Does Religion Affect Economic Decisions? Evidence from Ramadan Loans

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Abstract

We examine the effect of religious behavior on decision-making in the context of Ramadan, an entire lunar month of daily fasting from dawn to sunset and increased spiritual reflection in the Muslim faith. Using an administrative data set of all personal and business bank loans originated in Turkey during 2003-2013, we find that small business loans originated during Ramadan are about 10 to 15 percent more likely to become delinquent within two years of origination than loans originated outside of Ramadan. Despite their worse performance, Ramadan loans have lower credit spreads than non-Ramadan loans at origination. Consistent with Ramadan-induced judgment errors committed by individual loan officers, we find no relation between origination in Ramadan and the performance of personal loans which are mostly automated, and large business loans where approval decisions are made by credit committees. Loans granted by banks whose loan officers are more likely to observe the Ramadan perform worse, and so do loans originated on hot Ramadan days when adverse physiological effects of fasting are greatest, and loans that resemble charitable lending involving financially weak borrowers and financially strong lenders. Our identification strategy addresses alternative explanations including seasonality and changing borrower and loan characteristics during Ramadan.

JEL classification: G02; G21; Z12.

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1. Introduction

Exploring the role of religion in economic life, several recent studies uncover a negative relation between religious behavior and economic growth and development across countries (Barro and McCleary, 2003; McCleary and Barro, 2006). Besides institutional explanations, which tend to be persistent and difficult to study empirically at the country level, one broad class of alternative explanations involves religious practices that affect decisions made as well as effort supplied in the economic sphere by believers. The primary contribution of this paper is to provide causal evidence of judgment errors induced by a religious practice using rich micro-level data specifically and a decision-making channel connecting religion and economic performance generally.

Given the prominent status of religion as one of the defining features of culture and hence individual attitudes toward economic exchange (Guiso, Sapienza, and Zingales, 2003, 2006), religious behaviors and practices represent opportunities to be studied as determinants of economic performance. In addition, understanding the mechanisms through which religious behaviors and practices affect performance is important from a practical perspective for the design of rules and regulations that can productively harness religion's profound influence over society. However, developing knowledge at a causal level is fraught with identification challenges. First, economic performance can affect religiosity. Second, unobserved factors can drive economic performance and religiosity simultaneously. The empirical design that we adopt in this paper deals effectively with these identification challenges.

Our empirical setting is Turkey's banking industry where we study credit decisions made by local loan officers during the month of Ramadan. It is commonplace among Turks, who are predominantly Muslim, to fast without eating and drinking from dawn to sunset for the entire month. Fasting is one of the Five Pillars of Islam, and with reasonable medical exceptions, it is obligatory for believers after adolescence. The experience is believed to strengthen self-control against bad temptations, to develop empathy with those in need, and to intensify closeness to God through adherence to a difficult divine commandment. In addition, Ramadan is a time of charitable giving with most Muslims choosing to pay their annual charity tax (*zakat*, another Pillar of Islam) during the month. Survey evidence indicates that more than two-thirds of

adults in Turkey fast during Ramadan.

The data set for the paper is administrative and covers the universe of bank loans during the period 2003-2013. With extensive information including loan characteristics, borrower and bank branch identifiers, and subsequent default outcomes, we can cleanly estimate the magnitude of judgment errors made at the time of loan origination. With additional data on the type of bank (participation[1] bank versus conventional bank) as well as daily temperatures, we can test for the treatment intensity of Ramadan fasting. Because the Islamic calendar is lunar and the month of Ramadan moves earlier in the Gregorian calendar by about eleven days every year, we can also control for seasonal effects.

A further advantage of our empirical setting is that we can conduct a number of placebo tests for the possibility of an unspecified general Ramadan effect. These tests have the ability to falsify any spurious link from Ramadan fasting to loan officer judgment errors because certain types of loans do not involve much loan officer judgment due to automation. In particular, personal loans such as auto loans and residential mortgage loans are highly automated and granted based on credit scoring models. In contrast, commercial lending decisions rely critically on the judgment of loan officers because most small-sized businesses in the country do not have reliable financial statements, and most business borrowers have undocumented assets and sources of income. Also, differently from small business loan applications that are evaluated by individual loan officers at local branches, medium and large business loan applications tend to be evaluated by credit committees at regional offices or headquarters. This variation in the loan evaluation process allows us to test whether and to what extent committees mitigate individual judgment errors (Sah and Stiglitz, 1986).

Our main finding is that small business loans originated in the month of Ramadan are more likely to default in the next two calendar years than loans originated in other lunar months. With elevated levels of default ranging from 20 to 35 basis points in different specifications, the Ramadan effect is economically significant – the estimates represent about 10 to 15 percent of the mean rate of default on small business loans. The estimates also appear

[1]Participation banks are banks that follow the Sharia (Islamic law) principles in their transactions. These banks are commonly known as Islamic banks in the literature. See Kuran (1995) for an excellent overview of the historical background for the principles involved in modern-day Islamic banking and the symbolism in structuring Sharia-compliant products and services that are similar to their Western counterparts.

to reflect judgment errors in credit decisions and not a fundamental change in borrower and loan characteristics during Ramadan because we continue to find a significant Ramadan effect after controlling for an extensive set of default-relevant fundamental borrower and loan characteristics such as internal risk ratings, credit spreads, and collateral ratios as well as year, month, bank-branch, and borrower fixed effects. In addition, Ramadan loans default earlier than non-Ramadan loans, consistent with worsening credit decisions at origination during Ramadan.

Our cross-sectional tests point to a significant negative effect of Ramadan fasting on the quality of lending decisions. First, we find that the Ramadan effect is stronger where the loan officer is more likely to be fasting: in participation banks as opposed to conventional banks. Second, we find that the Ramadan effect is stronger for loans originated on more challenging fasting days such as hot and summer Ramadan days. Third, we find that the Ramadan effect is stronger for loans granted by financially strong lenders to financially weak borrowers, pointing to the presence of what one might call "charitable" or "spiritual" motives in some loan decisions during Ramadan. Fourth, we do not find a Ramadan effect for personal loans that do not involve much loan officer judgment due to automation. Finally, we find no Ramadan effect for large business loans, suggesting that decision-making by committees can effectively mitigate individual judgment errors.

We acknowledge that despite extensive controls for default-relevant borrower and loan characteristics in our empirical specifications, it is possible that the pool of loan applicants in Ramadan is different in a specific time-varying unobservable way that we cannot control for with borrower fixed effects. However, it is unlikely that such a difference can explain the diverse collection of cross-sectional and placebo findings summarized above. In addition, despite the higher default rates, Ramadan loans have lower credit spreads than non-Ramadan loans, a fact that further reinforces the interpretation that the main Ramadan effect reflects loan officer judgment errors. For instance, even if one were to argue that the main Ramadan effect does not reflect an error in risk assessment, then it must reflect an error in pricing given the default evidence. We note that in describing our various findings as errors in loan officer judgment, our perspective is purely an economic one and not whether the mistakes made by loan officers are conscious or unconscious mistakes – although one could argue that some

of our findings more likely reflect unconscious mistakes whereas others more likely reflect conscious mistakes.

A large body of scholarship in management, economics and finance examines factors that affect managerial decision-making under uncertainty to understand behavior at the individual and organizational levels. Our paper follows the tradition established by McNamara and Bromiley (1997) to focus on the credit decisions of loan officers. The advantage of focusing on credit decisions is that one can observe a standard day-to-day managerial decision, factors that go into the decision (fundamental default-relevant characteristics of the loan), and ex-post outcome (default or no default), making it possible to identify judgment errors. For example, McNamara and Bromiley (1997) find that a simple statistical model based on borrower characteristics better predict the performance of loans than do the assessments of loan officers, reflecting inconsistencies in credit decisions and confirming the view that "man as an intuitive statistician" is liable to incur significant judgment errors in processing information (Peterson and Beach, 1967). More recently, Cortés, Duchin, and Sosyura (2016) provide evidence that loan officer judgment errors in residential mortgage lending decisions arise in part from variation in the psychological state of loan officers based on fluctuations in local sunshine. Fisman, Paravisini, and Vig (2017) find that cultural proximity between loan officers and borrowers mitigates information frictions and improves loan outcomes. Nevertheless, as previous authors have also noted, the disadvantage of focusing on credit decisions made by loan officers is that those decisions may not be representative of the general population of managerial decisions.

Our paper is also related to the social psychology literature on decision fatigue, the finding that individuals become less effective at self-control as they perform more self-control tasks (Muraven, Tice, and Baumeister, 1998). Based on lab experiments, an intriguing explanation involves blood glucose as a limited energy resource that is depleted with repeated attempts at self-control (Gailliot, Baumeister, DeWall, Maner, Plant, Tice, Brewer, and Schmeichel, 2007; Gailliot and Baumeister, 2007). Neuro-imaging studies further support the role of blood glucose (Heatherton and Wagner, 2011). In a setting with experienced professionals, Danziger, Levav, and Avnaim-Pesso (2011) find that parole decisions of Israeli judges are markedly different around their daily food breaks with the probability of a favorable parole decision

gradually falling in each decision session. While it is tempting to draw parallels to fasting loan officers, we lack data on the sequence of loan decisions made on any given day. Our data does not include information on denied loan applications either.

Our paper also contributes to the literature on nutrition and economic activity. Foster and Rosenzweig (1994) find that daily calorie intake is positively associated with workers' effort, productivity, and wages, especially where employment contracts are incentive compatible (see also Strauss (1986); Strauss and Thomas (1998)). Foster (1995) provides further evidence that instead of giving workers incentives to increase calorie consumption by offering them sharecropping type of contracts, employers in their sample prefer to serve meals on the job site and thereby reduce the cost of monitoring calorie intake. More generally, Fogel (2004) argues that one of the principal sources of long-term growth in labor productivity over the past two centuries has been the increase in availability of calories per capita or what he terms *physiological capital*. These findings appear consistent with the evidence in the biomedical literature that calorie intake is associated with increases in maximum oxygen uptake (Spurr, 1983, 1988), which increases an individual's ability to work and produce. However, an important difficulty in identifying the causal impact of nutrition on economic outcomes is systematic errors in measurement of calorie intake, which might bias estimated effects of nutrition on productivity and wages (Strauss and Thomas, 1998). We think researchers in this literature can exploit the exogenous shock to calorie intake during daytime in Ramadan to reduce measurement error, similar to Schofield (2014) who uses Ramadan-crop-district variation over time along with uneven spatial distribution of Muslims to study the effect of calorie intake on agricultural productivity in India.

Finally, as shown by Campante and Yanagizawa-Drott (2016), longer Ramadan fasting leads to lower output growth in Muslim countries. While slow growth in Ramadan may in part be explained by reduced work hours in most Muslim countries, it may also arise in part from managerial judgment errors. Our work represents a first step toward recognizing the presence of a decision-making channel using micro-level data. In that respect, our paper is part of a reinvigorated literature on the economics of religion (Iannaccone, 1998; Iyers, 2016), and contributes to the line of research investigating the consequences of religion.

Ramadan observance and its effects on a wider set of corporate decisions likely go unno-

ticed in societies where Muslims are a small minority. However, lack of awareness can be to the detriment of those societies. According to the Pew Research Center, there were 1.6 billion Muslims in the world as of 2010 (about 23 percent of the world population) and roughly 93 percent of surveyed Muslim adults indicated that they fast during Ramadan.[2] This suggests that increases in managerial judgment errors during Ramadan might produce significant real effects worldwide, directly in countries with large Muslim populations and indirectly in other countries through international trade and investment.

The rest of this paper is organized as follows. In Section 2, we provide some background on Ramadan observance. Section 3 presents the data and summary statistics. We discuss our empirical results in Section 4 and provide concluding remarks in Section 5.

2. Background

Ramadan is the ninth month of the Islamic lunar calendar and the month of obligatory fasting (*sawm*) for Muslims. Fasting in Ramadan is one of the Five Pillars of Islam and requires abstinence from food, drinks, tobacco, and sexual activity from dawn to sunset for 29 or 30 days, depending on the length of the lunar month. Pre-pubertal children, pregnant women, women during menstruation or post-childbirth confinement and lactation, travelers of long distances, and people with physical or mental illnesses are exempt from Ramadan fasting. Islamic fasting is intermittent, in the sense that there are no calorie restrictions from sunset to dawn.

The daily routine of Ramadan involves a pre-dawn breakfast (*suhoor*), a fast-breaking meal at sunset (*iftar*), and a supererogatory late night prayer which is often performed with the congregation (*taraweeh*). Figure 1 provides an illustration of daily schedule during Ramadan.

[Fig. 1 about here.]

Muslims increase "spiritual" activities such as praying, recitation of the Quran, and donations to charities during Ramadan (see, e.g., Afifi (1997)). Moreover, most Muslims pay their

[2] Pew Research Center's Forum on Religion & Public Life, *The Future of the Global Muslim Population*, 2011, and *The World's Muslims: Unity and Diversity*, 2012.

annual charity tax (*zakat*) during Ramadan—*zakat* is one of the Five Pillars of Islam, just like *sawm*; it amounts to 2.5% of accumulated wealth and can be paid year-round. At the end of Ramadan, Muslims celebrate the three-day Eid al-Fitr or the Festival of Fast-Breaking, an official holiday in all Muslim-majority countries.

According to a survey conducted by the Pew Research Center in 2012, 97% of Turks identify themselves as Muslims and 87% of the Muslims say they fast during Ramadan.[3] The Religious Life Survey conducted in 2014 by the Turkish Statistical Institute on behalf of the Presidency of Religious Affairs finds a similar propensity of Ramadan fasting (82%) based on interviews with 37,624 households. However, Ramadan observance appears to be less common among Turkish professionals. For example, using a representative sample of 12,000 professionals surveyed during 2006-2011, Barem Research estimates that only 67% of Muslim professionals in Turkey observe the Ramadan.

Medical studies provide evidence that Ramadan fasting is associated with moderate increases in dehydration, headache, sleep deprivation, physical exhaustion, and stress-related irritability but no serious health problems (see the references in Leiper and Molla (2003)). These adverse physiological effects of fasting appear to have implications for workplace productivity. For example, Afifi (1997) and Yucecan and Karaagaoglu (2000) find that fasting reduces motivation to work, concentration, alertness, and cognitive abilities. Also, according to a survey by Dinar Standard (*Productivity in Ramadan*, 2011), about a quarter of Muslim professionals self-report a significant reduction in their workplace productivity during Ramadan. Finally, Campante and Yanagizawa-Drott (2016) find that long Ramadan fasting has a negative effect on output growth in Muslim countries.[4] They attribute the decline in output growth to reduced work hours as well as reduced productivity during work hours.

Recognizing the adverse physiological effects of fasting, governments in Muslim-majority countries officially reduce work hours by one to three hours during Ramadan and adjust them to start and end earlier in the day.[5] Turkey is one of the few Muslim-majority countries where work hours are not officially adjusted during Ramadan.

[3] In the same survey, 67% of Turkish Muslims said religion is a very important part of their lives, 27% said they regularly perform all five obligatory daily prayers, and 72% said they pay the *zakat*.

[4] They also find that fasting during Ramadan improves the subjective well-being of Muslims.

[5] Dinar Standard, *Productivity in Ramadan*, 2011.

Fasting would arguably be more challenging when the time from dawn to sunset is longer (which might exacerbate the physiological effects of abstaining from food and drinks as well as leaving observers fewer hours for sleep) or at high temperatures (due, for example, to greater dehydration). Time-series variation in the length and temperature of Ramadan days at a given location largely arises from the fact that the Islamic calendar is lunar and the month of Ramadan moves earlier by about eleven days in the Gregorian calendar every year, rotating over the seasons in cycles of roughly 33 years. For example, in Istanbul, the largest city in Turkey, the time between dawn and sunset exhibits substantial variation across seasons: it is 11 hours and 3 minutes on December 21st (the shortest day of the year) and 17 hours and 26 minutes on June 21st (the longest day of the year). Also, according to the Turkish State Meteorological Service (TSMS), over the period 1950 through 2015, the average temperature in Istanbul was 8.0°C in December, substantially lower than the average temperature of 20.4°C in June. Similar seasonal variations in the length of day and local temperature is observed in all other cities. As a result, at a given location in Turkey, fasting would presumably be harder during summer Ramadans than in winter Ramadans.

Cross-sectional variation in the difficulty of fasting arises in part from differences in temperature across locations as well as latitude (the primary determinant of sunrise and sunset times at any given date). For example, according to TSMS, the difference between the average temperatures for the warmest and the coldest cities in Turkey is 15.1°C in June and 19.4°C in December, indicating the presence of substantial temperature differences across different cities at a given point in time. Also, the time from dawn to sunset is 34 to 64 minutes (depending of the time of the year) shorter in Hatay, the southernmost city of Turkey, than in Sinop, the northernmost city of Turkey. Overall, there are sizable cross-sectional differences across regions especially in terms of temperature and to a lesser extent in the length of day, which could generate cross-sectional differences in the difficulty of fasting.

Note that the propensity to observe the Ramadan could fall as the difficulty of fasting rises, and this would be especially true during summers. Indeed, survey evidence from Barem Research suggests that the percentage of professionals in Turkey who regularly fast during Ramadan falls from around 70% in autumn Ramadans to roughly 50% in summer Ramadans. Moreover, according to survey evidence from DORinsight Research Co., 44% of the surveyed

professionals who fasted irregularly or did not fast at all during the Ramadan of 2011 said they could not fast regularly due to hot weather.

3. Data

The data for this study are provided by the Central Bank of the Republic of Turkey (CBRT). Specifically, we use electronic files of quarterly bank loan reports for the period 2003-2013. These files cover all personal and business loans made by banks operating in Turkey. Each record in these files is made up of a borrower identifier, bank identifier, city of the branch that made the loan, type and purpose of the loan, origination date, maturity date, principal amount, currency denomination, annual interest rate, regulatory risk-weight of the loan, and regulatory risk classification of the borrower, and earliest date on which the loan is classified as non-performing if and when that occurs. For privacy purposes, all personal details about borrowers are masked. Using the available information in each quarterly bank loan report, we create loan identifiers and track loan performance over time. For loan performance, we use the date in a dedicated data column where banks report the earliest date on which they classify a loan as non-performing following 90+ days delinquency or when future contractual payments become suspect.

Our raw data set includes close to 100 million records.[6] Since our data come from quarterly reports of all outstanding loans, and since we are interested in loan information at loan origination, we drop observations about a loan after its first appearance in the data while retaining default information from later reports. We further drop non-cash loans, loans tied to the value of a precious metal, and loans with potentially erroneous entries, e.g., records with negative collateral values, stated time-to-maturity above ten years, missing loan maturities, etc. We also drop loans made by state-owned banks since credit decisions of those banks are possibly affected by motives other than profit maximization. Our final data set consists of 21,224,514 loans made by conventional and participation banks. Within this data set, most of our analyses are based on 16,125,401 small business loans that critically rely on loan officer

[6] In reporting information to the CBRT, banks are allowed to bundle loans below a certain size cutoff. The cutoff varies over time and across banks, but is never higher than 20,000 Turkish Liras. Personal loans (especially credit card loans) are substantially more likely to be bundled than business loans. Bundled loans have missing borrower identifiers and thus are dropped from our sample.

judgment. The remaining 5,099,113 loans, namely large business loans and personal loans, serve as placebos for loan officer judgment as discussed in the introduction.

We supplement the loan data in several different ways. First, we obtain from the website of the Presidency of Religious Affairs (PRA) an official record of Ramadan days in the Gregorian calendar because the dates in our loan data set are in the Gregorian convention. Second, to compare the quality of loan decisions made on Ramadan days with varying degrees of physiological stress on fasting loan officers, we obtain historical city-level daily temperatures from the Turkish State Meteorological Service (TSMS). Third, to examine the role of financial conditions in shaping the quality of loan decisions made in Ramadan, we obtain quarterly bank-level capital adequacy ratios from the Banking Regulation and Supervision Agency (BRSA). Finally, to calculate credit spreads, we obtain historical daily yields of Turkish Treasury securities from CBRT.

Table 1 provides summary statistics for the sample of small business loans, the focus of our analyses. Appendix A provides detailed definitions of the variables in the table. Small business loans are defined as loans with a principal amount of one million Turkish Liras or less (deflated to 2008 prices using the Consumer Price Index), roughly equivalent to $770,000 US Dollars when translated with the average daily exchange rate 1.30 TRY/USD in 2008.[7] In coming up with this definition for small business loans, we interviewed several bank managers to better understand the loan approval process at local bank branches. Most banks tend to automate the analysis of "hard" information about loan applicants, e.g., financial statements, collateral assets, credit histories, etc., with a resulting quantitative risk rating and suggested interest rate for each applicant. Armed with that information, local loan officers then have discretion to make lending decisions by adding their "soft" information. The total amount that local loan officers are allowed to lend to small businesses differs across banks, across branches of the same bank, and over time. Most local loan officers have a lending limit of one million Turkish Liras or less.

It is reassuring to see the main Ramadan effect in simple univariate summary statistics. The average default rate on loans originated in the month of Ramadan (2.68 percent) is 38 basis points higher than the average default rate on loans originated outside of Ra-

[7] Average daily exchange rate for 2008 is from CBRT's Electronic Data Delivery System.

madan (2.30 percent). The difference represents an economically significant 16 percent of the average default rate for the whole sample (2.33 percent). In addition, Ramadan loans have lower credit spreads than non-Ramadan loans at origination (4.38 percent for Ramadan loans compared to 4.85 percent for non-Ramadan loans). Again the difference represents an economically significant 10 percent of the average credit spread for the whole sample (4.81 percent). Ramadan and non-Ramadan loans have comparable internal risk ratings, regulatory risk weights, collateralization levels and maturities. The local temperature is substantially higher for Ramadan loans (29.77 degrees Celsius) than it is for non-Ramadan loans (19.78 degrees Celsius). This is because during our sample period from 2003-2013, Ramadan has moved back from November to July – July and August are the two warmest months in Turkey. Restricting the sample to loans originated on calendar days that featured Ramadan fasting at least once during the sample period results in similar differences in default rates between Ramadan and non-Ramadan loans. When testing whether the difficulty of Ramadan fasting has a causal effect on loan officer judgment errors, we control for month fixed effects and include the direct effect of temperature to isolate an interaction effect due to temperature during Ramadan. Finally, about 15% of the small business loans in our sample are originated by participation banks. This suggests a tilt toward small business loan origination by participation banks as their comparable balance sheet share of the banking industry (excluding state-owned banks) is smaller during the sample period.

[Table 1 about here.]

4. Empirical Results

4.1. Quality of small business loan decisions in Ramadan

We start by examining the quality of small business loan decisions in Ramadan for the reasons outlined in the introduction. First, the discretion of an individual loan officer is crucial in most small business loans where the credit decision is based more on "soft" qualitative information that the loan officer generates and less on "hard" quantifiable information about the borrower. This is in part because in Turkey, small businesses rarely have audited financial

statements and they tend to have undocumented assets and sources of income. Second, other types of loans such as personal loans and large business loans can be seen as placebos for loan officer judgment because those loans either involve little loan officer judgment due to significant automation or are approved by credit committees that have the potential to mitigate the judgment errors of individual loan officers.

Our approach is to compare the performance of small business loans originated during Ramadan to the performance of small business loans originated outside of Ramadan. As a measure of loan performance, we consider whether the loan becomes non-performing within two years after origination. The choice of two years is common in the recent banking literature, reflecting a trade off between measurement accuracy and construct validity. Using a default measure that spans the entire life of a loan is perhaps the most economically relevant measure. However, loan defaults long after origination naturally tend to capture macroeconomic and loan-specific shocks more so than loan officer judgment at origination, which is our main interest.

Equation 1 shows our baseline specification for loan performance:

$$Default_{i,t+\tau} = \alpha + \beta \times \mathbb{I}\left[t \in Ramadan\right] + \gamma \times Z_{i,t} + \kappa_t + \epsilon_{i,t} \tag{1}$$

The unit of observation is a unique loan i originated at calendar time t. $Default_{i,t+\tau}$ is an indicator variable that equals one if the loan becomes non-performing between the origination date t and a future time $t+\tau$ which we set to two years throughout the paper, $\mathbb{I}$ is an indicator function that equals one if the loan is originated during Ramadan, and $Z_{i,t}$ is a vector of default-relevant fundamental loan characteristics including interest rate, loan size, loan maturity, internal risk rating of the borrower, and regulatory risk weight of the loan at origination. β is the main coefficient estimate of interest, the effect of loan origination in Ramadan on subsequent loan performance.

A strong point of the empirical setting from an identification standpoint is that the Islamic calendar is lunar, which moves the start of Ramadan earlier in the Gregorian calendar by about eleven days every year. This allows us to rule out seasonal as well as macroeconomic effects in loan origination and default by including κ_t, a vector of month and year dummies.

In addition, we saturate most of our specifications with bank-branch fixed effects to address the possibility that time-invariant unobserved differences in loan officer skill or borrower characteristics across bank branches due to location may explain our results.

We estimate Equation 1 using a linear probability model since we have information that allows us to include a series of fixed effects for additional identification. Another advantage of the linear probability model is the straightforward interpretation of coefficient estimates. To allow for correlation of error terms across loans, we report robust standard errors that are heteroskedasticity-consistent and clustered at the bank-branch level.

[Table 2 about here.]

Table 2 reports the results for small business loans in six columns. In column 1, we find that small business loans approved during the month of Ramadan are more likely to default than similar loans approved in the rest of the year. Relative to the average default probability of 2.33 percentage points in our sample, the difference between Ramadan and non-Ramadan loans (34.6 basis points) represents a roughly 15 percent higher delinquency rate relative to the sample mean. The specification of this estimate controls for seasonal and other macroeconomic factors with calendar month and year fixed effects.

Although month and year fixed effects rule out the possibility that seasonal or macroeconomic factors drive the Ramadan origination effect in loan performance, it could be that Ramadan loans are high risk loans that are not necessarily the result of poor decision-making. For instance, the higher probability of default could be compensated with higher interest rates and loan collateralization. Higher interest rates would provide compensation in the absence of default, while higher collateral to loan value would provide higher recovery rates in the event of default.

In column 2, we control for an extensive set of default-relevant loan characteristics that are available in our data set. Specifically, we control for the purpose of the loan, annual interest rate, internal risk rating of the borrower, regulatory risk-weight of the loan, the ratio of collateral to principal, loan maturity, the natural logarithm of loan size, and foreign currency dummy. With this additional set of controls including loan pricing and collateralization, we still find that Ramadan loans are more likely to default than non-Ramadan loans by 20.7 basis

points. It follows that loan officers do not sufficiently adjust important characteristics of loan contracts to reflect the elevated default risk of Ramadan loans. It is also reassuring that the Ramadan effect is robust to the inclusion of endogenous loan contract terms whose inclusion could be problematic in terms of over- or under-controlling specifications when estimating treatment effects. The apparent robustness is perhaps unsurprising given the predetermined and varying nature of Ramadan in calendar time.

In column 3, we add branch fixed effects to account for any time-invariant differences in the loan approval process or loan officer skill across bank branches. These fixed effects also span time-invariant geographic differences. With the inclusion of this set of fixed effects, we are comparing loans originated in the same branch over time, and testing whether loans that are originated during Ramadan are more likely to default than loans originated outside of Ramadan. The estimated coefficient (0.253) implies that based on within-branch variation, Ramadan loans are about 11 percent more likely to default than non-Ramadan loans. This specification addresses the concern that the Ramadan effect is a composition effect by which branches that approve more risky loans increase their market share during Ramadan.

In columns 4 and 5, we further control for branch$\times$month fixed effects and borrower fixed effects, respectively. These additional sets of fixed effects also address potential concerns about composition. In column 4, we find that within the same calendar month and bank branch, loans that are approved in the part of the calendar month that coincides with Ramadan have higher default rates than loans approved in the rest of the calendar month that does not coincide with Ramadan. In column 5, the Ramadan effect remains statistically significant with borrower fixed effects controlling for any unobserved time-invariant differences across borrowers. The estimates in columns 4 and 5 are comparable to those in columns 1-3.

Finally, not every calendar day over our sample period 2003-2013 features Ramadan fasting. For example, Ramadan did not take place during the month of January between 2003 and 2013. In column 6, we report the same specification as in column 4, but restrict the sample to loans originated on calendar days that featured Ramadan fasting at least once during our sample period. While this reduces the sample size from more than 16 million observations to less than 6 million, the Ramadan coefficient remains highly statistically significant, and the

magnitude is comparable to its counterpart in column 4.[8]

In unreported analyses, we define a dummy variable for early default that equals one if the borrower defaults within the first six months after loan origination, and zero otherwise. In univariate tests, we find that conditional on default, the incidence of early default is about 25 percent for Ramadan loans and 20 percent for non-Ramadan loans. The difference is statistically significant at the 1% level. In multivariate specifications similar to our default models but conditioned on default, we find that the likelihood of an early default is 1.4 percent higher for Ramadan loans than it is for non-Ramadan loans. Again, the difference is statistically significant at the 1% level. Overall, the evidence suggests that Ramadan loans have not only a greater likelihood of default but also a higher incidence of early default, consistent with worsening credit decisions of loan officers at origination during Ramadan.

4.2. Loan officer judgment

In Turkey, the approval and pricing of personal loans such as auto loans and residential mortgage loans are largely automated through credit scoring models, in part to remove costly errors in loan officer judgment. In particular, for auto loans and mortgage loans, the approval decision is based on the credit score of the loan applicant (available to banks from the Credit Registry Bureau), monthly documented income of the applicant (the ratio of monthly credit payments to monthly income is generally capped by banks at 50% or 60%), age of the applicant (maximum 65 or 70 years), age of the collateral asset being funded (maximum ten years for most structures and five to ten years for used cars), and presence of a co-signer (in the case of used cars). Also, loan rates vary with the applicant's choice of loan amount and maturity. Thus, we would expect Ramadan to have little or no effect on the quality of credit decisions involving personal loans. Similarly, we use medium and large business loans as placebos for loan officer judgment because such loans are typically approved by credit committees and not individual loan officers.

[8]Using the estimates from Table 2, a ballpark estimate for the total cost of Ramadan-induced loan officer judgment errors in our sample from 2003-2013 roughly works out to 78 million Turkish Liras in 2008 prices (or $60 million US Dollars when translated with the average daily exchange rate of 1.30 TRY/USD in 2008). To arrive at this estimate, we multiply (i) the aggregate size of small business loans originated in Ramadan (38.3 billion Turkish Liras in 2008 prices), (ii) the incremental effect of Ramadan-induced loan officer judgment errors on default rates (0.25 percent), and (iii) a loss-given-default rate estimate for secured small business loans in Turkey (81.5 percent in present value according to *Doing Business*, a series of annual reports from the World Bank).

Table 3 presents regression results by type of loan: medium business loans (column 1), large business loans (column 2), mortgage loans (column 3) and auto loans (column 4). There are some differences in sample size across the columns. The number of large business loans is lower than the number of medium business loans as one would expect. The number of auto loans is lower than the number of mortgage loans due to the reporting procedure that allows banks to bundle loans below a certain size cutoff. As a result, our sample only includes relatively large auto loans.

[Table 3 about here.]

As opposed to our findings for small business loans, we find no Ramadan effect on the quality of loan decisions when loan officers have lower discretion, either because the loan decision is more likely made by a credit committee at a regional office or higher, as in the case of medium and large business loans (corresponding specifications in columns 1 and 2), or because the loan approval process is largely automated to remove loan officer judgment, as in the case of personal mortgage and auto loans (corresponding specifications in columns 3 and 4). These placebo findings further strengthen the inference that the Ramadan effect reflects errors in loan officer judgment during Ramadan.

4.3. Loan price and risk

Our main finding so far is that small business loans originated during Ramadan are more likely to become delinquent over the next two years than small business loans originated outside of Ramadan. In our specifications, we include an extensive set of default-relevant fundamental loan characteristics $Z_{i,t}$ as control variables to address concerns about an omitted variable bias due to uncontrolled loan risk. Critically, we control for the interest rate and collateral amount of the loan at origination, two important ex-ante measures of loan risk.

The analysis in this subsection takes seriously the possibility that our linear controls for loan risk may be noisy. Our approach to address this possibility is to examine loan risk as reflected in the interest rate and collateralization of the loan at origination, in the same way we examine loan performance using Equation 1.

[Table 4 about here.]

Table 4 reports the results in six columns. In columns 1 and 2, we focus on the credit spread. Because there could be noise in the data, we eliminate foreign currency denominated loans as well as loans for which the credit spread over the maturity-matched Turkish Treasury security is non-positive. The coefficient estimate on Ramadan is negative in both columns, indicating that small business loans originated during Ramadan are priced as less risky, not more. The coefficient estimates on Ramadan (-0.339 in column 1 and -0.316 in column 2) imply that Ramadan loans have 7 percent lower credit spreads than non-Ramadan loans at origination.

In columns 3 to 6, we examine whether loans originated during Ramadan have lower expected default losses than loans originated outside of Ramadan, by comparing the collateralization levels of the two groups of loans. We use a continuous collateralization measure (i.e., collateral-to-loan ratio) in columns 3 and 4, and a binary measure indicating whether the loan is secured (i.e., collateral amount greater than zero) in columns 5 and 6. Overall, we find a statistically significant but economically small difference between the average collateralization levels of Ramadan and non-Ramadan loans. Specifically, the collateral-to-loan ratio is higher for Ramadan loans than it is for non-Ramadan loans, but the difference is 1.4% without controls for borrower and loan characteristics in column 3, and 1.3% with the full set of controls in column 4. Similarly, in columns 5 and 6, we find that the fraction of secured loans increases, but by less than 1% during Ramadan. With loss-given-default estimates for secured commercial loans in Turkey above 80% according to the World Bank, these findings imply economic magnitudes that are simply far short of the amount of additional collateral required to provide break-even protection against the increased default risk of Ramadan loans.

We view the evidence on small business loans, namely lower credit spreads at the time of origination (indicating lower credit risk) and similar levels of collateralization in Table 4, and higher default rates in Table 2, as conclusively pointing to a decline in the quality of loan officer decisions during Ramadan. The rest of our analyses shed light on the nature of that decline. Unless expressly stated otherwise, our analyses are based on the sample of small business loans for which loan officer discretion matters. We economize on expression and refer to small business loans simply as loans.

4.4. Role of religion

4.4.1. Loan officer religiosity

The decline in the quality of credit decisions during Ramadan offers an opportunity to study the role that religion and religious practices play in the economic sphere. If Ramadan observance explains the increase in poor credit decisions during Ramadan, we would expect to find a stronger Ramadan effect in the sub-sample of loans made by loan officers who are more likely to observe the Ramadan.

[Table 5 about here.]

To test this hypothesis in Table 5, we rely on the assumption that loan officers employed by non-conventional participation banks, commonly known as Islamic banks, are more likely to observe the Ramadan than loan officers employed by conventional banks either due to self-selection (more religious loan officers choosing to work for participation banks or participation banks hiring more religious loan officers) or peer pressure. This assumption is supported by ample casual empiricism.

Table 5 reports the results. Participation bank is a dummy variable that takes on the value of one if the loan is granted by a participation bank and zero otherwise. The coefficient estimate on the interaction term between Ramadan and participation bank is positive and statistically significant, indicating that the Ramadan effect is larger for participation banks than it is for conventional banks. Relative to the average Ramadan effect of 0.253 for both types of banks (column 3 of of Table 2), the interaction coefficient 0.173 is also economically significant.

4.4.2. Role of fasting

As discussed in Section 2, there are at least two non-mutually exclusive channels through which Ramadan observance could impact loan officers' credit decisions. First, loan officers could make judgment errors due to adverse physiological effects of fasting. Second, heightened state of spirituality during Ramadan could lead loan officers to use discretion in loan approval to benefit fellow Muslims by making what one might call "charitable" loans.

To identify the physiological impact of fasting on credit decisions, we examine whether the Ramadan effect is greater on physiologically more taxing fasting days. In particular, we expect summer Ramadans with longer hours between dawn and sunset as well as higher temperatures to induce more loan officer mistakes than non-summer Ramadans by exacerbating the adverse physiological effects of fasting: abstaining from eating and drinking during a long and hot day, and having fewer hours to sleep after traditional festivities and prayers at night. However, one caveat is that any increase in the difficulty of fasting during summer months could be offset by reduced propensity to fast and/or exert productive effort at work as discussed previously (also see Campante and Yanagizawa-Drott (2016)). To proxy for the difficulty of fasting, we use the average local temperature over a three-day period ending on the day of loan origination to capture the conditions experienced during loan processing. We also use a dummy variable that equals one if the day of loan origination is in June, July or August, and zero otherwise.

[Table 6 about here.]

Table 6 presents the results. In column 1, the interaction term between Ramadan and local temperature is positive and statistically significant, indicating that the Ramadan effect is indeed stronger for loans originated on warmer Ramadan days.[9] Consistent with an adverse physiological impact, a one additional degree in the Celsius scale on a Ramadan day leads to a 1 basis point increase in the probability of loan default within two years. The interaction effect is large enough to eliminate the direct Ramadan effect. In column 3, the interaction term between Ramadan and the summer dummy is also positive and statistically significant. At 8 basis points, the interaction term accounts for about one third of the direct Ramadan effect.

[Table 7 about here.]

In addition to making worse credit decisions, loan officers may also exert lower effort on physiologically more taxing fasting days, another channel through which fasting may affect

[9]The number of observations is lower due to missing temperature data for slightly more than 50% of the branch-days before 2008, about 40% of the branch-days in 2009, and less than 5% of the branch-days during 2010-2013.

credit decisions. Table 7 provides evidence on this effort channel, examining how loan origination activity at the branch level varies with the difficulty of fasting. The dependent variable is defined as one plus the natural logarithm of total number of loans originated at a bank branch location on a given day. This variable, which covers the nearly 29 million branch-days in our sample has a mean of 0.30 and a standard deviation of 0.57. Proxies for fasting difficulty are the same as those in Table 6, local temperature and summer dummy.

In column 1, we examine whether loan volume increases during Ramadan and find an economically small, 0.5%, increase. In column 2, consistent with loan officers responding to the increased difficulty of fasting during hot Ramadan days by reducing the quantity of loans that they approve, the interaction term between Ramadan and local temperature is negative and statistically significant. A one degree Celsius increase in temperature results in a 0.2% decrease in branch-level daily loan volume. Similarly in column 3, the interaction term is negative and statistically significant. Daily loan volume is about 4.4% lower on summer Ramadan days than it is on non-summer Ramadan days.

In principle, the reduction in loan origination volume on hot and summer Ramadan days could improve the performance of approved loans. If loan officers process fewer loan applications during those days, they could dedicate more time to each application and that in turn could help reduce potential judgment errors. We test this possibility with a triple interaction term involving Ramadan, fasting difficulty and branch-level loan origination volume in columns 2 and 4 of Table 6. The coefficient estimate on the triple interaction is positive and statistically significant in both columns, implying that when loan officers do not slow down during physiologically taxing Ramadan days, their credit screening performance suffers as measured by default of approved loans within two years.

Overall, the results in this subsection suggest that adverse physiological effects of fasting is a critical source of loan officer judgment errors during Ramadan.

4.4.3. Charitable lending

As discussed in Section 2, most practicing Muslims make donations to charities and pay their obligatory annual charity tax (*zakat*) during Ramadan. It is possible that these and other practices during Ramadan temporarily influence loan officers' beliefs and values that deter-

mine their credit decisions.[10] In particular, in Ramadan, loan officers could have a higher propensity to approve "charitable" loans to financially weak borrowers, especially when the bank is sufficiently strong financially to tolerate such loans (see Campante and Yanagizawa-Drott (2016) for a similar argument). If charitable loans increase during Ramadan, we would expect the Ramadan effect to be concentrated among loans involving financially weak borrowers and their financially strong lenders. Conversely, if charitable loans do not increase during Ramadan, the Ramadan effect would be homogeneous across different types of borrowers and lenders.

[Table 8 about here.]

The results in Table 8 are broadly consistent with presence of charitable lending during Ramadan. In column 1, the interaction term between Ramadan and borrower risk rating is positive and statistically significant, consistent with the Ramadan effect being more concentrated among loans to financially weaker borrowers. A loan extended in Ramadan to a borrower with a one point higher internal risk rating has a 45 basis point greater probability of default within two years. Though not tabulated, we find that the effect of Ramadan on default is greatest for borrowers with the highest risk rating of 5. Similarly, the interaction term in column 2 suggests that loans extended in Ramadan to financially weaker borrowers subsequently perform worse – a loan extended in Ramadan to a borrower without any collateral as compared to a borrower with full collateral has a 13 basis point greater probability of default within two years. In column 3, the interaction term between Ramadan and old client indicator is positive and statistically significant, suggesting that bank lending during Ramadan involves some degree of loan officer support to undeserving old clients (Drexler and Schoar, 2014). The estimates imply that the presence of a prior relationship reduces default risk by an economically significant 106 basis points in general, but that advantage is eroded by 21 basis points for Ramadan loans, consistent with some charitable lending to old clients during Ramadan.

Based on lender financial strength, the evidence is also consistent with the presence of

[10] On the borrower side, Baele, Farooq, and Ongena (2014) use an administrative data set of outstanding business loans in Pakistan in the period 2006-2008 and find that borrowers of Islamic loans are less likely to default, and even less so during Ramadan.

charitable lending during Ramadan. In column 4, the interaction term between Ramadan and the lending bank's capital adequacy ratio is positive and statistically significant. The coefficient estimate implies that a loan extended in Ramadan by a bank with a one percentage point higher capital adequacy ratio has a 17 basis point greater probability of default within two years. To check whether this result is driven by Islamic banks that could operate with high capital adequacy ratios (Beck, Demirg-Kunt, and Merrouche, 2013), we restrict the sample to loans originated by conventional banks in column 5. The interaction terms remains positive and statistically significant.

Since loan officer intent is unobservable, the evidence on the charitable lending channel is necessarily indirect. For instance, an alternative explanation is that loan applications from financially weaker borrowers are cognitively harder to assess, especially in Ramadan when loan officers fast and their cognitive faculties are weakened. Then a relatively larger Ramadan effect for loans involving financially weaker borrowers would reflect unconscious loan officer mistakes, and not conscious charitable lending. Nevertheless, the evidence on lender financial strength is harder to explain as anything other than charitable lending unless for some reason loan officers at financially stronger banks are more likely to fast during Ramadan.

4.5. Robustness

Before concluding the paper, in Table 9 we address a collection of issues that are best described as robustness.

There are two major religious holidays in Islam: Eid Al-Fitr, celebrated at the end of Ramadan (ninth month of the lunar calendar), and Eid Al-Adha, celebrated on the tenth day of Dhu Hijjah (twelfth month of the lunar calendar) during which as a symbol of Abraham's willingness to sacrifice his son, Muslims sacrifice a sheep, ram, goat, cow or camel depending on the region and the sacrificing individual's financial means. We examine whether the quality of credit decisions worsens before Eid Al-Adha, as it does before Eid Al-Fitr, to determine whether the Ramadan effect, rather than reflecting Ramadan observance, instead reflects general changes in credit decisions that occur before major religious holidays.

[Table 9 about here.]

In column 1, we present results from a specification where the performance of loans originated in the month before the *Eid al-Adha* is compared to the performance of loans originated in the remainder of the year. Controlling for the full set of borrower and loan characteristics together with month, year, loan purpose, and branch fixed effects, we find no significant effect of *Eid al-Adha* on loan performance, inconsistent with the hypothesis that the Ramadan effect is a general religious holiday effect.

In column 2, we split the month of Ramadan into three sub-periods: the first 10 days, the middle 10 days and the last 10 days of Ramadan. We find that loans approved in all three sub-periods of Ramadan are more likely to default than loans originated outside of Ramadan. This specification speaks to perhaps the most common type of reaction from readers who predict from either personal experience or casual intuition that the Ramadan effect should be strongest at the beginning or end of Ramadan, or peak somewhere in the middle. With many of the ideas having implications that are sometimes similar and sometimes working against each other, and without obvious proxies for them in our data set, it seems difficult to draw any strong conclusions.

In column 3, we implement a lower loan size cutoff for small business loans to further increase the probability that the sample includes loans that are approved by local loan officers and not by credit committees – based on our interviews with bank managers, lending limits of individual loan officers (i.e., maximum loan amount that a local loan officer is allowed to extend without approval from a credit committee) vary across banks, branches of the same bank, and over time. Specifically, we restrict the sample to loans with a principal amount below 100,000 Turkish Liras (deflated to 2008 prices) and find that in this sample, loans approved during Ramadan are more likely to default than loans approved in non-Ramadan months by 28.6 basis points, similar to the estimates in Table 2.[11]

In column 4, we exclude from the sample loans originated by bank branches located in Istanbul, Turkey's center of commerce and banking. Even though this reduces the sample

[11] In unreported analyses for loans in five separate size categories (0-50K, 50-100K, 100-250K, 250-500K, and 500-1,000K), we find a statistically significant Ramadan effect for loans in each of the smallest three categories, but not in the largest two categories.

size by about 35 percent, the coefficient estimate on Ramadan is strikingly similar to the estimates in Table 2. In column 5, we exclude from the sample loans originated in financial crisis years 2007 and 2008. This appears to have some impact, but the coefficient estimate on Ramadan remains statistically and economically significant.

Finally, in column 6 we separate non-Ramadan loans into two subgroups: loans approved during the month immediately before Ramadan (Shaban) and the month immediately after Ramadan (Shawwal); and loans approved during other months of the Islamic lunar calendar. Reassuringly, we find that the default rate of Ramadan loans is higher than that of each of these two subgroups.[12]

5. Conclusion

This paper provides causal evidence (for the first time we believe) that a religious practice has a material influence on economic decision-making. Using an administrative data set of bank loans in Turkey, we find that loan officers make worse credit decisions in the month of Ramadan, a period of heightened spiritual reflection and physiologically strenuous fasting without eating and drinking from dawn to sunset for practicing Muslims. Our main finding is that loans originated during Ramadan perform worse than loans originated outside of Ramadan. In addition, loans originated by participation banks, whose loans officers are more likely to observe the Ramadan, perform worse than loans originated by conventional banks. Our estimates of the Ramadan effect are economically large, indicating about 10% to 15% greater probability of default within two years of loan origination. Credit spreads at the time of loan origination are lower, not higher despite the apparently higher credit risk of Ramadan loans. Collateralization levels of Ramadan loans also do not increase sufficiently to offset the increase in default losses.

Exploring two non-mutually exclusive channels that could work through physiology and spirituality, we find evidence in support of both. Tracing the physiological effects of fasting during Ramadan, we find that the Ramadan effect is greater for loans originated on warmer

[12] In a similar unreported analysis, we also find that the performance of loans originated during Ramadan is statistically significantly worse than the performance of loans originated in every other month of the Islamic lunar calendar.

summer days that happen to coincide with Ramadan. We also find that the Ramadan effect is greater for seemingly charitable loans involving financially strong lenders and financially weak borrowers, consistent with increasing loan officer generosity during Ramadan. It would appear that situations affecting nutrition and religious sentiment can have an impact on economic decisions even in sophisticated activities.

Our findings underscore the importance of religious practices as determinants of economic activity and growth (Barro and McCleary, 2003; McCleary and Barro, 2006; Campante and Yanagizawa-Drott, 2016). They also call for important policy work because Ramadan affects a significant fraction of the world population directly and the rest of the world population indirectly via international trade and investment decisions made by managers who observe the Ramadan. Academic research examining the effects of Ramadan on managerial judgment errors is scarce. We believe this is a fruitful area for future research across many disciplines.

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Appendix A. Definitions of key variables

Default: When contractual payments on a loan are 90 days past due or when future payments are not expected to be received in full, banks classify the loan as non-performing and send an overdue notification to the borrower to request repayment of the loan balance as well as any accrued interest and fees in full within seven days after the receipt of notification. If no payment is made, the bank initiates an administrative investigation which involves negotiations with the borrower for a possible restructuring. During this process, the bank imposes default interest rate and reports the loan's status to the credit registry. If the restructuring fails, the bank initiates legal action. Sometimes legal action is initiated without a restructuring attempt.

Our data set includes a column that shows the earliest date on which the bank initiates administrative investigation or legal action. We consider this date as the default date of the loan. We create a dummy variable, *Default*, that equals one if an event of default occurs at any point within two years after loan origination; and zero otherwise.

Participation bank: Participation banks, commonly known as Islamic banks, raise funding primarily through the issuance of participation funds as opposed to conventional bank deposits. The fundamental principal of Islamic finance is the prohibition of interest (*riba*) and interest-based contracts. Therefore, participation funds neither have a pre-determined interest nor do they guarantee the repayment of principal. Instead, investors participate the losses and profits of the issuing bank.

Before the passage of the Turkish Banking Law No. 5411 in November 1, 2005, participation banks were considered "special finance houses", not banks, and hence they were not required to disclose their loan portfolios to banking regulators. Nonetheless, loans granted by participation banks before November 2005 enter into our sample if the loans were active when participation banks submitted their first electronic quarterly loan reports in December 2005.

We distinguish between loans extended by participation banks versus conventional banks using a participant bank dummy. We obtain the list of participation banks from the Participation Banks Association of Turkey (http://www.tkbb.org.tr/) and the list of conventional deposit

banks from the Banks Association of Turkey (https://www.tbb.org.tr).

Interest rate: At conventional deposit banks, interest rate equals the annual nominal rate of interest on the loan. For floating rate loans, the interest rate is calculated as the sum of the interest spread and the level of the base index (e.g., LIBOR) at the end of the month of origination. At participation banks, the interest rate column in our data set is set equal to the annualized nominal yield (or internal rate of return (IRR)) of scheduled future loan payments (including fees) at origination.

Discount points and front-loaded fees are uncommon in Turkey. While prepayment penalties do exist, they are often waived for business borrowers that refinance with the same bank, and are not systematically reported to our data provider.

Credit spread: The difference, at loan origination, between the interest rate on the loan and the annualized daily yield of the Treasury bond with the closest maturity date. We obtain data on Treasury yields from Borsa Istanbul.

Regulatory risk weight (loan): Banks calculate the appropriate risk weight of a loan based on standards published in Basel I and Basel II and guidelines provided by the Banking Regulation and Supervisory Agency (BRSA). The risk weight is used to calculate the minimum amount of capital that the bank must hold against a loan.

Internal risk rating (borrower): Internal risk rating is a five-scale rating assigned by the bank to each borrower to indicate the bank's assessment of the borrower's financial strength. The rating ranges between 1 and 5: 1. Very strong financial condition; 2. Good financial condition; 3. Short- and medium-term risks; 4. Very high short-term risks; 5. Default. Internal risk rating is missing for all loans originated before 2007. In our regression analyses, we include a dummy variable that equals one if the internal risk rating is missing; and zero otherwise.

Ramadan: We obtain an official record of Ramadan days in the Gregorian calendar from the Presidency of Religious Affairs (PRA). The table below shows the first and last days of Ramadan by year. Ramadan calendar is not universal: Muslims in Turkey begin fasting after they see the crescent of the new moon with a naked eye. Muslims in Middle Eastern countries, on the other hand, generally determine the beginning of Ramadan based on the moon's state of alignment with the earth. The difference in traditions sometimes leads Turks

to start fasting one day earlier or one day later.

Year	First day Ramadan	Last day Ramadan
2003	27-Oct	25-Nov
2004	15-Oct	14-Nov
2005	5-Oct	3-Nov
2006	24-Sep	23-Oct
2007	13-Sep	12-Oct
2008	1-Sep	30-Sep
2009	21-Aug	20-Sep
2010	11-Aug	9-Sep
2011	1-Aug	30-Aug
2012	20-Jul	19-Aug
2013	9-Jul	8-Aug

Eid-al Adha ("Festival of the Sacrifice"): The second of the two Islamic holidays, celebrated two months and ten days after the last day of Ramadan. In the Islamic lunar calendar, Eid al-Adha begins on the 10th day of Dhu al-Hijjah and lasts for four days until the 13th.

Temperature: Data on daily maximum temperature observed at each city center come from the Turkish State Meteorological Service (TSMS). We use the average temperature over a three-day period ending on the day of loan origination. Temperature data are missing for slightly more than 50% of the branch-days before 2008, about 40% of the branch-days in 2009, and less than 5% of the branch-days during 2010-2013.

Summer: A dummy variable that equals one if the loan is originated in June, July, or August; and zero otherwise.

Branch busyness: The natural logarithm of one plus the number of small business loans granted by the bank branch on a given day.

Old client at branch: A dummy variable that equals one for a loan if the borrower previously had a loan from the same bank branch; and zero otherwise.

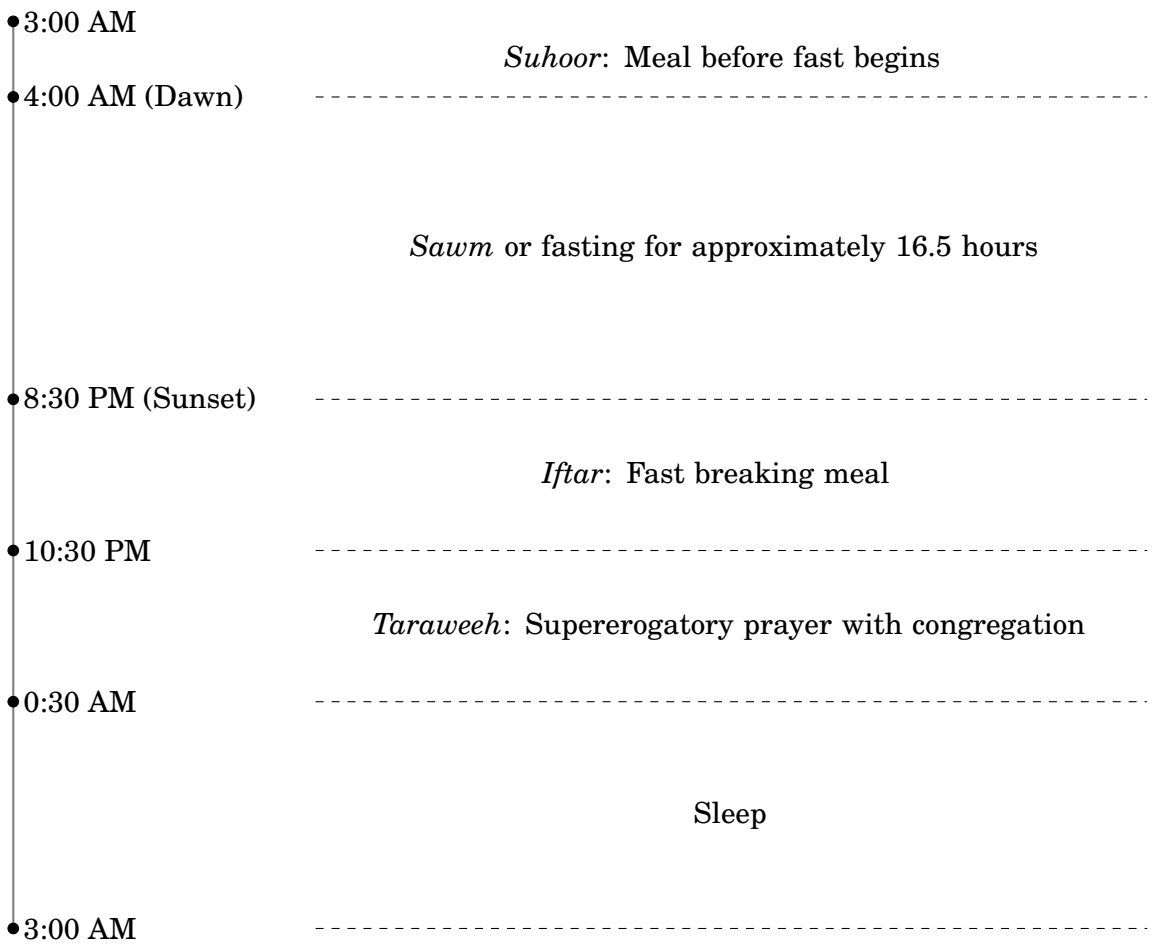

Figure 1. Illustration of daily schedule for a Muslim observing the Ramadan in Istanbul in August.

Table 1. Summary Statistics

This table presents summary statistics for small business loans originated in Turkey in the period 2003-2013. Small business loans are defined as loans with a principal amount of one million Turkish Liras or less (deflated to 2008 prices using the monthly Consumer Price Index obtained from the Central Bank of the Republic of Turkey (CBRT)). The table also presents summary statistics separately for loans originated during Ramadan (middle panel) and loans originated outside of Ramadan (right panel). Variable definitions are provided in Appendix A.

	All loans		Ramadan loans		Non-Ramadan loans	
N unique bank-branches	10,052		9,368		10,038	
N unique borrowers	1,338,209		341,602		1,300,146	
N loans	16,125,401		1,277,580		14,847,821	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
100 × Default	2.33	—	2.68	—	2.30	—
100 × Ramadan	7.92	—	—	—	—	—
100 × Participation bank	14.50	—	15.25	—	14.43	—
Credit spread (%)	4.81	14.88	4.38	14.24	4.85	14.93
Internal risk rating (borrower)	2.57	1.00	2.60	1.02	2.57	1.00
100 × Internal risk rating missing	68.49	—	67.71	—	68.56	—
Regulatory risk weight (loan, %)	76.58	40.04	75.74	40.25	76.66	40.02
Collateral-to-loan ratio (%)	84.49	79.64	84.54	79.75	84.49	79.64
Stated maturity (in months)	21.43	21.68	20.77	20.94	21.49	21.74
LN(Loan amount)	3.38	1.48	3.40	1.47	3.37	1.48
100 × FX-denominated	9.21	—	10.09	—	9.14	—
100 × Summer	23.85	—	53.17	—	21.32	—
Temperature (°C)	20.55	8.95	29.77	5.23	19.78	8.77
100 × Eid al-Adha	8.98	—	—	—	9.75	—
Branch busyness	1.47	1.12	1.33	0.97	1.48	1.13
100 × Old client at branch	74.32	—	73.72	—	74.37	—
Bank capital adequacy ratio (%)	15.94	2.44	15.86	2.44	15.95	2.44

Table 2. Ramadan Loans and Likelihood of Default: Small Business Loans

This table presents estimates from regressions explaining default of small business loans in the period 2003-2013. Default is measured as a dummy variable indicating borrower non-performance either following 90+ days delinquency or when future contractual payments become suspect within two years after loan origination. Columns 1 to 5 present regression results for the full sample whereas Column 6 presents regression results for loans originated on calendar days (July 9 to November 24) that featured Ramadan fasting at least once during the sample period from 2003-2013. All regressions include controls for borrower and loan characteristics as well as month, year, loan purpose, and branch fixed effects. Borrower and loan characteristics are regulatory risk rating of the borrower, regulatory (Basel) risk weight of the loan, loan spread, collateral-to-principal ratio, the natural logarithm of loan principal amount (deflated to 2008 prices), the natural logarithm of loan maturity (in months), and an indicator variable for whether the loan is denominated in a foreign currency. Standard errors that are heteroskedasticity-consistent and clustered at the branch level are reported in parentheses beneath coefficient estimates. ***, **, or * indicates that the coefficient estimate is significant at the 1%, 5%, or 10% level, respectively.

	100 × Prob(Default=1)					
	All days					Days spanned by Ramadan
	(1)	(2)	(3)	(4)	(5)	(6)
Ramadan	0.346***	0.207***	0.253***	0.248***	0.203***	0.254***
	(0.0246)	(0.0226)	(0.0223)	(0.024)	(0.0198)	(0.022)
N	16,125,401	16,125,401	16,125,248	16,122,949	15,799,615	5,829,651
R^2	0.005	0.128	0.178	0.183	0.377	0.186
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Loan purpose F.E.	No	Yes	Yes	Yes	Yes	Yes
Borrower/Loan characteristics	No	Yes	Yes	Yes	Yes	Yes
Branch F.E.	No	No	Yes	No	Yes	No
Branch × Month F.E.	No	No	No	Yes	No	Yes
Borrower F.E.	No	No	No	No	Yes	No

Table 3. Ramadan Loans and Likelihood of Default by Loan Type

This table presents estimates from regressions explaining loan default in the period 2003-2013. Default is measured as a dummy variable indicating borrower non-performance either following 90+ days delinquency or when future contractual payments become suspect within two years after loan origination. All regressions include controls for borrower and loan characteristics as well as month, year, loan purpose, and branch fixed effects. Borrower and loan characteristics are listed in Table 2. Standard errors that are heteroskedasticity-consistent and clustered at the branch level are reported in parentheses beneath coefficient estimates. ***, **, or * indicates that the coefficient estimate is significant at the 1%, 5%, or 10% level, respectively.

	$100 \times$ Prob(Default=1)			
	Business loans		Personal loans	
	Medium	Large	Mortgage	Auto
Explanatory variables	(1)	(2)	(3)	(4)
Ramadan	-0.008	0.051	-0.038	-0.062
	(0.055)	(0.153)	(0.034)	(0.123)
N	338,562	24,949	1,795,543	388,512
R^2	0.077	0.165	0.163	0.458
Month F.E.	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes
Loan purpose F.E.	Yes	Yes	Yes	Yes
Borrower/Loan characteristics	Yes	Yes	Yes	Yes
Branch F.E.	Yes	Yes	Yes	Yes

Table 4. Pricing and Collateral of Ramadan Loans

This table presents estimates from regressions explaining credit spreads (columns 1 and 2), collateral-to-loan ratio (columns 3 and 4), and collateral indicator (columns 5 and 6) of small business loans in the period 2003-2013. Foreign currency denominated loans and loans with non-positive credit spreads are excluded in columns 1 and 2. All regressions include month, year, loan purpose, and branch fixed effects. The specifications in columns 2, 4, and 6 also include controls for borrower and loan characteristics. Standard errors that are heteroskedasticity-consistent and clustered at the branch level are reported in parentheses beneath coefficient estimates. ***, **, or * indicates that the coefficient estimate is significant at the 1%, 5%, or 10% level, respectively.

	Credit spread (%)		Collateral-to-loan ratio		Pr(Collateral>0)	
Explanatory variables	(1)	(2)	(3)	(4)	(5)	(6)
Ramadan	-0.339***	-0.316***	0.014***	0.013***	0.007***	0.006***
	(0.030)	(0.025)	(0.001)	(0.001)	(0.001)	(0.001)
N	11,169,731		16,125,248		16,125,248	
R^2	0.230	0.345	0.318	0.342	0.282	0.310
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Loan purpose F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Branch F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Borrower/Loan characteristics	No	Yes	No	Yes	No	Yes

Table 5. Ramadan Effect: Participation Banks versus Conventional Banks

This table presents estimates from regressions explaining default of small business loans originated by participation and conventional banks in the period 2003-2013. Default is measured as a dummy variable indicating borrower non-performance either following 90+ days delinquency or when future contractual payments become suspect within two years after loan origination. Participation banks are commonly known as Islamic banks. The regression includes controls for borrower and loan characteristics as well as month, year, loan purpose, and branch fixed effects. Borrower and loan characteristics are listed in Table 2. Standard errors that are heteroskedasticity-consistent and clustered at the branch level are reported in parentheses beneath coefficient estimates. ***, **, or * indicates that the coefficient estimate is significant at the 1%, 5%, or 10% level, respectively.

Explanatory variables	$100 \times$ Prob(Default=1)
Ramadan	0.226***
	(0.023)
Ramadan $\times$ Participation bank	0.173**
	(0.069)
N	16,125,248
R^2	0.178
Month F.E.	Yes
Year F.E.	Yes
Loan purpose F.E.	Yes
Borrower/Loan characteristics	Yes
Branch F.E.	Yes

Table 6. Loan Default and Difficulty of Fasting at Origination

This table presents estimates from regressions explaining how default of small business loans varies with difficulty of fasting at origination in the period 2003-2013. Default is measured as a dummy variable indicating borrower non-performance either following 90+ days delinquency or when future contractual payments become suspect within two years after loan origination. In columns 1 and 2, proxy for difficulty of fasting is the average local temperature (in degrees Celsius) over a three-day period ending on day of origination to capture conditions experienced during loan processing. In columns 3 and 4, proxy for difficulty of fasting is an indicator variable for summer (June, July, August) on day of origination. All regressions include controls for borrower and loan characteristics as well as month, year, loan purpose, and branch fixed effects. Borrower and loan characteristics are listed in Table 2. Standard errors that are heteroskedasticity-consistent and clustered at the branch level are reported in parentheses beneath coefficient estimates. ***, **, or * indicates that the coefficient estimate is significant at the 1%, 5%, or 10% level, respectively.

	100 × Prob(Default=1)			
	Intensity measure:			
	Local temperature (°C)		Summer dummy	
Explanatory variables	(1)	(2)	(3)	(4)
Ramadan	-0.057	0.0045	0.146***	0.096***
	(0.115)	(0.045)	(0.031)	(0.035)
Intensity	-0.004***	-0.004***	0.041***	-0.006
	(0.001)	(0.001)	(0.015)	(0.016)
Ramadan × Intensity	0.010**	0.021***	0.077*	0.214***
	(0.004)	(0.005)	(0.043)	(0.063)
Branch busyness		-0.536***		-0.514***
		(0.024)		(0.021)
Intensity × Branch busyness		0.009***		-0.031
		(0.001)		(0.021)
Ramadan × Branch busyness		-0.331***		-0.142**
		(0.061)		(0.055)
Ramadan × Intensity × Branch busyness		0.036***		0.527***
		(0.007)		(0.112)
N	13,499,291	13,499,291	16,125,248	16,125,248
R^2	0.185	0.186	0.178	0.179
Year F.E.	Yes	Yes	Yes	Yes
Loan purpose F.E.	Yes	Yes	Yes	Yes
Borrower/Loan characteristics	Yes	Yes	Yes	Yes
Branch F.E.	Yes	Yes	Yes	Yes

Table 7. Branch-Level Daily Loan Volume and Difficulty of Fasting

This table presents estimates from regressions explaining how branch-level daily volume of small business loans varies with difficulty of fasting in the period 2003-2013. Loan volume is the natural logarithm of total number of small business loans originated at a bank branch location on a given day. In column 1, proxy for difficulty of fasting is the average local temperature (in degrees Celsius) over three days to capture conditions experienced during loan processing. In column 2, proxy for difficulty of fasting is an indicator variable for summer (June, July, August). All regressions include month, year, and branch fixed effects. Standard errors that are heteroskedasticity-consistent and clustered at the branch level are reported in parentheses beneath coefficient estimates. ***, **, or * indicates that the coefficient estimate is significant at the 1%, 5%, or 10% level, respectively.

	Branch busyness		
		Intensity measure:	
		Local temperature (°C)	Summer dummy
Explanatory variables	(1)	(2)	(3)
Ramadan	0.005***	0.049***	0.022***
	(0.000)	(0.002)	(0.001)
Ramadan × Intensity		-0.002***	-0.044***
		(0.000)	(0.001)
Intensity		-0.000***	-0.006***
		(0.000)	(0.000)
Unit of obs.	Branch-day	Branch-day	Branch-day
N	28,871,865	19,374,069	28,871,865
R^2	0.306	0.326	0.306
Year F.E.	Yes	Yes	Yes
Branch F.E.	Yes	Yes	Yes

Table 8. Charitable Lending in Ramadan

This table presents estimates from regressions explaining how default of small business loans varies for loans that resemble charitable lending in the period 2003-2013. Default is measured as a dummy variable indicating borrower non-performance either following 90+ days delinquency or when future contractual payments become suspect within two years after loan origination. Proxies for charitable lending are based on borrower financial weakness (internal risk rating of borrower ranging from 1 (low) to 5 (high) in column 1 and collateral-to-loan ratio as an inverse measure in column 2), borrower and lender acquaintance (old client indicator in column 3), and lender financial strength (bank capital adequacy ratio in columns 4 and 5). All regressions include controls for borrower and loan characteristics as well as month, year, loan purpose, and branch fixed effects. Borrower and loan characteristics are listed in Table 2. Standard errors that are heteroskedasticity-consistent and clustered at the branch level are reported in parentheses beneath coefficient estimates. ***, **, or * indicates that the coefficient estimate is significant at the 1%, 5%, or 10% level, respectively.

	100 × Prob(Default=1)				
	Charitable characteristics:				
Explanatory variables	Interal risk rating (1)	Collateral-to-loan ratio (2)	Old client at branch (3)	Bank capital adequacy ratio (4)	Bank capital adequacy ratio (5)
Ramadan	-0.916***	0.359***	0.088**	-2.417***	-2.703***
	(0.138)	(0.039)	(0.036)	(0.160)	(0.172)
Ramadan × Charitable	0.445***	-0.126***	0.209***	16.850***	18.390***
	(0.061)	(0.028)	(0.039)	(1.043)	(1.109)
Charitable	5.522***	-2.129***	-1.062***	14.220***	13.070***
	(0.111)	(0.087)	(0.041)	(1.228)	(1.345)
Sample	All	All	All	All	Conv. banks
N	5,080,874	16,125,248	16,125,248	15,555,627	13,217,877
R^2	0.406	0.178	0.179	0.180	0.212
Month F.E.	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes
Loan purpose F.E.	Yes	Yes	Yes	Yes	Yes
Borrower/Loan characteristics	Yes	Yes	Yes	Yes	Yes
Branch F.E.	Yes	Yes	Yes	Yes	Yes

Table 9. Robustness

This table presents estimates from regressions explaining default of small business loans in the period 2003-2013. Default is measured as a dummy variable indicating borrower non-performance either following 90+ days delinquency or when future contractual payments become suspect within two years after loan origination. Column 3 restricts the sample to loans smaller than 100,000TL (2008 prices) – the average default rate in this sample is 2.74 percent. Column 4 excludes loans originated by bank branches in Istanbul. Column 5 excludes loans originated in 2007 and 2008. Standard errors that are heteroskedasticity-consistent and clustered at the branch level are reported in parentheses beneath coefficient estimates. ***, **, or * indicates that the coefficient estimate is significant at the 1%, 5%, or 10% level, respectively.

	100 × Prob(Default=1)					
Explanatory variables	All loans (1)	All loans (2)	Loan size ≤ TL 100,000 (2008 prices) (3)	Exclude Istanbul branches (4)	Exclude financial crisis 2007-2008 (5)	Comparison with other lunar months (6)
30 days preceding Eid al-Adha	0.022					
	(0.018)					
First 10 days of Ramadan		0.193***				
		(0.030)				
Middle 10 days of Ramadan		0.342***				
		(0.037)				
Last 10 days of Ramadan		0.230***				
		(0.033)				
Ramadan			0.286***	0.286***	0.204***	
			(0.026)	(0.029)	(0.0223)	
Shaban and Shawwal						-0.130***
						(0.023)
Other lunar months						-0.399***
						(0.027)
N	16,125,248	16,125,248	12,875,649	10,640,522	13,414,347	16,125,248
R^2	0.178	0.178	0.209	0.201	0.184	0.178
Month F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Loan purpose F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Borrower/Loan characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Branch F.E.	Yes	Yes	Yes	Yes	Yes	Yes