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Immigrant religious practices and criminality: The case of Ramadan ☆

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ABSTRACT

Ramadan has attracted negative publicity and criticism in Western countries with large Muslim immigrant populations. Are these attitudes justified? Does the behavior of Muslim immigrants negatively affect host populations during this period? This paper investigates one important dimension of immigrant behavior that is a source of concern: criminal activity. Using the universe of criminal offenses registered by the Swiss police authorities, the paper documents that during Ramadan, crimes committed by Muslim migrants decline by 11%. The mechanism behind this reduction most consistent with the empirical results, is one of changes in beliefs and values of immigrants. Other explanations, such as time spent on community events and declining physical ability play only a minor role.

1. Introduction

Immigration is a contentious topic in modern politics and societies. While there are some clear benefits to host countries for example the supply of additional workforce, there can also be downsides. Social cohesion might diminish when integration into host countries is unsuccessful, or negative sentiment towards migrant minority groups is instrumentalized to form identity politics. [Colussi et al. \(2021\)](#), for example, show that increased salience of Muslims around Ramadan leads to more polarized voting outcomes in German municipalities with mosques. One mayor concern of host countries population that might spark such negative sentiment can be criminal activity of immigrants.

In this paper, we use administrative data on the universe of criminal offenses registered from 2009 to 2020 by the Swiss police authorities to study the criminal behavior of immigrants from Muslim countries. Taking advantage of the detailed information in the dataset, we estimate specifications with a rich set of fixed effects, and find that offenses committed by immigrants born in Muslim countries decrease by about 11% during the month of Ramadan. Our estimations include date fixed effects which absorb any host

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country level shocks affecting crimes, and country-of-origin#year fixed effects to control for any changes in the level of immigrants from a given country, or socio-economic shocks affecting them. This result brings some rigorous quantitative evidence that has been missing from the political discourses. We take a number of steps to understand the mechanism behind the reduced-form result. One possible explanation is that more intensive religious practice changes values and perceptions of individuals, and consequently reduces their propensity to commit crimes. While it is difficult to directly test this mechanism with the data at hand, we consider and rule out a number of competing behavioral outcomes that could also lead to the observed reduction in criminal activity: frequent family gatherings that require preparation, a higher likelihood of travel or visits to immigrants' home countries, which implies absence from Switzerland, physical exhaustion, and others. We estimate a number of specifications showing that these channels are at most of secondary nature.

First, we find that the differential decline in registered criminal offenses committed by immigrants from Muslim countries is quantitatively very large in 2020. In 2020 Ramadan took place in May, under strict lockdown and travel restrictions imposed by Swiss authorities and many other countries' due to unexpected and exogenous reasons. These policies severely restricted possibilities of public gathering events, as well as travel opportunities.

Second, we exploit the spatial dimension of the data, and include a canton#country-of-origin#year level fixed effect. This specification controls for yearly changes in each origin country's stock of migrants in each Swiss canton. If the effects are driven by community spillovers that rely on certain size thresholds of compatriots or co-believers, the estimates should severely decrease in size in this specification. This however is not reflected in the results, speaking against community spillovers being the principal explanatory component.

Third, we study the dynamics of crime declines over the course of the Ramadan month, to assess the role of declining physical ability. If criminal offenses require significant effort and energy to implement, then we should observe larger declines at the end of Ramadan when people are more exhausted from continuous fasting. We do not find evidence supporting such patterns. To shed more light on this issue, we conduct estimations exploiting the duration of fasting hours which vary due to exogenous reasons. If longer fasting hours deteriorate physical ability, then the declines in crime rates should be larger on days with more daytime light, which determines the daily duration of the fast. Our estimations show that there is no relationship between fasting hours and crime rates beyond the main effect of Ramadan.

Fourth, we investigate the time period just before and after Ramadan in an event study type design, to understand whether there is evidence for anticipatory or persistent effects. Particularly Sha'ban the month before Ramadan is interesting to analyze, as it is understood as a month of individual mental preparation for Ramadan. The distinct pattern of a reduced crime rate starting at the beginning of Sha'ban is our strongest piece of evidence for the results being driven by changes of beliefs and values of individuals, rather than any of the other mechanisms. The post Ramadan pattern is less clear. While the estimates show some persistence in the reduction of criminal activity after Ramadan, they lack the precision to be statistically significant. We argue that this is due to a highly idiosyncratic pattern of reverting to "natural" behavior of individuals, which can be mediated by factors such as liquidity constraints.

The Swiss dataset also provides information on the birth countries of victims. We use this information to explore some further aspects related to the context of the study. First, we investigate the dynamics of crimes committed against Muslim immigrants (Muller and Schwarz, 2020). It is possible that, because of increased salience, hate crimes against immigrants increase during Ramadan. Using information on the country of birth of victims we do not find evidence that the likelihood of Muslims becoming victims of violent or hate crimes increases during Ramadan. However there is a strong spike in hate crimes during the festivities marking the end of Ramadan, Eid al-Fitr. Second, we study whether the reduction in crime rates has a co-believer bias, i.e. during the Ramadan period perpetrators from Muslim countries become less likely to target people with whom they share their religion. This idea also fails to find support in the data.

The results presented in this paper show that the declining crime rates are driven by the effect of religion. However, the effect of religion can still be split into two channels (Moreno-Medina, 2021). The first is the direct effect at the level of individuals. When individuals weigh the costs and benefits of committing a crime, believers might take the promise of a reward or punishment in the afterlife into account. This channel is referred to in the literature as the "hellfire" hypothesis (Hirschi and Stark, 1969). The second is the effect at the community level. This channel operates through peer effects, social capital, and in-group/out-group dynamics.

The results presented in this paper allow us to reflect on this distinction as well. The fact that the effects in 2020 remained very large during a period in which people were not able to attend regular Ramadan events, had reduced interactions with family and friends, overall diminishing the strength of peer effects, is in favor of the individual level channel. This line of argumentation also tracks in the results highlighting the effects during Sha'ban, where the focus of religious practice is on mental preparation for Ramadan. Furthermore, our estimations on the canton level fail to bring up evidence in support of the peer effect channel. It should be stated that this is still circumstantial, rather than clear causal evidence. The empirical patterns are more consistent with the individual level mechanism, but a thorough follow-up study disentangling the two channels is necessary to claim higher importance of one of the channels over the other.

This paper contributes to the rapidly growing literature that studies the relationship between immigration and crime (see, for instance, Bianchi et al., 2012; Bell et al., 2013; Mastrobuoni and Pinotti, 2015; Freedman et al., 2018; Pinotti, 2017). In the context of current social and political developments this topic deserves rigorous quantitative analysis because anti-immigrant parties in many countries build their rhetoric on the criminal behavior of immigrants (Giavazzi et al., 2020). The Swiss crime dataset has been used by several authors to contribute to this literature. Couttenier et al. (2019) document that refugees, who have experienced violence in their home countries, are more likely to commit violent crimes in the host country. In another study (Couttenier et al., 2021) demonstrate that Swiss newspapers are more likely to cover crimes committed by migrants and their coverage had a causal effect

on voter behavior during the Swiss “minaret ban” referendum. A related contribution is (Keita et al., 2021). The literature has also studied the relationship between immigration and terror (Dreher et al., 2020). Given this politicized nature of Muslim migration our paper also touches base with the literature on Islam and political economy, an overview of which is given in Platteau (2017).

The paper is further related to an ever broadening literature on religion and societal outcomes. A number of studies analyze the relationship between religion and a broader set of economic outcomes, mostly using data at country level (McCleary and Barro, 2006). Iyer (2016) and Carvalho et al. (2019) provide an excellent survey of the economics of religion literature, and Kuran (2018) of Islam and economic outcomes. Within the field of the latter, scholars have shown a number of mechanisms through which Islam affects economic performance: Clingingsmith et al. (2009) find that Islamic pilgrimage fosters attitudes beneficial to economic growth. Campante and Yanagizawa-Drott (2015) exploit the varying timing of Ramadan to study the Ramadan Fasts’ effect, and document decreased output, however also increased subjective well-being among Muslims. Fasting during early pregnancy however generates worse economic outcomes through a secondary channel. Children of fasting mothers live shorter, less healthy lives (Almond and Mazumder, 2011; Van Ewijk, 2011), and show worse academic and labor market performance (Almond et al., 2015; Majid, 2015). A third dimension of fasting during Ramadan affecting economic outcomes has recently been documented by Hornung et al. (2021), who present evidence of longer fasting hours having a positive effect on school performance. In their survey of the literature Abedifar et al. (2015) conclude that there is little evidence for differential performance of Islamic banking and finance. Finally religious networks have been a subject of study. Murphy et al. (2022) analyze the effect of joint attendance of religious institutions and show increased information flow and trust. Our paper adds a new dimension to these mechanisms of Islam and economic performance.

Our study is most closely linked though to the literature that studies the relationship between religion and crime. In those studies the common approach is to regress crime rates on some measure of religious membership across geographic units using some instruments (for instance, Heaton, 2006). However, the validity of these instruments is questionable and it is not clear whether the results of such studies can be interpreted as causal. Two exceptions are Gruber and Hungerman (2008) and Moreno-Medina (2021) who use event study designs with plausibly exogenous shocks and establish a negative relationship between church attendance and crime rates in the US.¹

In a recent study Reese et al. (2017) provide evidence from three countries with high levels of terrorist activity (Iraq, Afghanistan, and Pakistan) of a substantial decline in violence during the period of Ramadan and other important Islamic holidays (see also Toft and Zhukov, 2015; Hodler et al., 2018). The authors argue that militant actors anticipate societal disapproval of violence. In our paper we focus on the host country rather than on the origin countries, and focus not on terrorist activity but crime more broadly. We include a narrow fixed effect structure to control for various other factors that can affect the propensity to commit crimes. Furthermore, we consider different mechanisms behind our result, and conduct tests to assess their importance.

The rest of the paper is organized as follows: Section 2 provides some brief background, introduces the data and the estimation strategy. Section 3 presents the main estimation results, evaluates the role of alternative mechanisms, and conducts robustness checks. Section 5 presents additional results using information on the birth country of victims. Section 6 provides concluding remarks.

2. Setting, data, and empirical methodology

2.1. Setting

The Islamic calendar is a lunar calendar consisting of 12 lunar months for a total of 354/355 days. Ramadan is its ninth month with 29 or 30 days. Because there are fewer days in a year in the Islamic calendar, Ramadan rotates forward by 10–12 days every year relative to the Gregorian calendar. In 2018, for example, Ramadan began on May 16th, while in 2019 it began on May 6th. For Muslims Ramadan is the holy month of fasting, prayer, reflection, and community. It is a time to practice self-restraint which is most commonly understood as the obligation to fast. However, more broadly it is interpreted not only as the obligation to refrain from food and drink between dawn and dusk, but also sexual activity, and all forms of immoral behavior, including impure or unkind thoughts.² The end of Ramadan is celebrated as Eid al-Fitr. The format of celebration varies across communities: children wear new clothes, women dress in white, special pastries are baked, gifts are exchanged, the graves of relatives are visited, and people gather for family meals and to pray in mosques.

Switzerland hosts a large number of immigrants from a diverse set of countries. According to the figures from the Population and Households Statistics (STATPOP) of the Swiss Federal Statistical Office (FSO), people born outside Switzerland accounted for about 30% of the total population in 2017. Of the countries with a high Muslim population, Kosovo with 88715 inhabitants (1% of total Swiss population) followed by Turkey with 80655 inhabitants are the countries with the most immigrants in Switzerland. Other predominantly Muslim countries with more than 10000 inhabitants in Switzerland are Bosnia and Herzegovina, Syria, Morocco, Afghanistan, Iran, Tunisia, Iraq, and Algeria.

¹ Recent studies have also made significant advances in terms of establishing a causal effect of religion on economic outcomes other than crime (for example, Bryan et al., 2020).

² “Ramadan”, Britannica.

2.2. Data

The original data source for offenses reported by the police on accused persons and victims is the Police Crime Statistics (PCS) of the FSO. The dataset includes the universe of offenses detected by the police where a person was charged with having violated the Swiss Penal Code. More specifically, the dataset provides information on the article of the Penal Code under which the offense was registered, and the date on which the offense commenced. Importantly for the purposes of our study, there is information on both the country of birth of the perpetrator and the victim.^{3,4} The dataset covers the period from 2009 to 2020. The main dependent variable in the regressions is the number of offenses registered by the representatives of a given nationality on a given date. Since there is information on the article of the Penal Code under which the offenses were registered, we can study different broad categories of crimes. The first group is property crimes (Swiss Penal Code, Title 2), which include thefts, burglaries, robberies, shopliftings, etc. The second group is violent crimes which includes offenses against life and limb (Swiss Penal Code, Title 1), felonies, and misdemeanors against liberty (Swiss Penal Code, Title 4).⁵

During the sample period over 2.4 million cases were registered but the number of observations in estimations will be different because we aggregate this information at country-of-origin#date level. Descriptive statistics are provided in Table A.1. According to this table, on the average day#country-of-origin about 2.5 crimes are detected. This number varies across countries depending on the population size and propensity to commit crimes. For people born in Switzerland the daily average is 256, for Kosovo it is 17, for Algeria 14, and for Turkey 10. Among non-Muslim foreign countries large numbers are recorded for Romania with an average of 20, and Portugal with 17.7. Table A.2 presents the total number of detected cases, as well as cases for property and violent crimes for the top 12 offending countries during the entire study period.

Couttenier et al. (2019) note that the dataset reports charged offenses and not convictions. However, they argue that both measures are highly correlated. In the context of the current study this can potentially introduce a bias if the police on certain days starts to exert differentially more effort in monitoring immigrants from Muslim countries or have a higher propensity to charge them. Given that Ramadan is likely to increase salience of Muslim immigrants' existence within Switzerland, if such biases exist we would expect them to be strongest during Ramadan. This implies that our estimation results can be thought of as a lower bound. Having made these clarifications, in the text that follows we use the terms detected crimes and committed crimes interchangeably. Also, we use the term migrants to refer to residents born in foreign countries.

The analysis requires a measure for the share of Muslim population across countries appearing in the crime dataset. This information comes from the Pew Research Center. There is a small number of cases where either the information on the Muslim share of a country is missing, or perpetrators' country-of-birth is recorded as stateless or unknown. We drop those cases from our sample. Finally, we use the Islamic calendar to generate an indicator variable for the days of Ramadan for the period of 2009–2020. Similarly, we construct dummies for other events, such as Eid al-Fitr.

2.3. Empirical methodology

In order to assess the causal impact of Ramadan on the criminal behavior of migrants from Muslim countries, we estimate specifications in which the dependent variable is the number of detected crimes on a given day (t) perpetrated by individuals born in a given country (i) denoted by $Crime_{it}$. The estimating equation is given by:

$$Crime_{it} = \beta_0 + \beta_1 Ramadan_t * Muslim_i + \beta_2 Eid\ al\ Fitr_t * Muslim_i + \gamma_t + \theta_{iy} + \varepsilon_{it}, \quad (1)$$

where $Ramadan_t$ is an indicator variable if a given day is in the month of Ramadan, $Muslim_i$ is the share of Muslim population in a birth country (i) and ε_{it} is the error term. The specification includes date fixed effects (γ_t) and country-of-origin#year fixed effects (θ_{iy}). Date fixed effects refer to unique dates, and absorb various factors that can affect the propensity to commit and detect offenses within a day, such as weather conditions, some political and economic events that affect Switzerland, or national holidays. These events coincidentally falling on the days of Ramadan could without controlling for the date introduce biases.

One useful feature of Ramadan, for the purpose of identification, is that it moves forward by 10–12 days every year relative to the Gregorian calendar (see Section 2.1). This feature can partly address some of the concerns listed above, even in the absence of date fixed effects.⁶ The inclusion of date fixed effects implies that our identification comes from variation within an unique day's

³ It should be noted that the victim information is not recorded for all cases. Oftentimes offenses are not committed against specific individuals. For example, the victim may be an organization or the government. Other types of offenses are general by nature, such as disruption of rail traffic. It also should be mentioned that the cantonal police authorities are not required to record the birth nation for victims. Despite this, victim information is reported for over 2 million cases, which is 83% of our sample. This implies that there is good coverage, and conducting additional estimations by exploiting this information is worthwhile. However, in order to answer the main research questions of the paper we need the information about perpetrators only, which the police is required to collect by law.

⁴ There are second generation immigrants who were born in Switzerland but whose parents come from Muslim countries. If such migrants behave like other migrants but we consider them in the control group, our estimates represent a lower bound. We also present results for a sample that excludes Switzerland, and thus second generation Swiss-born immigrants (see Section 4.1).

⁵ It is worthwhile to note that the media and politicians frequently accuse migrants in sexual crimes, however in the data migrants from Muslim countries and low-income countries very rarely commit such crimes. These types of crimes are more common among migrants from wealthier European countries. Because of these low numbers we do not study sexual crimes as a separate category.

⁶ If, for example, the propensity to commit crimes is lower when it rains, and Ramadan was always in Summer when the likelihood of rain is lower, then this could drive crime rates down automatically.

propensity of Muslims to commit crimes relative to others. Country-of-origin#year fixed effects are required to absorb potential movements in crime rates driven by changes in the number of immigrants from a given country, or differential economic shocks that can affect representatives of those countries if they tend to concentrate in specific industries or occupations.

We also include a distinct dummy variable $Eid\ al-Fitr_t$ interacted with $Muslim_i$ for the time period of Eid al-Fitr, to isolate the effect of these special festivities at the end of Ramadan. We are interested in the effect of Eid al-Fitr itself, but also want to ensure that it is not part of our control group. Within this empirical framework the control group will consist of all the days outside of Ramadan and Eid al-Fitr.⁷

Eq. (1) is estimated both with Ordinary Least Squares (OLS) and Poisson Pseudo Maximum Likelihood (PPML). In the case of OLS the dependent variable $arsinh(Crime_{it})$ is the inverse hyperbolic sine transformation of the number of crimes committed by residents born in a given country on a given date. With this transformation we look to address the many country-year observations with zeros, especially for countries with few migrants. In these empirical contexts it is however recommended to use the PPML approach (Santos Silva and Teneyro, 2011a) which we will adopt for the majority of the calculations. For PPML the dependent variable is specified in levels and includes zeros.⁸

In their study Campante and Yanagizawa-Drott (2015) exploit the fact that fasting hours vary over years and across countries to obtain identification. The main idea is that, for example, for a country located in the Northern Hemisphere daytime hours are longer when Ramadan is in June or July, and shorter when it is in January. Since their primary outcome of interest is at country level, this variation is important. In our context, identification can be obtained without any variation in the duration of the fasting hours, because we focus on one country, and the identification is found in the differential propensities to commit crime by people from different countries. Nevertheless, we also estimate a specification which interacts the main term of interest with daylight hours. The results of this estimation provide some useful information for the discussion of mechanisms. In particular, we will estimate the following specification:

$$Crime_{it} = \beta_0 + \beta_1 Ramadan_t * Muslim_i + \beta_2 Ramadan_t * Muslim_i * Hours_t + \beta_3 Eid\ al-Fitr_t * Muslim_i + \gamma_t + \theta_{iy} + \varepsilon_i \quad (2)$$

The only difference from Eq. (1) is the additional term which interacts the Muslim share on the days of Ramadan with log daylight hours on a day t ($Hours_t$). Log daylight hours are demeaned so that the average value during the Ramadan period is zero.⁹ Note that since the specification includes date fixed effects, there is no need to include daylight hours as a separate control variable. According to Campante and Yanagizawa-Drott (2015), daylight hours can affect the level of economic activity through direct and indirect channels. First, religious practices require time and resources that then become unavailable for economic activities. Second, they can also affect productivity by limiting social interactions with non-believers, or by imposing dietary restrictions. Third, they may shape beliefs and values that determine economic decisions. It is important to emphasize that the third mechanism is relatively independent of the daylight hours. If more intensive reading of religious texts affects the beliefs of people then this effect need not be limited to the fasting hours because stealing, for instance, is considered a sin regardless whether it is committed during fasting hours or not. Consequently, the estimated coefficient β_2 will allow us to disentangle the role of different mechanisms.

The detailed data and the specifications with rich fixed effects leave little concerns regarding the identification of the effect of Ramadan on crimes committed by people born in predominantly Muslim countries. However, understanding whether the decline in crime rates is driven by changes in beliefs and values, or some other factors is more challenging. For this reason, we conduct a number of tests with alternative definitions or time periods to assess the role of competing channels.

3. Results

3.1. Main results

Estimation results of Eq. (1) are presented in Table 1. The first column presents the results for the OLS specification. There is a significant decline in daily reported offenses committed by people from a fully Muslim populated country on the days of Ramadan. The results of the PPML approach are presented in the second column. In this case we observe a 11.2% decline, applying the formula described in footnote 8. Given that there are many observations with zero values, PPML is the preferred approach in this context, and this estimated coefficient is likely to reflect the correct size of the decline. In the third column we include the time period of Eid al-Fitr as a control variable in the regression. There are two reasons for this: First, we are interested in the coefficient itself. As Eid al-Fitr is the celebration in which Ramadan culminates, and that ends the month of Ramadan, we expect a strong effect for these days. Indeed we measure a large, precise effect in column (3). Second, we include the Eid al-Fitr period dummy in all subsequent regressions to remove this period from our control group. In the last two columns we limit the sample to property and violent crimes respectively, and run the PPML regressions. The results show that detected crimes decline in both categories, but the decline is especially large for property crimes.

⁷ In Section 3.5 this changes slightly, as we directly include dummies for the periods before and after Ramadan into our regression. Naturally they then disappear from the control group.

⁸ To compute the effect size for the PPML estimates, the appropriate formula is $(e^{b_i} - 1) \cdot 100\%$, where b_i is the estimated coefficient (see footnote 27 in Santos Silva and Teneyro 2006).

⁹ Astronomical Applications Department of the US Naval Observatory provides information on daily sunrise and sunset times. This information is used for the capital city Bern. The territory of Switzerland is relatively small and the spatial variation in daylight hours across its territory is negligible.

Table 1
Criminal offenses during Ramadan.

	(1) <i>arsinh(Crime_{it})</i>	(2) <i>Crime_{it}</i>	(3) <i>Crime_{it}</i>	(4) <i>Crime_{it}</i>	(5) <i>Crime_{it}</i>
Muslim share × Ramadan	-0.033*** (0.009)	-0.119*** (0.032)	-0.122*** (0.032)	-0.164*** (0.035)	-0.094*** (0.034)
Muslim share × Eid al-Fitr			-0.301*** (0.092)	-0.433*** (0.148)	-0.093 (0.076)
R-Adjusted/R-Pseudo	0.722	0.857	0.857	0.803	0.778
N	937962	811951	811951	746406	743277
Method	OLS	PPML	PPML	PPML	PPML
Crime type	All	All	All	Property	Violent

Notes: Regression results of Eq. (1). The dependent variable is the number of offenses detected on a day by residents born in a given country. Estimation method (OLS or PPML) is displayed at the bottom of the table. All regressions include date and country-of-origin#year fixed effects. The difference in the number of observations between column (1) and (2) stems from the PPML estimation automatically dropping 126,011 observations that are fully separated by the fixed effects. Standard errors are clustered at country-of-origin level. * (**) (***) indicates significance at the 10 (5) (1) percent level.

Table 2
Criminal offenses during Ramadan: daytime hours.

	(1) <i>Crime_{it}</i>	(2) <i>Crime_{it}</i>	(3) <i>Crime_{it}</i>	(4) <i>Crime_{it}</i>	(5) <i>Crime_{it}</i>	(6) <i>Crime_{it}</i>
Muslim share × Ramadan	-0.122*** (0.030)	-0.161*** (0.032)	-0.095*** (0.035)	-0.120*** (0.030)	-0.158*** (0.031)	-0.096*** (0.035)
Muslim share × Ramadan × Hours	-0.133 (0.783)	-0.588 (1.159)	0.295 (0.798)	0.647 (0.925)	0.343 (1.188)	1.005 (1.026)
Muslim share × Eid al-Fitr	-0.301*** (0.092)	-0.433*** (0.148)	-0.093 (0.076)	-0.280*** (0.091)	-0.393** (0.153)	-0.092 (0.075)
R-Pseudo	0.857	0.803	0.778	0.856	0.803	0.784
N	811951	746406	743277	937962	893928	894132
Country-year FE	Yes	Yes	Yes	No	No	No
Country FE	No	No	No	Yes	Yes	Yes
Method	PPML	PPML	PPML	PPML	PPML	PPML
Crime type	All	Property	Violent	All	Property	Violent

Notes: Regression results of Eq. (2). The dependent variable is the number of offenses detected on a day by residents born in a given country. Daytime hours are in logs and demeaned. Estimation method and fixed effect structure are displayed at the bottom of the table. Additionally all regressions include date fixed effects. Standard errors are clustered at country-of-origin level. * (**) (***) indicates significance at the 10 (5) (1) percent level.

Table 1 documents large and precisely estimated coefficients showing substantial declines in detected crimes on the days of Ramadan committed by migrants born in predominantly Muslim countries. This result brings some scientific evidence to the debate about the short term effects of Ramadan, and its consequences in Western countries. The quantitative evidence shows that when it comes to crime, which is one of the main concerns of immigration, Ramadan has a negative effect. This itself is an interesting outcome, however understanding the mechanisms behind this result is of high importance not only from a scientific perspective, but to inform the public and political debate. Therefore we look to conduct additional estimations in the following sections which help us understand the key mechanisms behind the main result.

3.2. Daytime hours

In Table 2, we present the results of the specification that includes an additional term interacted with daytime hours (Eq. (2)). The estimated coefficient of the interaction between Ramadan and the share of Muslim population in the first row is very close to the corresponding specification in Table 1. Meanwhile, the estimated coefficient of the additional term interacted with log daytime hours is negative in the first two columns, and very imprecisely estimated. This means that the duration of fasting hours has no additional effect on the crime rates. For violent crimes this term is even positive, but again imprecisely estimated.

One issue with these estimations is that, in the presence of year fixed effects, the variation of daytime hours comes only from within year daytime differences which are relatively small. For this reason we report the results for the all crimes sample with country fixed effects without year interactions in column (4) of the table. In our sample the shortest Ramadan day had 12.2 h of daylight, and the longest day had 15.9 h. The estimated coefficient and standard error for the main Ramadan effect are very close to the corresponding ones in column (1). The estimated coefficient for the term interacted with daylight hours is positive and not precisely estimated. This result further reassures that daylight hours do not play an important role. The results for the crime subcategories in column (5) and (6) are also very close to the ones in specifications with the full set of fixed effects.

The main takeaway from Table 2 is that what matters is whether a day is part of Ramadan or not, rather than the duration of fasting hours. This result has important implications, and allows us to refine the mechanism behind it. Following the discussion of mechanisms developed in Campante and Yanagizawa-Drott (2015), in Section 2.3, we argued that the absence of an effect of daytime hours on crime provides supportive evidence for the third mechanism according to which, religion shapes beliefs and values that

Table 3
Criminal offenses during Ramadan: 2020.

	(1)	(2)	(3)	(4)	(5)
	$Crime_{it}$	$Crime_{it}$	$Crime_{it}$	$Crime_{it}$	$Crime_{it}$
Muslim share × Ramadan	−0.426*** (0.102)	−0.509*** (0.143)	−0.312*** (0.091)	−0.407*** (0.093)	−0.460*** (0.118)
Muslim share × November				0.302 (0.184)	
Muslim share × Stringency index					0.016 (0.018)
Muslim share × Eid al-Fitr	−0.173 (0.130)	−0.320** (0.149)	−0.200 (0.230)	−0.155 (0.125)	−0.206 (0.148)
R-Pseudo	0.858	0.804	0.784	0.858	0.858
N	65880	59495	60390	65880	65880
Method	PPML	PPML	PPML	PPML	PPML
Crime type	All	Property	Violent	All	All

Notes: Regression results of Eq. (1). The dependent variable is the number of offenses detected on a day by residents born in a given country. Stringency index is in logs and is taken from Hale et al. (2021). Estimation method is displayed at the bottom of the table. All regressions include day and country of birth-by-year fixed effects. Sample period is only crimes committed in 2020. Standard errors are clustered at country level. * (**) (***) indicates significance at the 10 (5) (1) percent level.

determine economic decisions. If the effect of Ramadan was to operate through the time allocation channel, reducing the available time for income generating activities, such as crime, should lead to larger declines on days with longer fasting hours. The fact that fasting hours do not affect crime rates also runs against the declining physical ability channel, which we discuss in more detail in Section 3.5.1.

3.3. Social events

One potential mechanism that can cause a decline in crime rates is related to family and community events. More specifically, during Ramadan after dusk when believers break their fast, they may do so together with family, friends, and community members. This potentially requires some preparations in advance in the form of purchases, cooking, and other activities which can reduce the amount of time allocated to the planning and execution of criminal activities. Indeed, such gatherings happen during Ramadan, but they are not very frequent. According to Campante and Yanagizawa-Drott (2015), the duration of fasting hours is positively related with time spent on community events. Therefore if the reduction in the crime rate during Ramadan was strongly driven by the prevalence of such community events, we should have observed a significant differential effect in Table 2 of the interaction term with fasting hours. Furthermore, social events take place in the evenings when Muslims break their fast (*Iftar*). In Muslim countries other aspects of life, such as work and schooling may adjust to accommodate for the change in lifestyle. However in Switzerland Muslims and their children are expected to perform their regular duties, which limits their flexibility in terms of consistently participating in extended events at late hours.

We present an additional piece of evidence suggesting that it is unlikely that time required to prepare for family and community events is the key driving mechanism behind the results presented above. To this end we exploit the lockdowns of 2020 due to an unanticipated and exogenous global shock. The 2020 Ramadan started on April 24th and lasted until May 23rd. That period coincides with the lockdowns imposed in Switzerland and other countries. Hale et al. (2021) developed a country-level index of the stringency of COVID-19 restrictions (see Fig. A.1). According to this index, the level of restrictions that were introduced in Switzerland remained at a rather high level until the end of May. Lockdowns affected the entire hospitality sector, prohibited public gatherings, and imposed restrictions on the number of people attending meetings in general. Obviously these restrictions severely limited possibilities for family and community events. Table 3 replicates the results of Table 1, but restricts the sample to the year 2020 only. If community and family events are driving the main result, then we would expect the effects of Ramadan on crime to be smaller in 2020. Yet it turns out that the differential decline in crime rates among Muslims during the Ramadan period was even larger in 2020.

The estimation results for 2020 also allow us to rule out another possible channel, which could explain the measured reduction of criminal activity of foreign-born migrants during Ramadan. In particular, if Muslim migrants are more likely to travel (e.g. to their origin countries) during this period, their absence from Switzerland would mechanically reduce their likelihood of committing crimes. Since in Spring 2020, international travel was severely restricted, and travels were almost impossible, we can confidently rule out that the main result is driven by this explanation.

One concern with the estimations in Table 3 is that Muslim migrants might specialize in crimes that are more sensitive to lockdown restrictions. In order to address this concern, we exploit the lockdowns imposed in response to the second wave of infections in November. According to the Hale et al. (2021) index (Fig. A.1), the level of restriction in Switzerland in November was very close to the level observed during Ramadan, which makes it a relevant comparison period. We select November not December, as in December migrants from Christian countries might visit their families in their origin countries over Christmas, which can bias the results. If Muslims are specializing in crimes that are more sensitive to lockdowns, then we should observe a similar decline in crime rates in November. The estimation results are presented in column (4) of Table 3. The coefficient on the interaction of

Table 4
Criminal offenses during Ramadan: Canton fixed effect.

	(1)	(2)	(3)
	$Crime_{it}$	$Crime_{it}$	$Crime_{it}$
Muslim share \times Ramadan	-0.1210*** (0.0236)	-0.1631*** (0.0328)	-0.0939*** (0.0261)
Muslim share \times Eid al-Fitr	-0.1875* (0.0980)	-0.3974** (0.1745)	-0.0774 (0.0922)
R-Pseudo	0.627	0.554	0.521
N	9695883	7729916	7237744
Canton#country-of-origin#year FE	Yes	Yes	Yes
Method	PPML	PPML	PPML
Crime type	All	Property	Violent

Notes: Regression results of Eq. (1). The dependent variable is the number of offenses detected on a day in a Swiss canton by residents born in a given country. Estimation method and fixed effect structure are displayed at the bottom of the table. All regressions include date fixed effects. Standard errors are clustered at country-of-origin#canton level.¹⁰ * (**) (***) indicates significance at the 10 (5) (1) percent level.

Muslim share and the period November is positive. Another approach is to add an additional term to Eq. (1), which interacts the share of Muslim population with the log of stringency index from Hale et al. (2021). As can be seen from column (5), the main coefficient remains large in absolute size, while the new term is not significant. As such there is no empirical evidence implying that lockdowns and other Covid measures had a differential negative effect on criminal activities of Muslim migrants.

3.4. Communities

The dataset includes the information in which Swiss canton the offense took place. This information can be used to investigate whether there are spatial heterogeneities in reductions in crime rates during Ramadan. Hornung et al. (2021), who study the effect of Ramadan on academic performance, show that the performance of Muslim migrant students increases more in schools with higher shares of Muslim students. They interpret this result as evidence of community spillovers. This argument has some vulnerabilities because migrants tend to sort into specific locations based on their own, and location characteristics. For example, a specific location may attract more migrants who tend to be poor, more prone to criminal activity and more religious. These characteristics can be correlated with each other but without any causal links. In this case, larger reductions in crimes in places with more Muslim immigrants do not have to be the result of a community effect. It can also be driven by an individualistic effect, because migrants in such localities are more religious, and might therefore be more strongly affected by Ramadan.

With this discussion in mind, we exploit the spatial information of the dataset, and switch the unit of analysis to the level of canton#country-of-origin#date, which allows us to study whether the reductions in crimes committed by Muslims on the days of Ramadan are explained by canton-level characteristics such as the Muslim share in a given canton, or other distinct features of individual cantons. To this end we introduce a canton#country-of-origin#year fixed effect to Eq. (1), which would absorb community effects stemming from the year-specific Muslim share from a given country-of-origin in any of the 26 Swiss cantons.

It is important to mention that this switch in the unit of analysis vastly inflates the number of observations to over 24 million, however many observations will be dropped due to statistical separation (for this concept see Santos Silva and Tenreiro 2010, 2011b). This is due to the fact that for this highly granular unit crimes are a rare event, such that in many cases our outcome variable might never, or only outside of the month of Ramadan take on positive values. The results from this specification are presented in Table 4, where N displays the number of non-singleton, non-separated observations.

In all three columns the results very much resemble the ones from our baseline estimation in Table 1. The only noticeable difference are the more precisely estimated standard errors. The stability of our results with the canton#country-of-origin#year fixed effect reassures us that our baseline effects are not explained by differential effects across cantons that stem from their specific characteristics within a given year, such as the size of the migrant community from any given country. This result speaks against community spillovers as the main channel, as the results are not sensitive to introducing the canton-level fixed effect.

3.5. Time dynamics

In this section we present the empirical results in an event study type design, where we separate three distinct phases: pre-Ramadan, Ramadan, and post-Ramadan, while also separately identifying Eid al-Fitr. Within these phases we calculate effects employing granular 6-day bins to construct 5 individual estimates per month which allow us to investigate the dynamic development of the effects at high granularity. These results then speak to three key questions: Are the decreases in criminal activity due to exhaustion from prolonged fasting? Can we detect any effects before Ramadan perhaps due to anticipation and mental preparation? Is there a detectable pattern of persistently reduced criminal activity after Ramadan?

¹⁰ Results hold for clustering on the country-of-origin level only, or two way clustering on the country-of-origin and the canton level.

3.5.1. Decreased physical activity

First, Ramadan might reduce criminal activity if the long period of fasting puts pressure on the body, and reduces individuals' physical abilities. Many criminal actions require physical strength, high level of attention, or long hours of surveillance and planning. If perpetrators are physically exhausted because of Ramadan fasting, they can be inhibited to engage in these kinds of activities. The results that were presented in [Table 2](#) provide strong evidence against this argument. In particular, those results show that the duration of fasting does not have any effect on the crime rates. If fasting deteriorates physical conditions, and thereby decreases potential criminals' abilities, the effect should be stronger on days with longer daytime, and hence fasting hours. This hypothesis is not supported by the data.

We implement an additional test to assess the possible role of decreasing physical ability by studying how the number of detected crimes changes over the Ramadan period. If physical exhaustion is driving the results then we should observe only small negative effects in the beginning of Ramadan because perpetrators are in relatively good physical condition. The effect should then gradually increase in size over time as the exhaustion from prolonged fasting sets in.

The blue shaded area in [Fig. 1](#) depicts the month of Ramadan. The individual effects within this month do not exhibit the pattern described above, that would be consistent with the physical exhaustion mechanism. We rather observe a slight decrease in effect size over the time period, contradicting the exhaustion hypothesis. One interpretation that is consistent with the observed pattern is that some people who are engaged in criminal activity as a source of income, try to practice restraint during Ramadan, but as time proceeds they face liquidity constraints and again start committing actions from which they were supposed to restrain.

Taking together the results of the quantitative analysis of [Table 2](#) and [Fig. 1](#), there is strong evidence against the argument that declining crime rates are driven by worsening physical conditions. Nevertheless it is worthwhile to discuss some of the points made by [Campante and Yanagizawa-Drott \(2015\)](#). In that paper, the authors document a negative effect of Ramadan on output in Muslim countries, and argue that reduced level of physical activity is one of the channels driving their result. The authors provide references to several studies to support this claim. First, it should be noted that some of the studies listed in their paper emphasize such effects among people with chronic diseases, who regularly need to take pills, or who are not young (for example, [Nilgun Karaagaoglu, 2000](#)). Since they are interested in total country output, considering all groups of population is appropriate because people in those groups are also part of the labor force. These groups of population may be less relevant in our context, because typically crimes are committed by young men who tend to be healthy. Further, more recent studies that use advanced research designs rather than cross sectional surveys, are less inclined to arrive at the conclusion that during Ramadan young fasting people experience exhaustion or fatigue. For example, [Nugraha et al. \(2017\)](#) conduct an experiment on a sample of young men in Germany, and find that subjects in the treatment group do not experience an increase in fatigue during Ramadan. Even in more extreme environments, studies find that Ramadan fasting has only a small effect on athletes performing high endurance sports activities ([Chaouachi et al., 2009](#); [Aziz et al., 2010](#)).

3.5.2. Pretrends & persistence

We are not only interested in the time dynamics within the month of Ramadan, but also how criminal activity is shaped just before and after Ramadan. If our main finding, namely the strong reduction in the propensity to commit crimes for migrants from predominantly Muslim countries during Ramadan is indeed driven by changes in fundamental beliefs, we should observe some pattern of anticipation and potentially persistence before and after Ramadan.

The period before Ramadan is especially interesting to study, for two reasons: First, Muslims who have undergone Ramadan in previous years might recall previous years' experiences, and the beliefs and values they formed, even if they reverted on them some time later in the year. Second, it is not uncommon to engage in a number of preparatory activities during Sha'ban (the month before Ramadan). This can include voluntary fasting (only until the 15th of Sha'ban), Quran recital, and other mental preparation such as settling disputes.¹¹

The yellow shaded area in [Fig. 1](#) indeed showcases a pattern consistent with anticipation. Starting from 30 days before the beginning of Ramadan, there is a significant negative effect of similar size to the main effect during Ramadan. We interpret finding such a clear pattern before Ramadan as an indication that a key driver of the result is indeed linked to beliefs and values, for two reasons: For one, preparation in the month of Sha'ban will be a much more individualistic choice, reducing the confounding role that community events or perceptions might play. Also, the role of fasting in Sha'ban is much smaller, and therefore alternative mechanisms behind the reduction in crime rates such as decreased physical ability are less likely to be key.

The result that the strong message of religion leads to a temporary reduction in crime may lend some credence to a broader interpretation that religion has a similar qualitative effect during the rest of the year, but as the message is weaker its effect on crime is also weaker. For example, [Campante and Yanagizawa-Drott \(2015\)](#) argue that their finding that increased fasting hours affect beliefs, such as trust, indicates that the effect operates over a longer span of time. The same rational might apply to the findings presented in this paper. We take one additional step to assess this possibility quantitatively.

If the intensive practice of religion affects beliefs, and has long-term impact, we should observe some persistence of the effect after Ramadan. Naturally, some people will revert back to their "normal" criminal behavior, and over time their numbers will grow. If on the other hand Ramadan truly has only a temporary effect, and as soon as it is over people with criminal inclinations restore their activities, we should observe an increase in criminal activity shortly after Ramadan because of liquidity constraints.

¹¹ An important source of guidance for religious behavior of Muslims are *Hadith*, lore about the life of the prophet Muhammad. There are a number of canonical collections of this lore, some of which we will cite here to substantiate the prevalence of these mental preparations: preparatory fasting at the beginning of Sha'ban (Lataiful Ma'arif, pg. 248–249, Sunan Nasai, *Hadith*: 2923), Quran recital (Lataiful Ma'arif, pg. 258), settling of ill-feelings (Lataiful Ma'arif, pg. 264).

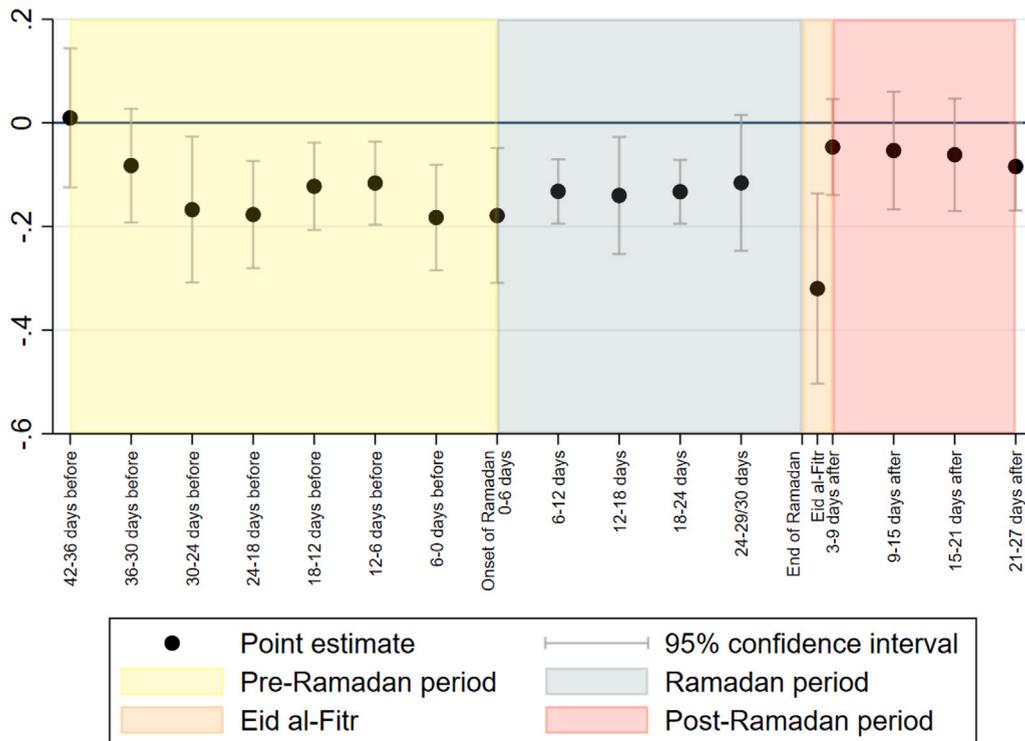


Fig. 1. Time dynamics around Ramadan. *Notes:* The figure plots the estimated coefficients of the interaction of Muslim share X Ramadan from Eq. (1). The dependent variable is the number of offenses detected on a day by residents born in a given country. The individual point estimates bin together 6-day periods, except for the last estimate of the Ramadan period, which consists of only 5-days whenever Ramadan is 29 days long, and Eid al-Fitr which is a 3-day bin. All coefficients are jointly determined such that the control group consists of days entirely outside the depicted period. The estimation method is PPML, and date as well as country-of-origin#year fixed effects are employed. Standard errors are clustered at country-of-origin level. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

The red shaded area in Fig. 1 depicts the post-Ramadan period. We see that the estimates are still negative, but no longer distinguishable from zero at a 5% significance level. It is likely that the reality regarding the longevity of the effect is between the extreme cases of long-run persistence, and short-term only, with patterns of reversion being highly idiosyncratic.

4. Robustness checks

4.1. Heterogeneity across countries

In this section we conduct various heterogeneity checks on our main estimates. First we investigate heterogeneous effects across countries in a jackknife type specification. To this end, we re-calculate estimation (1), but successively drop single countries.¹² In Fig. 2 we plot the resulting divergence of dropping individual countries denoted by their respective 3-letter iso-code from the average effect of Muslim share X Ramadan from Table 1 column 3 (red dotted line). The following intuition applies: If the resulting effect from dropping an individual country-of-origin is below (above) the average effect, that country’s migrants showcase a lesser (stronger) differential effect during Ramadan than the average. Generally the divergence is small, with the largest changes appearing from dropping Albania, Turkey, Kosovo, and Algeria. Importantly the effect remains statistically clearly distinguishable from zero, such that we can confidently rule out individual countries driving our main results.

As the host country, Switzerland takes on a special role as a country-of-origin. One reason is that some second generation Muslim immigrants were born in Switzerland, and thus will be in the control group. In turn Ramadan may have a small effect on the control group as well. In Panel A of Table 5, we therefore exclude crimes committed by people born in Switzerland, such that the sample includes only crimes committed by the foreign-born population. The estimated effect of Ramadan is 0.013 less for all crime categories, and 0.014 for property and violent crimes.

A second type of heterogeneity we look to explore across countries is the number of immigrants individual countries-of-origin have in Switzerland. This is an important aspect, since in the regressions so far each country-of-origin-day received an equal weight.

¹² We restrict this exercise to countries-of-origin having a Muslim population in the top quartile, as these are the countries relevant to our research question.

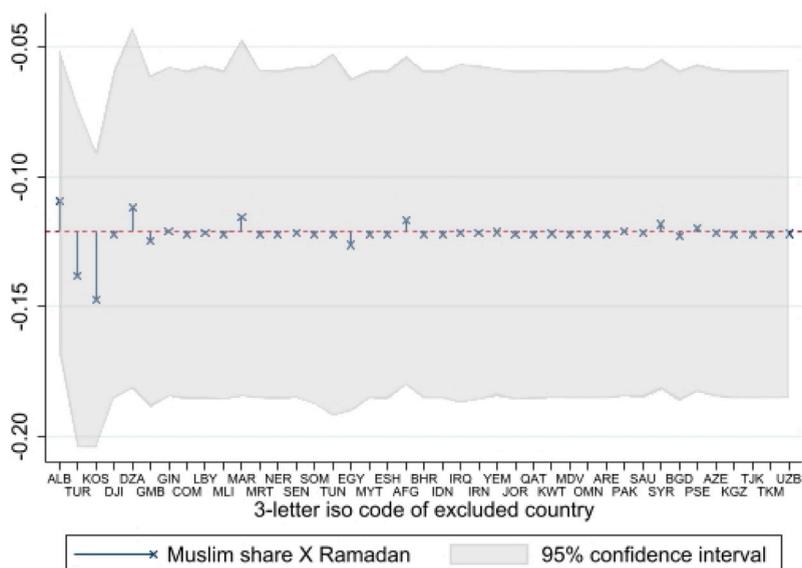


Fig. 2. Changes to the Average Effect from Dropping Individual Countries-of-Origin. Notes: The figure plots the estimated coefficients of the interaction of Muslim share X Ramadan from Eq. (1) dropping the country denoted by the 3-letter iso-code. The dependent variable is the number of offenses detected on a day by residents born in a given country. The estimation method is PPML, and date as well as country of birth-by-year fixed effects are employed. Standard errors are clustered at country of birth level.

However estimated low propensities to commit crimes might then be driven by relatively small numbers of immigrants from those countries, rather than those immigrants being relatively less likely to engage in criminal behavior.¹³ To address this issue, we construct weights based on the total number of detected crimes by country-of-origin-year, and re-estimate Eq. (1) with these weights. The results are presented in Panel B of Table 5, estimated coefficients are only marginally different from the ones in Table 1.

As a last robustness check we employ an alternative regression specification. Instead of interacting the precise share of Muslims in the population of the countries-of-origin, we construct an indicator variable grouping countries into quartiles by their share of Muslim population. The results of these estimations are presented in Panel C of Table 5. The first quartile serves as the reference group. The interaction term is significant only for countries in which the share of Muslims exceeds 75%, and in terms of size the coefficients are close to the baseline specification. For other quartiles the estimated coefficients are small in absolute size and imprecisely estimated.

5. Extension: Victims

5.1. Muslim victims

The dataset also provides information on the country of birth of victims. In this section we exploit that information to study whether people born in Muslim countries are more or less likely to become victims on the days of Ramadan. It is possible that Ramadan makes the presence of Muslims more salient which could lead to an increase in crimes against them. More specifically, we run regressions based on Eq. (1) where the dependent variable is the number of victims born in country i on a given day t and the variable $Muslim_i$, as before, denotes the share of Muslim population in that country.

The results of the estimations are presented in Table 6. The estimated effects in columns (1) to (3) are small in size, and statistically indistinguishable from zero. We are particularly interested in violent crimes as we believe that emotionally driven, hateful crimes against migrants are more likely to appear in this category. For that reason we take a closer look at violent crimes in column (4), where we restrict the sample to violent crimes perpetrated by Swiss-born offenders. The hypothesis is that hate crimes are primarily committed by natives who oppose the inflow of migrants, and might react violently to the increased salience of the Muslim population during Ramadan. We do not find evidence supporting that hypothesis, as the estimated effect in column (4) is negative and significant at the 10% level.

We drill down one more level on this matter, utilizing the existence of articles 261 and 261^{bis} in the Swiss Penal Code which constitute attacks on the freedom of faith and the freedom to worship, and discrimination and incitement to hatred respectively. In column (5) of Table 6 we restrict the sample to crimes of these types committed by Swiss-born perpetrators. It should be noted that

¹³ Note, for this issue to bias our results not only levels of crime must be different due to the different number of immigrants, but the Ramadan effect must be differential because of it.

Table 5
Criminal offenses during Ramadan: heterogeneity.

	(1) <i>Crime_{it}</i>	(2) <i>Crime_{it}</i>	(3) <i>Crime_{it}</i>
Panel A: excluding Switzerland			
Muslim share × Ramadan	−0.109*** (0.034)	−0.150*** (0.040)	−0.080** (0.040)
R-Pseudo	0.649	0.597	0.523
N	807568	742024	738894
Panel B: weighted estimations			
Muslim share × Ramadan	−0.106** (0.046)	−0.158*** (0.048)	−0.073*** (0.027)
R-Pseudo	0.954	0.910	0.905
N	811951	746406	743277
Panel C: Muslim shares by quartile			
Muslim share 2nd quartile × Ramadan	−0.004 (0.045)	0.001 (0.064)	0.007 (0.065)
Muslim share 3rd quartile × Ramadan	−0.026 (0.048)	0.032 (0.109)	−0.011 (0.049)
Muslim share 4nd quartile × Ramadan	−0.103*** (0.035)	−0.142*** (0.039)	−0.082** (0.038)
R-Pseudo	0.649	0.597	0.523
N	807568	742024	738894
Method	PPML	PPML	PPML
Crime type	All	Property	Violent

Notes: Regression results of Eq. (1). The dependent variable is the number of offenses detected on a day by residents born in a given country. All regressions include date and country-of-origin#year fixed effects. To improve readability we do not display Eid al-Fitr, but it is controlled for in all regressions. In Panel A crimes committed by Swiss born are excluded. In Panel B observations are weighted by the number of crimes by country-of-origin-year pair. Standard errors are clustered at country-of-origin level. * (**) (***) indicates significance at the 10 (5) (1) percent level.

Table 6
Criminal offenses against Muslims.

	(1) <i>Crime_{it}</i>	(2) <i>Crime_{it}</i>	(3) <i>Crime_{it}</i>	(4) <i>Crime_{it}</i>	(5) <i>Crime_{it}</i>
Muslim share × Ramadan	−0.014 (0.021)	−0.031 (0.026)	0.011 (0.037)	−0.132* (0.070)	−0.072 (0.348)
Muslim share × Eid al-Fitr	−0.053 (0.062)	−0.087 (0.072)	0.070 (0.081)	−0.031 (0.138)	2.060** (0.868)
R-Pseudo	0.937	0.935	0.859	0.840	0.259
N	854683	836415	769217	604483	18436
Method	PPML	PPML	PPML	PPML	PPML
Crime type	All	Property	Violent	Violent	Hate crimes
Perpetrator country	All	All	All	Switzerland	Switzerland

Notes: Regression results of Eq. (1). The dependent variable is the number of offenses detected on a day against residents born in a given country. Estimation method is displayed at the bottom of the table. Hate crimes are defined as violations of articles 261 and 261^{bis} of the Swiss Penal Code. All regressions include date and country-of-origin#year fixed effects. Standard errors are clustered at country-of-origin level. * (**) (***) indicates significance at the 10 (5) (1) percent level.

in this subsample there are relatively few observations because such crimes are rare, and for most victim-country pairs there are no cases during the entire sample period, which is why we would only identify very strong effects with sufficient statistical significance. This is not the case for the Ramadan effect, which is negative and sizable but comes with a very large standard error. However, interestingly we do estimate a very large and significant effect for the Eid al-Fitr period. Hate crimes by Swiss-born offenders under the articles 261 and 261^{bis} more than double during Eid al-Fitr, compared to the remainder of the year outside of Ramadan. Overall, the results of Table 6 imply that the hypothesis that (hate) crimes against Muslims increase during Ramadan is not supported by the data. For the period of Eid al-Fitr though there is a distinct increase in the number of hate crimes against Muslims, which again would be consistent with the salience argument.

5.2. Differential targeting by religion

The information of victims’ origin countries allows us to investigate whether the crime reducing effect of Ramadan has differential consequences for victims from various nationalities. It could be that Muslims target their victims based on religion, and on the days of Ramadan commit fewer crimes against co-believers. According to some radical Islamist ideologies, violence against non-believers

Table 7
Targeting victims by religion.

	(1)	(2)	(3)	(4)
	$Ratio_{it}$	$Ratio_{it}$	$Ratio_{it}$	$Ratio_{it}$
Muslim share × Ramadan	0.021*** (0.007)	0.009 (0.008)	0.020* (0.011)	0.086** (0.034)
Muslim share × Eid al-Fitr	0.021 (0.025)	0.009 (0.025)	0.028 (0.028)	0.058 (0.103)
R-Adjusted/R-Pseudo	0.166	0.055	0.235	0.088
N	141032	84151	99445	141032
Method	OLS	OLS	OLS	PPML
Crime type	All	Property	Violent	All

Notes: Regression results of Eq. (1). The dependent variable is the fraction of cases with Muslim victims to total cases on a day committed by perpetrators born in a given country. Estimation method (OLS or PPML) are displayed at the bottom of the table. All regressions include date and country-of-origin#year fixed effects. Standard errors are clustered at country-of-origin level. * (**) (***) indicates significance at the 10 (5) (1) percent level.

can be justified (see Ginges et al. (2016) for a discussion of this topic). To study this possibility, we re-estimate Eq. (1) but change the dependent variable to the ratio of victims from Muslim countries on a given day for each perpetrator country.

To construct this variable, we determine the probability of each victim being a Muslim based on the share of Muslims in the population of the victim's country of birth. Then, we sum over all Muslim victims (weighted by probabilities of being Muslim) for each perpetrator country-day, and divide the resulting measure by the total number of victims of a country-day pair. The measure is given by $Ratio_{it} = \frac{\sum_{kj} \mathbb{1}_{kjit} Share_j}{\sum_{kj} \mathbb{1}_{kjit}}$, where j denotes the country of the victim and i the country of the perpetrator of crime k .

The results of the estimations are presented in Table 7. Since the dependent variable is a ratio with zeros being less prevalent, we switch back to OLS as the preferred estimation method. We can observe positive small coefficients across all specifications, with statistically significant estimates for all crime types combined in column (1). There is evidence that this is driven by violent rather than property crimes, indicated by the non-significant smaller effect on property crime in column (2), and the larger at the 10% level statistically significant effect on violent crimes in column (3). Regarding the initial hypothesis, if Muslims were to differentially reduce crimes against their co-believers, then we should observe negative coefficients. Thus, there is no evidence for this behavior.¹⁴

6. Conclusions

In this paper, using data on the universe of criminal offenses registered by the Swiss police authorities, we estimated specifications with a rich set of fixed effects, and showed that migrants from countries with high shares of Muslim population become less likely to commit crimes during the holy month of Ramadan. We discussed a number of channels that can drive these results: preoccupation with social or community events, availability of opportunities, e.g. victims or length of night-time, physical exhaustion, and Covid lockdown restrictions. By conducting various tests, we show that none of the aforementioned explanations are the main driver of the effect.

We argue that the prime explanation remaining is one of changes in beliefs and values driven by more intensive practice of religion. The results of this study have important implications for the public discussion on Muslim immigrants and their religious practices in Western countries. Furthermore, the paper contributes to the broader literature on the relationship between religion and crime, and the mechanisms behind it.

Although the conducted tests allow us to argue that religion affects values and perception of immigrants, further research is needed to help us understand whether it operates at the individual level, or at the community level. At present we cannot sufficiently disentangle whether the reduction in crimes is due to an intrinsic updating of beliefs and values, e.g. intensified religious practices deter criminal behavior by increasing the costs of delinquency through the promise of punishment in the afterlife, or the effect stems from updating the beliefs about peers' and the community's reaction to criminal activities during Ramadan.

Another avenue for future research is understanding the persistence of the effect in greater detail. Particularly studying the competing interests of criminally active individuals' budget constraints, and their Ramadan induced reduction in criminal activity would allow us to understand the longevity of the effect, while adding a crucial dimension to any crime reducing policy intervention that considers religion.

Appendix

Please see Tables A.1 and A.2 and Fig. A.1.

¹⁴ The results in Table 7 allow us to also rule out another mechanism that could drive the decline in crimes committed by Muslims. In general there is a high likelihood of a victim to be from the same country as the perpetrator (Couttenier et al., 2019). If during Ramadan Muslims are less likely to leave their homes, or are more likely to be absent from Switzerland, then this can mechanically decrease the crimes committed by Muslim perpetrators because of lower availability of victims. If this was the case, then in Table 7 we would have observed a decline in the ratio of Muslim victims.

Table A.1
Descriptive statistics.

	Obs	Mean	Std	Min	Max
$arsinh(Crime_{it})$ (all)	937962	0.460	1.009	0	8.599
$Crime_{it}$ (all)	937962	2.530	20.542	0	2714
$Crime_{it}$ (property)	937962	1.131	8.899	0	1252
$Crime_{it}$ (violent)	937962	0.778	6.539	0	792
$Ramadan_t$	937962	0.081	0.272	0	1
$Muslim_t$	937962	0.239	0.367	0	0.997
$Ramadan_t * Muslim_t$	937962	0.019	0.123	0	0.997
$Ramadan_t * Muslim_t * Hours_t$	937962	0.000	0.007	-0.176	0.059

Notes: Descriptive statistics for the main variables used in the paper. Hours are in logs and demeaned.

Table A.2
Top offending countries.

Country	All	Violent	Property	Muslim share
Switzerland	1121168	343028	468151	0.043
Romania	87567	18623	63703	0.003
Portugal	77937	30142	26890	0.001
Kosovo	74977	27628	30648	0.896
Germany	70386	19622	29870	0.05
France	68090	19759	34056	0.06
Italy	64109	19321	28634	0.005
Algeria	63320	13372	43023	0.98
Serbia	58938	20201	26765	0.032
Marocco	43981	11046	26128	0.99
Turkey	43898	17699	13015	0.98
Tunisia	38505	10493	22523	0.995

Notes: This table presents the number of detected cases for all types of crimes, for major categories and the share of Muslim population for countries with highest number of cases.

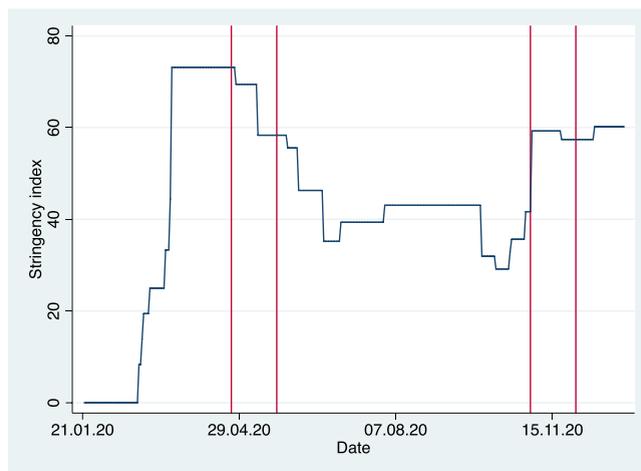


Fig. A.1. COVID-19 stringency index for Switzerland. *Notes:* The dynamics of the COVID-19 stringency index for Switzerland. Vertical lines show the period of Ramadan (April 24th–May 23rd) and the month of November.

Source: Hale et al. (2021).

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