School	1310	0.736	801	0.718	0.018	0.041
		(0.012)		(0.016)		
Urban	1577	0.219	998	0.147	0.071***	0.182
		(0.010)		(0.011)		
Num. children	1577	2.370	998	2.466	-0.096	-0.062
		(0.039)		(0.048)		
Household size	1577	5.955	998	6.056	-0.101	-0.043
		(0.058)		(0.076)		
Land area (ha.)	1422	1.872	905	1.936	-0.064	-0.018
		(0.088)		(0.125)		
Marital status	1577	4.200	998	4.159	0.040	0.018
		(0.058)		(0.073)		

Notes: The value displayed for t-tests are the differences in the means across the groups. The normalized difference is understood as the difference between the mean of the treatment group and the mean of the control one, over the square root of half of the sum of the treatment and control group variances (as defined in McKeinze, 2017). Standard errors are heteroskedastic. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. The F-test for the joint orthogonality is 3.90 with a corresponding p-value equal to 0.1%.

5 Empirical Strategy

We start by examining the direct effect of time allocation of working hours decided by individuals under the month of Ramadan. We assume Ramadan to be a cultural constraint, which occurs every year but on a non-fixed date, as explained in earlier sections. This has a crucial implication in household/individual decisions: Ramadan is seasonal, implying that it does not occur on a fixed date every year; thus, in summer months, fasting lasts for longer hours, contrary to when it takes place in winter months. Therefore, longer fasting hours means the ingestion of fewer calories during the day and it might lead to a decrease in individual productivity and therefore, in individual's hours worked. Whereas shorter periods of fasting should not have such an effect on labor supply and thus, allocations of working hours by individuals should not be significantly altered. Thus, it allows us to include year and seasonal fixed effects in our regression to control for some possible unobserved effects outside Ramadan.

The approach we use is a differences-in-differences estimation with individual, seasonal and year fixed effects testing whether there exists a change in the hours worked between those individuals that celebrate Ramadan relative to those that do not. Because Ramadan is understood as a religious constraint where individuals that take part of it cannot decide on the date when it occurs, we assume this cultural constraint to be randomly assigned. Hence, there is no obvious reason why it would be correlated with other region-year shocks.

First of all, we test for the immediate impact of Ramadan on the labor supply and check whether there are substantial differences in a first instance. Nevertheless, this specification does not take into account censoring (due to the number of zeros observed in hours worked) and sample selection, as there might be certain aspects that will determine the decision of working. Along this section, we disentangle these issues and give a final argument as to why the Heckman model is the preferred one for the intensive margins' analysis.

Equation (1) shows the first set of labor supply estimations of this project:

$$\vec{H_{i,t}} = \alpha + (islam, ramadan, islam \times ramadan)'_{i,t}\beta + \vec{X_{i,t}}'\theta + \eta_i + \tau_t + u_{i,t} \tag{1}$$

where $\vec{H_{i,t}}$ considers the three different dependent variables we are interested to estimate in this paper, which are: $Hours_{i,t}$ as the number of total hours that individual i has worked during the previous week in year t, $Housework_{i,t}$ represents the number of hours that individual i worked in the previous week in his/her household in year t and $Prod.Hours_{i,t}$ is the number of hours that individual i worked at his/her job along the past week in year t. $islam_{i,t}$ represents a dummy variable indicating whether individual i is Muslim or not; $ramadan_{i,t}$ is another dummy variable taking value one if the individual was interviewed during the Ramadan period; $islam \times ramadan_{i,t}$ is the interaction term between the previous two variables, where if the resulting outcome is one, it means that the individual belongs to the treatment group and if zero, then he/she is part of the control group. $\vec{X_{i,t}}$ is a vector of individual characteristics, which includes age and its square, marital status, educational level, whether the individual lives in an urban or rural area, the number of children living at home and the household size. η_i represents the individual fixed effects and finally, τ_t represents the year and seasonal fixed effects. Finally, $u_{i,t}$ is the error term of the regression.

The idea of adding the interaction term in this study is because the estimated coefficient reports the *real effect* of Ramadan into labor supply. In words, how the fact of being Muslim and having been interviewed during Ramadan affects the number of hours worked for this given individual. After estimating Equation (**??**), we proceed with the inclusion of individual characteristics:

As mentioned, Equation (1) might suffer from censoring and sample selection bias. The fact of analyzing the number of hours worked might report zeros for certain individuals. This might be because of censoring and thus, we should re-estimate our linear fixed effect model by using a Tobit model with effects. This solves the issue, allowing us to control for all the number of zeros that we might have in our data. However, it does not solve the whole problem; sample selection bias. In this case, there may be some factors that will have some implications in the decision of being part of the labor force (or labor market), such as the household size, the number of children one is responsible for within the household, the amount of land someone owns or the number of adults living in the same household, among other things. Hence, to control for this issue we need to estimate a Heckman model with fixed effects.

To introduce fixed effects into non-linear models, like Tobit and Heckman, we need to follow the approach proposed in Wooldridge (1995).

5.1 Tobit Model with Fixed Effects

The Tobit model is used in this analysis to deal with a significant number of zeros that we might observe in our dependent variable(s) and, thus, correct for downward bias due to censoring we may face in the observed number of hours worked in our sample.

In this case, following Wooldridge (1995) and Dustmann and Rochina-Barrachina (2007), we need to apply the *Wooldridge correction*. It consists of the following; instead of estimating the individual fixed effects coefficient, η, we need to include a vector of individual means over time of each variable that we include in the regression analysis. In this case, we express the vector of means as $\vec{\bar{X}_i}$, without subindex t, since we are extracting the average of the variables for each individual across years. This vector of means also includes the averages for $islam_i$, $ramadan_i$ and $islam \times ramadan_i$. Therefore, the regression we want to analyze is as follows:

$$\vec{H_{i,t}} = \alpha + (islam, ramadan, islam \times ramadan)_i'\beta + \vec{X_{i,t}}'\theta + \vec{\bar{X}_i}'\eta + \tau_t + u_{i,t} \tag{2}$$

Hence, the set of estimators we obtain using the Tobit estimation method are (α, β, θ, η, τ). With that, we are controlling for censoring, and we are solving the issue of controlling for fixed effects in a non-linear model, using the matrix of averages $\vec{\bar{X}_i}$.

5.2 Heckman Model with Fixed Effects

The use of the Heckman model in this set-up helps to solve the problem of sample selection. In this case, we first need to design the selection equation and decide which factors make an individual be part of the labor force or not, in other words, analyze the factors that might have influence on the decision of working (or being potentially looking for a job) for a given individual.

We need to highlight that Malawi belongs to a developing economy. Thus, personal decisions, like labor, are made at the household level, meaning that it is the head of the household who makes the decisions about which members of the household work at home and which ones need to look for a job outside the household (see Nagler and Naudé, 2014).

As mentioned in Section 3, the agricultural sector is a key one in the Malawian labor market. This implies that land ownership should have an impact on the decision of being part of the labor force. In fact, there are studies that show that the area of land each household has is a key determinant in whether to look for a job outside the home or to stay and work for the household (see Julien et al., 2019). Another important aspect that determines criteria for being part of the labor force is the number of adults living in the household, in other words, if many adult members live in the same household the chance that one works on the household's own land is lower (as enough people are working there) and thus, this person has more opportunities to look for a job outside the home and be more likely to be part of the labor market (see Nagler and Naudé, 2014).

Knowing this information, we use the ratio of area of land in a household divided by the number of adult members living in the same household as one of the instrumental variables for our selection equation. Moreover, we expect the exclusion restriction to be fulfilled as working on your own land should not affect your hours worked, since the time one dedicates to labor is established by a contract or it is simply a social norm: one works the same hours as his/her neighbors do.

We are also aware that gender, age and marital status can be crucial determinants for being part of the labor force in developing countries. Thus, we interact these variables with the ratio of land area over the number of adults living in the same household and use them as instrumental variables for the selection equation. But we exclude gender, as it is a time-invariant variable. Hence, the selection equation for the Heckman model is as

follows:

$$\begin{aligned}\mathbb{P}(LFP_{i,t}=1\mid X) &= \Phi((islam, ramadan, islam\times ramadan)'_{i,t}\gamma_1+\gamma_2 land\_person_{i,t}+\vec{Z_{i,t}}\gamma_3+\\ &\quad +\vec{X_{i,t}}'\gamma_4+\vec{Z}'_i\eta_1+\vec{X}'_i\eta_2+\tau_t+\varepsilon_{i,t})\end{aligned} \tag{3}$$

where $\Phi(.)$ defines the cumulative density function of the Probit model. $LFP_{i,t}$ is a dummy variable taking value one if the individual is part of the labor force and zero otherwise, $land\_person_{i,t}$ is the ratio between the amount of land owned by the household over the number of adults in the household, $\vec{Z_{i,t}}$ is the set of individual characteristics (age, gender and marital status dummies) interacted with the $land\_person_{i,t}$ variable, used as instrumental variable. $\vec{X_{i,t}}$ is the set of control variables, which are the same ones as in Equation (2), and $\vec{\bar{X}_i}$ is the vector of means of all control variables included in the regression. Finally, $\varepsilon_{i,t}$ is the error term of the selection equation.

Following the theory, we estimate Equation (3) through a Probit model (see Cameron and Trivedi, 2005 and Heckman, 1974). The set of instruments, $land\_person$ and $\vec{Z_{i,t}}$, satisfy the relevance property - as we see in Table 5, where the joint significant test shows that the set of instrumental variables are statistically significant and provides evidence that the set of instruments are strong and valid.[4] As mentioned above, the exclusion restriction is also satisfied. Thus, the selection equation is estimated using the Wooldridge (1995) technique, previously explained in subsection 5.1 - this also applies to the second step estimation of the Heckman model in Equation (4).

Next, we compute the second-stage equation using a Pooled Ordinary Least Squares (OLS) method. In this case, we add the Inverse of Mills' Ratio to the set of controls.[5] Therefore, the regression to estimate is as follows:

$$\vec{H_{i,t}}=\alpha+(islam, ramadan, islam\times ramadan)'_i\beta+\vec{X_{i,t}}'\theta+\vec{\bar{X}}'_i\eta+\psi\lambda_i+\tau_t+u_{i,t} \tag{4}$$

where we introduce the Inverse of Mills' Ratio (λ) as a control. The next step is to test for sample selection, where the null hypothesis is that $\psi=0$. If the null is rejected, then we have sample selection and Heckman is the appropriate model to use.

[4] Other studies that analyze labor supply effects, like Mroz (1987), are using household size and number of children as the set of instrumental variables for the selection equation. In our case, these two variables seem to be endogenous violating the exogeneity condition. However, in developed countries like the US, these two factors seem to be key determinants for the labor force participation.

[5] we calculate the inverse of the Mills' Ratio as a function of the controls and the obtained coefficients in Equation (3):

$$\lambda(x_{i,t}\hat{\gamma})=\frac{\phi(x_{i,t}\hat{\gamma})}{\Phi(x_{i,t}\hat{\gamma})}$$

where x_i represents all variables included in the selection equation and γ englobes all the estimated coefficients in Equation (3).

The standard errors are heteroskedasticity-robust ones, following Wooldridge (1995). To get them, we compute the Asymptotic Variance or robust variance matrix for the estimated coefficients: $Avar(\alpha, \beta, \theta, \eta, \psi)$. The way to estimate the Asymptotic Variance, using a method of moments, can be followed in the Appendix of Wooldridge (1995). Once this is done, the next step is to compute the root square of the diagonal of the Asymptotic Variance matrix to obtain the standard errors. Moreover, we also cluster the standard errors at the village level. The main reason for clustering at the village level and not at the household one is because shocks to labor and other unobserved determinants of labor outcomes may be correlated across individuals that live in the same village - notice that the Muslim population in Malawi is concentrated in the southern regions.

Nonetheless, the proposed regressions in this paper consider individuals treated in different years, which implies that the difference-in-difference estimation method is with staggered treatment, meaning that the number of treated observations in each period of the survey is varying across years; in other words, the size of the treatment changes along the periods and individuals that are treated in 2010 might not be treated in 2013 but can be treated again in 2016. This is because individuals are randomly interviewed in any moment of the year. Thus, the treatment effect can be heterogeneous, given the size change in each year, leading to a violation of the constant treatment effect assumption (see de Chaisemartin and D'Haultfoeuille, 2020). [6] Therefore, when this happens, the two-way fixed effects (TWFE) estimates might be biased and/or inconsistent, as there might be some individuals that are part of the treatment and control group along our analysis, which implies that the treatment group will be heterogeneous (see de Chaisemartin and D'Haultfoeuille, 2020; Callaway and Sant'Anna, 2021; and Goodman-Bacon, 2021). If this is the case in our study, we should expect to have a downward bias from the TWFE estimates, given the negative weights that the TWFE method assigns to periods with larger amounts of treated individuals- this is because of the difference in treatment sizes across periods (see de Chaisemartin and D'Haultfoeuille, 2020). [7] This is something to consider later in our results, as our treatment is staggered and it can lead to Type-I and Type-II errors (see Baker et al., 2021).

5.3 Intra-Household Allocation

We introduce in this section the intrahousehold effects on labor supply. The idea is to include a set of triple interactions to Equation (4) that allows us to investigate whether the effect of Ramadan on labor supply varies

[6] The constant treatment effect assumption imposes that the treatment effect should be constant across groups and over the years. This implies that there is a pre-treatment period, where none of the observations in the sample are observed during the Ramadan month, and a post-treatment period, where some individuals in the sample will be celebrating the Ramadan festivity after a given year.

[7] According to Goodman-Bacon (2021), the TWFE method assigns a weighted average treatment effect to the TWFE difference-in-difference (TWFEDD) estimators that compares timing groups to each other. If the constant treatment effect assumption holds, the TWFEDD estimates should not be biased. But if it is violated, the variance of the TWFEDD estimator might be incorrectly estimated and lead to inconsistent estimates, or the estimated treatment effect will be downward biased.

by household composition. Thus, the set of triple interactions is based on the number of children, adults and older people living in the household respectively, differentiating by males and females, interacted with the variables $islam$, $ramadan$ and $islam \times ramadan$. Therefore, the resulting regression we want to estimate under the Heckman method with fixed effects is:

$$\begin{aligned} \vec{H_{i,t}} &= \alpha + (islam, ramadan, islam \times ramadan)'_{i,t}\beta_{\mathbf{1}} + islam \times ramadan \times \vec{hh\_composition_{i,t}}'\beta_{\mathbf{2}} \\ &+ islam \times \vec{hh\_composition_{i,t}}'\beta_{\mathbf{3}} + ramadan \times \vec{hh\_composition_{i,t}}'\beta_{\mathbf{4}} + \vec{X_{i,t}}'\theta + \vec{\bar{X}_i}'\eta + \psi\lambda_i + \tau_t + u_{i,t} \end{aligned} \tag{5}$$

where the $hh\_composition_{i,t}$ considers all the categories described above: male and female children; male and female adults, and male and female aged members. In this case, we interact it with the treatment interaction term: $islam \times ramadan$, and with $islam$ and $ramadan$ itself. Moreover, $\vec{X_{i,t}}$ also takes into account each of these categories that are part of the household composition. Before estimating Equation (5), we introduce the same set of interactions to the selection equation described in Equation (3).

5.4 Extensive Margins

We also estimate the extensive margins to observe the effect of Ramadan on the probability that an individual has of working and being part of the labor force, respectively. To estimate both likelihoods under the Ramadan period, we use a conditional Logit model with fixed effects with clustered standard errors at the village level (see Chamberlain, 2010). Therefore, the set of regressions we estimate are:

$$work_{i,t} = \Lambda(\alpha + (islam, ramadan, islam \times ramadan)'_i\beta + X'_{i,t}\theta + \eta_i + \tau_t + u_{i,t}) \tag{6}$$

$$lfp_{i,t} = \Lambda(\alpha + (islam, ramadan, islam \times ramadan)'_i\beta + X'_{i,t}\theta + \eta_i + \tau_t + u_{i,t}) \tag{7}$$

where $\Lambda(.)$ represents the logistic cumulative distribution function. In Equations (6) and (7), we analyze just the pure effect of Ramadan; however, we also run another set of regressions in which we introduce the set of triple interactions described in the previous subsection to test the effect of household composition during the month of Ramadan into the extensive margins.

6 Results

This section presents the estimated results for the proposed regressions in the previous section. We show results for the reduced form, for the fixed effects and Tobit models, as well as for the Heckman model with fixed effects. Complete tables of results are in Appendix C. The intensive margins estimations for the Heckman model are also done for the female and male subsamples.

6.1 The Effect of Ramadan on Labor Supply on the Intensive Margin

Table 4 shows the results for the Fixed Effects estimation presented in Equation (1). There, we find that none of the coefficients of interest (*Ramadan* and $Islam \times Ramadan$) are statistically significant in any of the cases. In particular, if we observe one of the coefficients of interest, $Islam \times Ramadan$ (the interaction term, which estimates the effect for a Muslim interviewed during the Ramadan period) it has no effect on labor supply, not in reduced form estimation nor in the extended one. The same occurs with the estimates of *Ramadan*. From these results we observe that Ramadan, understood as a religious constraint that imposes a cultural/religious barrier to work by restricting nutrition at certain times of the day, does not have any effect on the number of hours worked. In addition, we perform an F-test to test the pure effect of Ramadan into labor supply by adding *Ramadan* and $Islam \times Ramadan$ coefficients. Hence, the null hypothesis is as follows:

Hypothesis 1:

H_0 : The pure Ramadan effect has no effect on labor supply.

H_a : The pure Ramadan effect has an effect on labor supply.

The results of the joint-test for all the regressions run under the fixed effects method fail to reject the null hypothesis and, thus, these indicate that labor supply is not affected under the Ramadan month. However, this method is biased since we are not considering censoring or sample selection.

When we estimate the Tobit model, including the Wooldridge correction, presented in Equation (2), we observe again the same pattern as before, where our coefficients of interest (*Ramadan* and $Islam \times Ramadan$) have a positive effect on the hours worked for those individuals who celebrate Ramadan, relative to those that do not (see Table 14 in the Appendix). However, these effects are not significant when we run the F-test under Hypothesis 1, where we fail to reject the null hypothesis that the celebration of Ramadan has no impact on the number of hours worked, neither in the household nor at a paid job. Under the Tobit estimation method, we are only controlling for censoring, but we are not considering sample selection; therefore, to correct for that we need to estimate a Heckman model.

Table 4: Labor Supply Allocation in Malawi - Panel Data FE

	(1) Hours	(2) Hours	(3) Housework	(4) Housework	(5) Prod. Hours	(6) Prod. Hours
Islam	2.307	2.375	1.659	1.049	0.669	1.390
	(0.68)	(0.63)	(0.86)	(0.58)	(0.36)	(0.63)
Ramadan	0.600	0.685	0.203	0.0420	0.388	0.725
	(0.60)	(0.61)	(0.62)	(0.13)	(0.49)	(0.77)
Islam× Ramadan	1.482	0.687	0.840	0.525	0.642	0.0467
	(0.66)	(0.33)	(0.93)	(0.63)	(0.42)	(0.03)
_cons	14.88***	18.64**	5.023***	5.928*	9.861***	13.29**
	(25.76)	(3.30)	(16.98)	(2.48)	(28.61)	(2.85)
F-test	1.04	0.50	1.57	0.49	0.57	0.36
p-value	0.3110	0.4790	0.2126	0.4853	0.4537	0.5502
Individual Controls	No	Yes	No	Yes	No	Yes
N	13902	10686	13911	10694	13936	10705
R-Squared	0.000636	0.00790	0.000913	0.00465	0.000284	0.00760

In this table we report the estimates for Equation (1). *Islam* is a dummy variable for Muslim self-identification. *Ramadan* is a dummy equal to one if the individual was interviewed during the Ramadan and zero otherwise. Finally, $Islam \times Ramadan$, is the interaction term between the previous two variables. Specifications presented in columns (1), (3) and (5) include the set of variables that belong to the Ramadan cultural barrier, including individual, year and seasonal fixed effects. On specifications in columns (2), (4) and (6), we also control for individual characteristics: age and its square, whether the individual has gone to school or not, whether he/she lives in an urban or rural area, the number of children in the household and the household size. We also include the set of marital status dummies and individual, year and seasonal fixed effects. We compute robust standard errors clustered at the village area level. t-statistics in parentheses: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. The full set of estimated coefficients are reported in Table 13 of the Appendix to this paper.
The F-test performs a joint significant test of the Ramadan cultural barrier variables on individuals' weekly hours worked. The null hypothesis is that individuals who are facing the cultural constraint of the Ramadan festivity do not alter their number of weekly hours worked during the Holy month of Ramadan.

Table 5 shows the results for the selection equation presented in Equation (3), estimated under the Probit model. We perform three different types of analysis to get a better understanding of the labor market situation in Malawi when the Ramadan month takes place: we estimate the effect for the entire sample, and for females and males subsamples separately. Analyzing the instrumental variables itself, we observe that when estimating the selection equation for the entire sample, the amount of land over the number of adults in the household itself positively affects the chances of being part of the labor force, and it is statistically significant. We also find a positive effect on the interaction of the marital status categories of polygamy and divorce, but in this case, the estimated effects are not statistically significant. On the other hand, the remaining set of instrumental variables negatively affect the likelihood of being in the labor force, but we only find a statistically significant effect on the interaction with gender, as well as with separated and widowed individuals. However, when we split the sample between males and females, labor force participation for males is not significantly affected by any of the proposed instrumental variables. The reason why the proposed instruments are not significant is

because, the proportion of males working in Malawi is high, as we discussed in Section 4, where 88% belong to the labor force. Hence, we can adopt a simple fixed effects model for the male subsample.

Table 5: Selection Equation - Labor Force Participation

	(1)	(2)	(3)	(4)	(5)	(6)
	Labor Force	Labor Force	Labor Force	Labor Force	Labor Force	Labor Force
land_person × age	0.00196	0.00156	0.00213	0.00224*	0.000837	0.00121
	(1.587)	(1.498)	(1.869)	(1.974)	(0.645)	(0.693)
land_person × gender	-0.0698*	-0.0431				
	(-2.395)	(-1.684)				
land_person*married	-0.0928	-0.0514	-0.0832	-0.0767	-0.00879	-0.00960
	(-1.776)	(-1.153)	(-1.648)	(-1.275)	(-0.251)	(-0.362)
land_person × polygamy	0.116	0.165	3.133	2.627	0.140	0.135
	(0.705)	(1.012)	(1.952)	(1.721)	(0.930)	(0.788)
land_person × separated	-0.274**	-0.214*	-0.233*	-0.238	-0.0459	-0.0406
	(-2.738)	(-2.235)	(-2.151)	(-1.348)	(-0.443)	(-0.194)
land_person × divorced	0.0864	0.272	0.146	0.301	0.0529	-0.0486
	(0.512)	(1.180)	(0.806)	(1.384)	(0.468)	(-0.832)
land_person × widowed	-0.205*	-0.155	-0.187*	-0.177*	0.292	0.181
	(-2.207)	(-1.829)	(-2.117)	(-2.085)	(1.189)	(0.696)
land_person	0.0480**	0.0240	0.00941	-0.00385	-0.0285	-0.0313
	(2.681)	(1.358)	(0.379)	(-0.177)	(-1.028)	(-1.054)
_cons	-2.239 ***	-2.925 ***	-1.623***	-2.342***	-1.444***	-1.207***
	(-12.17)	(-15.09)	(-11.21)	(-9.663)	(-7.920)	(-3.937)
F-test	18.92	14.52	14.75	14.56	4.70	4.09
p-value	0.0153	0.0692	0.0394	0.0421	0.6969	0.7692
Sample	Whole	Whole	Female	Female	Male	Male
Triple interaction	No	Yes	No	Yes	No	Yes
N	11768	11768	6059	6059	5709	5709

This table presents the results for the selection equation, estimated under a Probit model specification with fixed effects. We present the results for the entire sample, and the subsample of males and females, respectively. We present the results for the set of proposed instrumental variables for labor force participation, our selecting variable. The variable *land_person* is understood as the area of land a household has in his/her divided by the number of adults within the household. We interact this coefficient with age, gender and marital dummies, to check if any of these individual characteristics, jointly with the area of land over the number of adults in the household can interfere with the likelihood of an individual's participation in the labor force. In all specifications, we control for individual characteristics: age and its square, whether the individual has gone to school or not, whether he/she lives in an urban or rural area, the number of children in the household and the household size. We also include the set of marital status dummies and individual, year and seasonal fixed effects. In addition to that, specifications (2), (4) and (6) include the set of triple interactions. We compute robust standard errors clustered at the village area level. t-statistics in parentheses: $^{*}\ p < 0.05$, $^{**}\ p < 0.01$, $^{***}\ p < 0.001$. The full set of estimated coefficients are reported in Table 15of the Appendix to this paper.
The F-test checks the relevance condition for instrumental variables. The null hypothesis is that *the land size over total adults in the household and its interaction with different individual characteristics have no effect on labor force participation*.

On the other hand, when we analyze the labor force participation for females, we find that the size of land divided by total adults in the household negatively affects the likelihood of being in the labor force when the woman is separated or widowed, and this effect is statistically significant. We also find a negative effect on the interaction with married females, but in this case, the effect is not statistically significant.

Nevertheless, to check whether the set of proposed instrumental variables influence the probability of being

in the labor force, we need to test for the relevance condition of the instrumental variables, as well as the exogeneity one. The null hypothesis for the relevance condition is as follows:

Hypothesis 2:

H_0: The set of instrumental variables has no effect on self-selection to participate in the labor force.
H_a: The set of instrumental variables has an effect on self-selection to participate in the labor force.

After performing the F-test for the three samples, we observe that the relevance condition is satisfied for the whole sample and for the female subsample estimates, rejecting the null hypothesis proposed in Hypothesis 2; but for males we fail to reject the null hypothesis that the set of instruments are not relevant. Therefore, we conclude that for the entire sample and females, the choice set of instrumental variables is valid and strong, as the resulting F-test are 18.92 and 14.75, respectively.

We also analyze the selection equation under the set of triple interactions proposed in subsection 5.3. In this case, we observe that we still do not find any significant effects of the instrumental variables on labor force for males, and neither we reject the null in Hypothesis 2. However, when we analyze the whole sample and the female subsample, we observe that the significance of some coefficients is lost in both cases. For the entire sample, we only find that the size of land negatively affects the likelihood of being part of the labor force if the individual is separated. This is the only estimation that is statistically significant; the rest of the coefficients do not reveal any relevant impact on labor force. When analyzing the female subsample, we find that the only coefficient that keeps significantly (and negatively) affecting labor force is the area of land in the household over adults for widowed females. The rest of the coefficients do not have a significant effect on the chances of being part of the labor force for females. But when we perform the F-test under Hypothesis 2, again, the relevance condition is satisfied for the whole sample and the female subsample only. In both cases, the set of instrumental variables are valid and strong, with an F-test of 14.52 for the whole sample and 14.56 for females. However, for males, the set of instruments do not affect labor force participation, as we fail to reject the null hypothesis.

After estimating the selection equation, we compute the Inverse of Mills' Ratio and include it into the second-stage regression to control for sample selection. Results are in Table 6 for the entire sample and Table 7 for the female subsample.

Focusing first on the estimates for the entire sample of Equation (4), we find a significant change with respect

to previous estimations. Starting with the estimations for the whole sample, we observe that being part of the treatment group significantly affects labor supply, where individuals that take part in Ramadan do change their allocation of hours during the Holy month of Ramadan. Specifically, we observe that individuals interviewed during Ramadan increase, on average, their number of hours worked during Ramadan by 0.55 hours, compared with individuals interviewed in a different period of the year. This effect is obtained by adding the estimated coefficients for *Ramadan* and $Islam \times Ramadan$, as it provides us with the total effect of Ramadan on labor supply. Moreover, after performing the F-test, we find that the aggregate effect of Ramadan on total hours worked is statistically significant, and we reject the null hypothesis proposed in Hypothesis 1. For housework, we do not find significant effects of Ramadan on hours worked there. Finally, under hours of paid work, we find that individuals interviewed during Ramadan increase their number of hours worked by 0.52 hours, relative to individuals interviewed outside the Ramadan period. Again, this effect is obtained by adding the *Ramadan* and $Islam \times Ramadan$ estimates. We also find this effect to be statistically significant and thus, we do reject the null proposed in Hypothesis 1.

Table 6: Heckman second-stage Analysis - Entire Sample Estimation

	(1)	(2)	(3)	(4)	(5)	(6)
	Hours	Hours	Housework	Housework	Prod. Hours	Prod. Hours
Islam	1.7109 ***	4.6158 ***	2.4722 ***	5.1356 ***	-0.7468	-0.5267 *
	(9.40)	(11.50)	(6.18)	(15.32)	(-1.65)	(-1.96)
Ramadan	0.7800 ***	2.1672 ***	-0.1279	1.5585 ***	0.9331 ***	0.4025 ***
	(14.59)	(8.58)	(-1.39)	(17.13)	(8.36)	(4.75)
Islam × Ramadan	-0.2251	4.3872 ***	0.2110	0.7277 *	-0.4156 **	3.9611 ***
	(-1.66)	(9.18)	(0.82)	(2.51)	(-3.18)	(8.51)
Islam × Ramadan × Kids_male		9.1163 ***		1.6610 **		7.3625 ***
		(10.02)		(3.02)		(5.15)
Islam × Ramadan × Adult_male		-6.8118 ***		-0.1041		-6.9685 ***
		(-5.81)		(-0.18)		(-6.38)
Islam × Ramadan × Old_male		73.4700 ***		39.3472 ***		33.9753 ***
		(11.08)		(19.37)		(18.0)
Islam × Ramadan × Adult_female		-24.2207 ***		-5.9329 ***		-18.9979 ***
		(-22.68)		(-14.19)		(-15.10)
Islam × Ramadan × Old_female		-57.9785 ***		-35.5565 ***		-22.6978 ***
		(-10.27)		(-32.15)		(-17.12)
Lambda	-0.3528 **	-0.6567 ***	0.8201 ***	0.2693 **	-1.1850 ***	-0.9347 ***
	(-3.10)	(-4.15)	(20.26)	(3.10)	(-10.05)	(-7.94)
F-test	19.68	149.97	0.04	29.22	9.03	83.53
p-value	0.000	0.000	0.9801	0.000	0.0109	0.000
Triple interaction	No	Yes	No	Yes	No	Yes
N	5732	5732	5732	5732	5732	5732
R-Squared	0.0334	0.0465	0.0162	0.0264	0.0372	0.0469

In this table we present the results of the second step for the Heckman model with fixed effects, using the methodology proposed in Wooldridge (1995). The *Islam*, *Ramadan* and $Islam \times Ramadan$ variables are explained in Table 4. We control for individual characteristics: age and its square, whether the individual has gone to school or not, whether he/she lives in an urban or rural area, the number of children in the household, the household size and the set of marital status dummies, as well as individual, year and seasonal fixed effects. Besides, we control as well for sample selection, including the Inverse of Mills' Ratio (the lambda coefficient). Specifications (2), (4) and (6) include the set of triple interactions. We compute heteroskedastic-robust standard errors clustered at the village area level. t-statistics in parentheses: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. The full set of estimated coefficients are reported in Table 16 of the Appendix to this paper.

When we look at the household composition effects proposed in Equation (5), we observe that for the entire sample, Ramadan itself has a positive and statistically significant effect on total hours worked (see column (2)), as well as the interaction term. However, these estimates per se do not tell anything, as these assume that the household is composed by 1 individual only, which is unlikely (given the summary statistics presented in Table 1). Therefore, we need to also look at the estimates of the triple interactions to know the average effect of Ramadan on hours worked. In this case, we take also into account the proportion of children, adults and elderly people by gender that we obtained in Table 1 and, thus, we find that individuals work 0.07 hours less during Ramadan, compared to those individuals that do not celebrate Ramadan,[8] and this effect is statistically significant when looking at the F-test in column (2). When looking at the set of triple interactions in detail, we find that one extra male child at home has a positive impact on the total number of hours worked, as well as having an extra old male individual at home. The rest of interactions have a statistically significant and negative impact on total hours worked, meaning that an extra adult (male or female) or an extra old female at home leads to a decrease of hours worked for a given individual.

For the case of hours worked at home and under paid jobs, we observe a similar behavior regarding the Ramadan effects and the set of triple interactions. Individuals interviewed during the Holy month significantly decrease their hours worked at home by 0.184 hours per week, but increase them by 0.34 hours at their jobs.[9] When looking at the effects of the triple interactions in more detail, we find that in both cases an extra adult or elder female drastically decreases the hours worked under a paid job or at home for individual i. We find these effects to be statistically significant, except for the effect on housework of having an extra adult male in the household during Ramadan. On the other hand, having an extra child or elder male increases the allocation of hours worked in both places, and it is statistically significant too.

When we estimate the effect of Ramadan on hours worked for females (see Table 7), we do find that females that are interviewed during the Holy month of Ramadan work 1.08 hours less in total and 1.64 hours less in paid work, compared with females interviewed outside the Ramadan period.[10] When we perform the joint hypothesis test of the aggregate effect of Ramadan on labor supply, we find that at the 5% significance level it

[8] This effect is obtained by adding up all the estimated coefficients that take into account the Ramadan effect (i.e., Ramadan estimate per se, the set of double interactions and the set of triple interactions), times the average proportion of children, adults and elderly individuals in a household (by gender). In this case, we compute the average effect of Ramadan in total hours worked as follows:

$$\begin{aligned}\mathbb{E}(hours \mid Ramadan = 1 \& Islam = 1) \quad = \quad & 2,167 + 4,387 + 9,116 \times 0.19 - 6,812 \times 0.22 + 73,470 \times 0.03 \\ & -24,221 \times 0.23 - 57,979 \times 0.03 - 2,424 \times 0.19 - 2,921 \times 0.22 \\ & +10,351 \times 0.03 - 3,109 \times 0.23 - 3,379 \times 0.03 \approx -0.07\end{aligned}$$

[9] The way we compute such effects is the same one as in Footnote 8, but using the estimates for housework and productive hours respectively.

[10] These effects are the total effect of Ramadan on labor supply, which are obtained by aggregating the estimated coefficients for *Ramadan* and $Islam \times Ramadan$

is not significant and, thus, we do not reject the null hypothesis in Hypothesis 1. However, at the 10% level of significance, we do find both estimated effects statistically significant and, thus, females interviewed during the Holy month of Ramadan do significantly reduce their total number of hours worked and hours in a paid job. However, when we analyze the effect on housework, we find that females interviewed during Ramadan increase their time allocation by 0.67 hours.[11] This effect is statistically significant at the 5% significance level, when we perform the F-test. Based on these results, there is evidence that females that celebrate the Holy month of Ramadan do reallocate their hours by working more at home and less at their jobs, compared with females that do not celebrate Ramadan or are interviewed outside this period. This is one of the main findings in this paper; individual labor supply does not decrease during Ramadan, but individuals do reallocate their labor hours from their paid job to housework.

Table 7: Heckman second-stage Analysis - Female subsample Estimation

	(1)	(2)	(3)	(4)	(5)	(6)
	Hours	Hours	Housework	Housework	Prod. Hours	Prod. Hours
Islam	4.8618 ***	14.1385 ***	3.5531 ***	9.0465 ***	1.3157 ***	5.0853 ***
	(3.42)	(15.38)	(26.91)	(34.55)	(4.10)	(9.62)
Ramadan	0.3436	3.8531 ***	0.2245	1.5292 ***	0.1938	1.8371 ***
	(1.38)	(9.44)	(1.45)	(12.85)	(0.96)	(5.48)
Islam × Ramadan	-1.4203 ***	-2.5775	0.4485 **	1.7314 ***	-1.8372 ***	-3.5861 ***
	(-3.44)	(-1.89)	(2.69)	(5.54)	(-9.69)	(-4.04)
Islam × Ramadan × Kids_male		-1.5099		4.3155 ***		-5.9723 ***
		(-0.56)		(3.96)		(-3.59)
Islam × Ramadan × Adult_male		12.0572 ***		0.5019		10.7492 ***
		(7.97)		(0.62)		(8.77)
Islam × Ramadan × Old_male		85.6555 ***		35.6270 ***		49.6758 ***
		(24.66)		(32.75)		(30.08)
Islam × Ramadan × Adult_female		-10.2957 ***		-9.4947 ***		-2.3333
		(-4.53)		(-20.37)		(-1.53)
Islam × Ramadan × Old_female		-26.1405 ***		-25.2673 ***		-1.5390
		(-7.46)		(-15.04)		(-0.63)
Lambda	-2.7026 ***	0.5630 *	-1.0578 ***	0.4115 ***	-1.7804 ***	0.1048
	(-10.69)	(2.49)	(-13.62)	(5.21)	(-5.29)	(0.62)
F-test	5.54	14.52	14.75	14.56	4.70	4.09
p-value	0.0626	0.000	0.000	0.000	0.0953	0.1293
Triple interaction	No	Yes	No	Yes	No	Yes
N	2919	2919	2919	2919	2919	2919
R-squared	0.0302	0.0527	0.0231	0.0402	0.0292	0.0431

In this table we present the results of the second step for the Heckman model with fixed effects for the female subsample, using the methodology proposed in Wooldridge (1995). The *Islam*, *Ramadan* and *IslamRamadan* variables are explained in Table 4. We control for female individual characteristics: age and its square, whether she has gone to school or not, whether she lives in an urban or rural area, the number of children in the household, the household size and the set of marital status dummies, as well as individual, year and seasonal fixed effects. Besides, we control as well for sample selection, including the Inverse of Mills' Ratio (the lambda coefficient). Specifications (2), (4) and (6) account for the set of triple interactions. We compute heteroskedastic-robust standard errors clustered at the village area level. t-statistics in parentheses: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. The full set of estimated coefficients are reported in Table 17 of the Appendix to this paper.

[11] Again, this is the total effect that the Holy Month of Ramadan has on labor supply. This is computed by adding the estimates of *Ramadan* and $Islam \times Ramadan$.

When estimating the intra-household effects of Ramadan for females on labor supply, we find that they increase their housework by 1.08 hours compared to other females that do not celebrate Ramadan. On the other hand, females that celebrate Ramadan do decrease their hours worked by 1.14 hours in relation to those that do not celebrate it.[12] Hence, in total we find that the average Ramadan effect leads to a decrease of 0.18 total hours worked. And we find these effects to be statistically significant. When looking at the set of triple interactions individually, we observe that an extra female in the household (either adult or elder) significantly decreases the number of hours worked in the household or under a paid job for females that celebrate Ramadan, compared to those that do not. On the other hand, we find a positive and statistically significant effect on living with one extra old male in the household.

The effect of living with an extra adult male in the household also leads to a positive effect on hours worked, but the effect is only statistically significant for the aggregate of hours worked and hours worked under a paid job for females. The effect of having an extra child in the household leads to a significant increase in housework hours and a decrease of hours allocated to their jobs, meaning that when there is an extra child in the household, women spend more time taking care of children and working more hours in the household. This reinforces the evidence found before, where women reallocate their labor hours to working more at home for their families, instead of working at their jobs.

Finally, when testing for sample selection, we find that the lambda coefficient is statistically significant in all cases, except for paid jobs in the female subsample, when we perform the analysis using the set of triple interactions. This means that sample selection exists, as we do reject the null hypothesis that there is no sample selection in labor supply. Therefore, the Heckman model is the correct estimation method for labor supply in Malawi for the entire sample and the female subsample.

When analyzing the results for males (see Table 8), using a simple fixed effects models, as explained above; we find that males increase their total hours worked in their jobs by 1.29 hours per week, but they work 0.69 hours less at home. These estimates lead to a total increase in 0.62 hours per week for males that celebrate the Ramadan festivity, [13] compared with individuals that do not celebrate the Ramadan. However, we do not find any statistically significant effects of Ramadan into hours worked - either at the household or under paid jobs. Such effect is confirmed when we perform the joint hypothesis test under Hypothesis 1, where we fail to reject the null hypothesis. Therefore, for males, we do not find that Ramadan leads to time reallocation of

[12] The way we compute such effects is the same one as in Footnote 8, but using the estimates for females housework and productive hours respectively, shown in Table 7.

[13] These effects are computed by adding the estimated coefficients of $Ramadan$ and $Islam \times Ramadan$, in order to get the total effect that Ramadan has on housework hours.

hours worked, as we did find for females.

Table 8: Fixed effects analysis - Male subsample Estimation

	(1)	(2)	(3)	(4)	(5)	(6)
	Hours	Hours	Housework	Housework	Prod. Hours	Prod. Hours
Islam	-1.023	4.666	0.747	2.071	-1.726	2.716
	(-0.28)	(1.08)	(0.41)	(0.97)	(-0.57)	(0.73)
Ramadan	0.651	-0.322	-0.521	1.009	1.309	-1.099
	(0.42)	(-0.13)	(-1.02)	(1.08)	(1.06)	(-0.57)
Islam× Ramadan	-0.0300	-6.824	-0.169	-2.897	-0.0242	-4.158
	(-0.01)	(-0.89)	(-0.21)	(-1.17)	(-0.01)	(-0.73)
Islam× Ramadan× Kids_male 27.46		4.214		22.69		
		(1.50)		(0.56)		(1.89)
Islam× Ramadan× Adult_male		9.309		5.184		4.219
		(0.67)		(1.17)		(0.40)
Islam× Ramadan× Old_male		44.88		15.54		29.96
		(1.95)		(1.87)		(1.56)
Islam× Ramadan× Adult_female		-7.623		2.894		-10.04
		(-0.51)		(0.51)		(-0.86)
Islam× Ramadan× Old_female		-59.78*		-21.22*		-38.14
		(-2.16)		(-2.26)		(-1.73)
_cons	13.53	3.276	4.192	3.119	10.33	1.227
	(1.64)	(0.39)	(1.23)	(0.83)	(1.61)	(0.20)
F-test	1.13	0.05	0.67	1.02	0.11	0.52
p-value	0.2898	0.8287	0.4143	0.3157	0.7388	0.4721
Triple interaction	No	Yes	No	Yes	No	Yes
N	2721	2721	2721	2721	2721	2721
R-squared	0.0486	0.0689	0.0195	0.0311	0.0567	0.0769

In this table we present the results for the male subsample for their hours worked, using a fixed effects model estimation. In this case, as we do not observe significant results for the selection equation, we proceed with a simple fixed effects model. The *Islam*, *Ramadan* and *Islam* × *Ramadan* variables are explained in Table 4. We control for male individual characteristics: age and its square, whether he has gone to school or not, whether he lives in an urban or rural area, the number of children in the household, the household size and the set of marital status dummies, as well as individual, year and seasonal fixed effects. Specifications (2), (4) and (6) include the set of triple interactions. We compute robust standard errors clustered at the village area level. t-statistics in parentheses: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. The full set of estimated coefficients are reported in Table 18 of the Appendix to this paper.

If we analyze the family composition effect during Ramadan, we find a decrease of 1.13 housework hours and 0.34 hours in their jobs and, thus, a total decrease of 1.46 hours due to the Ramadan celebration. [14] However, none of these effects are statistically significant. When looking at the set of triple interactions in detail, we find that for males that do celebrate Ramadan, an extra male in the household leads to an increase in hours working at home at their jobs. However, the fact of having an extra female in households that take part in Ramadan leads to a decrease in all individuals' labor supply estimates, except for housework, where an extra adult female affects positively to the hours worked there. Nevertheless, these effects are not statistically significant, for any of the labor supply estimators.

[14] The way we compute such effects is the same one as in Footnote 8, but using the estimates for males total hours worked, housework and productive hours respectively, shown in Table 8.

Moreover, we also test for the parallel trend assumption, to check that individuals do not anticipate the potential treatment effects into labor supply. In this case, we observe that the parallel trend assumption holds at the 1% significance level (see Table 21 in the appendix) and, thus, individuals do not anticipate the change in hours worked in the pre-treatment period.

6.2 The Effect of Ramadan on Labor Supply on the Extensive Margin

In this subsection we analyze the obtained results for the extensive margins presented in Equations (6) and (7). Table 9 offers the estimated results for Malawi. We do not find any Ramadan effect on the likelihood of working or being in the labor force. Such effect is confirmed when we compute the joint hypothesis test for the aggregate effect of Ramadan on the likelihood of working or being in the labor force, where we aggregate all the marginal effects of the estimated coefficients of interest shown in Table 19 (see columns (3) and (6)). We also perform the joint hypothesis test under the null hypothesis that the Holy month of Ramadan has no effect on the extensive margins.

Table 9: Extensive Margins - Malawi

	(1) work	(2) work	(3) work	(4) Labor Force	(5) Labor Force	(6) Labor Force
Islam	-0.233	-0.243	-0.247	0.619	-0.0935	-0.877
	(-0.95)	(-0.75)	(-0.61)	(1.68)	(-0.13)	(-0.66)
Ramadan	0.114	0.0447	0.161	0.102	0.151	0.525
	(1.60)	(0.49)	(0.80)	(0.85)	(0.81)	(0.94)
Islam × Ramadan	-0.0445	-0.101	0.0307	-0.384	-0.300	-0.249
	(-0.28)	(-0.55)	(0.07)	(-1.45)	(-0.62)	(-0.16)
Individual Controls	No	Yes	Yes	No	Yes	Yes
Triple interaction	No	No	Yes	No	No	Yes
Aggregate Ramadan effect			0.37			-0.19
F-test	0.24	0.12	0.06	1.47	0.11	0.40
p-value	0.6247	0.7271	0.7990	0.2251	0.7394	0.5246
N	6220	4273	5114	2268	1990	1990

In this table we present the results for the extensive margins in Malawi, using a conditional Logit model, as proposed in Chamberlain (2010). The *Islam*, *Ramadan* and $Islam \times Ramadan$ variables are explained in Table 4. We control for individual characteristics: age and its square, whether the individual has gone to school or not, whether he/she lives in an urban or rural area, the number of children in the household, the household size and the set of marital status dummies, as well as individual, year and seasonal fixed effects. Specifications (3) and (6) control for the set of triple interactions. We compute robust standard errors clustered at the village area level. t-statistics in parentheses: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. The full set of estimated coefficients are reported in Table 19 of the Appendix to this paper.
The F-test performs a joint significant test of the Ramadan cultural barrier variables on the extensive margins. The null hypothesis is that *individuals who participate in the Ramadan festivity do not alter their probability of being employed or in the labor force during the Holy month*.

When we aggregate the estimates of triple interaction estimates from Malawi reported in Tables 19 we find that, on average, an individual has 37% more chance of working and 19% fewer options of being in the labor force during Ramadan in Malawi. However, the performed F-tests show that none of the effects are statistically significant at the 5% significance level. With that, we affirm that at the extensive margins there are no relevant effects of Ramadan in Malawi.

7 Conclusion

This paper analyzes the effect that religious practices have on individual labor supply decisions. Using household data from Malawi, available in the LSMS, we find evidence that individuals do reallocate their labor time resources, from paid jobs to housework, during the Holy month of Ramadan; a period where Muslims experience fasting during the sunlight hours - from sunrise to sunset. Therefore, individuals tend to spend more time at home, most likely preparing family/friends meetings to have meals all together at the allowed times. This effect is accentuated when we do the analysis for the female subsample. Moreover, we find that males do also increase their time allocation to hours worked in both housework and paid jobs. But only the increase in paid jobs is statistically significant.

As mentioned in the introduction, to our best knowledge, this is the first paper to analyze such effects at the individual level and to analyze the reallocation of hours between paid jobs and household work, also at the intra-household level. We performed a Heckman model using the Wooldridge (1995) correction to control for potential sample selection and allowing for individual fixed effects. In summary, we can assert that females work less at their jobs, but this effect is compensated for by household work. Therefore, it can be concluded that females that celebrate Ramadan do not work less, but they spend more time at home, most probably preparing activities for their family and friends during the Holy month of Ramadan.

The last thing done in this paper was the analysis of the extensive margins for Malawi. We observe that Ramadan has no effect on the extensive margins. These results support the evidence found in the intensive margins analysis in Malawi: labor is not reduced during Ramadan, there is only a reallocation of time between paid jobs and housework.

Our findings contribute to other studies in which religious events have a relevant impact in economic activity and economic decisions (see Barro and McCleary, 2003; Campante and Yanagizawa-Drott, 2016; Demiroglu et al., 2017). In our case, we provide evidence showing that Ramadan has a direct impact in labor decisions for those individuals that are under its practice. Therefore, this might lead to some policy implications in terms

of readjustments of labor market structures in countries where the practice of Ramadan is popular, as it has a significant effect on an important proportion of the world population.

Compliance with Ethical Standards

Conflict of interest: The author declares that he have no conflict of interest.

Ethical approval: This article does not contain any studies with human participants or animals performed by the author.

References

[1] Afifi, Z. E. M., *Daily practices, study performance and health during the Ramadan fast*, Journal of the Royal Society of Health, Vol. 117, num. 4, 1997, pp. 231-235.

[2] Almond, D. & Mazumder, B., *Health capital and the prenatal environment: the effect of Ramadan observance during pregnancy*, American Economic Journal, Vol. 3, num. 4, 2011, pp. 56-85.

[3] Baker, A.-C., Larcker, D.-F. & Wang, C.-Y., *How much should we trust staggered difference-in-differences estimates?.*, Journal of Financial Economics, Vol. 144, num. 2, 2021, pp. 370-395.

[4] Barro, R. J. & McCleary, R., *Religion and economic growth across countries* , American Sociological Review, Vol. 68, 2003, pp. 760-781.

[5] Barro, R. J. & McCleary, R., *Religion and economy*, Journal of Economic Perspectives, Vol. 20, 2006, pp. 49-72.

[6] Bone, D.S., *Islam in Malawi1*, Journal of Religion in Africa, Vol. 13, num. 2, 1982, pp. 126-138.

[7] Callaway, B. & Sant'Anna, P.-H., *Difference-in-differences with multiple time periods* , Journal of Econometrics, Vol. 225, num. 2, 2021, pp. 200-230.

[8] Cameron, Colin A. & Trivedi, Pravin K., *Microeconometrics Methods and Applications*, first edition, Ed. Cambridge, USA, 2005.

[9] Campante, F. & Yanagizawa-Drott, D., *Does Religion Affect Economic Growth and Happiness? Evidence from Ramadan*, The Quarterly Journal of Economics, Vol. 130, num. 2, 2015, pp. 615-658.

[10] Cantoni, D., *The economic effects of the Protestant Reformation: testing the Weber hypothesis in the German lands*, Journal of the European Economic Association, Vol. 13, num. 4, 2015, pp. 561-598.

[11] Çelen, A., *Influence of Holy Month Ramadan on Alcohol Consumption in Turkey*, Journal of religion and health, Vol. 54, num. 6, 2015, pp. 2122-2133.

[12] Chaisemartin, C., & d'Haultfoeuille, X., *Two-way fixed effects estimators with heterogeneous treatment effects*, American Economic Review , Vol. 110, num. 9, 2020, pp. 2964-96.

[13] Chamberlain, G., *Binary response models for panel data: Identification and information*, Econometrica, Vol. 78, num. 1, 2010, pp. 159-168.

[14] Cerulli, G., & Ventura, M., *Estimation of pre-and posttreatment average treatment effects with binary time-varying treatment using Stata*, The Stata Journal, Vol. 19, num. 3, 2019, pp. 551-565.

[15] *Culture Grams*, *World Edition*, *"Malawi"*, ProQuest. 2018. Web. 9 May. 2020: www.culturegrams.com.

[16] Demiroglu, C., Ozbas, O., Silva, R. C. & Ulu, M. F., *Does religion affect economic decisions? Evidence from Ramadan Loans*, Working Paper, 2017.

[17] Dercon, S. & Krishnan, P., *In sickness and in health: Risk sharing within households in rural Ethiopia*, Journal of Political Economy, Vol. 108, num. 8, 2000, pp. 668-727.

[18] Dustmann, C. & Rochina-Barrachina, M. E., *Selection correction in panel data models: An application to the estimation of females' wage equations*, The Econometrics Journal, Vol. 10, num. 2, 2007, pp. 263-293.

[19] Göçmen, E., Koç, M., Tez, M., Yoldas, Ö., Bilgin, A. & Keskek, M., *Effect of Ramadan on surgical emergencies*, Annals of emergency medicine, Vol. 44, num. 3, 2004, pp. 283-285.

[20] Goodman-Bacon, A., *Difference-in-differences with variation in treatment timing*, Journal of Econometrics, Vol. 225, num. 2, 2021, pp. 254-277.

[21] Harvey, E.E., Ioannou, C.A. & Golshirazi, F., *The Religious Observance of Ramadan and Prosocial Behavior*, Economic Inquiry, Vol. 56, num. 1, 2018, pp. 226-237.

[22] Heckman, J.J., *Life cycle consumption and labor supply: An explanation of the relationship between income and consumption over the life cycle*, The American Economic Review, Vol. 24, num. 1, 1974, pp. 188-194.

[23] Imbens, G. W. & Rubin, D. B., *Causal inference in statistics, social, and biomedical sciences*, Cambridge University Press, 2015.

[24] Julien, J., Bravo-Ureta, B.E. & Rada, N.E., *Assessing farm performance by size in Malawi, Tanzania, and Uganda*, Food Policy, Vol. 84, 2019, pp. 153-164.

[25] Karaagaoglu, N. & Yucecan, S., *Some behavioral changes observed among fasting subjects, their nutritional habits and energy expenditure in Ramadan*, International journal of food sciences and nutrition, Vol. 51, num. 2, 2000, pp. 125-134.

[26] Kuran, T., *Islam and economic performance: Historical and contemporary links.*, Journal of Economic Literature, Vol. 56, num. 4, 2018, pp. 1292-1359.

[27] Leiper, J. B. & Molla, A. M, *Effects on health of fluid restriction during fasting in Ramadan* , European journal of clinical Nutrition, Vol. 57, num. 2, 2003, pp. S30-S38.

[28] McKeinze, D., *Should we require balance t-tests of baseline observables in randomized experiments?*, World Bank Blogs, 2017.

[29] McKeinze, D., *When should you cluster standard errors? New wisdom from the econometrics oracle*, World Bank Blogs, World Bank Blogs, 2017.

[30] Mroz, T. A., *The sensitivity of an empirical model of married women's hours of work to economic and statistical assumptions*, Econometrica: Journal of the econometric society, 1987, pp. 765-799.

[31] Nagler, P & Naudé, W., *Labor productivity in rural African enterprises: empirical evidence from the LSMS-ISA*, IZA Discussion Paper No. 8524. Available at SSRN: https://ssrn.com/abstract=2508579, 2014.

[32] Odabasi, Y. & Argan, M., *Aspects of Underlying Ramadan Consumption Patterns in Turkey*, Journal of International Consumer Marketing, Vol. 21, num. 3, 2009, pp. 203-218.

[33] Owuor, S., *What Are The Biggest Industries In Bangladesh?*, World Atlas, 2019.

[34] Pew Research Center, The, *How religious commitment varies by country among people of all ages*, PEW Forum, 2018.

[35] Schofield, H., *The economic costs of low caloric intake: Evidence from India*, Unpublished Manuscript, Harvard University, 2014.

[36] Sheahan, M. & Barrett, C. B., *Ten striking facts about agricultural input use in Sub-Saharan Africa*, Food Policy, Vol. 67, 2017, pp. 12-25.

[37] Shephard, R. J., *The impact of Ramadan observance upon athletic performance*, Nutrients, Vol. 4, num. 6, 2012, pp. 491-505.

[38] van Ewijk, R., *Long-term health effects on the next generation of Ramadan fasting during pregnancy*, Journal of Health Economics, Vol. 30, num. 6, 2011, pp. 1246-1260.

[39] van Klaveren, M., *An Overview of Women's Work and Employment in Malawi: Decisions for Life MDG3 Project*, Country Report No. 6, AIAS, 2009.

[40] Wooldridge, J.M., *Selection corrections for panel data models unders conditional mean independence assumptions*, Journal of Econometrics, Vol. 68, 1995, pp. 115-132.

A Robustness check: Bangladesh

In this section we perform a robustness check of our results using Bangladesh as country of reference. The idea is to test if the results obtained for Malawi also hold for other countries where Ramadan takes an important role. We take Bangladesh as our country for the external validity, given the available data. Bangladesh, as Malawi, is a developing country where the main labor sector is again the agricultural one. However, there is an especial focus on the textile industry in Bangladesh, as this industry is the largest one in the world, after China. Approximately 80% of its total production is exported, divided between around 60% of total exports to Europe, and around 40% of total exports are to the American continent (see Owuor, 2019).

We use data from the Household Income and Expenditure Survey (HIES) and the Women's Life Choices and Attitudes Survey (WiLCAS). The HIES survey was conducted by the Bangladesh Bureau of Statistics (BBS) in 2010 and the WiLCAS was conducted by the University of Kent and the University of Malaya in collaboration with Data Analysis and Technical Assistance (DATA) in 2014. Hence, panel data is available for two years for households living in rural areas, in which a reasonable size of its total population is Muslim (87%) and a reasonable number of the interviews took place during Ramadan (19%) (see Table 12). We restricted the analysis for the Muslim subsample only, as they cover most of the sample;[15] therefore, to avoid multicollinearity problems we include only sets of double interactions between Ramadan and the ratio of children, adults and old males and females within the household over the total household size.

Moreover, we also perform a Balanced test, as we did for Malawi, and we observe in Table 11 that the sample is also well-balanced for Bangladesh. Hence, after having described the data and checked that sample is balanced, we perform the regression analysis of the extensive margins, using equations 6 and 7 as reference.[16]

We observe from the estimated results, for Bangladesh in Table 10, that individuals that are interviewed during the Holy month of Ramadan, experience a negative effect on the likelihood of working or being part of the labor force participation (see columns (2) and (4)), and it is statically significant. Nevertheless, when we control for household composition effects, the *Ramadan* coefficient loses all its statistical significance, but it still affects both probabilities negatively. However, to estimate the overall effect of Ramadan on the extensive margins,

[15] According to the Population and Housing Census in Bangladesh, collected in 2011 by the BBS, approximately 90% of the total population in Bangladesh is Muslim, and the country has the fourth-largest Muslim population in the world, after India, Indonesia and Pakistan. The second most followed religion in Bangladesh is Hinduism, where 8.5% of its population follows it, and only 0.6% are Buddhists and 0.4% are Christians.

[16] The reason why we focus only on the extensive margins is because the number of hours worked for each individual are given yearly; therefore, we cannot distinguish between hours worked during and outside of Ramadan. However, we know, on a weekly basis, whether an individual is working or not and whether he/she belongs to the labor force, which makes it feasible to observe the Ramadan effect in these labor market outcomes.

we need to aggregate all the estimates of double interactions in Table 20 and perform a joint significant test, to see if there is an effect in the extensive margins or not. Once we aggregate the effects, we find that an individual has 24% less chance of being employed and 8% less chance of being in the labor force during the Ramadan period in Bangladesh. However, none of them presents statistically significant results for the probability of working. Nevertheless, if we look at the labor force, we find that one extra adult female in the household reduces significantly the likelihood of being in the labor force in Bangladesh during the Holy month of Ramadan.

Table 10: Extensive Margins - Bangladesh

	(1) work	(2) work	(3) work	(4) Labor Force	(5) Labor Force	(6) Labor Force
Ramadan	1.354***	-0.260*	-0.118	0.542***	-0.250***	-0.0524
	(8.01)	(-2.27)	(-0.42)	(6.64)	(-3.50)	(-0.30)
Individual Controls	No	Yes	Yes	No	Yes	Yes
Triple interaction	No	No	Yes	No	No	Yes
Aggregate Ramadan effect			-0.24			-0.08
F-test			0.42			1.51
p-value			0.5192			0.2188
N	7844	7844	7844	9792	9776	9776

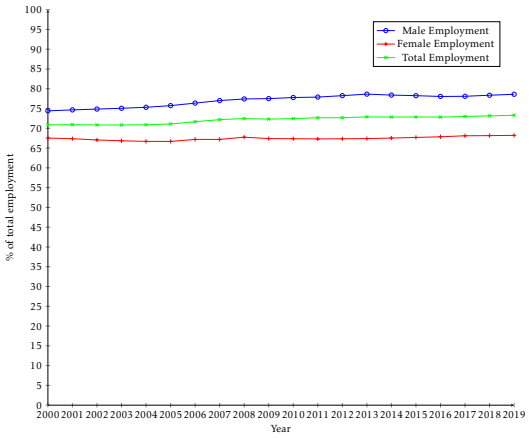
In this table we present the results for the extensive margins in Bangladesh, using a conditional Logit model, as proposed in Chamberlain (2010). The $Islam$, $Ramadan$ and $Islam \times Ramadan$ variables are explained in Table 4. We control for individual characteristics: age and its square, whether the individual has gone to school or not, whether he/she lives in an urban or rural area, the number of children in the household, the household size and the set of marital status dummies, as well as individual, year and seasonal fixed effects. Specifications (3) and (6) include the set of triple interactions. We compute robust standard errors clustered at the village area level. t-statistics in parentheses: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. The full set of estimated coefficients are reported in Table 19 of the Appendix to this paper.
The F-test performs a joint significant test of the Ramadan cultural barrier variables on the extensive margins. The null hypothesis is that *individuals who participate in the Ramadan festivity do not alter their probability of being employed or in the labor force during the Holy month*.

Therefore, as occurred in Malawi, we confirm that at the extensive margins there are no relevant effects of Ramadan neither in Bangladesh and we can reaffirm the obtained results for Malawi.

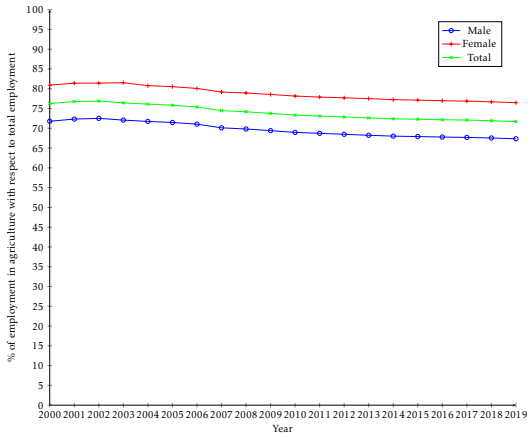
B Figures

Figure 1: Employment Gender Gap in Malawi

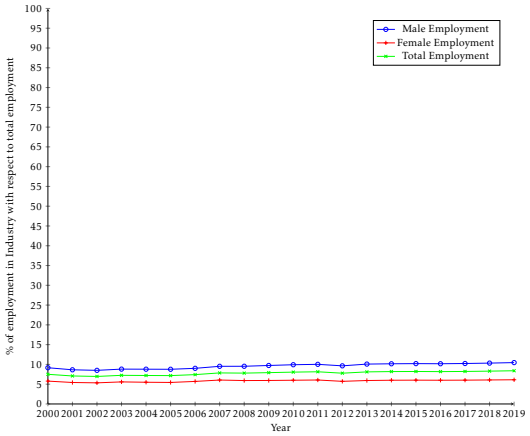
(a) Share of Total Employment



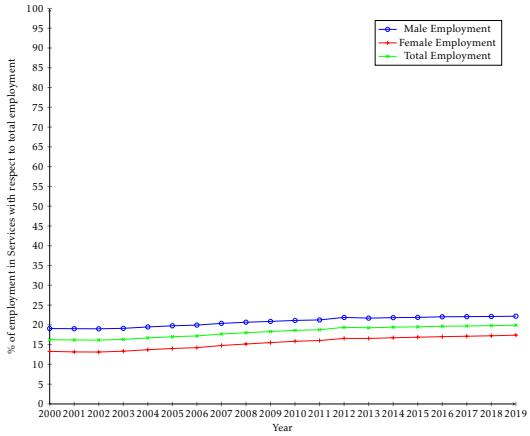
(b) Share of Total Employment in Agriculture



(c) Share of Total Employment in Insdustry



(d) Share of Total Employment in Services



Source: index mundi, ILOSTAT.

C Estimation Results

Table 11: Balance Summary Statistics - Bangladesh

	(1) Non-Ramadan Month		(2) Ramadan Month		T-test Difference	Normalized difference
Variable	N	Mean/SE	N	Mean/SE	(1)-(2)	(1)-(2)
Age	45360	26.466	10575	27.116	-0.649***	-0.034
		(0.090)		(0.184)		
School	45324	3.405	10575	3.519	-0.113***	-0.029
		(0.018)		(0.037)		
Num. children	45382	2.111	10628	2.184	-0.073***	-0.050
		(0.007)		(0.015)		
Household size	45382	6.145	10628	7.048	-0.904***	-0.337
		(0.012)		(0.028)		
Marital status	45360	1.618	10575	1.628	-0.011	-0.017
		(0.003)		(0.006)		

Notes: The value displayed for t-tests are the differences in the means across the groups. The normalized difference is understood as the difference between the mean of the treatment group and the mean of the control one, over the square root of half of the sum of the treatment and control group variances (as defined in McKeinze, 2017). Standard errors are heteroskedastic. ***, **, and * indicate significance at the 1, 5, and 10 percent critical level. The F-test for the joint orthogonality is 106.35 with a corresponding p-value equal to 0.0001.

Table 12: Summary statistics

Variable	**Mean**	**Std. Dev.**	**N**
Work	0.36	0.48	52272
Labor Force	0.364	0.4814	52272
Islam	0.879	0.326	63689
Ramadan	0.189	0.392	63689
Islam × Ramadan	0.167	0.373	63689
Age	26.807	19.213	63614
Male	0.477	0.499	63614
Num. adults	4.207	2.355	63689
Household size	6.299	2.673	63689

Table 13: Labor Supply allocation in Malawi - Panel Data FE

	(1) Hours	(2) Hours	(3) Housework	(4) Housework	(5) Prod. Hours	(6) Prod. Hours
Islam	2.307	2.375	1.659	1.049	0.669	1.390
	(0.68)	(0.63)	(0.86)	(0.58)	(0.36)	(0.63)
Ramadan	0.600	0.685	0.203	0.0420	0.388	0.725
	(0.60)	(0.61)	(0.62)	(0.13)	(0.49)	(0.77)
Islam× ramadan	1.482	0.687	0.840	0.525	0.642	0.0467
	(0.66)	(0.33)	(0.93)	(0.63)	(0.42)	(0.03)
Land area		-0.00836		0.00859		-0.0167
		(-0.35)		(1.82)		(-0.74)
Age		0.0889		0.0472		0.0185
		(0.33)		(0.48)		(0.08)
Age^2		-0.00704*		-0.00175		-0.00513*
		(-2.59)		(-1.42)		(-2.52)
School		1.177		0.00786		1.179
		(1.24)		(0.02)		(1.68)
Urban		-0.673		-0.770		0.208
		(-0.26)		(-0.64)		(0.12)
Num. children		-1.010*		-0.421*		-0.609
		(-2.28)		(-2.09)		(-1.79)
Household size		-0.224		-0.0241		-0.219
		(-0.82)		(-0.22)		(-0.98)
_cons	14.88***	18.64**	5.023***	5.928*	9.861***	13.29**
	(25.76)	(3.30)	(16.98)	(2.48)	(28.61)	(2.85)
N	13902	10686	13911	10694	13936	10705
R-Squared	0.000636	0.00790	0.000913	0.00465	0.000284	0.00760

This Table presents the extended results of Table 4, where we described in detail the specifications and the estimation process. We compute robust standard errors clustered at the village area level. t-statistics in parentheses: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 14: Labor Supply allocation in Malawi - Tobit

	(1)	(2)	(3)	(4)	(5)	(6)
	Hours	Hours	Housework	Housework	Prod. Hours	Prod. Hours
Islam	-1.625	1.193	1.161	2.366	-3.054	-0.579
	(-0.43)	(0.28)	(0.43)	(0.78)	(-0.86)	(-0.14)
Ramadan	1.289	0.461	0.743	0.198	0.632	0.222
	(1.01)	(0.31)	(1.18)	(0.30)	(0.40)	(0.12)
Islam× ramadan	0.759	0.222	0.182	0.277	1.064	0.0261
	(0.21)	(0.07)	(0.11)	(0.16)	(0.29)	(0.01)
Land area		-0.0319		0.00913		-0.0578
		(-1.73)		(0.58)		(-1.27)
Age		0.743		0.0960		0.965
		(1.50)		(0.32)		(1.73)
Age^2		-0.0116**		-0.00493		-0.0120**
		(-2.79)		(-1.91)		(-2.88)
School		2.921*		0.711		2.509
		(2.25)		(0.89)		(1.92)
Urban		-0.421		-2.275		-0.450
		(-0.14)		(-1.25)		(-0.16)
Num. children		-1.450*		-0.597		-1.837**
		(-2.29)		(-1.44)		(-2.98)
Household size		-0.390		-0.0626		-0.504
		(-1.07)		(-0.33)		(-1.25)
_cons	6.831***	8.325***	-4.222***	-1.350	-4.688***	-2.388
	(9.31)	(4.02)	(-8.27)	(-0.93)	(-4.91)	(-1.10)
F-test	0.37	0.05	0.34	0.09	0.24	0.01
p-value	0.5409	0.8309	0.5590	0.7639	0.5590	0.9383
Individual Controls	No	Yes	No	Yes	No	Yes
N	13902	10686	13911	10694	13936	10705

In this Table we present the Tobit model estimates with fixed effects, using the *Wooldridge correction* proposed in Wooldridge (1995). The $Islam$, $Ramadan$ and $Islam \times Ramadan$ coefficients are as explained before in Table 4. In the specifications presented in columns (1), (3) and (5), we include the set of variables that belong to the Ramadan cultural barrier, but we also control for individual, year and seasonal fixed effects. On specifications included in columns (2), (4) and (6), we also control for individual characteristics: age and its square, whether the individual has gone to school or not, whether he/she lives in an urban or rural area, the number of children in the household and the household size. We also include the set of marital status dummies. Moreover, we also include individual, year and seasonal fixed effects. We compute robust standard errors clustered at the village area level. t-statistics in parentheses: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. The full set of estimated coefficients are reported in Table 14 of the Appendix to this paper.
The F-test performs a joint significant test of the Ramadan cultural barrier variables (*Ramadan* and $Islam \times Ramadan$), on individuals weekly hours worked. The null hypothesis of the F-test is that *individuals who are facing the cultural constraint of the Ramadan festivity do not alter their number of weekly hours worked during the Holy month of Ramadan*.

Table 15: Selection Equation

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Labor Force	Labor Force	Labor Force	Labor Force	Labor Force	Labor Force
area/adults*age	0.00196	0.00156	0.00213	0.00224*	0.000837	0.00121
	(1.587)	(1.498)	(1.869)	(1.974)	(0.645)	(0.693)
area/adults*male	-0.0698*	-0.0431				
	(-2.395)	(-1.684)				
area/adults*married	-0.0928	-0.0514	-0.0832	-0.0767	-0.00879	-0.00960
	(-1.776)	(-1.153)	(-1.648)	(-1.275)	(-0.251)	(-0.362)
area/adults*polygamia	0.116	0.165	3.133	2.627	0.140	0.135
	(0.705)	(1.012)	(1.952)	(1.721)	(0.930)	(0.788)
area/adults*separated	-0.274**	-0.214*	-0.233*	-0.238	-0.0459	-0.0406
	(-2.738)	(-2.235)	(-2.151)	(-1.348)	(-0.443)	(-0.194)
area/adults*divorced	0.0864	0.272	0.146	0.301	0.0529	-0.0486
	(0.512)	(1.180)	(0.806)	(1.384)	(0.468)	(-0.832)
area/adults*widowed	-0.205*	-0.155	-0.187*	-0.177*	0.292	0.181
	(-2.207)	(-1.829)	(-2.117)	(-2.085)	(1.189)	(0.696)
area/adults	0.0480**	0.0240	0.00941	-0.00385	-0.0285	-0.0313
	(2.681)	(1.358)	(0.379)	(-0.177)	(-1.028)	(-1.054)
islam	0.163	0.163	0.328	0.174	-0.174	-0.412
	(1.304)	(0.979)	(1.898)	(0.711)	(-0.979)	(-1.514)
ramadan	0.0335	-0.179	0.0164	-0.309*	0.0425	0.288
	(0.916)	(-1.780)	(0.320)	(-2.235)	(0.872)	(1.780)
Islam*Ramadan	0.00950	0.279	0.0677	0.255	-0.0128	-0.345
	(0.143)	(1.647)	(0.726)	(0.593)	(-0.113)	(-1.040)
Islam*Ramadan*Kids_male		0.249		0.650		1.231
		(0.504)		(0.788)		(1.421)
Islam*Ramadan*Adult_male		-0.422		-0.149		0.308
		(-1.036)		(-0.156)		(0.489)
Islam*Ramadan*Old_male		-0.0419		0.0452		1.812
		(-0.0490)		(0.0242)		(1.618)
Islam*Ramadan*Adult_female		-0.898		-1.336		-0.155
		(-1.700)		(-0.989)		(-0.174)
Islam*Ramadan*Old_female		-0.875		-0.431		-1.896
		(-1.052)		(-0.367)		(-1.551)
Ramadan*Kids_male		0.0286		0.157		-0.777*
		(0.134)		(0.422)		(-2.345)
Ramadan*Adult_male		0.330		0.530		-0.114
		(1.665)		(1.235)		(-0.358)
Ramadan*Old_male		0.0650		-0.134		-0.975
		(0.154)		(-0.129)		(-1.457)

Selection Equation - continued

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Labor Force	Labor Force	Labor Force	Labor Force	Labor Force	Labor Force
Ramadan*Adult_female		0.607*		0.949*		-0.254
		(2.121)		(1.978)		(-0.771)
Ramadan*Old_female		-0.291		-0.168		0.100
		(-0.863)		(-0.343)		(0.187)
Kids_male		-0.370* *		1.176** **		-0.959*** ***
		(-2.027)		(2.960)		(-3.790)
Adult_male		0.452** **		0.0962		-0.343
		(3.035)		(0.141)		(-1.188)
Old_male		-0.189		-1.245** **		1.021** **
		(-0.620)		(-2.756)		(3.260)
Adult_female		0.618*** ***		1.091** **		0.0532
		(3.838)		(3.249)		(0.336)
Old_female		-0.159		-0.416		0.515
		(-0.594)		(-1.077)		(1.527)
age	-0.0319**	-0.0154	0.0137	0.0413**	-0.00570	0.00806
	(-3.086)	(-1.328)	(0.977)	(2.728)	(-0.528)	(0.679)
married	0.578***	0.660***	1.005***	1.372***	-0.102	-0.141
	(5.202)	(5.895)	(6.258)	(6.664)	(-0.848)	(-0.929)
polygamia	0.248	0.293	-0.647	-0.312	-0.303	-0.297
	(0.893)	(1.066)	(-0.897)	(-0.446)	(-1.122)	(-0.990)
separated	0.588**	0.537**	0.881***	1.150***	-0.350*	-0.652***
	(3.102)	(2.754)	(3.999)	(4.357)	(-2.552)	(-3.887)
divorced	0.286	0.131	0.466	0.590*	0.145	0.0244
	(1.240)	(0.474)	(1.684)	(2.136)	(0.635)	(0.0744)
widowed	0.391*	0.425*	0.806***	1.066***	-0.821*	-0.712
	(2.145)	(2.396)	(3.951)	(4.334)	(-2.166)	(-1.541)
school	-0.250***	-0.288***	-0.323***	-0.376***	-0.191**	-0.199**
	(-5.683)	(-6.058)	(-5.684)	(-6.025)	(-3.097)	(-2.794)
urban	0.167	0.192* *	0.170	0.168	0.235	0.241
	(1.839)	(2.052)	(1.249)	(1.192)	(1.687)	(1.604)
num_children	-0.251***	-0.209***	-0.251***	-0.184***	-0.252***	-0.242***
	(-12.96)	(-9.727)	(-7.620)	(-3.456)	(-9.521)	(-5.663)
hhsize	0.0480***	0.0661***	0.0527***	0.0746**	0.0392**	0.0194
	(4.441)	(5.420)	(3.487)	(2.987)	(2.987)	(0.946)
Constant	-2.239***	-2.925***	-1.623***	-2.342***	-1.444***	-1.207***
	(-12.17)	(-15.09)	(-11.21)	(-9.663)	(-7.920)	(-3.937)
Sample	Whole	Whole	Female	Female	Male	Male
N	11768	11768	6059	6059	5709	5709

This Table presents the extended results of Table 5, where we described in detail the specifications and the estimation process. We compute robust standard errors clustered at the village area level. t-statistics in parentheses: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 16: Heckman second-stage analysis - Entire Sample Estimation

	(1)	(2)	(3)	(4)	(5)	(6)
	Hours	Hours	Housework	Housework	Prod. Hours	Prod. Hours
Islam	1.7109 ***	3.5071 ***	2.4722 ***	3.4821 ***	-0.7468	0.0401
	(9.40)	(32.50)	(6.18)	(41.93)	(-1.65)	(1.23)
Ramadan	0.7800 ***	0.0071	-0.1279	-0.1846 ***	0.9331 ***	0.1761 ***
	(14.59)	(0.12)	(-1.39)	(-8.14)	(8.36)	(5.12)
Islam*Ramadan	-0.2251	-0.4207	0.2110	-0.2045 ***	-0.4156 **	-0.1619 *
	(-1.66)	(-1.69)	(0.82)	(-6.51)	(-3.18)	(-2.48)
Islam*Ramadan*Kids_male		13.3843 ***		1.6198 ***		11.6650 ***
		(26.81)		(11.66)		(34.51)
Islam*Ramadan*Adult_male		-9.5640 ***		-1.0293 ***		-8.8144 ***
		(-19.94)		(-11.75)		(-11.09)
Islam*Ramadan*Old_male		67.6752 ***		34.6047 ***		32.8909 ***
		(66.35)		(181.90)		(66.38)
Islam*Ramadan*Adult_female		-28.6123 ***		-7.1923 ***		-22.1345 ***
		(-19.84)		(-106.69)		(-55.93)
Islam*Ramadan*Old_female		-58.3492 ***		-35.2805 ***		-23.3228 ***
		(-35.15)		(-190.84)		(-19.34)
Ramadan*Kids_male		-1.2639 **		-1.0894 ***		-0.2362 *
		(-2.87)		(-8.33)		(-2.09)
Ramadan*Adult_male		-1.7570 ***		-2.8349 ***		1.3261 ***
		(-4.38)		(-82.02)		(8.32)
Ramadan*Old_male		11.7336 ***		2.5335 ***		9.0673 ***
		(22.96)		(31.44)		(41.05)
Ramadan*Adult_female		-2.5601 ***		-3.0816 ***		1.1631 ***
		(-6.70)		(-104.07)		(4.62)
Ramadan*Old_female		-5.7728 ***		-0.2172 *		-5.3452 ***
		(-16.83)		(-2.24)		(-24.99)
Kids_male		1.5192 ***		-1.8634 ***		3.2283 ***
		(5.35)		(-60.13)		(20.92)
Adult_male		2.2404 ***		0.3864 **		1.8735 ***
		(4.15)		(15.44)		(14.35)
Old_male		-2.3804 ***		-1.4919 **		-0.9717 ***
		(-5.05)		(-12.27)		(-4.45)
Adult_female		6.1419 ***		3.4651 ***		2.8132 ***
		(8.53)		(152.86)		(9.32)
Old_female		17.8363 ***		2.0603 ***		15.7562 ***
		(23.48)		(12.34)		(46.62)

Heckman second-stage analysis - Entire Sample Estimation (continued)

	(1)	(2)	(3)	(4)	(5)	(6)
	Hours	Hours	Housework	Housework	Prod. Hours	Prod. Hours
age	-0.2288 **	-0.4902 ***	-0.0077	0.1486 ***	-0.2106 **	-0.6246 ***
	(-3.04)	(-5.12)	(-0.31)	(8.03)	(-3.29)	(-22.21)
age2	0.0010 ***	0.0011 ***	0.0021 ***	0.0023 ***	-0.0012 ***	-0.0012 ***
	(4.79)	(7.51)	(24.16)	(53.72)	(-4.48)	(-10.86)
married	5.4403 ***	0.4280 ***	1.8526 ***	0.2219 ***	3.4533 ***	0.1816 ***
	(75.43)	(11.09)	(33.17)	(11.90)	(16.74)	(5.54)
polygamia	12.6087 ***	5.9709 ***	4.2791 ***	1.9231 ***	8.2055 ***	3.9043 ***
	(185.95)	(13.73)	(45.10)	(97.00)	(41.94)	(36.37)
separated	4.4094 ***	13.8103 ***	2.2479 ***	4.3524 ***	2.0643 ***	9.3329 ***
	(51.89)	(33.79)	(17.51)	(208.95)	(12.74)	(82.47)
divorced	5.6005 ***	3.6323 ***	2.2768 ***	1.9054 ***	3.2261 ***	1.6274 ***
	(40.50)	(11.76)	(36.70)	(100.23)	(15.21)	(19.34)
widowed	4.9291 ***	4.7453 ***	1.6898 ***	2.2186 ***	3.1254 ***	2.3994 ***
	(45.51)	(12.81)	(20.25)	(115.62)	(13.90)	(30.85)
school	3.0264 ***	5.9696 ***	-0.0056	1.6936 ***	3.0083 ***	4.1592 ***
	(65.46)	(19.26)	(-0.07)	(56.59)	(58.05)	(43.21)
urban	1.1680 ***	2.9361 ***	-0.5085 **	-0.0488 ***	1.7242 ***	2.9548 ***
	(8.47)	(58.26)	(-2.81)	(-3.43)	(8.72)	(84.47)
num_children	-0.4984 ***	0.6330	-0.3779 ***	-0.6059 ***	-0.1066 ***	1.3079 **
	(-17.58)	(1.43)	(-22.02)	(-75.29)	(-3.66)	(88.24)
hhsize	-0.7228 ***	-0.4299 ***	0.0271	-0.1989 ***	-0.7549 ***	-0.1927 ***
	(-41.93)	(-4.60)	(1.95)	(-27.68)	(-54.06)	(-4.56)
lambda	-0.3528 **	-0.1575 **	0.8201 ***	0.0581 **	-1.1850 ***	-0.2066 ***
	(-3.10)	(-2.64)	(20.26)	(16.16)	(-10.05)	(-7.14)
cons	42.6497 ***	-0.7191 ***	9.4973 ***	0.1299 ***	33.1639 ***	-0.8604 ***
	(125.71)	(-6.17)	(33.53)	(4.29)	(72.68)	(-12.72)
N	5732	5732	5732	5732	5732	5732
R-Squared	0.0334	0.0465	0.0162	0.0264	0.0372	0.0469

This Table presents the extended results of Table 6, where we described in detail the specifications and the estimation process. We compute robust standard errors clustered at the village area level. t-statistics in parentheses: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 17: Heckman second-stage analysis - Female subsample Estimation

	(1)	(2)	(3)	(4)	(5)	(6)
	Hours	Hours	Housework	Housework	Prod. Hours	Prod. Hours
Islam	1.7109 ***	3.5071 ***	2.4722 ***	3.4821 ***	-0.7468	0.0401
	(9.40)	(32.50)	(6.18)	(41.93)	(-1.65)	(1.23)
Ramadan	0.7800 ***	0.0071	-0.1279	-0.1846 ***	0.9331 ***	0.1761 ***
	(14.59)	(0.12)	(-1.39)	(-8.14)	(8.36)	(5.12)
Islam*Ramadan	-0.2251	-0.4207	0.2110	-0.2045 ***	-0.4156 **	-0.1619 *
	(-1.66)	(-1.69)	(0.82)	(-6.51)	(-3.18)	(-2.48)
Islam*Ramadan*Kids_male		13.3843 ***		1.6198 ***		11.6650 ***
		(26.81)		(11.66)		(34.51)
Islam*Ramadan*Adult_male		-9.5640 ***		-1.0293 ***		-8.8144 ***
		(-19.94)		(-11.75)		(-11.09)
Islam*Ramadan*Old_male		67.6752 ***		34.6047 ***		32.8909 ***
		(66.35)		(181.90)		(66.38)
Islam*Ramadan*Adult_female		-28.6123 ***		-7.1923 ***		-22.1345 ***
		(-19.84)		(-106.69)		(-55.93)
Islam*Ramadan*Old_female		-58.3492 ***		-35.2805 ***		-23.3228 ***
		(-35.15)		(-190.84)		(-19.34)
Ramadan*Kids_male		-1.2639 **		-1.0894 ***		-0.2362 *
		(-2.87)		(-8.33)		(-2.09)
Ramadan*Adult_male		-1.7570 ***		-2.8349 ***		1.3261 ***
		(-4.38)		(-82.02)		(8.32)
Ramadan*Old_male		11.7336 ***		2.5335 ***		9.0673 ***
		(22.96)		(31.44)		(41.05)
Ramadan*Adult_female		-2.5601 ***		-3.0816 ***		1.1631 ***
		(-6.70)		(-104.07)		(4.62)
Ramadan*Old_female		-5.7728 ***		-0.2172 *		-5.3452 ***
		(-16.83)		(-2.24)		(-24.99)
Kids_male		1.5192 ***		-1.8634 ***		3.2283 ***
		(5.35)		(-60.13)		(20.92)
Adult_male		2.2404 ***		0.3864 **		1.8735 ***
		(4.15)		(15.44)		(14.35)
Old_male		-2.3804 ***		-1.4919 **		-0.9717 ***
		(-5.05)		(-12.27)		(-4.45)
Adult_female		6.1419 ***		3.4651 ***		2.8132 ***
		(8.53)		(152.86)		(9.32)
Old_female		17.8363 ***		2.0603 ***		15.7562 ***
		(23.48)		(12.34)		(46.62)

Heckman second-stage analysis - Female subsample Estimation (continued)

	(1) Hours	(2) Hours	(3) Housework	(4) Housework	(5) Prod. Hours	(6) Prod. Hours
age	-0.2288 **	-0.4902 ***	-0.0077	0.1486 ***	-0.2106 **	-0.6246 ***
	(-3.04)	(-5.12)	(-0.31)	(8.03)	(-3.29)	(-22.21)
age2	0.0010 ***	0.0011 ***	0.0021 ***	0.0023 ***	-0.0012 ***	-0.0012 ***
	(4.79)	(7.51)	(24.16)	(53.72)	(-4.48)	(-10.86)
married	5.4403 ***	0.4280 ***	1.8526 ***	0.2219 ***	3.4533 ***	0.1816 ***
	(75.43)	(11.09)	(33.17)	(11.90)	(16.74)	(5.54)
polygamia	12.6087 ***	5.9709 ***	4.2791 ***	1.9231 ***	8.2055 ***	3.9043 ***
	(185.95)	(13.73)	(45.10)	(97.00)	(41.94)	(36.37)
separated	4.4094 ***	13.8103 ***	2.2479 ***	4.3524 ***	2.0643 ***	9.3329 ***
	(51.89)	(33.79)	(17.51)	(208.95)	(12.74)	(82.47)
divorced	5.6005 ***	3.6323 ***	2.2768 ***	1.9054 ***	3.2261 ***	1.6274 ***
	(40.50)	(11.76)	(36.70)	(100.23)	(15.21)	(19.34)
widowed	4.9291 ***	4.7453 ***	1.6898 ***	2.2186 ***	3.1254 ***	2.3994 ***
	(45.51)	(12.81)	(20.25)	(115.62)	(13.90)	(30.85)
school	3.0264 ***	5.9696 ***	-0.0056	1.6936 ***	3.0083 ***	4.1592 ***
	(65.46)	(19.26)	(-0.07)	(56.59)	(58.05)	(43.21)
urban	1.1680 ***	2.9361 ***	-0.5085 **	-0.0488 ***	1.7242 ***	2.9548 ***
	(8.47)	(58.26)	(-2.81)	(-3.43)	(8.72)	(84.47)
num_children	-0.4984 ***	0.6330	-0.3779 ***	-0.6059 ***	-0.1066 ***	1.3079 **
	(-17.58)	(1.43)	(-22.02)	(-75.29)	(-3.66)	(88.24)
hhsize	-0.7228 ***	-0.4299 ***	0.0271	-0.1989 ***	-0.7549 ***	-0.1927 ***
	(-41.93)	(-4.60)	(1.95)	(-27.68)	(-54.06)	(-4.56)
lambda	-0.3528 **	-0.1575 **	0.8201 ***	0.0581 **	-1.1850 ***	-0.2066 ***
	(-3.10)	(-2.64)	(20.26)	(16.16)	(-10.05)	(-7.14)
cons	42.6497 ***	-0.7191 ***	9.4973 ***	0.1299 ***	33.1639 ***	-0.8604 ***
	(125.71)	(-6.17)	(33.53)	(4.29)	(72.68)	(-12.72)
N	2919	2919	2919	2919	2919	2919
R-Squared	0.0302	0.0527	0.0231	0.0402	0.0292	0.0431

This Table presents the extended results of Table 7, where we described in detail the specifications and the estimation process. We compute robust standard errors clustered at the village area level. t-statistics in parentheses: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 18: Heckman second-stage analysis - Male subsample Estimation

	(1)	(2)	(3)	(4)	(5)	(6)
	Hours	Hours	Housework	Housework	Prod. Hours	Prod. Hours
Islam	-1.023	4.666	0.747	2.071	-1.726	2.716
	(-0.28)	(1.08)	(0.41)	(0.97)	(-0.57)	(0.73)
Ramadan	0.651	-0.322	-0.521	1.009	1.309	-1.099
	(0.42)	(-0.13)	(-1.02)	(1.08)	(1.06)	(-0.57)
Islam*Ramadan	-0.0300	-6.824	-0.169	-2.897	-0.0242	-4.158
	(-0.01)	(-0.89)	(-0.21)	(-1.17)	(-0.01)	(-0.73)
Islam*Ramadan*Kids_male 27.46		4.214		22.69		
		(1.50)		(0.56)		(1.89)
Islam*Ramadan*Adult_male		9.309		5.184		4.219
		(0.67)		(1.17)		(0.40)
Islam*Ramadan*Old_male		44.88		15.54		29.96
		(1.95)		(1.87)		(1.56)
Islam*Ramadan*Adult_female		-7.623		2.894		-10.04
		(-0.51)		(0.51)		(-0.86)
Islam*Ramadan*Old_female		-59.78*		-21.22*		-38.14
		(-2.16)		(-2.26)		(-1.73)
Ramadan*Kids_male		-8.132		-3.715		-4.001
		(-1.36)		(-1.34)		(-0.90)
Ramadan*Adult_male		0.450		-1.033		1.278
		(0.08)		(-0.41)		(0.30)
Ramadan*Old_male		5.539		0.0936		5.088
		(0.57)		(0.02)		(0.60)
Ramadan*Adult_female		8.602		-2.834		11.09
		(0.97)		(-0.70)		(1.74)
Ramadan*Old_female		8.676		0.388		7.786
		(0.84)		(0.09)		(1.01)
Kids_male		4.794		-2.392		7.343*
		(1.03)		(-1.16)		(2.24)
Adult_male		0.934		-0.944		1.818
		(0.30)		(-0.62)		(0.83)
Old_male		-5.359		-2.284		-3.059
		(-0.68)		(-0.89)		(-0.46)
Adult_female		8.169		4.512		3.662
		(1.56)		(1.69)		(1.20)
Old_female		3.924		1.927		2.062
		(0.64)		(0.58)		(0.41)

Heckman second-stage analysis - Male subsample Estimation (continued)

	(1)	(2)	(3)	(4)	(5)	(6)
	Hours	Hours	Housework	Housework	Prod. Hours	Prod. Hours
Age	0.499	0.642	0.0831	0.0946	0.368	0.497
	(1.17)	(1.57)	(0.53)	(0.57)	(1.12)	(1.62)
Age2	-0.00899	-0.00764	-0.000661	-0.0000982	-0.00794*	-0.00714*
	(-1.96)	(-1.63)	(-0.33)	(-0.05)	(-2.42)	(-2.19)
Married	-2.315	-3.335	-0.716	-0.922	-1.628	-2.397
	(-0.71)	(-1.10)	(-0.45)	(-0.60)	(-0.68)	(-1.06)
Polygamia	3.010	2.719	0.711	0.587	2.292	2.162
	(0.55)	(0.47)	(0.29)	(0.23)	(0.61)	(0.55)
Separated	3.497	4.186	1.793	1.532	1.695	2.641
	(0.73)	(0.87)	(0.92)	(0.76)	(0.45)	(0.75)
Divorced	-5.938	-6.612	-1.707	-1.217	-4.199	-5.268
	(-0.82)	(-1.06)	(-0.63)	(-0.44)	(-0.76)	(-1.20)
Widowed	6.115	5.598	3.197	3.281	2.876	2.291
	(1.19)	(1.07)	(1.03)	(1.01)	(0.73)	(0.58)
School	2.349	2.251	0.592	0.668	1.780	1.606
	(1.69)	(1.57)	(1.05)	(1.13)	(1.68)	(1.50)
Urban	0.445	0.519	0.251	0.248	0.183	0.272
	(0.13)	(0.15)	(0.22)	(0.21)	(0.07)	(0.10)
Num. children -0.279	-0.0171	-0.126	0.128	-0.200	-0.217	
	(-0.45)	(-0.02)	(-0.48)	(0.39)	(-0.42)	(-0.44)
Household size	-0.679	-0.237	-0.130	-0.198	-0.569	-0.0614
	(-1.60)	(-0.50)	(-0.81)	(-1.14)	(-1.64)	(-0.16)
_cons	13.53	3.276	4.192	3.119	10.33	1.227
	(1.64)	(0.39)	(1.23)	(0.83)	(1.61)	(0.20)
N	2721	2721	2721	2721	2721	2721
R-Squared	0.00797	0.0212	0.00436	0.0129	0.00985	0.0251

This Table presents the extended results of Table 8, where we described in detail the specifications and the estimation process. We compute robust standard errors clustered at the village area level. t-statistics in parentheses: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 19: Extensive margins - Malawi

	(1) work	(2) work	(3) work	(4) Labor Force	(5) Labor Force	(6) Labor Force
Islam	-0.233	-0.243	-0.247	0.619	-0.0935	-0.877
	(-0.95)	(-0.75)	(-0.61)	(1.68)	(-0.13)	(-0.66)
Ramadan	0.114	0.0447	0.161	0.102	0.151	0.525
	(1.60)	(0.49)	(0.80)	(0.85)	(0.81)	(0.94)
Islam*Ramadan	-0.0445	-0.101	0.0307	-0.384	-0.300	-0.249
	(-0.28)	(-0.55)	(0.07)	(-1.45)	(-0.62)	(-0.16)
Age		0.0331	-2.083***		-0.287***	-0.309
		(1.29)	(-14.96)		(-4.76)	(-1.72)
School		0.226*	0.244**		-1.142***	-1.230***
		(2.38)	(2.60)		(-3.97)	(-4.21)
Urban		-0.380	-0.510*		0.0901	0.0590
		(-1.52)	(-2.34)		(0.31)	(0.19)
Num. children		-0.105*	-0.113*		-1.008***	-1.016***
		(-2.32)	(-2.34)		(-5.31)	(-4.61)
Household size		-0.0128	-0.0116		0.199**	0.249**
		(-0.49)	(-0.40)		(3.12)	(3.05)
Islam*Ramadan*Children_male			-1.522			0.412
			(-1.32)			(0.19)
Islam*Ramadan*Adult_male			-0.657			2.284
			(-0.69)			(0.70)
Islam*Ramadan*Old_male			0.753			-4.006
			(0.43)			(-0.72)
Islam*Ramadan*Adult_female			1.265			-3.529
			(1.32)			(-1.29)
Islam*Ramadan*Old_female			-0.707			1.354
			(-0.41)			(0.26)

Extensive margins - Malawi (continued)

	(1) work	(2) work	(3) work	(4) Labor Force	(5) Labor Force	(6) Labor Force
[1em] Ramadan*Children_male			0.349			-0.348
			(0.72)			(-0.32)
Ramadan*Adult_male			0.163			-1.019
			(0.39)			(-0.72)
Ramadan*Old_male			0.261			1.162
			(0.34)			(0.70)
Ramadan*Adult_female			-0.640			0.310
			(-1.33)			(0.33)
Ramadan*Old_female			-0.0625			-1.477
			(-0.09)			(-0.98)
Children_male			0.043			0.614
			(0.03)			(-1.57)
Adult_male			0.598			0.143
			(0.76)			(0.49)
Old_male			1.251			0.252
			(0.81)			(0.32)
Adult_female			0.344			0.135
			(0.46)			(0.45)
Old_female			0.094			0.390
			(0.07)			(0.62)
N	6220	4273	5114	2268	1990	1990

This Table presents the extended results of Table 9, where we described in detail the specifications and the estimation process. We compute robust standard errors clustered at the village area level. t-statistics in parentheses: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 20: Extensive margins - Bangladesh

	(1) work	(2) work	(3) work	(4) Labor Force	(5) Labor Force	(6) Labor Force
ramadan	1.354***	-0.260*	-0.118	0.542***	-0.250***	-0.0524
	(8.01)	(-2.27)	(-0.42)	(6.64)	(-3.50)	(-0.30)
hhsize		0.00116	0.00140		0.000416	0.000708
		(0.73)	(0.89)		(0.40)	(0.68)
num_childre		0.00187	0.000838		0.00152	0.000367
		(0.57)	(0.26)		(0.76)	(0.18)
age		0.114	0.104		0.0500	0.0243
		(0.20)	(0.11)		(0.15)	(0.03)
age2		-0.00885***	-0.00945***		-0.00335***	-0.00233***
		(-18.64)	(-14.99)		(-9.98)	(-6.23)
education		-0.0247	-0.0255		0.0480**	0.0496**
		(-0.79)	(-0.83)		(2.69)	(2.81)
Ramadan*Child_male			-0.238			0.0682
			(-0.28)			(0.15)
Ramadan*Adult_male			0.644			0.459
			(0.99)			(1.09)
Ramadan*Old_male			1.235			-0.702
			(0.93)			(-0.79)
Ramadan*Adult_female			-0.834			-0.957**
			(-1.33)			(-2.65)
Ramadan*Old_female			-1.684			-0.801
			(-1.16)			(-0.92)
Child_male			-4.932			0.892
			(-1.83)			(0.29)
Adult_male			-4.662			-0.493
			(-1.72)			(-0.16)
Old_male			-4.876			0.416
			(-1.79)			(0.13)
Adult_female			-4.046			0.835
			(-1.51)			(0.27)
Old_female			-1.304			0.299
			(-0.46)			(0.10)
N	7844	7844	7844	9792	9776	9776
ll	-2489.6	-1090.2	-1076.3	-3337.7	-2717.5	-2669.2

This Table presents the extended results of Table 10, where we described in detail the specifications and the estimation process. We compute robust standard errors clustered at the village area level. t-statistics in parentheses: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 21: Testing the Parallel Trend Assumption - Malawi

	Housework	Prod. Hours	Hours
Total sample	1.65	1.80	2.59
	(0.1997)	(0.1801)	(0.1073)
Females	0.81	5.93	4.67
	(0.3683)	(0.0150)	(0.0307)
Males	0.61	0.07	0.03
	(0.4360)	(0.7893)	(0.8648)

In this table we present the results for the parallel trend assumption test, where we expect that individuals do not anticipate the Ramadan effects on their working hours. In this case, we report the test effects and the p-values in parenthesis. The main conclusions from this table are that, at the 1% significance level, individuals do not alter their hours worked, prior to the Ramadan and, thus, the parallel trend assumption is satisfied. We use the *time varying* treatment command, following the analysis in Cerulli and Ventura, 2017.