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Filipe R. Campante
David H. Yanagizawa-Drott

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ABSTRACT

We study the economic effects of religious practices in the context of the observance of Ramadan fasting, one of the central tenets of Islam. To establish causality, we exploit variation in the length of the fasting period due to the rotating Islamic calendar. We report two key, quantitatively meaningful results: 1) longer Ramadan fasting has a negative effect on output growth in Muslim countries, and 2) it increases subjective well-being among Muslims. We then examine labor market outcomes, and find that these results cannot be primarily explained by a direct reduction in labor productivity due to fasting. Instead, the evidence indicates that Ramadan affects Muslims' relative preferences regarding work and religiosity, suggesting that the mechanism operates at least partly by changing beliefs and values that influence labor supply and occupational choices beyond the month of Ramadan itself. Together, our results indicate that religious practices can affect labor supply choices in ways that have negative implications for economic performance, but that nevertheless increase subjective well-being among followers.

Filipe R. Campante
Harvard Kennedy School
79 JFK Street
Cambridge, MA 02138
and NBER
filipe_campante@harvard.edu

David H. Yanagizawa-Drott
79 JFK Street
Cambridge, 02138 MA
USA
David_Yanagizawa-Drott@hks.harvard.edu

1 Introduction

Religions are essentially ubiquitous across human societies. It is thus natural to speculate that they may affect important economic outcomes, such as economic growth – as many have done dating at the very least to Max Weber's (1905) celebrated work. While this possibility is certainly appealing, assessing its prevalence and importance is a rather complicated task, both conceptually and empirically, not the least because religions are multifaceted social phenomena whose different aspects could most likely have different effects.

That said, one fundamental aspect that is common to all forms of religion is that they prescribe rules of behavior, or practices, that constrain followers. In other words, religious practices are a kind of informal institution (North 1991), imposing constraints that structure economic, political and social interactions. First, religious practices impose an immediate trade-off, as they require time and resources that are then unavailable for production. Going to temples or to pilgrimages, taking time to pray or to meditate or to study sacred books, spending money on religious rituals, not working on religious days of rest: these will all take away from what is devoted to (materially) productive activities. Second, they could also directly affect productivity, for instance by limiting social interactions with non-believers or by imposing dietary restrictions. Third, they may shape beliefs and values that determine economic decisions such as labor supply, occupational choice, or savings behavior.

The recent empirical literature that has studied the relationship between religion and economic performance – after years of relative neglect from economists – has found a negative correlation between religious practices (e.g. attendance at religious services) and economic growth (Barro and McCleary 2003, McCleary and Barro 2006), and between religiosity and income at the cross-country and individual levels (e.g. Barro and McCleary 2003). However, as religious behavior and religiosity are likely endogenous and affected by economic growth itself, convincing evidence that there is a causal effect driving these relationships has proved elusive.[1]

Still, taking this evidence at face value, if religions prescribe rules and practices that constrain the behavior of followers in ways that lead to lower material living standards, it begs the question of whether these practices also have private, non-pecuniary benefits. If such benefits exist, it would help explain why religious practices are sustained in equilibrium and why religions are so ubiquitous.[2] An empirical strand of literature in the social sciences suggests that they do exist, as religious engagement and religiosity is associated with higher levels of self-reported happiness

[1] The causal identification challenge was obviously acknowledged by the literature. For instance, Barro and McCleary (2003) try to address it using instrumental variables (e.g. presence of a state religion). While reassuring with respect to reverse causality, the limitations of their empirical setting do not let them deal with omitted variables.

[2] There are many arguments for the persistence of costly religious practices, relying on approaches ranging from economic (e.g. Iannaccone 1992) to psychological (e.g. Plante and Sherman 2001) or evolutionary (e.g. Hinde 2009).

and life satisfaction, or more generally, subjective well-being (SWB) at the individual level (e.g. Dolan, Peasgood, and White 2008; Deaton and Stone 2013). However, whether such associations can be given a causal interpretation remains very much an open question as endogeneity issues remain a fundamental challenge in this literature as well (Argyle 2003, Francis 2010).

Against this background, we present in this paper what is, to the best of our knowledge, the first estimate of a causal effect of a religious practice on economic growth and subjective well-being.[3] We do so by focusing on the specific example of fasting in observance of the Islamic holy month of Ramadan. Ramadan fasting is surely a very prominent example of religious practice: as one of the Five Pillars of Islam, its observance is understood to be obligatory for all billion-plus Muslim believers. As this religious practice has a well-defined rule specifying that Muslims shall fast from dawn to sunset, and as the month of Ramadan rotates over the seasons according to the lunar calendar, it also provides us with an ideal context for dealing with the causal identification issues that confound the study of the links between religious practices and economic outcomes.

To give a concrete example, when Ramadan falls in the Northern Hemisphere winter, the prescribed length of fasting according to the Qur'an will be longer in Bangladesh than in Turkey, because Bangladesh is closer to the Equator. However, when Ramadan falls in the summer, fasting will be longer in Turkey than in Bangladesh. This interaction of latitude and the vagaries of the lunar calendar being exogenous to our outcomes of interest, we thus have an ideal source of idiosyncratic variation in the prescribed intensity of the practice.

Using country-level panel data, we show that longer prescribed Ramadan fasting has a robust negative effect on output growth in Muslim countries, whether measured by GDP per capita or GDP, and whether measured in yearly rates or aggregated up to five-year periods. Most reassuringly, we find no effect whatsoever on GDP growth in non-Muslim countries, underscoring that the result is unlikely to be spurious.

The quantitative significance of our estimates can be illustrated as follows: if average daily Ramadan fasting were to increase from the actual average of 12 hours to 13 hours – which is about one standard deviation of the variation for the typical Muslim country over the Ramadan cycle – output growth would be lower by about 0.7 percentage point. As a comparison, the coefficient found by Barro and McCleary (2003) implies that a one-standard-deviation increase in church-going would be associated with a 1.1 percentage point decline in growth rates.

We then use the same empirical strategy to estimate the causal effect of Ramadan fasting on SWB. Using data from the World Values Survey, we find that Ramadan fasting leads Muslim individuals to report greater levels of both happiness and life satisfaction. Once again, we find no

[3]Clingingsmith, Khwaja, and Kremer (2009) document that the *Hajj* pilgrimage to Mecca, another of the Five Pillars of Islam, leads to an increase in negative feelings suggesting distress (for women only). However, they find no effect on self-reported life satisfaction.

effect whatsoever on the SWB of non-Muslim individuals in non-Muslim countries.

The results thus shed light on the question of why religions persist despite containing practices that impose constraints on individuals. Our evidence indicates that exogenously inducing Muslims to fast longer, for religious reasons, has a *net* positive impact on their SWB: put simply, it makes them happier in spite of making them relatively poorer. This is particularly interesting since recent research has provided evidence that economic growth leads to higher SWB at the cross-country level (Stevenson and Wolfers 2008), in contrast with the well-known "Easterlin paradox" (Easterlin 1974). Therefore, to the extent that lower GDP growth causally reduces SWB, our results show that this effect is trumped by the non-pecuniary benefits of the practice on SWB.

To further understand these results, we turn to the mechanisms that might be driving the effects on economic growth. In particular, we focus on an arena that we would expect to be of first-order importance: labor markets. The key insight is that different mechanisms would have distinct implications in this domain. On the one hand, if labor productivity goes down because of fasting, this would lead to a downward shift in labor demand. On the other hand, if increased fasting leads workers to simply choose to work less – whether because of the direct competition from religious activities or of an indirect effect through changed attitudes towards work in general – this should correspond to a leftward shift in labor supply.

Using country-level panel data on employment and wages in manufacturing sectors, and individual survey data on employment status, we find evidence that the labor-supply effect dominates. This evidence indicates that the negative effect of Ramadan fasting on GDP growth is mostly driven by occupational choice out of formal employment and into the informal sector, rather than simply by decreased productivity directly associated with fasting.

In addition, we find direct suggestive evidence that Ramadan fasting affects work-related individual beliefs and values. Specifically, Ramadan leads Muslim men to report that they care relatively more about religion and less about work and material rewards. This is interesting in its own right, but may also help explain the underlying mechanism driving the shifts in labor supply and occupational choice decisions. More generally, this finding underscores the view that religious practices affect the formation of beliefs and values whose impact goes well beyond the month of Ramadan itself.

This evidence on mechanisms is illuminating in two crucial ways. First, it helps reconcile the results linking religion, growth, and happiness. If the growth effect works at least partly through labor supply choices – that is, individuals choosing to work less or in more flexible, if less productive, occupations – that seems consistent with any potential impact of reduced growth on SWB being relatively muted. To the extent that religious practices affect individual preferences, it is less surprising that negative effects on growth could co-exist with a net positive effect on subjective well-being, in spite of the generally positive correlation between the latter and the former.

Second, and just as important, that the effect is not driven simply by the impact of fasting on productivity suggests that it is not specific to Ramadan, but rather an indication of the potential effects of religious practices in general. In short, what we find are *not* the effects of fasting per se (reduction in nutritional intake affecting productivity), but rather that more intense practicing of religion has an impact on individual beliefs and values that reduce labor supply. More generally, this is consistent with the view of religious practices as an input into the production of beliefs and values (Barro and McCleary 2003), such as attitudes towards work, thrift, trust, etc., which can enduringly and significantly affect economically relevant decisions. By changing them, religious practices can thus have a substantial aggregate impact, such as that which our estimation detects.

To be sure, neither our results nor those of the extant literature should be interpreted as implying that religion, broadly understood, necessarily causes poor economic performance. Just as importantly, we focus on religious practices, and other aspects of religion could have much different effects.[4]

Besides the aforementioned literature studying religion and income and growth, and religion and SWB, our paper also relates to a number of additional strands. Some have studied the effects of adherence to different religions on a number of economic and political outcomes (Barro 1997, La Porta et al 1999), or used survey evidence to study the connection between religiosity and economic attitudes (Guiso, Sapienza, and Zingales 2003).[5] We differ in that we focus on a specific example of religious practice, which lets us deal with the issue of identifying a causal effect and considering specific mechanisms. More broadly, we build on the by now vast literature documenting the effects of culture – of which religion is certainly a very important component – on a number of economic outcomes (see Guiso Sapienza and Zingales 2006 for an early survey and Nunn 2012 for a more recent discussion).

Our use of micro evidence to study the impact of religion on individual economic decisions also puts us in line with a recent and growing literature, which looks at specific topics such as work ethic (Spenkuch 2011), entrepreneurship (Audretsch, Boente, and Tamvada 2007), loan repayment decisions (Baele, Farooq, and Ongena 2011), social trust (Berggren and Bjornskov 2011), and human capital accumulation (Becker and Woessmann 2009), among others. Within this literature, our paper is closest to Clingingsmith, Khwaja, and Kremer (2009), who study the impact of the *Hajj*. Consistent with our evidence, they also find an important impact of this practice on individual views and beliefs.

[4]For instance, Barro and McCleary (2003) and McCleary and Barro (2006) find a positive relationship between economic growth and religious beliefs such as belief in hell. For skeptical takes on this result, see Durlauf, Kourtellos, and Tan (2012) and Young (2009).

[5]In particular, those studies tend to find a negative coefficient for Muslim adherence in regressions focusing on growth or institutional development. Our results do not speak directly to that, since we focus on one specific aspect of Islam. Kuran (2004) provides an extensive discussion of possible economic implications of Islamic institutions.

The remainder of the paper is organized as follows: Section 2 lays out some background on Ramadan practices, their potential effects, and how they relate to our source of variation. Section 3 provides a motivating conceptual discussion, and Section 4 describes the data and empirical strategy. Section 5 presents the results, which we then discuss in Section 6. Section 7 concludes.

2 Background

Ramadan is the ninth month of the Islamic (*Hijri*) calendar, and is considered sacred as the month in which the Prophet Muhammad first received revelations. Fasting (*sawm*) during that month is one of the Five Pillars of Islam – the five basic acts that are considered an obligation for all believers, and the foundation of Muslim life. The fasting encompasses abstention from food and drink, as well as smoking and sexual activities, between dawn and sunset during the entire month.[6]

Ramadan fasting entails obvious physiological consequences because of the constraints it places on the ingestion of food and liquids, and these have been extensively studied in the medical literature. Not surprisingly, the literature has consistently found body weight loss and significant metabolic changes (e.g. Hallak and Nomani 1988, Ziaee et al 2006). In addition, Leiper, Molla, and Molla (2003) summarize the research as finding symptoms such as irritability, headaches, sleep deprivation, and lassitude being commonly reported – although with few major health problems.

More broadly, it stands to reason that these effects would have potential implications for productivity at work. Indeed, research has found significant prevalence of individuals reporting tiredness and unwillingness to work, as well as reduced levels of activity and concentration ability, during the month of Ramadan (Afifi 1997, Karaagaoglu and Yucecan 2000).[7] More specific studies focusing on worker productivity in heavy labor activities have also found "evidence of [...] substantial health hazard to Islamic workers in such situations," going as far as "strongly [urging] employers to refrain from assigning Islamic workers to heat work or heavy daytime work during Ramadan" (Schmahl and Metzler 1991). In short, there is strong indication that Ramadan fasting affects followers in ways that affect their productivity at work, although any negative effects seem unlikely to persist beyond the fasting period (Toda and Morimoto 2004). Consistent with that, a recent survey on the impact of Ramadan on productivity (Dinar Standard 2011) finds that up to one in four Muslim professionals admits to not maintaing the same level of productivity as compared with other months.

No less important are the broader effects of Ramadan on individual lifestyle and social life during the holy month (Maqsood 2007, Marshall Cavendish Corporation 2010). The daily rou-

[6] There are exemptions from the obligation, typically for children, the ill and the elderly, travelers, and breastfeeding women.

[7] Recent research by economists has focused on the effects of Ramadan fasting on fetal health, and its potential long-term consequences (Almond and Mazumder 2011, Van Ewijk 2011).

tine incorporates major pre-dawn (*suhur*) and fast-breaking (*iftar*) meals, which are social events involving family, friends and acquaintances, and co-workers – turning *iftar* in particular into a "unique opportunity for socializing" (Chenar 2011). *Iftar* events often take place in mosques, which, more broadly, typically hold many special events throughout the month. As a result of this, and of the additional *tarawih* prayers that are meant to be performed on Ramadan days (beyond the five daily prayers that are another Pillar of Islam), increased mosque-going is an important feature of the period. Major festivities also mark the end of the month, with the fast-breaking festival of Eid al-Fitr. While there is substantial variation across countries regarding the specifics of these and other Ramadan practices, social activities and increased interaction with fellow believers are common themes.

Not all Ramadan practices are of a social nature, of course. Indeed, the (optional) ritual of *i'tekaf* ("staying in on place") is a traditional part of the last ten days of the month, and reading the Qur'an is also strongly encouraged. Consistent with that, for instance, Afifi (1997) reports that fasting individuals tend to get more involved in "stress reducing" (such as watching TV, listening to radio or visiting friends) and "spiritual" activities (such as praying and reading the Qur'an).

Given all of these unique features and practices that take place during the holy month, one might expect that the intensity of Ramadan engagement would affect social interactions in ways that impact economic decisions and the formation of economically relevant beliefs. First, although it could also be the case that enhanced networking opportunities might increase productivity, the fact remains that those practices obviously compete for time with regular work activities. In fact, the aforementioned survey by Dinar Standard (2011) estimates that reduced Ramadan working hours could have a substantial impact on production during the month, of up to 4% per weekday working hour lost. In addition, the salience of religiosity and familiy life during that month could certainly have an effect on individual beliefs and attitudes towards work, family, savings, and so on. These could in turn extend the impact of Ramadan far beyond the month itself.

Needless to say, observance of each specific Ramadan practice will vary tremendously across individuals and countries, and is very hard to observe on a systematic basis. However, our empirical strategy will take advantage of factors that will exogenously shock that intensity of engagement to identify its impact on our outcomes of interest.

Our strategy, as we will later on discuss in greater detail, is based on the fact that the Islamic calendar is lunar, so that months correspond to lunar cycles (around 29.5 days). As a result, the year is ten to eleven days shorter than the solar year, and months rotate over the seasons accordingly, in cycles of roughly 33 years. This means that the number of hours of daily fasting – corresponding to the period between sunrise and sunset – will vary depending on the time of the year in which Ramadan happens to fall in any given year, and also on latitude. Simply put, our basic idea revolves around the effect of a longer daily fasting period – as is the case when Ramadan occurs during the

summer, and particularly so at greater latitudes – and our central assumption is that the intensity of engagement increases with those extra hours.

The longer hours obviously amplify the physiological impact of going without food and drink – especially under conditions of heat and humidity – and of the fewer hours of sleep that come from having to wake up for pre-dawn meals. Just as importantly, dealing with that impact requires changes in daily routines and activities that affect the broader lifestyle changes we have discussed. Indeed, it is not hard to find reports underscoring that point: summer Ramadans seem to entail more time spent with family, in worship, and in contemplative activities, as well as a general "slowdown" in daily activities so as to conserve energy and avoid the ill effects of heat and humidity.[8] More directly, summer Ramadans also seem associated with a greater crowding out of work activities, as "the working day shortens by two or three hours" (*The Economist* Aug 12, 2010).

In sum, the anecdotal evidence corroborates the idea that summer Ramadans and its longer fasting hours constitute a particularly challenging and intense experience, which is likely to have stronger effects on individual views and behavior. This justifies our use of the length of fasting hours as the key source of variation in the intensity of Ramadan practices.

3 Conceptual Framework

Religious practices in general, and Ramadan in particular, could in principle affect many different economic outcomes in many different ways. As such, it is important to very briefly motivate our empirical investigation in terms of the variables we will focus on, and of some of the most natural potential channels of impact associated with them.

3.1 Economic Growth

When it comes to economic growth, it is easiest to start with reference to an aggregate production function. Consider a standard Cobb-Douglas neoclassical production function $Y = (AL)^{\alpha}K^{1-\alpha}$, with standard designations for output, capital and labor inputs, and the productivity of labor, and $\alpha \in (0,1)$ corresponding to the share of labor in total output. We can write output growth as follows:

$$g_Y = \alpha g_A + \alpha g_L + (1-\alpha) g_K \ , \tag{1}$$

[8] For instance, a Canadian report (*Hamilton Spectator*, July 17, 2013) quotes individuals stating that to withstand the long fasting hours of summer Ramadans they tend to " [spend] time with [...] family at the mosque where they read from the Koran", to "read more of the Koran", to "[stay] busy helping out at home and being involved in [community programs], and to "spend more time in active worship and prayer [to take their] mind off it". The impact is not felt only at higher latitudes, however, as exemplified by reports on challenging summer Ramadans in Egypt ("a fast to test all our willpower", *The National (UAE)* Aug 7, 2010) or Saudi Arabia (*Arab News* Jul 11, 2013).

where g_j is the growth rate of j. It follows that there are essentially two different ways in which religious practices could have a direct impact on growth. First, they might affect the evolution of input supply decisions, L and K; second, they might affect the evolution of productivity, A.

When it comes to inputs, religious practices impose an immediate trade-off, to the extent that they require time and resources that are then unavailable for producing output. Similarly, those practices could affect productivity as well: from facilitating or limiting social interactions with correligionists and outsiders (Iannaccone 1992) to purely physiological effects (e.g. dietary restrictions).

In the case of Ramadan, we have argued that the holy month involves a number of activities that evidently fit that pattern of competing for time and resources, thereby potentially affecting input supply. By the same token, there are the physiological costs associated with fasting. While this could be mitigated by a positive effect on productivity arising from increased networking and socialization, it is natural to posit that more intense Ramadan fasting would have a negative direct impact on labor productivity. Both of these channels would lead us to expect a negative effect of more intense fasting on economic activity during the month of Ramadan itself, consistent with the anecdotal perception of a general slowdown.

There remains the question, however, of whether this immediate impact would translate into a negative effect that could be picked up over the longer horizons for which one would typically measure macroeconomic aggregates. In particular, would we expect to find an effect for the yearly GDP numbers that we will consider in our empirical analysis?

The answer could be no: individuals could well choose to compensate a month of especially intense Ramadan fasting by increasing economic activity over the rest of the year. This would be all the more plausible in light of the fact that the variation in Ramadan fasting hours is entirely predictable.

Alternatively, there could be an effect in yearly growth rates, for instance, in the absence of such compensation. In that case, the slowdown during the month of Ramadan would translate into lower measured economic activity over the year – albeit, of course, at only one-twelfth of the monthly rate.

Moreover, yearly rates could be affected because a more intense Ramadan might also have an impact beyond the month itself. Broadly speaking, religious practices could have important indirect implications for economic activity, by affecting preferences, beliefs, and values (Barro and McCleary 2003). These might certainly include individual input-supply decisions, for instance by affecting preferences for work versus other endeavors, and might also affect the path of A, say via occupational choice between activities or sectors with distinct productivity growth profiles. It is quite clear that the intensity of the Ramadan experience, with its salient religious and social dimensions, could very well affect this channel, thus opening the door for a more persistent effect.

3.2 Subjective Well-Being

As for SWB, one might expect both positive and negative effects of religious practices in general, and of Ramadan in particular. On the positive side, there could be an impact through religious engagement fostering socialization (Argyle 2003, p.366), or through its instilling a sense of meaning and purpose (Myers 2000). Either way, our previous discussion would lead us to expect Ramadan to activate those channels, in light of the intense socialization and general exposure to religious content that it entails.

These forces, however, pertain to the partial effect of a shock to religious involvement. Survey responses to questions on happiness and life satisfaction, however, will inevitably capture the total impact. This is important because, to the extent that income and individual SWB tend to be strongly positively correlated, one might expect that the negative effect on output growth would work towards a negative net impact on the SWB of the average individual. In addition, the potential repercussions on beliefs, values, and economic decisions would also likely affect individual perceptions of happiness and life satisfaction, quite possibly in durable ways as well.

As such, the overall impact of more intense Ramadan fasting would be ambiguous from an *ex ante* perspective.

3.3 Mechanism

Our discussion concerning the possible impact of Ramadan fasting on economic growth has highlighted a few different channels, and it is worth discussing how we could assess their presence and relative importance. When it comes to the distinction between the direct productivity and input-supply channels, the key is in the behavior of labor markets. Needless to say, religious practices could also affect the long-run accumulation of capital, of both the physical and human varieties. We will leave these aside, since our empirical strategy will necessarily focus on short-to medium-run variation. Within this horizon, it makes sense to take the capital stock as essentially fixed and instead focus attention on what happens to the supply and demand of labor.[9]

It turns out that those two channels would have distinct implications when it comes to labor markets. The labor-supply mechanism would naturally represent a movement of the labor supply, as individuals choose to work less for the benefit of religious engagement. The productivity mechanism would in turn operate via labor demand, as a decrease in the marginal productivity of labor. From basic economic theory, we would expect the labor-supply effect to be associated with slower employment growth but faster wage growth, while the labor-demand channel would imply the former, but not the latter.

[9]We will later show evidence that the yearly growth rate of the capital stock indeed does not seem to be affected by Ramadan fasting.

This is easiest to see again with reference to the aggregate production function, now leaving aside the role of capital. With perfectly competitive markets, the wage rate (w) is equal to the marginal productivity of labor, and we can write wage growth as:

$$g_w = \alpha g_A - (1-\alpha) g_L \ . \tag{2}$$

It immediately follows that a decrease in labor supply will be associated with rising wages, whereas declining productivity will be associated with falling wages. We will therefore look into the effects of Ramadan fasting on labor markets as a way of disentangling these different channels.

Our discussion also highlighted the indirect channel via beliefs and values. The simplest way to get at the empirical relevance of this indirect channel is to use direct evidence on how individuals value work and material rewards relative to other aspects of their lives. We can couple that evidence with information on individual occupational choice decisions in order to paint a more precise picture of the ultimate impact of those individual preferences on labor supply and productivity, and of how this may help us understand the connections between the effects of Ramadan fasting on economic activity and SWB.

4 Empirical Framework

4.1 Data

Our first key variable is the number of stipulated fasting hours during Ramadan. To calculate that, we collect data from the Astronomical Applications Department of the U.S. Naval Observatory. Their online data service provides sunrise and sunset times for any geographic coordinate on earth, at any given date in the Gregorian calendar. To map historical Ramadan dates from the Islamic calendar to the Gregorian calendar, we use data from Islamic Philosophy Online.[10] For each Ramadan since 1950, we calculate the average daily daylight hours during Ramadan, in every country and year.[11]

We then match the data on Ramadan fasting hours with various datasets. For data on the Muslim share of a country's population, we use a time invariant measure from Miller (2009). Data on economic growth comes from the Penn World Tables 8.0 (PWT8.0) (Feenstra, Inklaar, and

[10] Available at http://www.muslimphilosophy.com/ip/hijri.htm.

[11] To keep things simple, we use a country's capital as the coordinates of interest, downloaded from www.cepii.fr/anglaisgraph/bdd/distances.htm. This obviously induces some measurement error in our data. Similarly, the Qur'an specifies that fasting should start at dawn (first light), while we measure the start exactly at sunrise, and this subtle difference may therefore introduce some minor measurement error. Moreover, in some Muslim societies fasting does not start until the new crescent moon of Ramadan has been sighted. The sunrise and sunset patterns of Mecca is also sometimes followed. Since these deviations are likely idiosyncratic, measurement error is likely to be classical and would lead to attenuation bias in our estimates.

Timmer 2013), resulting in an unbalanced panel of 167 countries between 1950-2011. Our main outcomes of interest are data from the national accounts on real GDP growth, real GDP growth per capita, and real GDP growth per worker, all in constant 2005 prices. Note that, since the variation in fasting hours that we use is at a yearly level, we will focus on year-on-year growth.

To asses whether Ramadan affects subjective well-being (SWB), we use data from all waves of the World Values Survey (WVS). The surveys were conducted from 1981 to 2008 in 87 countries, totaling more than 256,000 interviews. We use the two key standard measures of SWB. First, "Feeling of Happiness" is a hedonic measure taken from the answer to the question: "Taking all things together, would you say you are: not at all happy, not very happy, quite happy, very happy?". We construct the standard indicator variable equal to one if the respondent answers "quite happy" or "very happy", and zero otherwise. The second measure, "Life Satisfaction", is more evaluative, based on the question: "How satisfied are you with your life as a whole these days?" (on a numerical 10-point scale). We construct an indicator variable equal to one if the answer is above 5, and also present results using the raw number. The survey also contains data on employment status, work-related preferences (whether work is more important than religion in one's life; preferences for whether good hours is important in a job; preferences whether a high income is the most important aspect when searching for a job), and a number of socio-economic characteristics. Finally, it provides information on religiosity, or "religious values" (Norris and Inglehart 2011) (whether religion is very important in one's life).

Yearly data on wages and employment in the manufacturing sector comes from INDSTAT2 2013 edition, which is available for 166 countries for the 1963-2010 period.[12] The data are arranged at the 2-digit level of the International Standard Industrial Classification of All Economic Activities (ISIC) Revision 3, pertaining to the manufacturing sector, which comprises 23 industries. The data is based on surveys of establishments with at least 5-10 employees (the cut-off varies by country). It includes the total number of persons employed in each sector, and the wages paid to those persons.[13] Since our variation in Ramadan hours is at the country-year level, we aggregate the sector data to the country-year level, resulting in an unbalanced panel dataset on employment (number of workers) and wage (annual wages per worker) growth.[14]

[12]Version 8.0 of the Penn World Tables contains, for the first time, data on employment. However, the data for Africa and the Middle East is actually refering to the labor force, thus conflating the employed and the unemployed (Inklaar and Timmer 2013) and rendering it inappropriate for our purposes.

[13]The wage data is comprised of all payments paid to employees each year, including bonuses and housing allowances.

[14]The data for Azerbaijan in 1992 shows an arguably implausible wage growth of more than 2500 percent, or about 1200 standard deviations above the mean. We exclude this observation as it is an extreme outlier.

4.2 Identification Strategy and Specifications

Our identification strategy exploits the fact that the number of daylight hours during Ramadan will vary differentially across countries over time, because the Islamic calendar follows the lunar cycle. There are two key factors that interact to give rise to arguably idiosyncratic and exogenous variation in Ramadan fasting hours. First, the *timing* of the start of Ramadan is a factor: in years when Ramadan is held during summer months, the sun is up for longer, and fasting hours as stipulated by the Qur'an increase accordingly. Second, the geographical location of the country, and more specifically its *latitude*, also matters: it is the primary determinant of sunrise and sunset times at any given date. During summer Ramadan the hours will be longer the further away from the Equator, while during winter Ramadan the relationship is reversed as the hours are short the further away from the Equator. As long as we control for year and country fixed effects, we automatically control for any possible independent effects of Ramadan timing and country latitude. We are then left with the variation due to the *interaction* of the two factors, and this is what we exploit.

To illustrate the nature of that variation, we first show, in Figure 1, a map highlighting the 32 Muslim countries in the PWT8.0 sample, defined as those where more than 75 percent of the population are Muslim. We can see that there is substantial variation in latitude within that sub-sample, in spite of there being no Muslim countries in very high latitudes.[15]

[FIGURE 1 HERE]

Figure 2 then illustrates the way latitude and timing interact in affecting stipulated fasting, to provide visual intuition for the variation we use for identification. It plots for every year the average daily fasting hours for three countries, namely Bangladesh, Indonesia, and Turkey. There is within-country variation over time, but most important is the fact that the time variation is different across the three countries. Compare first Bangladesh, which is roughly at the average latitude for the sub-sample of Muslim countries, to Turkey, which has one of the highest latitudes in that sample. Bangladesh has shorter fasting hours when Ramadan falls during the Northern Hemisphere summer (as in the early 1950s and 1980s), and the opposite happens when it falls in the winter months (as in the mid 1960s or late 1990s/early 2000s). Indonesia in turn illustrates yet another source of idiosyncratic variation, coming from the fact that seasons are reversed in the Southern Hemisphere.[16] Note also that the farther from the Equator, the greater the amplitude of variation.

[FIGURE 2 HERE]

[15]Note that some Muslim-majority countries, such as Algeria or Libya, are not highlighted in the map. This is because they are not included in the PWT8.0 sample.

[16]Note that all curves cross when Ramadan falls around the vernal or autumnal equinoxes, when days and nights are of equal length.

Finally, Figure 3 shows the implications when we take the sample of Muslim countries as a whole: the average daily length of Ramadan fasting fluctuates according to the Northern Hemisphere seasons, since that is where the vast majority of Muslim countries are, and the variation around the average (as measured by the lines marking the 20th and 80th percentiles of the hours distribution bands) peaks on December and June Ramadans.

[FIGURE 3 HERE]

We implement this identification strategy by estimating the following equation:

$$g_{ct} = \beta * \log RamadanHours_{ct} + \delta_c + \mu_t + \varepsilon_{ct}, \tag{3}$$

where g is an outcome (real GDP growth, real GDP per capita growth, etc.) in country c in year t, $RamadanHours$ is the average daily number of fasting hours during Ramadan, and δ and μ capture country and year fixed effects, respectively. Our basic hypothesis that Ramadan has a negative effect on economic growth would thus translate into $\beta < 0$.[17]

The country fixed effects account for all time-invariant differences across countries, such as geography or cultural factors that do not vary over time. The year fixed effects in turn control for factors that vary across time but are constant across countries, such as global business cycles or the time of the year when Ramadan happens to be held. Put together, they let us focus on the idiosyncractic variation we have described.[18] We will also present results controlling for population growth, although by assumption this would not be necessary since population growth is uncorrelated to Ramadan fasting. Still, this may reduce residual variation, leading to more precise estimates. We do not control for other economic factors because they may be endogenous to Ramadan fasting. Finally, we estimate the model on our Muslim country sub-sample only.[19] This is because we would expect Ramadan to meaningfully affect economic growth only in countries that have a substantial Muslim population.

This latter feature also presents us with the possibility of further enhancing our identification strategy. A priori, there is no obvious reason why one would expect the variation in fasting hours to be endogenous to other determinants of economic growth, such as technological shocks, human capital growth, saving rates, etc. Nevertheless, to account for this possibility, we complement (3) with an alternative (differences-in-differences) specification that makes use of the fact that

[17] We should stress that what we estimate, as indicated by (3), is the marginal effect of increasing the number of Ramadan fasting hours. We cannot estimate an effect against a counterfactual where Ramadan is absent – a linear extrapolation to zero hours would be patently absurd.

[18] It is worth noting that there is meaningful residual variation in Ramadan fasting hours: the fixed effects account for 36 percent of the variation across all countries and years.

[19] In the Appendix we show that the results are robust to varying the 75-percent threshold, and to including linear country trends.

Ramadan fasting hours should not affect economic growth in countries that have very small Muslim populations. Specifically, we estimate:

$$(4)\quad g_{ct} = \beta \log RamadanHours_{ct} \times Muslim_c + \lambda \log RamadanHours_{ct} + \delta_c + \mu_t + \gamma_{ct} + \varepsilon_{ct},$$

where *Muslim* is a dummy equal to one if Muslims make up at least 75 percent of the population, and zero if there are less than 25 percent Muslims. This specification also allows us to include Muslim-country-by-year fixed effects, γ_{ct}, which control for any yearly shocks that might differentially affect Muslim countries. If Ramadan fasting truly affects economic outcomes, we would expect $\lambda = 0$ and $\beta < 0$.

We leave aside the small group of countries in the intermediate range of the share of Muslims, namely those where Muslims are a large minority or small majority, for the simple reason that these counties would be an evidently improper "control" group.[20] Note that, as depicted in Figure 4, the variation over time in average Ramadan hours in Muslim and non-Muslim countries is very similar, indicating that the non-Muslim countries indeed provide a suitable comparison.[21]

[FIGURE 4 HERE]

Still in the realm of cross-country panel data, we will estimate the impact of Ramadan on labor markets. We will reproduce specification (3) and (4), with employment and wage growth in the manufacturing sector as our dependent variables of interest. A negative effect of Ramadan fasting on employment growth, $\beta < 0$, would be consistent with a decrease in labor demand due to lower labor productivity, or a decrease in labor supply, or both. Estimating the effects on wages helps us separate between the two possible mechanisms. A decrease in wage growth ($\beta < 0$) would be consistent with a decrease in labor demand predominating over any negative labor supply effects, whereas an increase in wage growth ($\beta > 0$) would be consistent with the opposite pattern.

When it comes to individual survey data, on SWB, labor market status, and beliefs regarding work and religion, we implement our identification strategy with the following specification:

$$(5)\qquad y_{ict} = \beta * \log RamadanHours_{ict} + \delta_c + \mu_t + X_{ict}\gamma' + \varepsilon_{ict},$$

where subscript i denotes individual i living in country c surveyed in year t, and X_{ict} is a vector of

[20] The results are not sensitive to the specific cutoffs. In any case, the average Muslim share of population in countries is estimated at around 25 percent, so that the 25 percent cutoff characterizes as "non-Muslims" those countries that have a below-average Muslim population.

[21] This is tantamount to saying that the average latitude for the two groups are very similar. We also use as an alternative comparison group the sub-sample of non-Muslim countries such that all of them are within the range of latitudes covered by the Muslim sample, and the results are essentially identical.

demographic controls.[22]

We estimate this equation on the sample of individuals who are presumably "treated" by Ramadan fasting: those who self-identify in the survey as religious Muslims. Excluding non-religious Muslims reduces compliance issues, since these are more likely not to fast during Ramadan.[23] Of course, religious Muslims may still not perfectly comply with the formal fasting hours. In this case, what we estimate is the reduced form effects of formal fasting hours, leading to underestimates of the true effects of Ramadan fasting. We will henceforth use the terms religious Muslim and Muslim interchangeably, in the context of the individual survey data.

This focus on Muslim individuals, rather than countries, also means that we can actually use information from a broader set of countries. In particular, we now have additional variation in latitude at our disposal, as can be readily seen from Figure 5, depicting the size of samples coming from each country.

[FIGURE 5 HERE]

Another important factor to keep in mind when interpreting our results is that, since the survey takes place throughout the calendar year, the vast majority of the data points (presumably 11/12, and most likely more) will lie outside of the month of Ramadan. As exact interview dates are not recorded in the data, we define $RamadanHours$ as the number of fasting hours during the most recent Ramadan preceding the survey year.[24]

Finally, we note that all of our specifications will report standard errors clustered at the country level, to allow for the possibility that the error term might be correlated for different observation within a country – particularly since fasting hours vary smoothly from one year to the next. Tables A3 and A7 in the Appendix show that the results are robust to two-way clustering by country and by year (Cameron, Gelbach, and Miller 2011).

4.3 Placebo Regressions

We have discussed the two contributing factors that lead to the within-country variation in Ramadan fasting hours, and our identifying assumption is that this variation is idiosyncratic and uncorrelated with other determinants of our outcome variables. This assumption would be violated and lead to spurious results if, for example, countries located further away from the Equator were, for some

[22]The controls are: gender dummy, second-order polynomial in age, marital status dummies, number of children, and education dummies.

[23]According to survey evidence from Dinar Standard (2011), from five Muslim countries (Malaysia, Saudi Arabia, Egypt, Pakistan, UAE) and five countries where Muslims are a minority (USA, UK, Canada, India, Australia), 98% of Muslims report fasting during Ramadan.

[24]The results are essentially identical if we use the hours in the survey year itself (results available upon request).

reason unrelated to Ramadan, systematically less (or more) productive in years when fasting hours are longer, compared to countries located closer to the Equator.

We can provide some evidence to assess this possibility, again making use of the fact that we would expect Ramadan to have no effect in countries with small Muslim populations, nor on the individual behavior of non-Muslims in those countries. We can thus run "placebo" versions of (3) and (5), restricted to those sub-samples. Were we to find any effects, these would most likely be spurious, and indicate that our identification assumption is somehow violated.[25]

Table 1 presents the results from the placebo regressions for all of our main dependent variables of interest. There is no evidence of spurious results. Not only are all the coefficients insignificant at conventional levels, they are also quantitatively very small, indicating that the lack of significance is not due to imprecision. In short, Ramadan fasting hours are uncorrelated with economic growth, employment and wage growth, unemployment or self-reported well-being in non-Muslim countries. This lends credibility to our identification strategy.

[TABLE 1 HERE]

5 Results

We first present our main results on the effect of Ramadan on economic growth and SWB. We then examine the implications for the labor market, to understand some of the mechanisms behind those results.

5.1 Effects on Economic Growth

Table 2 presents the results on economic growth. We start by showing a simple regression of real per capita GDP growth on (log) Ramadan fasting hours, in Column (1). The estimate is negative and statistically significant, implying that country-year pairs with long fasting hours tend to have on average lower growth rates. Column (2) then includes country fixed effects, to control for factors that affect growth and also covary with country latitude. We see a similar negative coefficient, implying that, for a given country, years with summer Ramadan display on average lower growth. Column (3) includes year fixed effects instead, to control for growth correlates that also covary with the timing of Ramadan. Here the estimate implies that, in any given year (and thus conditional on when Ramadan occurs), countries with longer fasting hours grow more slowly on average.[26]

[25] We do not include non-Muslims in Muslim countries for the simple reason that the hypothesis under investigation is that Ramadan affects the entire economy of a country, which implies general equilibrium effects.

[26] The stability of the coefficient across the specifications with year and country fixed effects suggests that the variation in temperature during the month of Ramadan, which naturally correlates with prescribed hours of fasting and

[TABLE 2 HERE]

Column (4) then displays our benchmark specification, including both year and country fixed effects. The estimate is again statistically significant (β=-0.099, p=0.013), very similar in magnitude, and shows that Ramadan fasting has a negative effect on real GDP growth, consistent with our stated hypothesis. Column (5) shows that controlling for population growth does not affect the point estimate. Quantitatively, the last line in Table 2 shows that a one standard deviation increase (in the sample of Muslim countries) in Ramadan fasting hours, of roughly 10 percent, induces a decrease in economic growth of around one-ninth of a standard deviation.

We then present the differences-in-differences estimate, in Column (6). It is also statistically significant (p=0.020) and again similar in magnitude (β=-0.091). Importantly, the estimate on Ramadan Hours captures the estimated effect on non-Muslim countries and is very close to zero, as expected, confirming the message from Table 1.

Columns (7)-(12) in turn present results for GDP growth, as opposed to per capita GDP, using the same permutations of specifications and samples as Columns (1)-(6). These estimates are qualitatively and quantitatively similar.[27]

Our results are robust to a wide variety of checks, which we report in the Appendix. Table A3 shows that the estimates are robust to the inclusion of country-specific linear time trends: they are significant at conventional levels and, if anything, increase in magnitude when the country trends are included. The table also shows that the estimates are statistically significant when using a lower %-Muslims sample inclusion threshold. The coefficient generally decreases in magnitude as the threshold is lowered, which is unsurprising given that countries where a smaller share of the population are fasting are gradually included.

The results are not driven by outliers either. Figure A1 in the Appendix makes that point visually by showing the outcome residuals plotted against log Ramadan hours residuals from the baseline specification. Alternatively, Figure A2 shows that the results are unchanged when we drop each Muslim country from the sample, one at a time: the coefficients are very stable, and statistically significant. By the same token, the log specification does not seem to matter: Table A4 shows that the results are very similar in specifications with Ramadan fasting hours in levels.

Our next step is to consider the possibility that results could be somehow affected by convergence or mean-reversion. To deal with that, we include lagged (log) income on the right-hand side of our specifications, to account for convergence. Since there are substantial econometric challenges in estimating the rate of convergence, especially in the presence of country fixed effects,

also affects the intensity of Ramadan practice, does not explain much of the effect we find. After all, the variation in temperature should be more important in the contrast between summer and winter Ramadans within a country than in the comparison between different Muslim countries in a given season.

[27] Table A2 in the Appendix shows the results for GDP per worker (for which there is less data available), which are very similar, with a slightly larger estimated effect that nevertheless cannot be statistically distinguished.

we control for lagged income while imposing that it falls within the confines established by the growth literature (Barro 2012). Specifically, we allow for the rate of convergence to be right at the level of the "iron law of convergence" (2% per year), or at the lower and upper bounds (1.7% and 2.4% respectively). In addition, following standard practice in the growth literature, we also collapse our data in blocks of five years (and also two, three, or four) so as to filter out noise in the yearly variation. In our case, most of the within-country variation in Ramadan fasting comes from comparing blocks of years (e.g. summer versus winter Ramadans), which is another reason to consider the results with the collapsed data.[28] Table A5 shows that the results are robust to different combinations of these procedures, both in the statistical significance and quantitative senses, as we can see by comparison with the baseline estimates that are reported in the first column.

Finally, we also consider robustness to the possibility of terms of trade shocks. We control for measures of export and import prices (from the Penn World Tables 8.0), in order to account comprehensively for the possibility that the evolution of terms of trade – encompassing commodity price shocks or similar developments – could confound our results. Table A6 shows that the results are indeed robust, with coefficient sizes again very much in line with our baseline results.

We thus find robust evidence of a causal effect of longer Ramadan fasting on economic growth. Quite importantly, the estimated magnitudes are also robust, and quantitatively meaningful. To translate them into a more concrete example, consider a thought experiment whereby the average daily Ramadan fasting were to increase to 13 hours, instead of the actual mean of 12 hours. This is about one standard deviation of the variation experienced over the Ramadan cycle by the average Muslim country in our sample, corresponding roughly to the latitude of Bangladesh. Our range of estimates implies that output growth would then be lower by roughly between 0.6 and 0.9 percentage point. (For the sake of comparison with the pre-existing literature on religious practices and growth, Barro and McCleary (2003) find that a one-standard-deviation increase in monthly church attendance is associated with a decrease of about 1.1 percentage point in the growth rate.) Alternatively, the magnitudes imply that the average growth rate in Bangladesh at the height of the (Northern) summer Ramadan cycle would be about 1 percentage point greater than that of Turkey, which has longer summer fasting hours. In contrast, growth in Bangladesh would be about 1 percentage point lower than in Turkey over the winter Ramadan years.

5.2 Effects on Subjective Well-Being

We now turn to the SWB results. Table 3 presents the results on the two key self-reported measures, happiness and life satisfaction. When estimating the effects on the first measure for all

[28] To avoid needlessly throwing away relevant variation, we define the blocks so as to minimize the variation in fasting hours within them. We have checked the results for blocks of up to eight years, and they are robust. We do not report these results for the sake of keeping tables relatively uncluttered, but they are available upon request.

Muslims in the sample (Columns (1) and (2)), the coefficients are positive and highly statistically significant (p=0.001-0.003), indicating that Ramadan fasting increases measured SWB for Muslim individuals.

[TABLE 3 HERE]

Columns (3) and (4) then estimate the effects separately for men and women. The coefficients are significant and positive for both genders, with a larger effect for women. Column (5) restricts the sample to countries where more than 75 percent of the population are Muslim. It shows that the effect is significant (p=0.028), and with a larger estimated coefficient, though the standard error is naturally larger as a result of substantially less variation in fasting hours and the estimates cannot be statistically distinguished. Column (6) in turn shows that the results are robust to running an ordered logit regression where the dependent variable is the four-category answer to the happiness question.

Columns (7)-(12) then present the results for the same exercise, using life satisfaction as the dependent variable. We see results that are qualitatively very similar to those for happiness, though the effect is generally larger from a quantitative perspective. In Table A7 of the Appendix, we show that the results are robust to two-way clustering of the standard errors and controls for country-specific trends, and Figure A3 and A4 in the Appendix shows that the estimates are not driven by outlier observations or individual countries. Finally, Table A8 establishes that the results are essentially the same if we use Ramadan fasting hours in levels rather than logs.

The quantitative implications of the SWB results are also meaningful, as was the case with GDP. The estimates imply that our aforementioned thought experiment of increasing average fasting hours from 12 to 13 increases the likelihood that a Muslim is happy by about 4 percentage points, corresponding to a standardized effect that is roughly similar to what we found for GDP. The same exercise increases the likelihood that a Muslim is satisfied with life by approximately 9 percentage points, which translates into a standardized effect that is slightly larger.

In short, while Ramadan fasting has an important material cost in Muslim countries, it is associated with Muslims feeling significantly happier and more satisfied with their lives.

5.3 Mechanisms

We now turn our attention to the question of what mechanisms drive these effects. A number of channels are possible but, as discussed in Section 3, we approach this challenge by looking at the distinct implications for what is a first-order arena: the labor market.

5.3.1 Effects on the Labor Market: Employment and Wages

Table 4 presents results on labor market outcomes using data from the manufacturing sector. Note that, since the manufacturing sector is disproportionately concentrated in the formal sector, and particularly so in developing countries such as most of the Muslim world, we should interpret this data as more indicative of equilibrium outcomes in the formal economy.

[TABLE 4 HERE]

The first four columns report results on employment growth. The point estimate in Column (1) is negative and statistically significant (p=0.065), with similar estimates and standard errors when controlling for population growth (Column (2)), country trends (Column (3)), or when running the differences-in-differences specification (Column (4)). The point estimate of 0.21 implies that a one standard deviation in fasting hours leads to approximately a 2 percentage point decrease in yearly employment growth, and corresponds to a standardized effect of -0.17. The evidence thus indicates that Ramadan fasting leads to fewer workers in the formal manufacturing sector.

This negative effect on employment is consistent with a decrease in labor demand, with a decrease in labor supply, or possibly both. To further understand the mechanisms, and whether there are demand or supply shifts in the labor market, Columns (5)-(8) present estimates on the evolution of wages in the manufacturing sector. The point estimates are similar across specifications (β=0.49-0.61), statistically significant (p=0.006-0.011), and show that the decrease in employment growth is accompanied by an *increase* in wage growth. These effects are also quantitatively meaningful. A one standard deviation increase in Ramadan fasting is estimated to cause a 4 percentage point increase in wage growth (the mean growth rate in Muslim countries is 8.5 percent yearly), or a 0.23 standardized effect.

The evidence thus suggests that Ramadan has a negative impact on labor supply. Moreover, it indicates that, to the extent that there is any decrease in labor demand driven by lower productivity, it is being dominated by the labor supply effects. A natural question is therefore whether the GDP growth effects can be explained solely explained by a shift in labor supply. A simple back-of-the-envelope calculation suggests that labor supply is a key explanatory factor, but that it is unlikely to fully explain how the GDP effects arise. To see this, let the marginal effect on employment growth of Ramadan be -0.2 (from Table 4) and assume a standard labor share of income of 2/3, then we would expect the predicted marginal GDP growth effect in equation (1) to be 0.13. This is certainly in the ball park of the estimates found in Table 2 (0.9-0.10), but taken literally it suggests that the GDP effects would have been even larger, unless in the unlikely case that Ramadan increases labor productivity.

There are two important limitations to this calculation, however. First, the estimate on employment growth only reflects changes in the formal manufacturing sectors, and labor supply in other

sectors may be less affected by Ramadan. Second, the observed employment decrease in manufacturing does not imply that the marginal workers stop working altogether, but may reflect that workers choose to engage in productive activities outside of manufacturing (e.g., self-employment or agriculture). In other words, Ramadan may also influence occupational choice, in addition to how much to work.

Our next step is thus to complement the results from Table 4 with survey-level evidence, using the WVS. This allows for a more granular analysis of the labor market, and lets us investigate employment status more broadly. Since there is no a priori reason why Muslims in some countries would differentially shift their labor supply decisions, we use data from all countries in the dataset. As formal labor force participation by Muslim women is very low, we focus on the sample of Muslim men.[29]

The results are in Table 5. The estimates in Columns (1)-(4) confirm that employment decreases, but clarify that the effects seem primarily driven by a decrease in part-time, rather than full-time, employment: the point estimates on part-time employment, in Columns (3) and (4), are negative and statistically significant, while the estimates on full-time employment in Columns (1) and (2) are substantially smaller in magnitude and insignificant. This is perhaps not that surprising, given that part-time workers are arguably more likely to be closer to the extensive margin in the formal sector. Quantitatively, a one standard deviation increase in fasting hours decreases the likelihood that a Muslim is employed part time by 2.9 percentage points.[30] When scaled by the standard deviation of the outcome among Muslims, this corresponds to a negative 0.10-0.12 standardized effect.

[TABLE 5 HERE]

In contrast, there is no evidence that Ramadan affects unemployment (Columns (7)-(8)). Instead, Columns (5)-(6) show that Ramadan fasting affects the likelihood of being self-employed. The implied effect suggests that a one standard deviation increase in fasting hours increases the likelihood that a Muslim is self-employed by 2.5 percentage points, or a 0.07-0.09 standardized effect. Furthermore, despite the decrease in formal employment and the increase in self-employment, Columns (9)-(10) show that individuals report a greater satisfaction with their financial situation, consistent with a voluntary reduction in labor supply.

At this point it is worth restating that the individuals in the WVS dataset are surveyed throughout the year. The dataset does not record information on the date of each interview, but if we assume a uniform distribution then we would expect only approximately 1/12 of individuals to be

[29] We present results on labor market outcomes for women in Table A10 in the Appendix.

[30] Our data contains the full sample of all adult Muslim men, and therefore also includes retired persons and students. 25 percent of the individuals are employed full time.

surveyed during the month of Ramadan. (This is probably an overstatement, since in practice it is relatively unlikely that many interviews would be conducted at that time.) Given the magnitude of the effects, it is arguably implausible that the estimates solely reflect effects during the month of Ramadan. Instead, they suggest that there is a shift in labor supply that stretches *beyond* the holy month itself.

Together, the evidence in Tables 4 and 5 shows that Ramadan fasting has an economically substantial effect on the labor market, which helps explain the mechanisms driving lower economic growth. The results show that Ramadan fasting leads to lower labor supply in the manufacturing sector, suggesting a shift of workers out of formal employment and into self-employment. The magnitude of the effects indicate that Ramadan affects Muslim country economies beyond the month of Ramadan itself. Since self-employment in developing countries is generally associated with informality and lower productivity (La Porta and Shleifer, 2008), it thus seems that the negative effect on GDP growth is at least in part driven by voluntary occupational choice into the informal sector.[31]

5.3.2 Effects on the Labor Market: Preferences and Values

A long tradition in the social sciences that has held that religion in general, and religious practices in particular, can affect preferences and values that in turn influence individual behavior in markets. It is thus natural to wonder whether the documented effect of Ramadan on labor supply and occupational choice is partly due to shifts in labor-related preferences and values. We now turn to this question.

Table 6 presents the results from the WVS dataset and shows that Ramadan affects values and preferences related to work and priorities in life among Muslims. First, Columns (1)-(2) show that longer Ramadan fasting leads to a statistically significant (p = 0.009) increase in self-reported religiosity. There is no statistically significant effect on the self-reported, absolute, importance of work (Columns (3)-(4)), but when comparing the *relative* importance of work versus religion (Columns (5)-(6)), i.e. their relative rank about what is important in life, the estimates imply that a one standard deviation decreases the likelihood that work is viewed as more important than religion by approximately 2.9 percentage points, corresponding to a -0.09 standardized effect. To put this in perspective, this is approximately equivalent to the difference in views between Muslims that have completed high school versus those that have a college degree. Alternatively, 11 percent of Muslim men in the sample view work as more important than religion, compared to 50 percent

[31] Another possible interpretation is that the shift towards the informal sector reduces measured GDP, as distinct from actual output. Still, GDP is the best measure we have, and the two possibilities are not mutually exclusive: it is reasonable to think that part of the GDP reduction corresponds to actual output lost to lower productivity, while measurement issues make up another portion of it.

among non-Muslim men, and the estimate implies a decrease of approximately 26 percent in the number of Muslim men viewing work as relatively more important.

[TABLE 6 HERE]

The regressions in Columns (7)-(10) provide further evidence that preferences related to labor markets and job search are affected by Ramadan fasting. When asked about whether a high income is the most important aspect when searching for a job, Muslims are significantly less likely to report that a good income is the first priority (as compared to finding a job where you work with people you like, doing an important job, getting a safe job, or doing something for the community). This indicates that Ramadan reduces material, or monetary, preferences, at least when it comes to job search. Moreover, Ramadan fasting affects preferences about what a "good job" entails, as longer fasting hours are significantly associated with preferences for good hours in a job. The estimated effect of 1.00-1.08 in Columns (9)-(10) implies that a one standard deviation increase in fasting hours increases the share of Muslim men that view good hours as important by 12-13 percent. This suggests that preferences for jobs with fewer hours, or more flexible hours, are affected.

This result is in fact broadly consistent with survey evidence of Muslims interviewed in ten countries (DinarStandard, 2011), when asked about work-related issues pertaining to Ramadan fasting in particular. A key finding of the study was that employees in the formal sector would like employers to increase work flexibility in order to be able to conduct the religious practices good Muslims are supposed to, such as prayer or reading of the Qur'an, during the month of Ramadan. 42 percent of the respondents would also like employers to set special Ramadan hours.

The results in Tables 5 and 6 therefore provide evidence that an underlying reason for the decrease in labor supply in the formal sector, and shifting of workers into self-employment, is that Muslims voluntary choose to work less – and that this decrease in formal employment is, at least in part, due to changes in work-related preferences and values. That is, the religious practice of Ramadan makes Muslims more religious, less likely to consider work as more important than religion, and less interested in job characteristics associated with jobs in the formal sector, namely relatively good wages but less flexible work hours (Maloney, 2004).

6 Discussion

Our central results are very clear. First, longer Ramadan fasting has a robust, statistically significant, and quantitatively important negative effect on economic growth in Muslim countries. This is very much in line with the correlation patterns previously found in the literature that has looked at the links between religious practices and economic growth, though quantitatively our estimates

imply an effect of religious practices that is somewhat smaller than what is found for instance in Barro and McCleary (2003).

Second, longer Ramadan fasting has a robust, statistically significant, and quantitatively important positive effect on the subjective well-being of Muslim individuals. This seems consistent with the extant literature on religion and happiness, but is in fact in tension with the previous result on growth: since what we measure is a net effect on SWB, our evidence indicates that Muslims are happier in spite of being poorer. Any negative effect of reduced GDP growth and material living standards on SWB are therefore trumped by the non-pecuniary benefits of a longer, or more intense, prescribed religious practice.

How can we understand the underlying mechanisms driving these results, and what explains the diverging effects on GDP and SWB? It is here that our evidence on labor markets and work-related preferences, by shedding light on the mechanisms behind the effect on economic growth, is especially useful.

The first step comes from the recognition that direct effects from Ramadan on economic growth could come from its impact on labor supply decisions and/or from its impact on productivity. The second step is to note that these different channels have different implications for labor markets. Our results indicate that labor supply decisions are the most important factor in practice: we find that Ramadan negatively affects employment growth in the manufacturing sector, but has a positive impact on wage growth, consistent with a shock to labor supply. The survey evidence then shows that workers seem to shift from (mostly part-time) formal employment, and into self-employment, most likely in the informal sector

The evidence thus suggests that, rather than a direct effect on productivity due to fasting, what matters most are the changes in labor supply decisions and occupational choice, towards a lower productivity sector. The more important productivity losses are, so to speak, an indirect consequence of Ramadan fasting, via shifts in individual decisions.

This begs the question of what lies behind these shifts. Ramadan certainly demands time and involvement that compete with work activities, and our central result rejects the hypothesis that the intensity of those demands is compensated for over the rest of the year. Still, the results point at deeper, more durable changes. First of all, not only do they not seem driven by direct productivity losses due to fasting, but also the magnitudes involved suggest that the effect we document is not limited to lost working hours during the month itself: when it comes to output, employment or wages, the effects in yearly data seem too large to be ascribed to a one-month slowdown. This suggests that the intensity of Ramadan fasting entails longer-lasting effects that spill over beyond the month.

Moreover, the survey data provide direct support for that conclusion, especially since the vast majority of responses, in all likelihood, do not come from the month of Ramadan. First, those data

show causal evidence of an effect of Ramadan fasting on labor market status, as discussed above. In addition, there also is causal evidence that Ramadan influences what Muslims view as important in life: they report caring relatively less about work and material rewards, when compared to religion or, more prosaically, things like job flexibility. This suggests that the changes in labor supply decisions are at least partly associated with relatively persistent changes in preferences and values.

This evidence also helps assuage the apparent contrast between the material cost of the practice and the increased self-reported happiness and life satisfaction that result from it. It suggests that SWB increased not only due to possible direct benefits of the practices itself (socialization, time devoted to prayer and reflection, time spent with family and friends), but also to a reduced focus on the material and monetary aspects in life and work. In light of such a possibility, it may not be that puzzling that longer Ramadan fasting makes people "poorer, but happier".

These facts open up interesting questions of external validity and the extent to which other religious practices would have similar effects, qualitatively or quantitatively. Needless to say, our regression estimates obviously cannot be directly extrapolated to other practices – Islamic or non-Islamic – but given that many of them share common elements, it seems reasonable to expect that they could put in motion similar mechanisms to the ones our evidence highlights.

In that regard, our finding that the impact of Ramadan cannot be mainly attributable to the direct physiological consequences of nutritional intake during the month of Ramadan itself is important. Had we found otherwise, one would have had fewer reasons to believe similar effects might arise from other religious practices, given that most of them do not directly prescribe rules of behavior related to fasting.

It is also important to note that nothing in what we find is indicative that the effects regarding labor supply and occupational choice come about due to doctrinal aspects of Islam – in fact, the Qur'an and Islamic doctrine place substantial emphasis on the importance of work (e.g. Ali 2005, ch.4). Therefore, changes in work-related beliefs and values could well be driven by non-doctrinal behavioral mechanisms associated with Ramadan – say, because social interactions among family members and friends influence beliefs through various peer effects, or because spiritual experiences induce reflection on what behavior and choices increase happiness and life satisfaction. Many other kinds of non-Islamic religious practices that do not involve fasting, such as the Shabbath, Christmas, or Diwali, are nevertheless similar to Ramadan in key dimensions that could put such mechanisms in motion: they foster time-consuming social interactions and spiritual activities, in a coordinated fashion among members of the religious community. This underscores that the Ramadan context may very well exemplify a more wide-ranging phenomenon.

To push this logic even further, one may speculate whether secular mechanisms, such as statutory vacations, holidays, festivals, and civic celebrations, could have similar effects as well. While our results on views regarding the importance of religion do indicate that there is something about

religious content behind the impact of religious practices, it is certainly possible that changes in behavior and subjective well-being are in part triggered by their more generalizable features.

Ultimately, however, the extent to which other religious practices and holidays affect work-related beliefs and values, reduce labor supply and economic growth – while simultaneously increasing subjective well-being – is an empirical question that only future research can answer.

7 Concluding Remarks

Using idiosyncratic variation induced by the rotating Islamic calendar, we have established causal evidence for a negative effect of Ramadan fasting on economic growth in Muslim countries. We have also established, however, that this is accompanied by an increase in the levels of self-reported happiness and life satisfaction among Muslims. We have argued that these are primarily associated with labor supply and occupational choice decisions of Muslim individuals, rather than through direct productivity decreases due to the fasting itself. We have also shown that part of the effect is associated with changes in the way those individuals value work and material rewards.

Based on these results, we can speculate over the possible functional roles played by religion and some puzzling questions that naturally arise. First, the fact that we identify that a costly religious practice can increase subjective well-being is consistent with people having a demand for religious practices. Understanding the deeper determinants of this demand, what type of practices that that are sustained over time and why, are interesting avenues for future research. Second, and related, our results arguably give rise to a few questions about individual decisions, particularly to the extent that one could interpret the measures of reported SWB as indicative of welfare in a broader sense.[32] If people are happier when they are exogenously induced to fast longer, why were they not fasting longer to begin with? Similarly, if the increased happiness comes from working less, why had they not chosen to do so without the extra inducement? These puzzles seem to suggest that religious practices could improve outcomes, say, by playing roles as devices for providing self-control (e.g. McCullough and Willoughby 2009) or coordination (e.g. Carvalho 2010). For instance, people may be willing to fast longer or work less, but only as long as others are also fasting longer or working less (perhaps due to stiff competition in the labor market). In that case, religious practices may provide a way to coordinate around that presumably better outcome.

Last but not least, our paper also provide some new insights for the ongoing debate regarding how to assess the effects of policy interventions on welfare. Our results identify circumstances in which GDP growth and SWB are pushed in different directions, and in doing so they substantiate calls for considering measures of SWB as important indicators, in addition to standard measures such as GDP (Stiglitz, Sen and Fitoussi 2009).

[32] For a discussion of that extent, see Benjamin et al. (2012).

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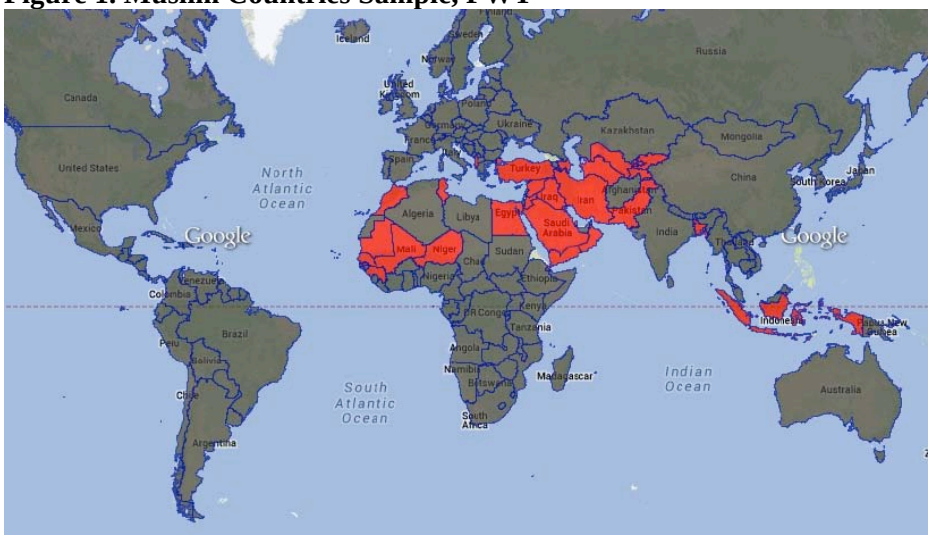
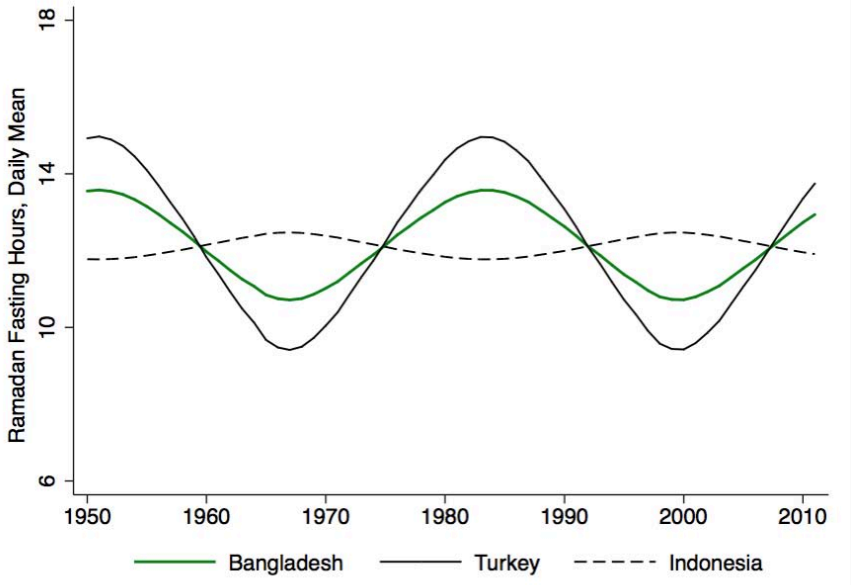
Figure 1. Muslim Countries Sample, PWT



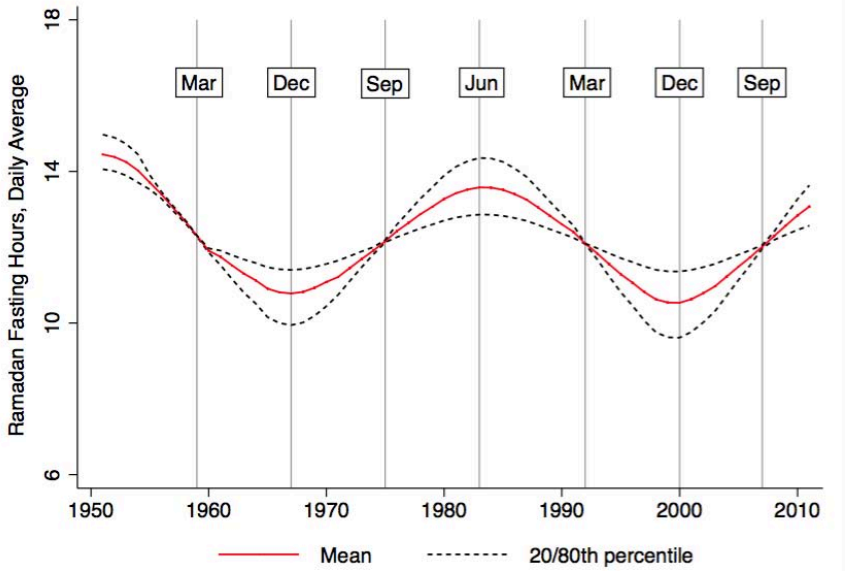
Note: The map indicates (in red) the 32 sampled Muslim countries (>75% Muslim population) in the Penn World Tables dataset.

Figure 2. Daily Ramadan Fasting Hours, 3 countries example



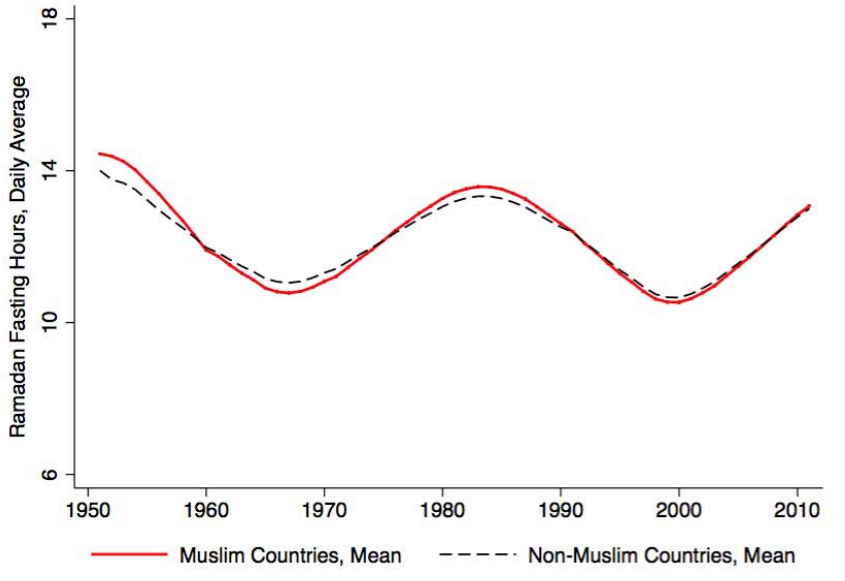
Note: Each line represents the average daily number of sunrise-to-sunset hours during the month of Ramadan in each year, measured in each country's capital.

Figure 3. Daily Ramadan Fasting Hours in Muslim Countries, PWT



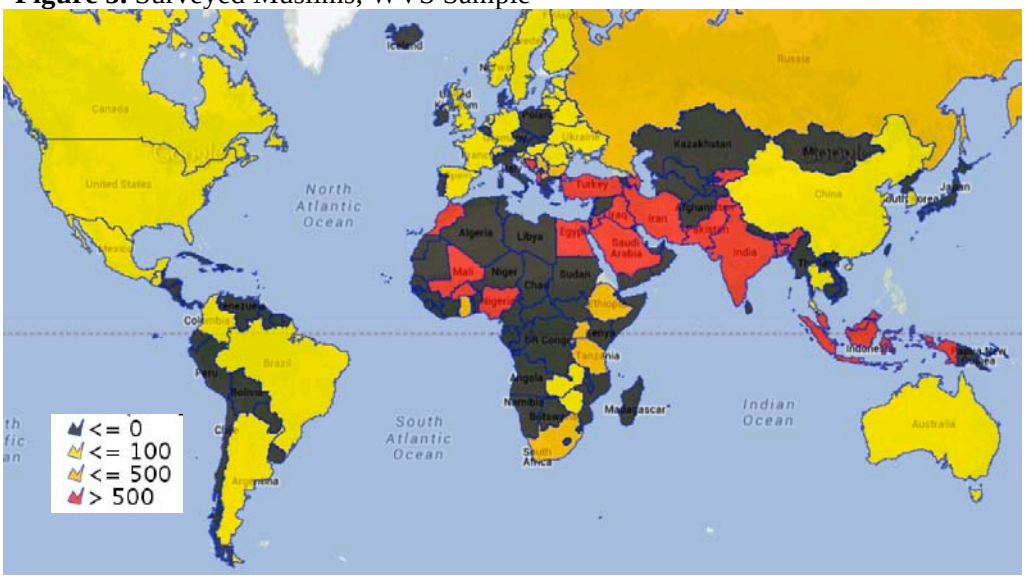
Note: Each line represents the average daily number of sunrise-to-sunset hours during the month of Ramadan in each year, for different parts of the distribution among Muslim countries. The red line is the mean, while the dashed lines represent the 20th and 80th percentiles. The boxes at the top indicate which month Ramadan starts in. The graph shows that most of the within-year variation in fasting hours occurs during summer and winter Ramadan (June and December), while there is no variation when Ramadan is held in equinox months (March and September).

Figure 4. Daily Ramadan Fasting Hours in Muslim and Non-Muslim Countries, PWT



Note: Each line represents the average daily number of sunrise-to-sunset hours during the month of Ramadan in each year, for Muslim countries (>75% Muslim population) and non-Muslim countries (<25% Muslim population) in the Penn World Tables dataset.

Figure 5. Surveyed Muslims, WVS Sample



Note: The map shows the 69 countries with surveyed Muslims in the World Values Survey dataset, during 1981-2008. Black color indicates nobody was sampled, yellow indicates up to 100 individuals, orange indicates up to 500, and red indicates more than 500 sampled individuals. There is a total of approximately 40'000 surveyed Muslims in the sample.

Table 1. Placebo Tests, Non-Muslim Countries

	Country-Level Data						*Individual-level Survey Data*					
	GDP Growth	GDP per Capita Growth	GDP per Worker Growth	Capital Stock Growth	Employ-ment Growth	Wage Growth	Employed Full Time	Employed Part Time	Self Employed	Unemploy-ed	Happine-ss	Life Satisfact-ion
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Ramadan Hours, Log	-0.009	-0.007	-0.005	-0.006	0.011	0.007	0.065	-0.035	-0.016	0.045	-0.026	-0.016
	(0.007)	(0.006)	(0.006)	(0.006)	(0.022)	(0.022)	(0.048)	(0.023)	(0.039)	(0.049)	(0.023)	(0.049)
Observations	6021	6021	5153	5973	2537	2537	158848	158848	158848	158848	160649	163817
R-squared	0.17	0.16	0.16	0.29	0.19	0.19	0.05	0.02	0.09	0.05	0.10	0.17
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dataset	PWT	PWT	PWT	PWT	INDSTAT	INDSTAT	WVS	WVS	WVS	WVS	WVS	WVS
P-value	**0.15**	**0.25**	**0.39**	**0.32**	**0.24**	**0.62**	**0.17**	**0.17**	**0.66**	**0.37**	**0.27**	**0.75**

Note: *Ramadan hours* is the average number of sunrise to sunset hours during the month of Ramadan, measured in the country's capital. All samples consist of non-Muslim countries (less than 25 percent Muslim population). In the individual-level survey data all individuals are non-Muslims, and the dependent variables are dummy variables. See section 4.1 for a description of the datasets. Robust standard errors in parentheses, clustered at the country level. *** p<0.01, ** p<0.05, * p<0.1.

Table 2. The Effects of Ramadan on Economic Growth in Muslim Countries

	Real GDP per Capita Growth						Real GDP Growth					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Ramadan Hours, Log	-0.087***	-0.092***	-0.099***	-0.099**	-0.099**	-0.008	-0.052**	-0.067**	-0.084**	-0.101**	-0.101**	-0.007
	(0.026)	(0.026)	(0.032)	(0.040)	(0.038)	(0.006)	(0.023)	(0.025)	(0.032)	(0.039)	(0.039)	(0.007)
Muslim Country*Ramadan Hours, Log						-0.091**						-0.093**
						(0.039)						(0.040)
Observations	1416	1416	1416	1416	1416	7437	1416	1416	1416	1416	1416	7437
R-squared	0.01	0.06	0.08	0.13	0.15	0.15	0.00	0.05	0.08	0.12	0.12	0.17
Sample Countries	Muslim	Muslim	Muslim	Muslim	Muslim	All	Muslim	Muslim	Muslim	Muslim	Muslim	All
Country FE	No	Yes	No	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes
Year FE	No	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Population Growth Control	No	No	No	No	Yes	Yes	No	No	No	No	Yes	Yes
Year-by-Muslim-Country FE	No	No	No	No	No	Yes	No	No	No	No	No	Yes
Standardized Effect	-0.11	-0.11	-0.12	-0.12	-0.12	-0.11	-0.06	-0.08	-0.10	-0.13	-0.13	-0.12

Note: Country-year panel data from Penn World Tables 8.0, 1950-2011. All outcome variables are in constant 2005 prices. *Ramadan hours* is the average number of sunrise to sunset hours during the month of Ramadan, measured in the country's capital. A *Muslim country* is defined as having more than 75 percent of the population of Muslim denomination. The sample in columns (6) and (12) includes non-Muslim countries, defined as having a Muslim population of less than 25 percent. Robust standard errors in parentheses, clustered at the country level. *** p<0.01, ** p<0.05, * p<0.1.

Table 3. The Effects of Ramadan on Subjective Well-Being Among Muslims

	Happiness						Life Satisfaction					
	Dummy	Dummy	Dummy	Dummy	Dummy	Likert, Ologit	Dummy	Dummy	Dummy	Dummy	Dummy	10p scale
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Ramadan Hours, Log	0.462***	0.521***	0.340**	0.747***	1.155**	1.350***	0.965***	1.149***	1.197***	1.207***	4.167	6.991***
	(0.152)	(0.145)	(0.158)	(0.179)	(0.524)	(0.293)	(0.308)	(0.310)	(0.314)	(0.342)	(3.306)	(1.647)
Observations	39636	37821	18456	19365	30830	37821	39490	37689	18411	19278	30712	37689
R-squared	0.09	0.10	0.11	0.11	0.10	0.13	0.09	0.10	0.10	0.10	0.09	0.11
Sample Countries	All	All	All	All	Muslim	All	All	All	All	All	Muslim	All
Sample Individuals	All	All	Males	Females	All	All	All	All	Males	Females	All	All
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Standardized Effect	0.10	0.12	0.07	0.17	0.24	N/A	0.17	0.21	0.21	0.22	0.69	0.24

Note: Individual-level outcome data from the World Values Survey, 1981-2008. All individuals in the sample are Muslims. *Ramadan hours* is the average number of sunrise to sunset hours during the month of Ramadan in the year preceding the survey, in the country's capital. The controls are: age, age squared, number of children, marital status dummies, education level dummies, and a gender dummy. A Muslim country (column (5) and (11)), is defined as before. Robust standard errors in parentheses, clustered at the country level. *** p<0.01, ** p<0.05, * p<0.1.

Table 4. The Effects of Ramadan on Employment and Wage Growth in Muslim Countries, Country-Level

	Employment Growth, Number of Workers				Wage Growth, Average Wages			
Sample Countries	*Muslim*	*Muslim*	*Muslim*	*All*	*Muslim*	*Muslim*	*Muslim*	*All*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ramadan Hours, Log	-0.207*	-0.210*	-0.200**	-0.015	0.500**	0.498**	0.605***	0.012
	(0.107)	(0.117)	(0.079)	(0.014)	(0.182)	(0.179)	(0.213)	(0.022)
Muslim Country * Ramadan Hours, Log				-0.195*				0.487***
				(0.111)				(0.174)
Observations	581	581	581	3,118	581	581	581	3,118
R-squared	0.22	0.23	0.28	0.17	0.17	0.17	0.19	0.18
Sample Countries	Muslim	Muslim	Muslim	All	Muslim	Muslim	Muslim	All
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Population Growth Control	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Country Trends	No	No	Yes	No	No	No	Yes	No
Year-by-Muslim-Country FE	No	No	No	Yes	No	No	No	Yes
Standardized Effect	-0.17	-0.17	-0.16	-0.16	0.23	0.23	0.23	0.22

Note: Country-year unbalanced panel data on employment and average wages from UNIDO INDSTAT manufacturing dataset, 1963-2010. All variables are defined as before. The full sample consists of 166 countries, of which 26 are Muslim countries. Standard errors clustered at the country level. *** p<0.01, ** p<0.05, * p<0.1.

Table 5. The Effects of Ramadan on Employment Among Muslims, Individual-Level Survey Data

	Employed Full Time		Employed Part Time		Selfemployed		Unemployed		Satisfaction with Financial Situation of Household	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Ramadan Hours, Log	-0.119	-0.160	-0.295**	-0.363***	0.404**	0.311**	-0.022	-0.081	8.16***	8.97***
	(0.334)	(0.283)	(0.119)	(0.123)	(0.190)	(0.137)	(0.135)	(0.134)	(1.24)	(1.05)
Observations	18720	17968	18720	17968	18720	17968	18720	17968	19338	18417
R-squared	0.09	0.21	0.03	0.04	0.07	0.12	0.05	0.10	0.11	0.13
Sample Countries	All	All	All	All	All	All	All	All	All	All
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Standardized Effect	-0.02	-0.03	-0.10	-0.12	0.09	0.07	-0.01	-0.02	0.28	0.31

Note: Individual-level outcome data from World Values Survey, 1981-2008. The sampled individuals are Muslim men. *Ramadan hours* is the average daily number of sunrise to sunset hours during the month of Ramadan in the year preceding the survey, measured in the country's capital. All dependent variables are indicator variables, except Financial Satisfaction which is given on a 10-point scale. The controls are the same as in Table 3. Robust standard errors in parentheses, clustered at the country level. *** p<0.01, ** p<0.05, * p<0.1.

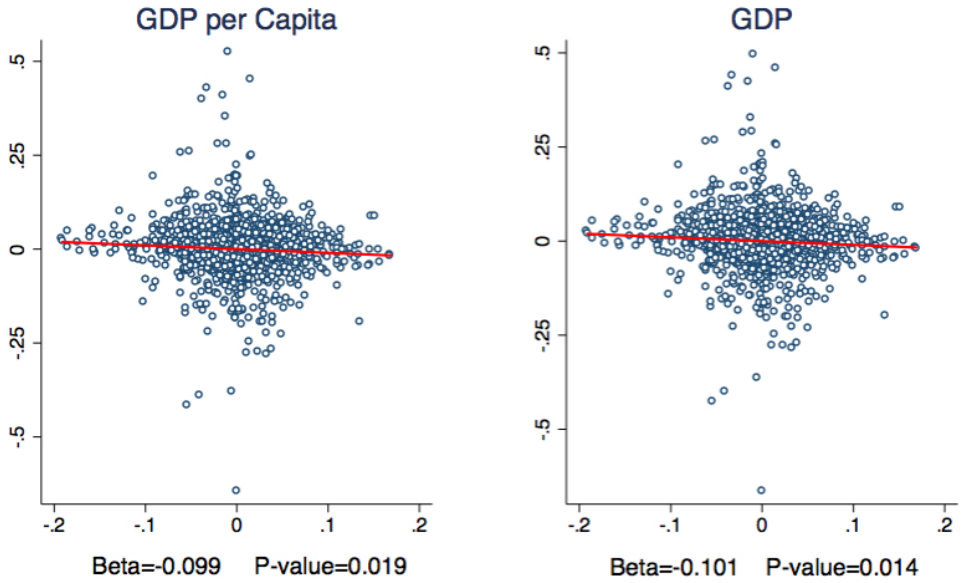
Table 6. The Effects of Ramadan on Religiosity and Labor-Related Preferences Among Muslims, Survey Data

	Important in Life: Religion		Important in Life: Work		Important in Life: Work more Important than Religion		Important for Job Choice: A Good Income		Important in a Job: Good Hours	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Ramadan Hours, Log	0.143**	0.139**	-0.035	-0.052	-0.299***	-0.263**	-0.625*	-0.865**	1.00***	1.08**
	(0.055)	(0.057)	(0.079)	(0.103)	(0.110)	(0.101)	(0.316)	(0.343)	(0.35)	(0.47)
Observations	19475	18544	19438	18505	19375	18448	19598	18651	10888	10414
R-squared	0.08	0.08	0.03	0.05	0.17	0.18	0.17	0.17	0.19	0.19
Sample Countries	All	All	All	All	All	All	All	All	All	All
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Standardized Effect	0.07	0.07	-0.02	-0.03	-0.09	-0.08	-0.16	-0.22	0.18	0.19

Note: Individual-level outcome data from World Values Survey, 1981-2008. *Ramadan hours* is the average daily number of sunrise to sunset hours during the month of Ramadan in the year preceding the survey, measured in the country's capital. The sampled individuals are Muslim men. All dependent variables are indicator variables. Robust standard errors in parentheses, clustered at the country level. *** p<0.01, ** p<0.05, * p<0.1.

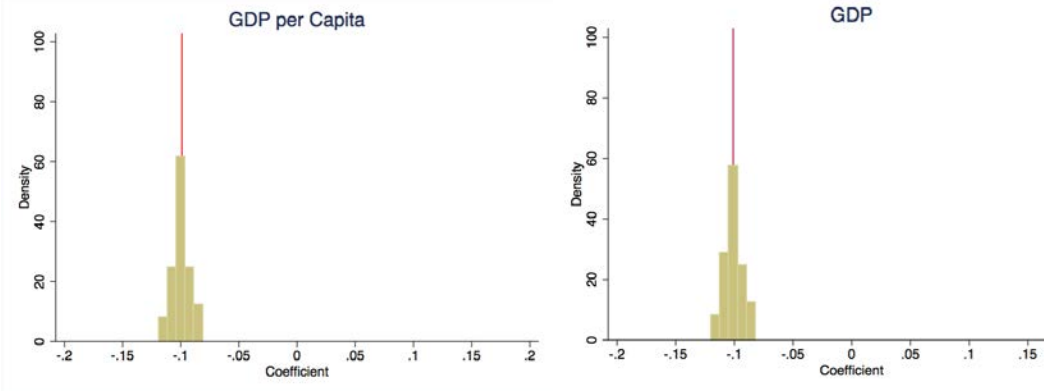
APPENDIX

Figure A1. The Effect of Ramadan on GDP Growth in Muslim Countries, Residuals



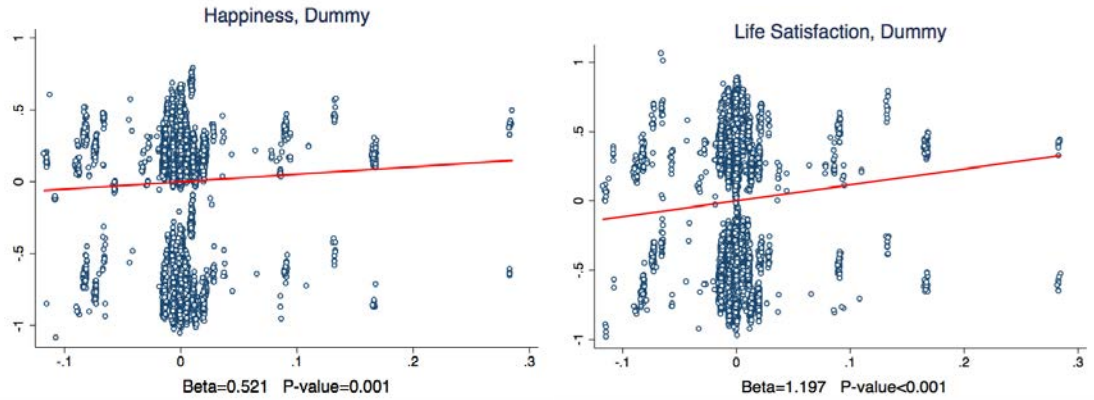
Note: Each graph plots the residuals from the baseline specification (regressions from Table 2, columns (5) and (11), respectively). The red line indicates the estimated slope, with associated coefficients and p-values below. The figure shows that outliers do not drive the negative coefficient estimates.

Figure A2. GDP Estimates when Dropping Countries One-by-One



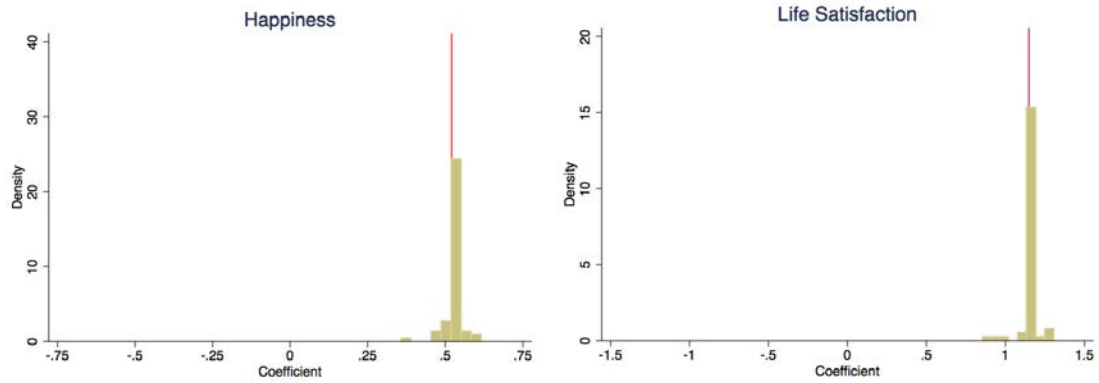
Note: The red vertical line in each graph corresponds to the baseline specification point estimate (from Table 2, columns (5) and (11), respectively) and the distribution of estimates when countries are dropped one-by-one from the sample. The figure shows that a particular country does not drive the estimates.

Figure A3. The Effect of Ramadan on SWB Among Muslims, Residuals



Note: Each graph plots the residuals from the baseline specification (regressions from Table 3, columns (2) and (8), respectively). The red line indicates the estimated slope, with associated coefficients and p-values below. The figure shows that outliers do not drive the positive coefficient estimates.

Figure A4. SWB Estimates when Dropping Countries One-by-One



Note: Each graph plots the distribution of point estimates from the baseline specification (country and year fixed effects) when countries are dropped one-by-one from the sample. The red vertical line corresponds to the baseline specification estimate when no country is dropped. The figure shows that a particular country does not drive the estimates.

Table A1. Summary Statistics

	Full Sample			Muslim Countries		
Country-Level Data, PWT 8.0, 1950-2011	N	Mean	Std. Dev.	N	Mean	Std. Dev.
Real GDP Growth, 2005 Constant USD	8107	0.041	0.065	1416	0.045	0.079
Real GDP per Capita Growth, 2005 Constant USD	8107	0.022	0.064	1416	0.017	0.078
Real GDP per Worker Growth, 2005 Constant USD	6992	0.019	0.063	1274	0.013	0.081
Population Growth	8111	0.018	0.015	1416	0.028	0.019
Capital Stock Growth	8059	0.043	0.038	1416	0.047	0.039
Muslim Population Share	8107	0.234	0.355	1416	0.938	0.613
Ramadan Hours	8107	12.05	1.553	1416	12.00	1.164
Country-Level Data, INDSTAT2, 1963-2010						
Employment Growth, Number of Workers	3301	0.024	0.122	581	0.050	0.147
Wage Growth, Average Wages	3301	0.081	0.196	581	0.085	0.257
Population Growth	3301	0.016	0.019	581	0.027	0.035
Muslim Population Share	3301	0.222	0.353	581	0.947	0.536
Ramadan Hours	3301	11.88	1.865	581	11.89	1.413

	Full Sample			Muslim Individuals		
Individual-Level Survey Data, WVS, 1981-2008	N	Mean	Std. Dev.	N	Mean	Std. Dev.
Ramadan Hours	230759	11.33	1.492	40027	10.93	0.975
Non-Muslim	230759	0.783	0.412	40027	0.000	0.000
Feeling of Happines, Dummy	223931	0.790	0.407	39636	0.800	0.400
Feeling of Happines, Likert Scale	223931	2.027	0.756	39636	2.012	0.758
Life Satisfaction, Above 5 Dummy	226169	0.648	0.478	39490	0.551	0.497
Life Satisfaction, 10-point Scale	226169	6.489	2.520	39490	5.992	2.605
Employed, Full Time	220475	0.344	0.475	38235	0.252	0.434
Employed, Part Time	220475	0.074	0.261	38235	0.064	0.244
Selfemployed	220475	0.111	0.314	38235	0.139	0.346
Unemployed	220475	0.097	0.295	38235	0.106	0.308
Satisfaction with Financial Situation, Dummy	219975	5.534	2.636	39443	5.344	2.565
Important in Life: Religion	213375	0.751	0.432	39716	0.971	0.167
Important in Life: Work	213715	0.925	0.264	39537	0.927	0.260
Important in Life: Work more Important than Religion	211465	0.366	0.482	39425	0.092	0.289
Important for Job Choice: A Good Income	230759	0.762	0.426	40027	0.850	0.357
Important in a Job: Good Hours	145470	0.517	0.500	21529	0.659	0.474

Note: See section 4.1 for a description of data sources and variable constructions. A Muslim country is defined as having more than 75 percent Muslim population.

Table A2. The Effects of Ramadan on Economic Growth in Muslim Countries, GDP per Worker

	Real GDP per Worker Growth					
	(1)	(2)	(3)	(4)	(5)	(6)
Ramadan Hours, Log	-0.099***	-0.098***	-0.143***	-0.146***	-0.140***	-0.006
	(0.031)	(0.031)	(0.034)	(0.036)	(0.036)	(0.006)
Muslim Country*Ramadan Hours, Log						-0.138***
						(0.035)
Observations	1274	1274	1274	1274	1274	6427
R-squared	0.02	0.07	0.09	0.15	0.19	0.16
Sample Countries	Muslim	Muslim	Muslim	Muslim	Muslim	All
Year FE	No	No	Yes	Yes	Yes	Yes
Country FE	No	Yes	No	Yes	Yes	Yes
Population Growth Control	No	No	No	No	Yes	Yes
Year-by-Muslim-Country FE	No	No	No	No	No	Yes
Standardized Effect	-0.12	-0.12	-0.18	-0.18	-0.17	-0.17

Note: Same note as in Table 2 applies. Robust standard errors in parentheses, clustered at the country level. *** p<0.01, ** p<0.05, * p<0.1.

Table A3. Robustness: Sample Restrictions, Country Trends, and Two-Way Clustered Standard Errors

	Baseline Specification				Baseline Specification + Country Trends					
	Coeff	*S.E. Baseline*	*S.E. Two-way*	*R2*	*Coeff*	*S.E. Baseline*	*S.E. Two-way*	*R2*	*N-Countries*	*N-Obs.*
Dep. Var.: *GDP per Capita Growth*										
>75% Muslims	-0.099	(0.040)**	(0.040)**	0.13	-0.134	(0.044)***	(0.045)***	0.23	32	1416
>70% Muslims	-0.095	(0.037)**	(0.039)**	0.14	-0.130	(0.043)***	(0.045)***	0.22	34	1507
>60% Muslims	-0.081	(0.035)**	(0.037)**	0.14	-0.110	(0.042)**	(0.044)**	0.22	36	1604
>50% Muslims	-0.069	(0.032)**	(0.034)**	0.11	-0.106	(0.040)**	(0.041)***	0.17	41	1830
Dep. Var.: *GDP Growth*										
>75% Muslims	-0.101	(0.039)**	(0.040)**	0.12	-0.136	(0.045)***	(0.046)***	0.21	32	1416
>70% Muslims	-0.096	(0.038)**	(0.040)**	0.12	-0.131	(0.044)***	(0.046)***	0.20	34	1507
>60% Muslims	-0.082	(0.036)**	(0.038)**	0.12	-0.112	(0.043)**	(0.045)**	0.20	36	1604
>50% Muslims	-0.070	(0.033)**	(0.034)**	0.09	-0.106	(0.040)**	(0.041)***	0.16	41	1830

Note: Each estimate comes from a separate regression of economic growth on Log(Ramadan Hours), as specified in equation 1. For each point estimate, two standard errors are reported: *S.E. Baseline* clusters the standard errors by country, while *S.E. Two-way* clusters the standard errors by country and by year (Cameron, Gelbach and Miller, 2006). The baseline specification includes country fixed effect, year fixed effects, and population growth control. Country trends allows for a linear trend for each country. Each row corresponds to the %-Muslims sample inclusion restriction. N-countries is the number of countries in the sample, and N-Obs is the number of observations. *** p<0.01, ** p<0.05, * p<0.1.

Table A4. The Effects of Ramadan on Economic Growth in Muslim Countries, Ramadan Hours in Levels

	Real GDP per Capita Growth				Real GDP Growth				Real GDP per Worker Growth			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Ramadan Hours	-0.0078***	-0.0081**	-0.0080**	-0.0005	-0.0056**	-0.0081**	-0.0081**	-0.0005	-0.0082***	-0.0120***	-0.0113***	-0.0004
	(0.0022)	(0.0034)	(0.0032)	(0.0005)	(0.0021)	(0.0033)	(0.0033)	(0.0006)	(0.0026)	(0.0031)	(0.0030)	(0.0005)
Muslim Country*Ramadan Hours				-0.0076**				-0.0077**				-0.0113***
				(0.0033)				(0.0034)				(0.0030)
Observations	1416	1416	1416	7437	1416	1416	1416	7437	1274	1274	1274	6427
R-squared	0.06	0.13	0.15	0.15	0.05	0.12	0.12	0.17	0.07	0.15	0.19	0.16
Sample Countries	Muslim	Muslim	Muslim	All	Muslim	Muslim	Muslim	All	Muslim	Muslim	Muslim	All
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Population Growth Control	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Year-by-Muslim-Country FE	No	No	No	Yes	No	No	No	Yes	No	No	No	Yes
Standardized Effect	-0.12	-0.12	-0.12	-0.11	-0.08	-0.12	-0.12	-0.12	-0.12	-0.18	-0.17	-0.17

Note: Country-year panel data from Penn World Tables 8.0, 1950-2011. All outcome variables are in constant 2005 prices. *Ramadan hours* is the average number of sunrise to sunset hours during the month of Ramadan, measured in the country's capital. A *Muslim country* is defined as having more than 75 percent of the population of Muslim denomination. The sample in columns (4), (8) and (12)) includes non-Muslim countries, defined as having a Muslim population of less than 25 percent. Robust standard errors in parentheses, clustered at the country level. *** p<0.01, ** p<0.05, * p<0.1.

Table A5. Robustness: Collapsed Growth Data and Controls for Beta-Convergence

	Baseline Specification			Baseline + "Iron law" Beta-Convergence (2%)			Baseline + Barro Lower-Bound Beta-Convergence (1.7%)			Baseline + Barro Upper-Bound Beta-Convergence (2.4%)		
	Coeff	*S.E.*	*N*	*Coeff*	*S.E.*	*N*	*Coeff*	*S.E.*	*N*	*Coeff*	*S.E.*	*N*
GDP per Capita Growth												
Yearly data	-0.099	(0.040)**	1416	-0.084	(0.036)**	1416	-0.086	(0.036)**	1416	-0.081	(0.036)**	1416
2-year periods data	-0.101	(0.041)**	722	-0.087	(0.038)**	694	-0.090	(0.038)**	694	-0.084	(0.037)**	694
3-year periods data	-0.097	(0.040)**	480	-0.081	(0.034)**	463	-0.084	(0.035)**	463	-0.078	(0.034)**	463
4-year periods data	-0.101	(0.045)**	371	-0.081	(0.037)**	342	-0.083	(0.038)**	342	-0.078	(0.037)**	342
5-year periods data	-0.116	(0.049)**	308	-0.094	(0.044)**	276	-0.096	(0.045)**	276	-0.090	(0.043)**	276
GDP Growth												
Yearly data	-0.101	(0.039)**	1416	-0.082	(0.037)**	1416	-0.085	(0.037)**	1416	-0.079	(0.036)**	1416
2-year periods data	-0.103	(0.042)**	722	-0.086	(0.038)**	694	-0.088	(0.039)**	694	-0.082	(0.038)**	694
3-year periods data	-0.099	(0.041)**	480	-0.079	(0.035)**	463	-0.083	(0.035)**	463	-0.075	(0.035)**	463
4-year periods data	-0.102	(0.047)**	371	-0.079	(0.038)**	342	-0.082	(0.039)**	342	-0.076	(0.038)**	342
5-year periods data	-0.117	(0.050)**	308	-0.092	(0.045)**	276	-0.094	(0.046)**	276	-0.088	(0.045)**	276

Note: Each estimate comes from a separate regression of economic growth on Log(Ramadan Hours) in Muslim countries. The baseline specification estimates from Table 2 are reproduced for each outcome, followed by rows of regressions with data averaged over various period lengths. The baseline specification includes country fixed effect, year fixed effects, and population growth control. Additional columns correspond to regressions that control for Beta-convergence, where the rate of convergence (2%, 1.7% and 2.4%, respectively) enters the regression as a constraint on the coefficient for the one-period lagged logged income (GDP per Capita and GDP, respectively), acquired from Barro (2012). *** p<0.01, ** p<0.05, * p<0.1.

Table A6. Robustness: Controlling for Terms of Trade Shocks

	Real GDP per Capita Growth		Real GDP Growth	
	(1)	(2)	(3)	(4)
Ramadan Hours, Log	-0.104***	-0.093**	-0.106***	-0.094**
	(0.036)	(0.037)	(0.037)	(0.038)
Observations	1,416	761	1,416	761
R-squared	0.16	0.20	0.13	0.18
Sample Countries	Muslim	Muslim	Muslim	Muslim
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Population Growth Control	Yes	Yes	Yes	Yes
Price Level of Exports Controls	Yes	Yes	Yes	Yes
Price Level of Imports Controls	Yes	Yes	Yes	Yes
Standardized Effect	-0.13	-0.13	-0.13	-0.13

Note: Same note as in Table 2 applies. Columns (1) and (3) controls for aggregate price level of exports and imports, from PWT 8.0. Columns (2) and (4) use goods-specific price levels for the following goods: capital goods; consumer goods; fuels and lubricants; food and beverages; industrial supplies; transport equipment. The sample size is reduced in these cases due to limited data availability in the PWT 8.0 dataset. Robust standard errors in parentheses, clustered at the country level. *** p<0.01, ** p<0.05, * p<0.1.

Table A7. Robustness: SWB Regressions with Two-Way Clustered Standard Errors and Country Trends

	Happiness			Life Satisfaction				
	Dummy	Dummy	Dummy	Dummy	Dummy	Dummy	10p scale	10p scale
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ramadan Hours, Log	0.462	0.521	0.419	0.965	1.149	0.613	6.991	4.851
S.E. Baseline	(0.152)***	(0.145)***	(0.073)***	(0.308)***	(0.310)***	(0.111)***	(1.647)***	(0.881)***
S.E. Two-Way	(0.136)***	(0.114)***	(0.067)***	(0.274)***	(0.156)***	(0.102)***	(0.844)***	(0.873)***
Observations	39636	37821	37821	39490	37689	37689	37689	37689
R-squared	0.09	0.10	0.11	0.09	0.10	0.12	0.11	0.12
Sample Countries	All	All	All	All	All	All	All	All
Sample Individuals	All	All	All	All	All	All	All	All
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	No	Yes	Yes	Yes	Yes
Country Trends	No	No	Yes	No	No	Yes	No	Yes

Note: Samples and specifications are the same as in Table 3. *S.E. Baseline* clusters the standard errors by country, and *S.E. Two-Way* clusters the standard errors by country and by year (Cameron, Gelbach and Miller, 2006). *** p<0.01, ** p<0.05, * p<0.1.

Table A8. The Effects of Ramadan on SWB Among Muslims, Ramadan Hours in Levels

	Happiness						Life Satisfaction					
	Dummy	Dummy	Dummy	Dummy	Dummy	Likert, Ologit	Dummy	Dummy	Dummy	Dummy	Dummy	10p scale
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Ramadan Hours	0.0401***	0.0463***	0.0300**	0.0663***	0.123**	0.325***	0.0824***	0.101***	0.103***	0.108***	0.442	0.617***
	(0.0129)	(0.0123)	(0.0128)	(0.0157)	(0.056)	(0.079)	(0.0251)	(0.024)	(0.025)	(0.026)	(0.355)	(0.113)
Observations	39636	37821	18456	19365	30830	37821	39490	37689	18411	19278	30712	37689
R-squared	0.09	0.10	0.11	0.11	0.10	0.13	0.09	0.10	0.10	0.10	0.09	0.11
Sample Countries	All	All	All	All	Muslim	All	All	All	All	All	Muslim	All
Sample Individuals	All	All	Males	Females	All	All	All	All	Males	Females	All	All
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Standardized Effect	0.10	0.11	0.07	0.16	0.28	N/A	0.16	0.19	0.21	0.22	0.69	0.24

Note: Individual-level outcome data from the World Values Survey, 1981-2008. All individuals in the sample are Muslims. *Ramadan hours* is the average number of sunrise to sunset hours during the month of Ramadan in the year preceding the survey, in the country's capital. The controls are: age, age squared, number of children, marital status dummies, education level dummies, and a gender dummy. A Muslim country (column (5) and (11)), is defined as before. Robust standard errors in parentheses, clustered at the country level. *** p<0.01, ** p<0.05, * p<0.1.

Table A9. The Effects of Ramadan on Capital Stock Growth in Muslim Countries

	Capital Stock Growth				Capital Stock per Capita Growth			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ramadan Hours, Log	-0.001	-0.001	-0.008	-0.005	-0.001	-0.001	-0.008	-0.005
	(0.033)	(0.033)	(0.032)	(0.006)	(0.034)	(0.033)	(0.031)	(0.006)
Muslim Country * Ramadan Hours, Log				0.004				0.004
				(0.033)				(0.032)
Observations	1416	1416	1416	7389	1416	1416	1416	7389
R-squared	0.42	0.44	0.60	0.33	0.40	0.45	0.61	0.36
Sample Countries	Muslim	Muslim	Muslim	All	Muslim	Muslim	Muslim	All
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Population Growth Control	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Country Trends	No	No	Yes	No	No	No	Yes	No
Year-by-Muslim-Country FE	No	No	No	Yes	No	No	No	Yes
Standardized Effect	-0.004	-0.003	-0.021	0.011	-0.002	-0.003	-0.021	0.011

Note: Country-year panel data from Penn World Tables 8.0, 1950-2011. Capital stock is measured in constant 2005 prices. All other variables use the same definitions as in Table 2. Standard errors clustered at the country level. *** p<0.01, ** p<0.05, * p<0.1.

Table A10. The Effects of Ramadan on Employment and Work-Related Preferences, Muslim Women Sample

	Employment					Labor-Related Preferences				
	Employed Full Time	Employed Part Time	Self-employed	Unemployed	Satisfaction with Financial Situation of Household	Important in Life: Religion	Important in Life: Work	Important in Life: Work More Important Than Religion	Important for Job Choice: A Good Income	Important in a Job: Good Hours
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Ramadan Hours, Log	-0.355	-0.470**	0.174*	-0.079	6.77***	-0.046	-0.025	-0.006	-0.631*	0.387
	(0.425)	(0.219)	(0.0941)	(0.217)	(1.86)	(0.096)	(0.106)	(0.141)	(0.365)	(1.002)
Observations	18772	18772	18772	18772	19233	19440	19304	19257	19538	10175
R-squared	0.18	0.05	0.13	0.13	0.14	0.09	0.08	0.17	0.18	0.20
Sample Countries	All	All	All	All	All	All	All	All	All	All
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Standardized Effect	-0.09	-0.20	0.07	-0.03	0.23	-0.08	-0.01	0.00	-0.16	0.07

Note: Individual-level outcome data from World Values Survey, 1981-2008. The sampled individuals are Muslim women. Variable definitions are the same as in Table 5 and 6. Robust standard errors in parentheses, clustered at the country level. *** p<0.01, ** p<0.05, * p<0.1.