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RELIGION, FOOD CHOICES AND DEMAND SEASONALITY: EVIDENCE FROM THE ETHIOPIAN MILK MARKET

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Religion, Food Choices, and Demand Seasonality: Evidence from the Ethiopian Milk Market

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Abstract

The impact of religious behaviour on food systems in developing economies has been understated in scholarly studies. With its different Christian, Islamic, and traditional faiths, Ethiopia emerges as a natural experiment to investigate the impact of religious practices on demand. The inclusion of livestock products in Ethiopian diets is extremely low, even by African standards; a phenomenon often explained by supply and marketing problems combined with low income levels. We deviate from this dominant narrative and single out the impact of religion. We show how fasting practices of Orthodox Christians, the largest religious group, affect milk intake decisions and channels through which consumed milk is sourced. Employing countrywide data collected by the Living Standards Measurement Studies, we find, as expected, that the Orthodox fasting adversely affect milk consumption and decreases the share of milk sourced from own production in Orthodox families, an effect we quantify in this paper. Moreover, we observe spillover effects of Orthodox fasting on other religious groups in dominant Orthodox localities. Our findings improve the understanding of the broader societal implication of religiously inspired consumption rituals and underscore the challenges resulting from religion-induced demand cycles to design policies that aim at developing the livestock sector.

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1: Introduction

The term 'Livestock Revolution' was introduced by Delgado, Rosegrant, Steinfeld, Ehui, & Courbois (1999) to point to the unprecedentedly rapid increase in demand for livestock produce noted in the developing world since the 1970s. Population growth, progressive urbanization and growing per capita income levels are thought to be the revolution's driving forces (Delgado et al., 1999). While individual intake of livestock produce indeed exploded in some transforming and urbanised economies of Asia and Latin-America (particularly in China, India, and Brazil), the livestock revolution surpassed the majority of developing countries. Annual growth rates of per capita milk, meat and egg consumption in Sub-Saharan Africa (SSA) were -0.2, 0.2, and 0.3 per cent respectively for the period 1987-2007 (Gerosa & Skoet, 2013). Problems of structural supply, poorly developed local markets, low income levels, and lack of consumer awareness regarding the nutritional benefits of animal source foods (ASF) have been advanced to explain this stagnation. Yet, the association of low intake of ASF with cultural values and practices in general, and religion in particular, has been largely neglected and understudied; a research gap we address in this paper.

The significance of including an appropriate level of ASF in diets to improve dietary quality and nutritional outcomes is underpinned in an abundant number of studies (Muslimatun & Wiradnyani, 2016; Zhang, Goldsmith, & Winter-Nelson, 2016; inter alia). ASF are valuable and dense sources of several micro and macronutrients which are hard to retrieve in adequate amount from plant source foods only (Murphy & Allen, 2003). Livestock-based interventions are therefore deemed to be a decisive strategy to reduce malnutrition, especially in SSA where half of the world's malnourished population is residing, and where diets predominantly consist of cereal or root staple crops (Hetherington, Wiethoelter, Negin, & Mor, 2017). Of all livestock produce, milk is the largest source of animal-based protein in developing countries. It accounts for 60 per cent of total per capita consumption of primary livestock products (i.e. meat, milk, and eggs) (Gerosa & Skoet, 2013). Particularly the fact that milk production has one of the lowest production costs when compared to other plant and animal protein sources, makes it a desirable source of nutrients for improved nutritional and health outcomes in developing countries (Drewnowski, 2010).

Within SSA, Ethiopia hosts the largest estimated livestock herd (Tilahun & Schmidt, 2012), yet Ethiopian diets contain relatively little ASF; animal produce account for only 1.7 per cent and 3 per cent of the total energy intake of rural and urban households respectively (Hirvonen, Taffesse,

& Hassen, 2015), whereas starchy staples provide three-quarters of the total calorie intake (Worku, Dereje, Minten, & Hirvonen, 2017). Desiere, Yung, Verbeke, & D'Haese (2018) reported that only 19 per cent of the households interviewed by the Living Standards Measurement Survey (LSMS) in Ethiopia consumed meat or fish. In August 2015, the Ethiopian government launched the national Livestock Master Plan to boost livestock production and productivity. Roadmaps were developed for different key livestock value chains. Although the plan acknowledges the importance of promoting livestock produce consumption, the core of the proposed interventions relates to improving livestock production and productivity through enhanced herd management, genetic resources, feed, and health care (Shapiro et al., 2015). With this one sided policy focus on supply side factors, the gap between demand and supply of ASF is likely to widen further in the future.

By contrast, our study emphasises the importance of the demand side of the milk market. Changes in ASF consumption patterns in SSA societies not only depend on changing income levels, but also reflect prolonged cultural processes that are influenced by deeply embedded religious traditions. Robinson & Pozzi (2011) point out that particularly cultural and religious values and practices have slowed down the substitution of high value foods such as ASF for starchy staples in African food baskets. So far consumption oriented research has mostly ignored or underestimated the role of the diverse cultural and religious traditions in everyday life decisions (Heiman, Gordon, & Zilberman, 2017).

In terms of faiths, Christianity (63%) and Islam (30%) are the two dominant religious affiliations in SSA (Pew Research Center, 2014). Both religions have been co-existing for centuries and are amongst the fastest growing religious faiths in SSA (Schulz & Janson, 2016). Ethiopia, the second most populous country of the continent, is home to Orthodox (44% of the population), Muslim (34%), Protestant (19%), Catholic (1%), and traditional faiths (3%) (Central Statistical Agency of Ethiopia, 2010). The country hosts the second largest community of Orthodox Christians in the world after Russia (Brill, n.d.). The particular fasting rituals are one of the main identifying factors of the Orthodox Church. During fasting spells, which are scattered throughout a religious year, Orthodox followers are presumed to pursue a vegan diet, hence to abstain from consuming any animal product. With around half of the Ethiopian population being member of the Ethiopian Orthodox Church (EOC) and a total sum of about 180 Orthodox fasting days per year, religion

inevitably influences demand for animal produce in the country. Although several studies mention that fasting undeniably impacts livestock consumption patterns as it is causing a seasonal demand cycle (Bachewe, Minten, & Yimer, 2017; Abegaz, Hassen, & Minten, 2018), none has attempted to quantify the effect of fasting practices on livestock consumption decisions of households at a national level.

This paper aims to evaluate the impact of religion on household's milk intake decisions and milk sourcing strategies in Ethiopia. Based on our findings, we argue that religious values and practices (along with other factors) lie at the root of the observed low and stationary consumer demand for animal produce in the country and contribute to an intentional demand seasonality. Moreover, the impact of religious rituals is not limited to demand, as the seasonal demand cycle also causes shifts in sourcing channels of consumed milk at household level. Furthermore, our results show that these collective fasting rituals not only affect the practicing Orthodox Christian group, but spills over to other religious communities, and in particular to the Ethiopian Muslim community.

Our research contributes to the literature on economic and societal impact of religion in food systems in four important ways: 1) we study fasting amongst Orthodox Christian households and its impact on milk consumption in an African context, while most research was done on religion and food habits and consumer choices in a Western context within the predominant studied religion of Islam; 2) we present results from a nationwide study, while other studies are limited to case studies of a few villages or cities; 3) Ethiopia hosts households of different religious affiliations, which allows the setting of a natural experiment to investigate the impact of religious practices; and 4) the study shows the broader societal impact of Orthodox fasting which is due to important spillover effects on consumption and sourcing patterns of households across religious affiliations. This should draw attention of policy makers when designing livestock programmes.

2: Literature Review

2.1: Linking Religion and Consumer Behaviour

Research has tried to link habits, norms and/or customs to various outcomes at household, regional, sectorial, national and international levels[1]. How culture in general, and religion in particular, influences consumption behaviour is however vastly understudied. Religion influences consumers both directly via explicit instructions laid out in holy texts and/or by religious leaders and indirectly through beliefs and attitudes established within the larger religious group (Harrell, 1986). Quantitative analyses on the impact of specific religious beliefs and practices on consumer behaviour and associated market outcomes remain scarce and scattered (Mathras, Cohen, Mandel, & Glen, 2016; Heiman et al., 2017).

A large majority of the studies to date unravel behavioural intentions rather than revealed behavioural actions and have a predominant focus on Islamic traditions. Furthermore, the available empirical research is mostly business oriented. These studies are informative for advertising strategies, store and brand image building, product decisions, and establishing (new) market channels. Fam, Waller, & Erdogan (2004) and Putrevu & Swimberghek (2013) find that offensiveness vis-à-vis advertising controversial product groups (like gender related produce) differs significantly across religious denominations and levels of devoutness. Some studies give valuable insights that can guide the establishment of particular religiously guided market channels e.g. Verbeke, Rutsaert, Bonne, & Vermeir (2013), and Heiman et al. (2017) who focus on different Halal and Kosher certification systems and accompanying supply channels.

[1] Cultural factors have been linked to (amongst other): marriage patterns (Fafchamps & Quisumbing, 2005), educational attainment (Asadullah & Chaudhury, 2010; Borooah, 2012), migration intention (Falco & Rotondi, 2016), sanitation practices (Vyas & Spears, 2018), fertility rates (Madsen, Moslehi, & Wang, 2018), female labour force participation (Dildar, 2015), wages differentials (Mainali, Jafarey, & Montes-Rojas, 2017), aid allocation (Neumayer, 2003), service supply (Wietzke, 2014), resource management (Cox, Villamayor-Tomas, & Hartberg, 2014), technological innovation (Coccia, 2014), state governance (B.W. Carroll & Carroll, 1997), corruption (Dincer, 2008; Isaksson, 2015), happiness (Mookerjee & Beron, 2005), economic growth (Barro & McCleary, 2003; Noland, 2005), poverty (Churchill & Smyth, 2017), and agricultural productivity (Stifel, Fafchamps, & Minten, 2011; Kijima & Gonzalez, 2013).

Consumption behaviour for products that are linked to religious practices is also mirrored by demand differences towards specific product characteristics, e.g. environmentally friendly produce (Felix & Braunsberger, 2016), fairtrade products (Doran & Natale, 2011), genetically modified products (Hossain & Onyango, 2004), and whole fresh chicken versus cut or frozen chicken (Heiman, Just, McWilliams, & Zilberman, 2004). While the diverse range of topics reflected in the literature shows the desire of researchers to gain insight into traditional values and religious patterns from the point of view of marketing and consumer communication, it also shows that the broad impact of religion in shaping individual and collective food consumption choices has been understated in scholarly studies (Heiman et al., 2017). Rather than focusing on the narrow perspective of religious food specifications, we intend to improve our understanding of religiously inspired consumption rituals and their broader societal implications.

2.2: Costly Religious Food Restrictions

Rules and restrictions are inherent to religious institutions and often relate to dietary practices. These food restrictions give rise to distinct consumption patterns and are established either temporarily (such as fasting) and/or permanently (e.g. restriction to Kosher and Halal food in Jewish and Islamic traditions respectively) and require either abstinence from all (e.g. Ramadan from dawn to sunset) or certain foods (e.g. by the abstinence from ASF for Orthodox Christians) (Sabaté, 2004).

Fasting is a fundamental pillar of several religious denominations. Various studies analyse how participation in Ramadan, the Islamic fasting month, affects outcomes, such as dietary and nutrient intake (Maughan, Bartagi, Dvorak, & Zerguini, 2008; Norouzy et al., 2013), mental and physical health (Chtourou, Hammouda, Chaouachi, Chamari, & Souissi, 2017; Nugraha, Ghashang, Hamdan, & Gutenbrunner, 2017), educational performance (Majid, 2013; Oosterbeek & van der Klaauw, 2013), physical performance (Meckel, Ismaeel, & Eliakim, 2008; Chaouachi, Leiper, Chtourou, Aziz, & Chamari, 2012), fetal development (Majid, 2013; Daley et al., 2017), and output growth (Campante & Yanagizawa-Drott, 2015).

The existing literature on Orthodox Christians mainly concentrates on the Greek community and examines how religious fasting impacts physical and biochemical body parameters through changing food and nutrient intake patterns (Sarri et al., 2009; Karras et al., 2017; Koufakis et al., 2017). Only one previous study directly addresses the fasting practice of the Orthodox Church in Ethiopia. Knutsson and Selinus (1970) elaborate on the Easter fasting and how it impacts food intake amongst families and factory workers in the capital, Addis Ababa, and one village in the Oromia region. They detect a substantial drop in the total volume and quality of protein intake by small children between the age of six months and three years, which can be attributed to the exclusion of milk and other ASF from their diet during Easter fasting. Given the modest appearance of animal produce in nonfasting periods, fasting resulted in a deficiency of 25 per cent compared to recommended total protein intake, which might be harmful for children's growth and development.

Other authors indirectly controlled for Orthodox fasting practices in their papers. Hirvonen et al. (2015) who studied seasonality trends in Ethiopian diets, uncovered that the average energy intake and diversity of urban households' diets sharply fell during the two main Orthodox fasting periods (Easter and Christmas). This trend was not observed in rural areas, possibly because ASF were not as regularly incorporated in rural diets. Other studies mention how Orthodox fasting practices affect ASF purchases, availability, and sales. Negassa (2009) evaluates the determinants of purchasing raw milk and butter within two towns of the Oromia region, accomodating 200 urban households. They observe that housheulds who participated in fasting were less likely to purchase raw milk and butter. Moreover conditional on household's purchases, the quantity of raw milk purchased declined significantly for households practicing fasting, although the effect of fasting on the quantity of purchased butter was not significant, probably because of the small purchase volumes of butter[2]. Ayenew, Wurzinger, Tegegne, & Zollitsch (2009), who studied the supply side of the milk market in (peri-urban) areas, found that milk sales and prices were significantly higher during nonfasting days, while there was no such effect of fasting versus nonfasting on the volume of butter sales. Only butter prices were slightly higher in nonfasting periods. Both observations imply that the reduced milk sales are not compensated for by an increased sale of butter nor is the reduced milk intake during fasting events offset by a rising butter cconsumption. An older study

[2] Average monthly consumption in the study of Negassa (2009) conditional upon purchase was 4.44 liters of fluid milk per capita and 0.44 kg of butter per capita.

by Avery (2004) on the meat value chain in Addis Ababa reveals that 85 per cent of the butcheries close on traditional Wednesday and Friday Orthodox fasting days and 43 per cent of the supermarkets report a drop in meat sales on those days. Moreover, the France Vétérinaire Internationale-Institute de l'Elevage (2016) found that Orthodox fasting practices put great pressure on abattoirs' capacity in Addis Ababa as the number of cattle, sheep, and goats slaughtered fell by 75 per cent during the Orthodox Easter fasting period. Such drop was not observed during Muslim major fasting season (Ramadan). Finally, Aklilu, Almekinders, Udo, & Van der Zijpp (2007) who examined village poultry consumption and marketing in the Tigray region, established that religious fasts and feasts periodically shift local demand, sales, and prices of poultry.

In sum, the above mentioned literature agrees that fasting rituals in Ethiopia have an undeniable impact on demand seasonality in milk and meat markets which has a costly impact on the livestock sector. This paper builds on these findings by providing a nation wide quantification of the impact of Orthodox fasting and by estimating the spillover effects across religious.

3: Background and Data

3.1: The Ethiopian Livestock Sector

ASF that are commonly consumed in Ethiopia are dairy products, beef, mutton and goat, chicken, and eggs. Pork is rarely consumed because of religious traditions (Muslim and Orthodox), and also camel, fish, and honey contribute significantly less to the average Ethiopian diet. Dairy products still remain the most import animal component in Ethiopian diets and include a wide variety of products: milk (from cows, camel, goats, and sheep), powdered milk, yoghurt, cottage cheese, buttermilk and butter. Cow milk and butter are the most important dairy products, representing about half and one third of total dairy consumption respectively (Abegaz et al., 2018). Although dairy products are the most important livestock products at national level, Tafere and Worku (2012) found that urban inhabitants consume larger quantities of meat than dairy (11.5 kg of meat per capita annually versus 8.5 kg of dairy products; in rural areas this ratio is four kg of meat versus 18.4 kg of dairy).

Abegaz et al. (2018) found that at national level, 39 per cent of the consumed ASF are sourced from own production. A large disparity is found between the rural and urban areas in the degree of selfsufficiency; rural areas source about 52 per cent from own production whereas urban dwellers on average purchase 95 per cent of the ASF they consume. Besides this rural-urban discrepancy, important differences are also find among ASF types. Of all livestock products, the share of dairy products sourced from own production is the highest (about 70 per cent at national level); 14.5 per cent of the urban dwellers source milk from own production while in rural areas this number rises to about 80 per cent. Having a cow is thus an important way to improve nutritional outcomes, especially so in remote areas where dairy markets are often lacking (Hoddinott et al., 2015).

Seasonality in consumption of ASF is widely observed in Ethiopia. Fluctuations in the supply of ASF is partially driving this seasonal consumption, and production variations have been associated with fluctuating livestock product prices (Bachewe et al., 2017). However, religious practices (especially the fasting event within the Orthodox Christian Church) are particularly driving this seasonality in ASF consumption.

3.2: The Christian Orthodox Church and Fasting Practices

Fasting is a ritual commonly practiced within the Orthodox Church. It is seen as an integral part of religious identity, and serves as a measure of piousness (Knutsson & Selinus, 1970). As Boylston (2013) witnesses, Ethiopian people would rather ask a person first whether he/she would fast instead of asking this person whether he/she is Christian. Unique to EOC (and broad Christian Orthodox Church by extension) is that fasting is performed during different periods throughout a religious year. Orthodox traditions prescribe their members not to eat any food from animal origin. The fasts performed differ in duration and can be categorised into two main types: one day fasts occurring on Wednesdays and Fridays all year round (except for the two months after Ethiopian Easter) and longer fasting seasons around or preceding holy events. The Easter fast, also known as Lent, is the longest continuous and most important of all fasts (55 days). Other major fasting periods occur in December-January (40 days) and August (16 days). Besides commonly imposed

fasts, a large variety of spontaneous individual fasts is applied which makes it very difficult to assess the exact number of fasting days. For nonclergy, the number of fasting days amounts to 166 to 180, while priests, nuns and monks typically fast for about 250 days a year (Ayenew et al., 2009; Abegaz et al., 2018). Although fasting rules are strict, pregnant and lactating women, severely ill or weak persons, as well as children below the age of seven can be fully exempt from fasting (Ayenew et al., 2009).

Abegaz et al. (2018) analysed the consumption of ASF throughout the year and observed large fluctuations in the intake of animal protein. Average value of per capita consumption of ASF varied between 100-150 for Birr[3] about half of the year but dropped below 100 Birr during the months March and December (which coincide with Easter and Christmas fasting respectively). Peaks in consumption were observed in January-February (150-200 Birr), April (250 Birr) and September (300 Birr), all of them corresponding to Orthodox festivities: Ethiopian Christmas and Timket, Easter, and Ethiopian New Year respectively. When comparing the seasonal fluctuation of dairy and meat products, Abegaz et al. (2018) observed less variation in dairy intake. Per capita consumption of dairy fluctuated between 50-100 Birr per capita per month throughout the year whereas beef consumption varied from 20 Birr to about 155 Birr. Detailing consumption patterns of cow milk and butter, the two major dairy components, revealed that butter consumption followed a similar pattern of peaks and troughs as ASF intake, whereas consumption of cow milk deviated from this pattern. Intake of cow milk seems to follow a downward trend from January up until September (from 48 to 18 Birr), after which it increases again gradually to 43 Birr in December. Feed availability seemingly drives this pattern of cow milk intake (with a dry season between February-June, a rainy season from July-September and a main harvest season in October-December). A drop in cow milk consumption is observed in March (Easter fasting), followed by a peak in April-May (Easter), after which intake of cow milk starts dropping again.

[3] Birr is the currency of Ethiopia. The data used by Abegaz et al. (2018) date back from 2011 during which the exchange rate fluctuated around 17 Birr equalling one US Dollar (Exchange rates UK, n.d.).

3.3: Data

We use data from the LSMS, a household survey program housed within the Survey Unit of the World Bank's Development Data Group that provides technical assistance to the Central Statistical Agency of Ethiopia for conducting the actual survey on the territory of Ethiopia. The empirical analysis is based on data collected from a total of 5262 households in 2013-2014, the second data collection wave[4]. The data set covers all regional states including the capital, Addis Ababa. Respondents are selected by means of a stratified two stage cluster sample design (Central Statistical Agency of Ethiopia & World Bank 2015). A minimum number of enumeration areas (EAs) is set per regional state, using the Probability Proportional to Size sampling method. The EAs correspond to (parts of) municipalities or kebeles, the smallest administrative entities in Ethiopia. In total, 433 EAs are covered by the survey, 290 in rural areas, 43 in small town areas and 100 in major town areas. Within each EA, households are randomly selected[5].

The LSMS questionnaire provides information on individual attributes of household members, including religious affiliation, and household consumption of selected food items using a the seven day recall period. The interviews were implemented between February-April 2014, which was before, during and after Lent (24 February 2014-19 April 2014), the longest continuous fast of the EOC. As we do not have information about household's actual involvement in fasting rituals, we matched dates of the fasting period with the individual recall period: a household record is labelled fasting if at least part of the seven day recall period coincides with Lent fasting days, and nonfasting otherwise. This is a reasonable assumption since 87 per cent of the Ethiopian Orthodox Christians report that they fast during holy times such as Lent (Pew Research Center, 2017). We find that a third of the consumption survey records occur during the Orthodox Lent fasting season. This allows us to compare consumption patterns outside and during the fasting season. Ramadan took place later that year outside the data collection period (28 June 2014-28 July 2014). Only detailed consumption data were available for milk but not butter. Moreover, no data were available

[4] We did not consider the first (2011-2012) or the third (2015-2016) wave as the first wave did not include all urban areas (only rural and small town areas were surveyed), while the third wave had only 599 observations during Lent across all religious groups, whereas these amount to 1771 in 2013-2014.
[5] More information can be found on the LSMS website.

on the production and/or processing of milk within that seven day recall period, hence we could only approximate what happens at the market level by looking into the milk sourcing strategies by milk consuming households.

3.4: Econometric Approach

We start from the premise that religious denomination only influences the decision of a household whether or not to consume milk. We have no reason to expect that, ceteris paribus, religious affiliation as such would influence the level of consumption, conditional on the household consuming milk. Especially during Orthodox fasting, the likelihood to consume animal produce within an Orthodox family diminishes. We allow this effect of fasting on milk consumption to be heterogeneous across religious affiliations by interacting religion and timing of the consumption records.

As we are only interested to analyse which factors determine a household's likelihood to consume milk, we apply a Probit regression to model the binary outcome of a household's decision to consume or not to consume milk:

$$Y_{i,z} = 0 \; if \; Y^*_{i,z} \leq 0 \tag{1}$$

$$Y_{i,z} = 1 \; if \; Y^*_{i,z} > 0 \tag{2}$$

$$Y^*_{i,z} = \propto_0 + \sum \propto_i R_i \; + \sum \propto_i R_i \, F_i + \; \sum \propto_i H'_i + \sum \propto_i L'_z + \varepsilon_i \tag{3}$$

In the above equations, the dependent variable ($Y_{i,z}$) takes a value one if the household consumed milk during the seven days prior to the survey, zero otherwise. The probability that a household i in locality z chooses alternative one depends on the net utility ($Y^*_{i,z}$) a household derives from consuming milk. Only when the net utility of drinking milk is positive, a household will decide to consume. This net utility, in turn, is shaped by a vector of household (H'_i) and location (L'_z) controls, the household's religious affiliation (R_i), the interaction term of religious affiliation with fasting (F_i), and the error terms (ε_i).

As we suspect that the Orthodox fasting practices may also cause shifts in sourcing channels of the consumed milk at household level, we run a Heckprobit model in which the first stage (equation 6) models the likelihood of a household to consume milk, while the second regression models the probability that (part of) this milk consumption originates from own production or purchase (equation 7). The dependent variable $W_{i,z}$ (or $W'_{i,z}$) takes a value one if (part of) the milk that a household consumed originated from own production (or purchase), and zero otherwise. The probability that a household i in locality z chooses alternative one depends on the net utility ($Y^*_{i,z}$) a household derives from consuming milk as well as the net the net utility a household derives from producing milk it consumes ($W^*_{i,z}$) or from purchasing the milk it consumes ($W'^*_{i,z}$). We assume that the explanatory variables in both the first and the second stage of the Heckprobit regressions are identical, except for household member composition, which in turn is used as identifying variable in the first stage regression. Vulnerable groups such as young children, and elderly people are often prioritized and exempt from religious prescriptions when it comes to milk intake at household level (Negassa, 2009; Dorp, 2014) and thus will increase the likelihood of a household to consume milk. However, presence of these groups in the household will not necessarily increase or decrease a household's probability to source milk from own production, conditional on consuming milk in the first place. We also add the main effect of the density of EOC followers in each enumeration area (O_{ea}), and its interactions with religion dummies in the second stage regression to study how the propensity to source consumed milk from own production during fasting spells fluctuates across different densities of EOC members. We included these variables based on findings from the descriptive analysis.

$$W_{i,z} \; or \; W'_{i,z} = 0 \; if \; Y^*_{i,z} > 0 \; \& \; W^*_{i,z} \leq 0 \tag{4}$$

$$W_{i,z} \; or \; W'_{i,z} = 1 \; if \; Y^*_{i,z} > 0 \; \& \; W^*_{i,z} > 0 \tag{5}$$

$$Y^*_{i,z} = \beta_0 + \sum \beta_i R_i \; + \sum \beta_i R_i F_i + \; \sum \beta_i H'_{a,i} + \sum \beta_i L'_z \; + \varepsilon_{i,1} \tag{6}$$

$$W^*_{i,z} \; or \; W'^*_{i,z} = \gamma_0 + \gamma_1 O_{ea} + \sum \gamma_i R_i + \sum \gamma_i R_i F_i + \sum \gamma_i R_i O_{ea} + \sum \gamma_i F_i O_{ea} + \sum \gamma_i R_i F_i O_{ea} + \sum \gamma_i H'_{b,i} + \sum \gamma_i L'_z + \varepsilon_{i,2} \tag{7}$$

Based on empirical studies focusing on determinants of milk consumption (Negassa, 2009; Njarui et al., 2011; Trung et al., 2014; Kusiluka, Badi, & Lunyelele, 2015; inter alia) and the available data within the LSMS, we include the following household level controls in our analysis: gender, age, marital status, and educational background of the household head, household's living standard, number of young children below the age of seven, children between the age of seven and 9 , older people (aged 65 and above) and remaining household members. Household composition variables are included in the first stage H_(a,i)^' but not in the second stage H_(b,i)^'. In the second stage we only accounted for the total household size. We also consider milk cow and milk goat ownership to control for the household's direct access to milk . Finally, we add location level controls by incorporating the household's residence (be it in a rural village, a small town or a large town), the milk price to control for market accessibility, and a regional state dummy to adjust for possible variations in milk consumption and production across the regions due to differences in livestock population densities (Tilahun & Schmidt, 2012), tribal practices (Central Statistical Agency of Ethiopia & World Food Programme, 2014), and religious densities. A detailed description of the dependent and explanatory variables used in the models can be found in Annex (Table A.1). More extended statistical analyses to test the robustness of our findings can be found in the Appendix.

4: Descriptive Statistics

When average milk consumption is calculated irrespective of a household's religious affiliation, volumes consumed significantly decrease during Lent: from 1.55 liters/household during a nonfasting week recorded in the interviews compared to 1.04 liters/household during fasting time. Figure 1 gives a comparison of the consumption patterns across the different religious groups (i.e. Orthodox, Protestant, Muslim, and other). Overall, Orthodox families seem to consume less milk compared to other religious communities (Figure 1 part a), which can partly be explained by the smaller proportion of Orthodox households that consume milk (Figure 1 part b). Part a of Figure 1 shows that Orthodox Christians consumed almost 30 per cent less milk during Lent compared to their religious peers outside the fasting season (milk intake drops from 0.66 liters/household to 0.48 liters/household). This drop might seem small as we would expect consumption to drop to

zero, yet, we also still find a large proportion of Orthodox households that consume milk during Lent (Figure 1 part b). Comparing the household characteristics of Orthodox families that consumed milk during fasting with those that abstained from milk, reveals that those households that maintain their milk consumption during Lent have significantly larger families with significantly more young children (on average, consuming families had twice as many young children). Moreover, milk cow herds of these families are twice as large as the herds of Orthodox households refraining from milk intake (Table 1).

[Figure 1 near here]

[Table 1 near here]

Moreover, not only Orthodox families seem to reduce their consumption. The difference in milk consumption levels outside and during Lent across Muslim households is notable (part a Figure 1). Part b of Figure 1 reveals that the proportion of Muslim households drinking milk reduces from 57 to 49 per cent, which partially explains this sizable drop. An opposite trend is observed amongst Protestant families. As explained in Section 2.3., consumption, availability, and sales of ASF alter sharply during fasting. If the market for dairy produce unravels during Orthodox fasts, we would expect that milk intake would drop for both Protestants and Muslims, but this is not what we observe.

Next, we studied how fasting impacts milk sourcing strategies by reviewing the changes in the share of consumed milk coming from own milking cows or purchase during and outside fasting. We find that on average the share of home produced milk in total milk intake lowers by a third for milk drinking households interviewed during fasting (from 60% to 41%) while the share of purchase increases by 40 per cent (from 32% to 53%). Figure 2 reveals that a lower sourcing from own milk production is only found amongst Orthodox and Muslim families interviewed during Lent compared to those interviewed outside Lent (part a), while the importance of milk purchase to satisfy household's milk needs increases significantly for Orthodox, Muslim, and Protestant families (part b).

As milk prices are low during fasting, purchase of milk might be a better way to satisfy the household needs. For both Orthodox and Muslim households total milk intake drops during

Orthodox fasting (Figure 1 part a) thus reducing the amount of milk to be sourced from either production or purchase. One may expect that both Orthodox and Muslim families might prefer to process the milk they produce into butter. This butter, when processed with proper sanitation methods and stored appropriately, can last for about a month (Gebremedhin et al., 2014) and hence be used as a coping strategy to overcome Orthodox fasting periods. Once the fasting period is finished, the butter might be sold or consumed by the household. However, we can argue that butter processing and sales unlikely to fully cover the forgone milk consumption during fasting, nor will an increased reliance on milk purchase avoid an overproduction of milk during fasting. The first has been rebutted by Ayenew et al. (2009), who found that butter sales are unaffected by Orthodox fasting, implying that butter sales are not going up once the Lent fasting period is finished (whereas this is true for the raw milk sales). Moreover, even if butter consumption might indeed increase after fasting, butter intake still remains rather low (Negassa, 2009) and it is likely that during prolonged fasting periods such as Lent, which last for about 55 days, that the shelf life of butter is insufficiently long. Also an increased purchase of milk volumes is not happening as Negassa (2009) found that raw milk purchases decrease significantly during fasting compared to nonfasting periods. The limitations of our data set do not allow us to further explore these observations in greater depth.

[Figure 2 near here]

5: Modelling the Probability of Milk Intake at Household Level

Results from the Probit regression are presented in Table 2. The model yields a fairly high pseudo R square of about 26 per cent. Marginal effects of the factor variables included in the full Probit model (i.e. first column in Table 2) are presented in Table 3 and results from the Heckprobit regression[6] can be found in Table 4 for the probability that (part of) the consumed milk is sourced

[6] The first stage in the Heckprobit regression corresponds to the full Probit model as represented by the first column in Table 2.

from own production and in Table 5 for the probability that (part of) the consumed milk is retrieved through purchase[7].

[Table 2 near here]

[Table 3 near here]

5.1: Religion Matters

Religion clearly impacts household's milk intake as it alters the likelihood of a household to drink milk (Table 2). The effects are multiple and not limited to the Orthodox fasting community, and remain fairly constant when gradually building up the model. In the following we will focus on the results from the full Probit model. Firstly, religious affiliation has a statistically significant effect on the probability of families to consume milk. Protestant and Muslim families are eight and 20 percentage points more likely to consume milk compared to Orthodox households respectively (Table 3). Secondly, when we interact religious affiliation with the interview period (whether consumption records were gathered during or outside fasting), we find that the predicted average probability of a household to consume milk during a Lent fasting week drops by eight percentage points compared to a nonfasting week, irrespective of a household's religious affiliation (Table 3). Although this drop might seem small, part of the households consumption data which are labelled as fasting reflect consumption both during Lent and nonfasting days, which might happen if a household was interviewed in the beginning of the Lent fasting period or after Lent fasing. When we detail the impact of Orthodox fasting across the different religious groups, we find that the probability of milk intake decreases by 10 and nine percentage points for Orthodox and Muslim families respectively, while Protestant households' probability increases by three percentage points (Table 3). Since the Orthodox and Muslim community jointly represent 80% of the Ethiopian population this observation implies a non negligible impact on national milk demand.

[7] In the discussion below, we focused on the Orthodox, Protestant and Muslim communities as the group with another religious denomination was too small (N=143) to draw nonfallacious conclusions.

Third, we find an effect of the milk cow herd size, along with religious affiliation and period of consumption. In the descriptive analysis, we observed significant differences in the sizes of milk cow herds for the different religious groups interviewed during and outside Lent. To control for this, we introduced a three-way interaction term of religious affiliation, interview period and size of the milk cow herd. Larger herd sizes tend to have a positive effect on the probability of a household to consume milk, irrespective of fasting or nonfasting, for all religious denominations studied except for the Orthodox households (Table 2). Regardless of the number of milking cows an Orthodox household possesses, fasting dramatically reduces their probability to consume milk (the coefficient is -0.16).

Next we studied how fasting impacts on the milk market development by reviewing the changes in the likelihood to source consumed milk from own milking cows (Table 4) or purchase (Table 5) during and outside fasting. This allows us to assess the societal impact in terms of milk market changes. Generally, we observe that Orthodox fasting negatively affects purchase intention, especially so for Orthodox (p value is 0.12) and Protestant families, who are less likely to buy milk from the local market. This underscores the observation of unravelling markets during Orthodox fasting. This reduced likelihood to source milk from purchase, is not compensated for by an increased reliance on home production; except for Protestant households. Furthermore, we find that in dominant Orthodox localities, the likelihood to buy milk decreases significantly, irrespective of religious affiliation. This suggest that due to repeating fasting spells, local dairy market development in such settings has been hampered. Only Muslim families are increasingly likely to source milk from purchase in dominant Orthodox settings. But milk purchase volumes are not increasing during fasting (see Negassa (2009)) nor is milk increasingly sourced from own production (Table 4), hence this implies that milk intake reduces the more dominant the Orthodox religion is within a locality and thus that religious fasting practices are increasingly more likely to spillover to neighbours from another religious denomination (evidence also provided in Appendix).

[Table 4 near here]

[Table 5 near here]

5.2: Insufficient Supply and Low Demand

The results for all other controlling variables are as expected. The presence of young children and elderly people increases the likelihood of a household to drink milk by three and five percentage points for each additional young child and elderly person respectively (Table 3). When the household head is female, and/or received secondary and above secondary school education, families are more inclined to consume milk (probability rises with seven and nine percentage points respectively) (Table 3). Moreover, rising living standard and milk cow herd sizes positively affect the probability of milk intake (Table 2). Having one additional milking cow or a doubling of household nominal expenditure increases a household's probability to consume milk by approximately 20 percentage points (Table 3). However, the effect of cow ownership reduces with increasing living standards (negative interaction), and vice-versa, which suggests that cows are particularly important for poor(er) households to provide access to milk (Table 4 first stage). This is supported by the results from the Heckprobit model, which reveal that mainly poor and low educated households source their milk from home production suggested by the negative coefficients for both income logarithm and educational background of the household head (Table 4).

High milk prices are found to curtail the demand for milk (probability to consume drops by three percentage points when milk prices increase by one Birr) (Table 3). This negative price elasticity illustrates that milk is a luxurious product that is mostly consumed by the better of households. The high price of milk is attributed to insufficient production and high marketing costs (Tafere & Worku, 2012). Moreover, Bachewe et al. (2017) found that costs of ASF are increasing over time; reflected by the fact that during the time period 2005 and 2011, expenditures on ASF grew by 22 per cent, while actual ASF intake only slightly increased by about 6 per cent (Abegaz et al., 2018).

Finally, location matters. We find that families residing in urban areas are more likely to consume milk, and tend to rely more on local milk markets than on home milk production compared to their rural counterparts (suggested by the negative interaction term between milk price and location in the first stage of the Heckprobit regression in Table 4). Densely populated areas are known to ease

the establishment of local markets as they face lower transaction costs (Staal, Pratt, & Jabbar, 2008). The above observations were however only significant for small urban towns. Higher transaction costs may still persist in large urban areas, hampering development of milk markets which, combined with the (more) limited space for keeping milking cows, poses difficulties in accessing milk for urban households (Ayenew et al., 2009).

6: Conclusion and Policy Implications

Using countrywide data from the Living Standard Measurement Studies, we accentuate the so far underexplored impact of religiously inspired consumption rituals. We study the impact of fasting rituals amongst Orthodox households not only on consumption decisions, but also on sourcing strategies of consumed milk. Including consumption and sourcing patterns of households of different religious affiliations in the study allows to account for spillover effects across the society. We show that Orthodox fasting reduces milk intake and alters sourcing strategies of consumed milk, both impacts which are not only limited to the Orthodox community. The surprisingly negative effect of Orthodox Lent on both the Muslim milk consumption and the propensity of Protestants and Muslims to consume milk from the local market (without an increased reliance on home production) when surrounded by an increasing number of Orthodox Christians is suggestive of the fact that the Orthodox reduction in milk consumption during Orthodox Lent spills over to the followers of other religious denominations.

As fasting periods are spread throughout the year, religion can therefore cause a strong pattern of seasonality in milk demand that is hard to cope with for milk farmers and other producers in the dairy supply chain. Investing in the improved of traditional (informal) methods of milk processing storage as well as the establishment of processing plants and adequate storage capacity and technology will be extremely important to overcome this systematic religious seasonal supply/demand mismatch and its consequent losses and spoilage. Till today, only 35 active dairy processors are operative in the country (although often below capacity), and these are located principally around Addis Ababa (Zijlstra, Van Der Lee, Berhanu, Vernooij, & Boere, 2015). While factors as income, urbanization and population are dynamic, religion is a rather static parameter and we can expect that religious values and related fasting practices will persist in the near future.

Further research in this regard is therefore imminent – also to address the limitations our study faces. As we do not have information about households' actual involvement in fasting rituals, we match dates of the fasting period (Lent) with the period of LSMS data collection to determine whether or not consumption data were gathered during or outside Orthodox fasting. Moreover, the households interviewed during fasting are not the same as those interviewed outside Lent. Therefore, we recommend that follow up studies focus on a cohort of households before, during and after fasting and incorporate a variable of household involvement in religiously inspired rituals, such as fasting.

Nonetheless, this study presents evidence that religious practices can have negative repercussions on the development of an effective functioning milk value chain. It therefore underscores the need of addressing both supply and demand side inefficiencies and accounting for religiously inspired cultural differences in order to promote the development of the Ethiopian dairy sector. To come to more coherent and inclusive policy interventions, strong political commitment to the processing and promotion component of initiatives such as the Livestock Master Plan is required. Awareness raising campaigns, focusing e.g. on nutritional benefits of dairy products, are crucial in this context. Moreover, the government might contribute through the establishment of school milk programs. Since children below the age of seven are exempt from fasting, such programs could be a very effective policy action not only to improve food security and adequate nutrition, but also to stabilise milk demand and supply in Ethiopia in the face of religious seasonality.

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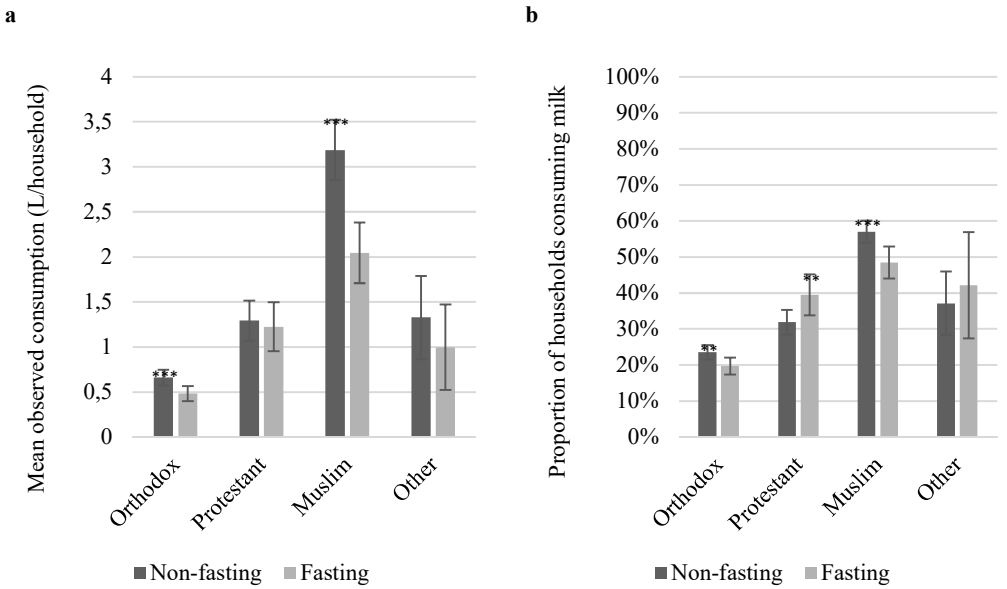

Figure 1 Average observed milk consumption (part a) and proportion of households consuming milk (part b) across religious groups at Orthodox fasting and nonfasting; with confidence intervals drawn at α=0.05

Notes: ***, **and * represent statistical significance at a probability of less than 1, 5 and 10% respectively.

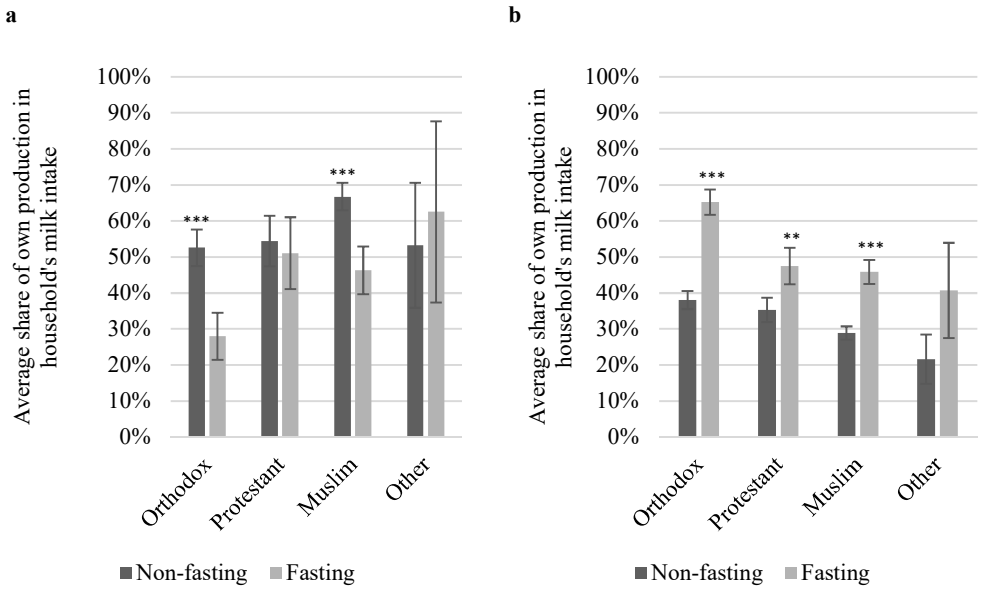

Figure 2 Average share of home production (part a) and purchase (part b) in total milk intake among milk consuming religious households at Orthodox fasting and nonfasting; with confidence intervals drawn at α=0.05

Notes: ***, **and * represent statistical significance at a probability of less than 1, 5 and 10% respectively.

Table 1. Descriptive household characteristics of consuming and nonconsuming Orthodox families during Lent

	Mean	
	Nonconsuming Orthodox households	Consuming Orthodox households
Proportion of male heads	0.58 (0.02)[a]	0.64 (0.03)[a]
Age heads	43.17 (0.59)[a]	41.72 (1.01)[a]
Proportion of married heads	0.54 (0.02)[a]	0.70 (0.03)[b]
Proportion of heads with:		
Illiterate or informal education	0.40 (0.02)[a]	0.30 (0.03)[b]
Primary education	0.26 (0.02)[a]	0.29 (0.03)[a]
Secondary education	0.23 (0.02)[a]	0.31 (0.03)[b]
College/university education	0.10 (0.01)[a]	0.10 (0.02)[a]
Number of young children (0-6)	0.46 (0.03)[a]	0.86 (0.06)[b]
Number of children (7-9)	0.27 (0.02)[a]	0.35 (0.04)[a]
Number of elderly (65 and above)	0.17 (0.01)[a]	0.12 (0.03)[a]
Number of remaining members	2.93 (0.07)[a]	3.34 (0.13)[b]
Milk cow herd size	0.20 (0.02)[a]	0.44 (0.08)[b]
Milk goat herd size	0.00 (0.00)	0 (0)
Income (Birr/week)	403.65 (11.92)[a]	683.62 (35.54)[b]
Proportion residing in		
Rural area	0.32 (0.02)[a]	0.26 (0.03)[a]
Small town area (urban)	0.06 (0.01)[a]	0.04 (0.01)[a]
Large town area (urban)	0.62 (0.02)[a]	0.70 (0.03)[b]

Notes: [a-b] Means within a row with different superscripts differ significantly ($p < .05$). Standard errors are given in brackets.

Table 2. Results from Probit models

	Probit 1	Probit 2	Probit 3	Probit 4
Religion *(Orthodox omitted)*				
Protestant	0.07 (0.09)	0.24 (0.07)***	0.08 (0.08)	0.22 (0.07)***
Muslim	0.46 (0.08)***	0.54 (0.06)***	0.50 (0.07)***	0.48 (0.06)***
Other	0.29 (0.19)	0.47 (0.13)***	0.28 (0.16)*	0.34 (0.16)**
Interaction (religion * interview period) *(Orthodox * nonfasting omitted)*				
Orthodox * fasting	-0.29 (0.07)***	-	-0.34 (0.07)***	-
Protestant * fasting	0.12 (0.12)	-	0.09 (0.11)	-
Muslim * fasting	-0.21 (0.09)**	-	-0.23 (0.08)***	-
Other * fasting	-0.22 (0.33)	-	0.20 (0.27)	-
Interaction (religion * interview period * milk cow herd size) *(Orthodox * nonfasting omitted)*				
Protestant * nonfasting * milk cow herd size	0.04 (0.08)	-	-	-0.03 (0.08)
Muslim * nonfasting * milk cow herd size	0.17 (0.10)*	-	-	0.16 (0.10)*
Other * nonfasting * milk cow herd size	-0.01 (0.19)	-	-	-0.03 (0.19)
Orthodox * fasting * milk cow herd size	-0.16 (0.08)**	-	-	-0.28 (0.07)***
Protestant * fasting * milk cow herd size	-0.03 (0.14)	-	-	-0.03 (0.13)
Muslim * fasting * milk cow herd size	0.11 (0.11)	-	-	-0.03 (0.10)
Other * fasting * milk cow herd size	1.56 (0.63)**	-	-	1.36 (0.58)**
Household controls	Yes	Yes	Yes	Yes
Location controls	Yes	Yes	Yes	Yes
Constant	-4.11 (0.35)***	-4.30 (0.35)***	-4.19 (0.35)***	-4.20 (0.35)***
Pseudo R^2	0.27	0.26	0.26	0.26

Notes: ***,** and * represent statistical significance at a probability of less than 1, 5 and 10% respectively. Standard errors are given between brackets.

Table 3 Predicted probability to consume milk at household level evaluated at the mean of the covariates

	Average predicted probability to consume milk
Religion *(Orthodox omitted)*	
Protestant	0.08 (0.02)***
Muslim	0.20 (0.02)***
Other	0.19 (0.06)***
Interview period *(nonfasting omitted)*	
Fasting	-0.08 (0.02)***
Interaction (religion * interview period)	
Orthodox * nonfasting	0.28 (0.02) ***
Orthodox * fasting	0.18 (0.02) ***
Protestant * nonfasting	0.31 (0.02) ***
Protestant * fasting	0.34 (0.03) ***
Muslim * nonfasting	0.47 (0.02) ***
Muslim * fasting	0.38 (0.03) ***
Other * nonfasting	0.38 (0.06) ***
Other * fasting	0.53 (0.11) ***
Sex head (*female omitted*)	-0.07 (0.02)***
Age head	0.00 (0.00)
Marital status head (*not married omitted*)	0.01 (0.02)
Educational background head (*no or informal education omitted)*	
Primary education	-0.01 (0.02)
Secondary education	0.09 (0.03)***
College/university education	0.09 (0.04)**
Number of young children (0-6)	0.03 (0.01)***
Number of children (7-9)	0.02 (0.01)
Number of elderly (65 and above)	0.05 (0.02)**
Number of remaining members	-0.02 (0.01)***
Milk cow herd size	0.20 (0.02)***
Milk goat herd size	0.02 (0.01)**
Logarithm of income	0.21 (0.01)***
Location (*rural omitted*)	
Small town (urban)	-0.07 (0.03)**
Large town (urban)	0.09 (0.03)***
Region	Yes
Milk price	-0.03 (0.01)***

Notes: ***,** and * represent statistical significance at a probability of less than 1, 5 and 10% respectively. Standard errors are given between brackets.

Table 4 Results from the Heckprobit model

	First stage	Second stage
Religion *(Orthodox omitted)*		
Protestant	0.06 (0.09)	-0.20 (0.27)
Muslim	0.44 (0.08)***	-0.15 (0.28)
Other	0.30 (0.19)	-0.78 (0.37)**
Interaction (religion * interview period) *(Orthodox * nonfasting omitted)*		
Orthodox * fasting	-0.30 (0.07)***	0.49 (0.52)
Protestant * fasting	0.12 (0.12)	0.64 (0.27)**
Muslim * fasting	-0.20 (0.09)**	-0.13 (0.14)
Other * fasting	-0.27 (0.33)	0.77 (0.80)
EA Orthodox concentration	-	0.38 (0.32)
Interaction (religion * EA Orthodox concentration) *(Orthodox omitted)*		
Protestant * EA Orthodox concentration	-	-0.61 (0.63)
Muslim * EA Orthodox concentration	-	-0.63 (0.56)
Other * EA Orthodox concentration	-	4.19 (3.10)
Interaction (interview period * EA Orthodox concentration) *(nonfasting omitted)*		-0.39 (0.61)
Interaction (religion * interview period * EA Orthodox concentration) *(Orthodox * fasting omitted)*		
Protestant * fasting * EA Orthodox concentration	-	0.84 (1.06)
Muslim * fasting * EA Orthodox concentration	-	0.15 (1.15)
Other * fasting * EA Orthodox concentration	-	-2.94 (3.57)
Interaction (religion * interview period * milk cow herd size) *(Orthodox * nonfasting omitted)*		
Protestant * nonfasting * milk cow herd size	0.05 (0.08)	-
Muslim * nonfasting * milk cow herd size	0.19 (0.10)*	-
Other * nonfasting * milk cow herd size	-0.02 (0.19)	-
Orthodox * fasting * milk cow herd size	-0.14 (0.08)*	-
Protestant * fasting * milk cow herd size	-0.01 (0.14)	-
Muslim * fasting * milk cow herd size	0.12 (0.11)	-
Other * fasting * milk cow herd size	1.65 (0.63)**	-
Sex head *(female omitted)*	-0.19 (0.06)***	0.16 (0.12)
Age head	0.00 (0.00)	0.00 (0.00)
Marital status head *(not married omitted)*	0.03 (0.07)	0.11 (0.13)
Educational background head *(no or informal education omitted)*		
Primary education	-0.03 (0.06)	-0.27 (0.10)***
Secondary education	0.24 (0.08)***	-0.93 (0.16)***
College/university education	0.25 (0.10)**	-0.96 (0.25)***
Household size	-	0.10 (0.02)***
Number of young children (0-6)	0.09 (0.02)***	-

Number of children (7-9)	0.05 (0.04)	-
Number of elderly (65 and above)	0.12 (0.07)*	-
Number of remaining members	-0.04 (0.01)***	-
Milk cow herd size	1.62 (0.27)***	1.10 (0.46)**
Milk goat herd size	0.06 (0.02)**	0.03 (0.02)
Logarithm of income	0.66 (0.04)***	-0.17 (0.10)
Interaction (logarithm of income * milk cow herd size)	-0.20 (0.04)***	-0.16 (0.07)**
Location *(rural omitted)*		
Small town (urban)	1.47 (0.63)**	0.16 (0.88)
Large town (urban)	0.08 (0.33)	-0.54 (0.74)
Region	Yes	Yes
Milk price	-0.08 (0.02)***	0.13 (0.03)***
Interaction (location * milk price) *(rural omitted)*		
Small town * milk price	-0.15 (0.05)***	-0.08 (0.08)
Large town * milk price	0.01 (0.03)	-0.13 (0.06)**
Interaction (location * milk cow herd size) *(rural omitted)*		
Small town * milk cow herd size	0.24 (0.13)*	0.09 (0.12)
Large town * milk cow herd size	0.15 (0.19)	1.08 (0.32)***
Constant	-4.12 (0.35)***	-0.23 (0.91)
Athrho	-0.67 (0.26)***	

Notes: ***,** and * represent statistical significance at a probability of less than 1, 5 and 10% respectively. Standard errors are given between brackets. The dependent variable in the first stage regression is a dummy variable which takes on the value 1 if the household consumed milk in the last seven days prior to the interview and 0 otherwise. The dependent variable in the second stage regression is a dummy variable which takes on the value 1 if (part of) the milk consumed by the household originates from own production and 0 otherwise.

Table 5 Results from the Heckprobit model

	First stage	Second stage
Religion *(Orthodox omitted)*		
Protestant	0.06 (0.09)	-0.01 (0.29)
Muslim	0.46 (0.08)***	-0.03 (0.29)
Other	0.33 (0.19)*	0.49 (0.39)
Interaction (religion * interview period) *(Orthodox * nonfasting omitted)*		
Orthodox * fasting	-0.30 (0.07)***	-0.70 (0.45)
Protestant * fasting	0.12 (0.12)	-0.54 (0.28)*
Muslim * fasting	-0.22 (0.09)**	-0.07 (0.14)
Other * fasting	-0.27 (0.33)	-0.32 (0.87)
EA Orthodox concentration	-	-0.71 (0.34)**
Interaction (religion * EA Orthodox concentration) *(Orthodox omitted)*		
Protestant * EA Orthodox concentration	-	0.61 (0.63)
Muslim * EA Orthodox concentration	-	1.11 (0.55)**
Other * EA Orthodox concentration	-	-1.87 (1.70)
Interaction (interview period * EA Orthodox concentration) *(nonfasting omitted)*	-	0.88 (0.56)
Interaction (religion * interview period * EA Orthodox concentration) *(Orthodox * fasting omitted)*		
Protestant * fasting * EA Orthodox concentration	-	-0.12 (1.01)
Muslim * fasting * EA Orthodox concentration	-	-0.94 (0.89)
Other * fasting * EA Orthodox concentration	-	1.68 (3.13)
Interaction (religion * interview period * milk cow herd size) *(Orthodox * nonfasting omitted)*		
Protestant * nonfasting * milk cow herd size	0.06 (0.08)	-
Muslim * nonfasting * milk cow herd size	0.17 (0.10)*	-
Other * nonfasting * milk cow herd size	-0.04 (0.19)	-
Orthodox * fasting * milk cow herd size	-0.15 (0.08)*	-
Protestant * fasting * milk cow herd size	0.00 (0.14)	-
Muslim * fasting * milk cow herd size	0.13 (0.11)	-
Other * fasting * milk cow herd size	1.50 (0.65)**	-
Sex head *(female omitted)*	-0.20 (0.06)***	-0.34 (0.12)***
Age head	0.00 (0.00)	-0.00 (0.00)
Marital status head *(not married omitted)*	0.05 (0.07)	0.11 (0.13)
Educational background head *(no or informal education omitted)*		
Primary education	-0.03 (0.06)	0.36 (0.11)***
Secondary education	0.25 (0.08)***	0.72 (0.15)***
College/university education	0.25 (0.10)**	0.78 (0.21)***
Household size	-	-0.05 (0.02)**
Number of young children (0-6)	0.09 (0.02)***	-
Number of children (7-9)	0.05 (0.04)	-

Number of elderly (65 and above)	0.14 (0.07)**	-
Number of remaining members	-0.04 (0.01)***	-
Milk cow herd size	1.62 (0.26)***	-0.25 (0.49)
Milk goat herd size	0.05 (0.02)**	0.02 (0.02)
Logarithm of income	0.66 (0.04)***	0.42 (0.10)***
Interaction (logarithm of income * milk cow herd size)	-0.20 (0.04)***	0.00 (0.08)
Location *(rural omitted)*		
Small town (urban)	1.20 (0.65)*	0.85 (1.18)
Large town (urban)	0.07 (0.33)	-1.19 (0.62)*
Region	Yes	Yes
Milk price	-0.08 (0.02)***	-0.20 (0.03)***
Interaction (location * milk price) *(rural omitted)*		
Small town * milk price	-0.12 (0.06)**	0.01 (0.10)
Large town * milk price	0.01 (0.03)	0.24 (0.05)***
Interaction (location * milk cow herd size) *(rural omitted)*		
Small town * milk cow herd size	0.23 (0.13)*	-0.10 (0.13)
Large town * milk cow herd size	0.11 (0.19)	-0.41 (0.26)
Constant	-4.05 (0.35)***	-0.55 (0.91)
Athrho	0.62 (0.25)**	

Notes: ***,** and * represent statistical significance at a probability of less than 1, 5 and 10% respectively. Standard errors are given between brackets. The dependent variable in the first stage regression is a dummy variable which takes on the value 1 if the household consumed milk in the last seven days prior to the interview and 0 otherwise. The dependent variable in the second stage regression is a dummy variable which takes on the value 1 if (part of) the milk consumed by the household was sourced through purchase and 0 otherwise.

Appendix

To test the robustness of our results, we ran more extended models for both the Probit and Heckprobit regression. First of all, we ran additional models using church density instead of Orthodox density, to approximate the dominance of Christian congregations in each EA. Both variables (church density and Orthodox density within EA) were alternatingly included in the Probit and Heckprobit regressions. Other important additions were the inclusion of extra control variables for household characteristics (e.g. age squared of the household head, the interaction term of age and gender of the household head, a more detailed categorization of household composition, and whether or not a household took credit in the past year) and location characteristics (e.g. the interaction term of region and milk cow herd size, the distance of a household's residence to the nearest market, the interaction term of distance to the market and milk cow herd size, and the three way interaction between location, milk price and milk cow herd size). The regression results can be found in the tables below.

Generally, we observe that the inclusion of church concentration (Tables A.2 and A.4) yielded more significant effects than when accounting for the density of Orthodox members in an EA (Tables A.1 and A.3). The church density variable represents all possible Christian congregations rather than only the Orthodox community. This implies that in dominant Christians settings, the impact of religion on milk intake decisions is bigger. Furthermore, we see that our results remain fairly robust when incorporating extra control variables, although the effects become smaller. Firstly, Muslim families are more likely to consume milk compared to Orthodox households. Secondly, Orthodox fasting reduces the likelihood to consume milk, irrespective of religious denomination (in table A.1 the p value is 0.131). This effect is especially strong for Orthodox households suggested by the negative interaction between Orthodox affiliation, fasting and milk

cow herd size. The impact of Orthodox fasting is also bigger for the Muslim community as compared to the Protestant households. Thirdly, modelling the probability to source consumed milk from own production in Table A.3 and A.4 reveals that in dominant Christian setting, the importance of home production to satisfy milk demand increases, irrespective of religious affiliation (this effect was not significant when accounting for the density of Orthodox members in an enumeration area see table A.3). Especially Protestant households are less likely to source milk from home production with an increasing density of Orthodox members and churches, as the effect for Muslim families was not significant.

In the extended Probit model (which corresponds to Probit 7 in both Table A.1 and A.2), we also included the church and Orthodox density variable at an enumeration level area, the results of which can be seen in Figure A.1 and A.2. An increasing density of EOC members and churches negatively impacts milk intake decisions, *ceteris paribus*. This effect is however dependent on the interview period and the religious affiliation of the household. Whereas an increasing density of Orthodox members reduces milk intake for all religions and fasting and nonfasting periods (Figure A.1), the impact of church concentration is mixed (Figure A.2). As such we observe that an increasing church concentration barely affects milk intake decisions of Orthodox families during fasting. Protestant families are increasingly likely to consume milk during nonOrthodox fasting periods with rising church concentration but an opposite trend is observed during fasting. Muslim families consume significantly less milk during with increasing church density irrespective whether it is an Orthodox fasting or nonfasting period.

Table A.1 Results from the extended Probit models accounting for the density of Orthodox believers in an enumeration area

	Probit 1	Probit 2	Probit 3	Probit 4	Probit 5	Probit 6	Probit 7
Religion *(Orthodox omitted)*							
Protestant	0.24 (0.07)***	0.07 (0.08)	0.07 (0.13)	0.07 (0.08)	-0.08 (0.14)	-0.04 (0.15)	-0.08 (0.16)
Muslim	0.54 (0.06)***	0.50 (0.07)***	0.36 (0.13)***	0.34 (0.08)***	0.31 (0.14)**	0.34 (0.15)**	0.34 (0.16)**
Other	0.45 (0.13)***	0.26 (0.16)	0.54 (0.20)***	0.30 (0.14)**	0.34 (0.21)	0.38 (0.23)	0.36 (0.25)
Interview period *(nonfasting omitted)*							
Fasting	-	-0.35 (0.07)***	-	-0.21 (0.05)***	-0.45 (0.16)***	-0.36 (0.23)	-0.34 (0.23)
Interaction (religion * interview period) *(Orthodox * nonfasting omitted)*							
Protestant * fasting	-	0.45 (0.12)***	-	-	0.53 (0.16)***	0.41 (0.27)	0.46 (0.28)
Muslim * fasting	-	0.11 (0.11)	-	-	0.23 (0.16)	0.12 (0.25)	0.13 (0.25)
Other * fasting	-	0.56 (0.28)**	-	-	0.79 (0.30)***	0.67 (0.43)	-0.00 (0.56)
EA Orthodox concentration			-0.37 (0.14)***	-0.39 (0.10)***	-0.37 (0.15)**	-0.33 (0.17)**	-0.35 (0.17)**
Interaction (religion * EA Orthodox concentration) *(Orthodox omitted)*							
Protestant * EA Orthodox concentration	-	-	0.14 (0.24)	-	0.01 (0.24)	-0.06 (0.30)	-0.00 (0.30)
Muslim * EA Orthodox concentration	-	-	-0.09 (0.23)	-	-0.12 (0.23)	-0.20 (0.29)	-0.17 (0.29)
Other * EA Orthodox concentration	-	-	-0.93 (0.45)**	-	-1.14 (0.46)**	-1.23 (0.60)**	-1.18 (0.60)*
Interaction (interview period * EA Orthodox concentration) *(nonfasting omitted)*							
Fasting * EA Orthodox concentration	-	-	-	-	0.10 (0.18)	-0.01 (0.27)	0.06 (0.27)
Interaction (religion * interview period * EA Orthodox concentration) *(Orthodox * nonfasting omitted)*							
Protestant * fasting * EA Orthodox concentration	-	-	-	-	-	0.20 (0.48)	0.09 (0.49)
Muslim * fasting * EA Orthodox concentration	-	-	-	-	-	0.20 (0.43)	0.13 (0.43)
Other * fasting * EA Orthodox concentration	-	-	-	-	-	0.22 (0.93)	1.05 (1.04)
Interaction (religion * interview period * milk cow herd size) *(Orthodox * nonfasting omitted)*							
Orthodox * fasting * milk cow herd size	-	-	-	-	-	-	-0.18 (0.08)**
Protestant * nonfasting * milk cow herd size	-	-	-	-	-	-	0.04 (0.11)
Protestant * fasting * milk cow herd size	-	-	-	-	-	-	-0.07 (0.16)
Muslim * nonfasting * milk cow herd size	-	-	-	-	-	-	-0.04 (0.11)
Muslim * fasting * milk cow herd size	-	-	-	-	-	-	-0.09 (0.13)
Other * nonfasting * milk cow herd size	-	-	-	-	-	-	-0.02 (0.21)
Other * fasting * milk cow herd size	-	-	-	-	-	-	1.43 (0.71)**
Household controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Location controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-4.74 (0.69)***	-4.59 (0.70)***	-4.37 (0.71)***	-4.29 (0.70)***	-4.22 (0.72)***	-4.26 (0.72)***	-4.16 (0.73)***
Pseudo R^2	0.27	0.28	0.27	0.28	0.28	0.28	0.28

Notes: ***,**and * represent statistical significance at a probability of less than 1, 5 and 10% respectively. Standard errors are given between brackets.

Table A.2 Results from the extended Probit models accounting for the density of churches in an enumeration area

	Probit 1	Probit 2	Probit 3	Probit 4	Probit 5	Probit 6	Probit 7
Religion *(Orthodox omitted)*							
Protestant	0.24 (0.07)***	0.07 (0.08)	0.08 (0.23)	0.28 (0.07)***	-0.18 (0.24)	-0.68 (0.32)**	-0.70 (0.32)**
Muslim	0.54 (0.06)***	0.50 (0.07)***	0.71 (0.11)***	0.45 (0.07)***	0.58 (0.13)***	0.53 (0.14)***	0.54 (0.14)***
Other	0.45 (0.13)***	0.26 (0.16)	0.95 (0.52)*	0.56 (0.15)***	0.64 (0.52)	0.97 (0.58)*	0.92 (0.60)
Interview period *(nonfasting omitted)*							
Fasting	-	-0.35 (0.07)***	-	-0.26 (0.05)***	-0.55 (0.14)***	-0.67 (0.17)***	-0.64 (0.17)***
Interaction (religion * interview period) *(Orthodox * nonfasting omitted)*							
Protestant * fasting	-	0.45 (0.12)***	-	-	0.42 (0.13)***	1.53 (0.47)***	1.56 (0.47)***
Muslim * fasting	-	0.11 (0.11)	-	-	0.27 (0.14)*	0.38 (0.20)*	0.36 (0.21)*
Other * fasting	-	0.56 (0.28)**	-	-	0.68 (0.31)**	-1.28 (1.39)	-0.45 (1.43)
EA church concentration	-	-	-0.02 (0.11)	-0.21 (0.09)**	-0.15 (0.13)	-0.21 (0.14)	-0.24 (0.14)*
Interaction (religion * EA church concentration) *(Orthodox omitted)*							
Protestant * EA church concentration	-	-	0.24 (0.27)	-	0.36 (0.27)	0.93 (0.36)**	0.93 (0.36)**
Muslim * EA church concentration	-	-	-0.69 (0.21)***	-	-0.67 (0.21)***	-0.60 (0.25)**	-0.58 (0.26)**
Other * EA church concentration	-	-	-0.45 (0.60)	-	-0.36 (0.60)	-0.76 (0.68)	-0.72 (0.69)
Interaction (interview period * EA church concentration) *(nonfasting omitted)*							
Fasting * EA church concentration	-	-	-	-	0.18 (0.17)	0.35 (0.22)	0.43 (0.22)**
Interaction (religion * interview period * EA church concentration) *(Orthodox * nonfasting omitted)*							
Protestant * fasting * EA church concentration	-	-	-	-	-	-1.32 (0.54)**	-1.42 (0.56)**
Muslim * fasting * EA church concentration	-	-	-	-	-	-0.16 (0.38)	-0.23 (0.39)
Other * fasting * EA church concentration	-	-	-	-	-	2.23 (1.56)	0.76 (1.67)
Interaction (religion * interview period * milk cow herd size) *(Orthodox * nonfasting omitted)*							
Orthodox * fasting * milk cow herd size	-	-	-	-	-	-	-0.22 (0.09)**
Protestant * nonfasting * milk cow herd size	-	-	-	-	-	-	0.08 (0.11)
Protestant * fasting * milk cow herd size	-	-	-	-	-	-	0.02 (0.17)
Muslim * nonfasting * milk cow herd size	-	-	-	-	-	-	-0.09 (0.12)
Muslim * fasting * milk cow herd size	-	-	-	-	-	-	-0.07 (0.13)
Other * nonfasting * milk cow herd size	-	-	-	-	-	-	0.05 (0.25)
Other * fasting * milk cow herd size	-	-	-	-	-	-	0.00 (0.00)
Household controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Location controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-4.74 (0.69)***	-4.59 (0.70)***	-4.88 (0.72)***	-4.56 (0.71)***	-4.58 (0.73)***	-4.53 (0.74)***	-4.42 (0.75)***
Pseudo R^2	0.27	0.28	0.27	0.27	0.28	0.28	0.28

Notes: ***,**and * represent statistical significance at a probability of less than 1, 5 and 10% respectively. Standard errors are given between brackets.

Table A.3 Results from the extended Heckprobit model accounting for the density of Orthodox believers in an enumeration area

	First stage	Second stage
Religion *(Orthodox omitted)*		
Protestant	-0.10 (0.16)	-0.02 (0.34)
Muslim	0.33 (0.16)**	0.07 (0.34)
Other	0.35 (0.25)	-0.87 (0.49)*
Interview period *(nonfasting omitted)*		
Fasting	-0.34 (0.23)	0.05 (0.70)
EA Orthodox concentration	-0.35 (0.17)**	0.37 (0.40)
Interaction (religion * interview period) *(Orthodox * nonfasting omitted)*		
Protestant * fasting	0.47 (0.28)*	0.50 (0.79)
Muslim * fasting	0.13 (0.25)	-0.11 (0.72)
Other * fasting	-0.00 (0.56)	0.50 (2.12)
Interaction (religion * EA Orthodox concentration) *(Orthodox omitted)*		
Protestant * EA Orthodox concentration	0.02 (0.30)	-1.34 (0.75)*
Muslim * EA Orthodox concentration	-0.18 (0.29)	-0.95 (0.64)
Other * EA Orthodox concentration	-1.17 (0.60)*	4.94 (4.24)
Interaction (interview period * EA Orthodox concentration) *(nonfasting omitted)*		
Fasting * EA Orthodox concentration	0.06 (0.27)	-0.31 (0.79)
Interaction (religion * interview period * EA Orthodox concentration) *(Orthodox * nonfasting omitted)*		
Protestant * fasting * EA Orthodox concentration	0.07 (0.49)	1.39 (1.32)
Muslim * fasting * EA Orthodox concentration	0.15 (0.43)	-0.14 (1.42)
Other * fasting * EA Orthodox concentration	1.05 (1.05)	-4.41 (5.67)
Interaction (religion * interview period * milk cow herd size) *(Orthodox * nonfasting omitted)*		
Orthodox * fasting * milk cow herd size	-0.17 (0.08)**	0.23 (0.24)
Protestant * nonfasting * milk cow herd size	0.04 (0.11)	0.08 (0.19)
Protestant * fasting * milk cow herd size	-0.06 (0.16)	0.22 (0.41)
Muslim * nonfasting * milk cow herd size	-0.04 (0.11)	0.11 (0.21)
Muslim * fasting * milk cow herd size	-0.09 (0.13)	-0.13 (0.22)
Other * nonfasting * milk cow herd size	-0.01 (0.21)	0.13 (0.29)
Other * fasting * milk cow herd size	1.43 (0.71)**	6.30 (2,040.13)
Sex head *(female omitted)*	-0.07 (0.14)	0.24 (0.13)*
Age head	-0.02 (0.02)	-0.01 (0.02)
Age head squared	0.26 (0.20)	0.22 (0.29)
Interaction (sex * age head) *(female omitted)*	-0.00 (0.00)	-
Marital status head *(not married omitted)*	0.03 (0.07)	-
Educational background head *(no or informal education omitted)*		
Primary education	-0.03 (0.06)	-0.34 (0.11)***
Secondary education	0.24 (0.08)***	-1.00 (0.21)***
College/university education	0.19 (0.10)*	-1.05 (0.33)***
Number of infants (<1)	0.26 (0.07)***	0.19 (0.13)
Number of young children (1-6)	0.05 (0.03)*	0.14 (0.05)***
Number of children (7-9)	0.04 (0.04)	-
Number of adolescents (10-19)	-0.05 (0.02)**	-
Number of elderly (65 and above)	0.16 (0.07)**	-
Number of remaining members	-0.06 (0.02)***	0.08 (0.05)
Size of milk cow herd	1.64 (0.31)***	3.48 (0.91)***
Size of milk goat herd	0.05 (0.02)**	0.04 (0.03)*
Logarithm of income	0.69 (0.04)***	0.17 (0.22)

Interaction (logarithm of income * milk cow herd size)		-0.19 (0.05)***	-0.20 (0.10)*
Region		Yes	Yes
Location *(rural omitted)*			
	Small town (urban)	1.16 (0.63)*	1.97 (1.15)*
	Large town (urban)	-0.19 (0.34)	0.29 (1.11)
Milk price		-0.09 (0.02)***	0.22 (0.07)***
Interaction (location * milk price) *(rural omitted)*			
	Small town * milk price	-0.12 (0.06)**	-0.24 (0.10)**
	Large town * milk price	0.02 (0.03)	-0.20 (0.09)**
Interaction (region * milk cow herd size)		Yes	Yes
Interaction (location * milk cow herd size) *(rural omitted)*			
	Small town * milk cow herd size	0.16 (0.15)	4.35 (2.97)
	Large town * milk cow herd size	0.08 (0.21)	0.39 (3.27)
Distance nearest market		0.01 (0.00)***	0.00 (0.00)
Distance nearest market squared		-0.15 (0.03)***	-0.03 (0.07)
Interaction (milk cow herd size * distance nearest market)		-0.00 (0.00)***	-0.00 (0.00)**
Interaction (location * milk price * milk cow herd size)			
	Rural * milk price * milk cow herd size	-	-0.18 (0.06)***
	Small town * milk price * milk cow herd size	-	-0.54 (0.26)**
	Large town * milk price * milk cow herd size	-	-0.13 (0.27)
Credit use		-	0.18 (0.11)*
Constant		-4.11 (0.73)***	-4.81 (1.77)***
Athrho		0.17 (0.53)	

Notes: ***,**and * represent statistical significance at a probability of less than 1, 5 and 10% respectively. Standard errors are given between brackets. The dependent variable in the first stage regression is a dummy variable which takes on the value 1 if the household consumed milk in the last seven days prior to the interview and 0 otherwise. The dependent variable in the second stage regression is a dummy variable which takes on the value 1 if (part of) the milk consumed by the household originates from own production and 0 otherwise.

Table A.4 Results from the extended Heckprobit model accounting for the density of churches in an enumeration area

	First stage	Second stage
Religion *(Orthodox omitted)*		
Protestant	-0.69 (0.32)**	1.42 (0.95)
Muslim	0.53 (0.14)***	0.15 (0.36)
Other	0.94 (0.60)	-3.13 (1.33)**
Interview period *(nonfasting omitted)*		
Fasting	-0.64 (0.17)***	0.17 (0.62)
EA church concentration	-0.24 (0.14)*	0.87 (0.32)***
Interaction (religion * interview period) *(Orthodox * nonfasting omitted)*		
Protestant * fasting	1.55 (0.47)***	-1.17 (1.41)
Muslim * fasting	0.36 (0.21)*	-0.26 (0.63)
Other * fasting	-0.48 (1.43)	-9.50 (12,347.67)
Interaction (religion * EA church concentration) *(Orthodox omitted)*		
Protestant * EA church concentration	0.92 (0.36)**	-2.30 (1.04)**
Muslim * EA church concentration	-0.60 (0.26)**	-0.62 (0.58)
Other * EA church concentration	-0.72 (0.69)	2.25 (1.46)
Interaction (interview period * EA church concentration) *(nonfasting omitted)*		
Fasting * EA church concentration	0.42 (0.22)*	-0.37 (0.71)
Interaction (religion * interview period * EA church concentration) *(Orthodox * nonfasting omitted)*		
Protestant * fasting * EA church concentration	-1.40 (0.56)**	2.29 (1.54)
Muslim * fasting * EA church concentration	-0.21 (0.39)	0.20 (1.24)
Other * fasting * EA church concentration	0.78 (1.67)	10.01 (12,347.67)
Interaction (religion * interview period * milk cow herd size) *(Orthodox * nonfasting omitted)*		
Orthodox * fasting * milk cow herd size	-0.22 (0.09)**	0.37 (0.28)
Protestant * nonfasting * milk cow herd size	0.07 (0.12)	0.16 (0.19)
Protestant * fasting * milk cow herd size	0.02 (0.17)	0.23 (0.41)
Muslim * nonfasting * milk cow herd size	-0.08 (0.12)	0.21 (0.21)
Muslim * fasting * milk cow herd size	-0.07 (0.13)	0.00 (0.23)
Other * nonfasting * milk cow herd size	0.04 (0.25)	0.64 (0.32)**
Other * fasting * milk cow herd size	6.12 (1,183.29)	7.57 (3,550.79)
Sex head *(female omitted)*	-0.09 (0.15)	0.21 (0.12)*
Age head	-0.02 (0.02)	-0.01 (0.02)
Age head squared	0.24 (0.20)	0.23 (0.29)
Interaction (sex * age head) *(female omitted)*	-0.00 (0.00)	-
Marital status head *(not married omitted)*	0.03 (0.07)	-
Educational background household head *(no or informal education omitted)*		
Primary education	-0.04 (0.06)	-0.31 (0.12)**
Secondary education	0.24 (0.08)***	-1.07 (0.18)***
College/university education	0.24 (0.11)**	-1.06 (0.30)***
Number of infants (<1)	0.22 (0.07)***	0.13 (0.14)
Number of young children (1-6)	0.05 (0.03)*	0.12 (0.06)**
Number of children (7-9)	0.06 (0.04)	-
Number of adolescents (10-19)	-0.02 (0.02)	-
Number of elderly (65 and above)	0.18 (0.08)**	-
Number of remaining members	-0.06 (0.02)**	0.12 (0.05)**
Size of milk cow herd	1.72 (0.33)***	2.30 (1.28)*
Size of milk goat herd	0.04 (0.02)*	0.05 (0.03)
Logarithm of income	0.68 (0.04)***	-0.08 (0.22)
Interaction (logarithm of income * milk cow herd size)	-0.20 (0.05)***	-0.12 (0.13)

Region		Yes	Yes
Location *(rural omitted)*			
	Small town (urban)	1.24 (0.64)*	1.44 (1.26)
	Large town (urban)	-0.12 (0.36)	-0.01 (1.13)
Milk price		-0.09 (0.03)***	0.24 (0.06)***
Interaction (location * milk price) *(rural omitted)*			
	Small town * milk price	-0.12 (0.06)**	-0.19 (0.12)*
	Large town * milk price	0.03 (0.03)	-0.16 (0.09)*
Interaction (region * milk cow herd size)		Yes	Yes
Interaction (location * milk cow herd size) *(rural omitted)*			
	Small town * milk cow herd size	0.21 (0.17)	3.93 (2.88)
	Large town * milk cow herd size	-0.00 (0.20)	2.72 (3.35)
Distance nearest market		0.01 (0.00)***	-0.00 (0.00)
Distance nearest market squared		-0.13 (0.03)***	0.04 (0.07)
Interaction (milk cow herd size * distance nearest market)		-0.00 (0.00)***	-0.00 (0.00)**
Interaction (location * milk price * milk cow herd size)			
	Rural * milk price * milk cow herd size		-0.13 (0.07)**
	Small town * milk price * milk cow herd size		-0.46 (0.25)*
	Large town * milk price * milk cow herd size		-0.27 (0.27)
Credit use			0.19 (0.11)*
Constant		-4.31 (0.74)***	-3.49 (2.44)
Athrho		-0.38 (0.59)	

Notes: ***,** and * represent statistical significance at a probability of less than 1, 5 and 10% respectively. Standard errors are given between brackets. The dependent variable in the first stage regression is a dummy variable which takes on the value 1 if the household consumed milk in the last seven days prior to the interview and 0 otherwise. The dependent variable in the second stage regression is a dummy variable which takes on the value 1 if (part of) the milk consumed by the household originates from own production and 0 otherwise.

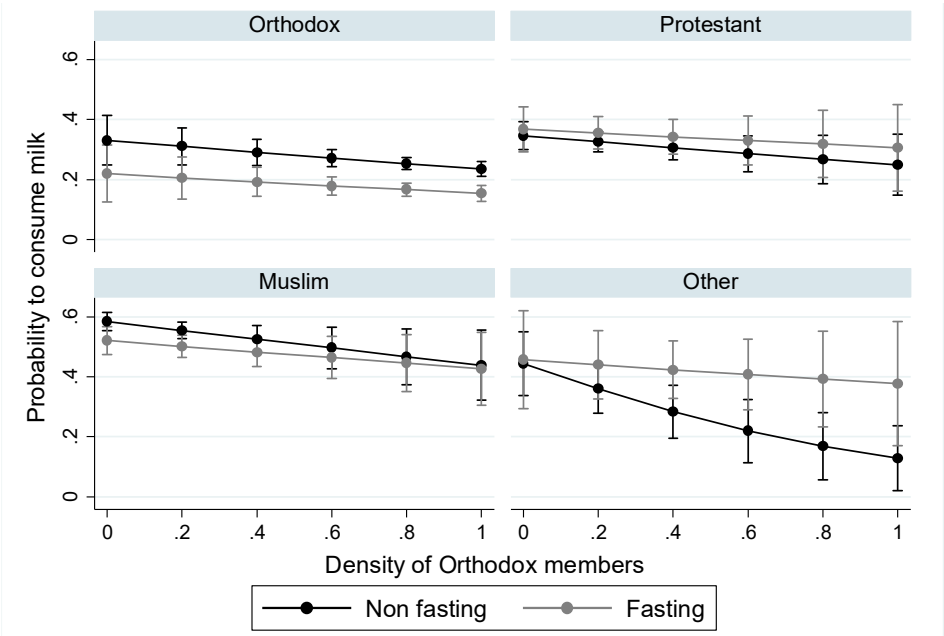

Figure A.1 Predicted probability to consume milk at household level evaluated at the mean of the other covariates for different religious groups and interview periods at different densities of Orthodox believers in an enumeration area

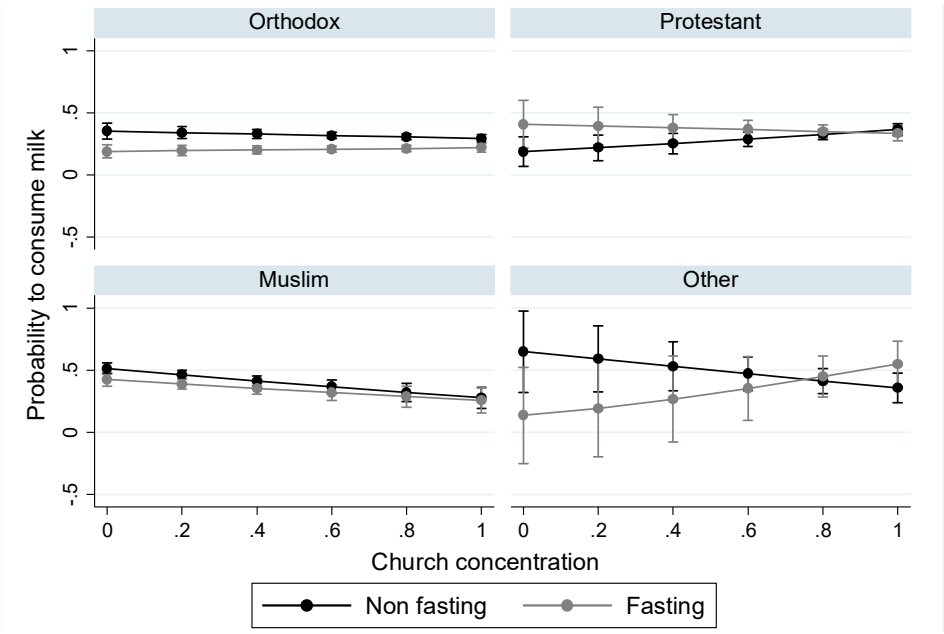

Figure A.2 Predicted probability to consume milk at household level evaluated at the mean of the other covariates for different religious groups and interview periods at different densities of churches in an enumeration area

Table A.5 Variables names, definitions and description statistics

Variable	Definition	Mean (SE)
Dependent variables		
Milk consumption	Dummy variable equal to 1 if a household consumed milk in the week prior to the interview; 0 otherwise	0.34 (0.01)
Consumed milk sourced from own production	Dummy variable equal to 1 if (part of) the milk consumed by the household originates from own production; 0 otherwise	0.55 (0.01)
Consumed milk sourced from purchase	Dummy variable equal to 1 if (part of) the milk consumed by the household is sourced through purchase; 0 otherwise	0.40 (0.01)
Independent variables		
Religion	Nominal variable equal to 1 if the religious affiliation of the household head is Orthodox, 2 for Protestant, 3 for Muslim, and 4 for other religious affiliations (e.g. Catholic, Pegan, Wakifata and traditional faiths); we assumed that the religious affiliation of the household head corresponds to the prevailing religious orientation within a family.	
	Proportion Orthodox households	0.50 (0.01)
	Proportion Protestant households	0.18 (0.01)
	Proportion Muslim households	0.29 (0.01)
	Proportion Other households	0.03 (0.00)
Interview period	As we have no information on whether or not a household participated in the Lent fasting, we matched the one week period of consumption data with the Lent period. This resulted in a dummy variable equal to 0 if records reflect consumption during nonfasting days, and 1 if (part of) the records were collected during fasting days.	0.34 (0.01)
EA Orthodox concentration	Continuous variable (ranging from 0 to 1) representing the share of Orthodox households relative to the other religions at enumeration area-level; this variable was calculated by dividing the number of interviewed Orthodox members by the total number of religious members (irrespective of religious affiliation), accounting for household size.	0.50 (0.01)

EA church concentration	Continuous variable (ranging from 0 to 1) representing the share of churches relative to the total number of churches and mosques at enumeration area-level	0.61 (0.01)
Household controls		
Sex head	Dummy variable equal to 1 if household head is male; 0 otherwise	0.70 (0.01)
Age head	Continuous variable reflecting the age of the household head (years)	44.15 (0.22)
Marital status head	Dummy variable equal to 1 if household head is married (monogamous or polygamous); 0 otherwise	0.68 (0.01)
Educational background head	Ordinal variable equal to 0 if household head is illiterate or received informal/non-regular education (e.g. Kuran education); 1 if household attended primary education; 2 for secondary education; and 3 for college/university education	
	Proportion illiterate or informal education	0.53 (0.01)
	Proportion primary education	0.28 (0.01)
	Proportion secondary education	0.14 (0.00)
	Proportion college/university education	0.06 (0.00)
Number of young children	Continuous variable representing the number of household members less or equal to 6 years old	0.88 (0.01)
Number of children	Continuous variable representing the number of household members between 7 and 9 years old	0.45 (0.01)
Number of elderly	Continuous variable representing the number of household members greater or equal to 65 years old	0.18 (0.01)
Number of remaining members	Continuous variable representing the number of household members greater than 9 years and less or equal to 64 years old	3.31 (0.03)
Milk cow herd size	Continuous variable representing the number of female cows owned by the household and that gave milk during the past 12 months prior to the interview	0.38 (0.01)
Milk goat herd size	Continuous variable representing the number of female goats owned by the household and that gave milk during the past 12 months prior to the interview	0.20 (0.02)

Logarithm of income	Continuous variable representing the logarithm of the nominal weekly consumption of a household. It is used to proxy a household's living standard. The variable is included in the LSMS dataset and is calculated based on the consumption from three sources: food, nonfood purchases, and education expenses (Birr/week)	5.82 (0.01)
Credit	Dummy variable equal to 1 if someone within the household borrowed on credit during the past year prior to the interview; 0 otherwise	0.25 (0.01)
Location controls		
Location	Nominal variable equal to 0 if a household resides in a rural area,1 for urban small town area, and 2 for urban large town area	
	Proportion rural	0.63 (0.01)
	Proportion small town (urban)	0.09 (0.00)
	Proportion large town (urban)	0.28 (0.01)
Region	Nominal variable representing the regional state where the household resides	
	Proportion Tigray	0.12 (0.00)
	Proportion Afar	0.03 (0.00)
	Proportion Amhara	0.20 (0.01)
	Proportion Oromia	0.20 (0.01)
	Proportion Somali	0.06 (0.00)
	Proportion Benshagul Gumuz	0.02 (0.00)
	Proportion SNNP	0.23 (0.01)
	Proportion Gambelia	0.02 (0.00)
	Proportion Harari	0.03 (0.00)
	Proportion Addis Ababa	0.06 (0.00)
	Proportion Diredwa	0.04 (0.00)

Milk price	Continuous variable representing the prevailing milk price for a household. The variable was calculated using the approach adopted by LSMS. First, prices were calculated for those families that had purchased milk (amount paid/amount purchased). Then the price was set as the median price at the lowest geographical unit for which there were at least 10 price observations (Birr)	12.03 (0.03)
Distance to the nearest market	Continuous variable representing the distance of a household to the nearest market (in kilometers)	54.05 (0.70)