Religious Practice and Worker Performance: Evidence from Ramadan in Indonesia

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Abstract

More than six billion people practice certain religions. How religious practices affect worker performance is theoretically ambiguous. On the one hand, religious practices require time that is then unavailable for production. Moreover, certain practices, such as fasting, may also directly impact worker productivity. On the other hand, religion may foster better work ethic and workers may find ways to attenuate the potential economic costs. Our paper examines the effects of religious practices on labor supply and productivity and how workers respond to a change of external constraints in the context of observing Ramadan fasting. We obtain high-frequency administrative data from a large retail chain in Indonesia and utilize an event-study approach to compare the performance of Muslim salespersons and their non-Muslim colleagues during Ramadan. We find that Muslim salespersons leave work 22 minutes earlier, and their productivity (after controlling for demand side changes) decreases by 21% around sunset, compared to their non-Muslim counterparts. Meanwhile, they exert more effort earlier in the day to compensate for decreased productivity later in the day or shorter working hours. Due to their reallocation of efforts, there is no significant change in the aggregate daily sales of Muslim salespersons during Ramadan. Lastly, we find that such effort reallocation is more salient among workers with more Ramadan experience in the workplace, suggesting this optimization is learned over time.

Keywords: Religious Practices, Worker Performance, Ramadan, Effort reallocation

JEL classification: J24, Z12

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1. Introduction

More then six billion people worldwide practice certain religions. The relation between religion and economic performance and economic activity has attracted researcher across the different disciplines (See Iyer (2016) for a review). While, how religious practices affect worker performance is theoretically ambiguous and still understudied. On one hand, as argued by (Campante and Yanagizawa-Drott, 2015), religious practices impose an immediate trade-off, as they require time and resources that are then unavailable for production. Certain religious practices may directly affect labor supply and productivity such as religious fasting. On the other hand, religious practices may foster better work ethic which may help to motivate workers to perform better (Weber, 1905), and workers may find ways to attenuate the potential economic cost of religious practice.

In this paper, we examine the effect of religious practice on worker performance and how workers response to it, in the context of Muslim's practice of the Islamic holy month of Ramadan. During the month of Ramadan, adult Muslims are obligated to refrain from eating and drinking water from dawn to sunset. The Ramadan fasting is one of the most prominent example of religious practices that is observed by more than 1.6 billions Muslims in the world annually. Fasting practice is not unique in Islam but also a common religious practice in Buddhism, Christianity, Judaism, and Hinduism. For example, the Eight Precepts in Buddhism require believers to fast from every noon to dawn of the following day.

To investigate the causal effect of religious practice on worker performance and adaptation, we first obtain high-frequency administrative data from a large retail chain in Indonesia. We then utilize an event-study approach to compare the labour supply and productivity of Muslim salespersons and their non-Muslim colleagues during Ramadan with pre-Ramadan period as the baseline.

The administrative data is a great fit to our research purpose. First, commission, on average, accounts for more than one third of salespersons' income in this retail chain. Therefore, salespersons in our sample do have strong economic incentive to maximize the sells and attenuate the economic cost of observing Ramadan. Second, the data include detailed information about each transaction. We match each transaction to the corresponding salesperson and calculate the salespersons' daily and hourly sales as a measurement of incentivized productivity. The high-frequency measures of productivity at the hourly level enable us a rare opportunity to observe

the productivity within a day as fasting continues. Third, the clock-in/clock-out data provide us labor supply measurements not only at the extensive margin - absence from work, but also at the intensive margin - working hours. Fourth, a four-year subsample of data has detailed information about customer traffic in each store for every 15 minutes. It is enable us to control for demand side changes and interpret the changes in total sales as changes in salespersons' productivity.

We first use an event-study approach to estimate the effects of observing Ramadan on daily total sales by comparing Muslim and non-Muslim salespersons during Ramadan with pre-Ramadan periods as the baseline. We find no significant decrease of daily total sales for Muslim salespersons during the Ramadan period for both day shift salespersons (work from 9 a.m. to 5 p.m. and can choose to work overtime since they earn commission) and night shift salespersons (work from 2 p.m. to 10 p.m.). This negligible total impact of Ramadan on total sales during the Ramadan period maybe due to 1) practicing Ramadan has no effects on productivity or labor supply in the first place or 2) practicing Ramadan could have effects but salespersons manage to find ways to attenuate the potential negative effects.

To understand the reason driving the negligible impact of Ramadan on the output of Muslim workers, we break down their daily total sales into labour supply - both extensive margin (absence) and intensive margin (working hours) - and hourly productivity. Although we do not find any impact of observing Ramadan on the extensive margin of labour supply - absence from the work, there are strong evidence showing that day shift Muslim salespersons, on average, decreases their labor supply at the intensive margin by leaving work 22 minutes earlier in a Ramadan day. Moreover, a closer investigation of hourly productivity shows the productivity of day shift Muslims salespersons, relative to their non-Muslim colleagues, decreased by 21% during the hour before sunset (when they have fasted for around 12 hours) and the hour after sunset (when they may take time off to break the fast).

In the mean time, compared to their non-Muslim colleagues, Muslim salespersons have higher productivity earlier in a Ramadan day when they are less affected by fasting or influid restriction. The increased productivity earlier in a Ramadan day suggests that day shift Muslim salespersons reallocate their efforts to attenuate the economic cost of observing Ramadan.

This pattern of results is unique to the Ramadan period. Moreover, for salespersons who may leave work earlier during Ramadan, the increased productivity earlier in a day is large enough to cover the loss from both lower productivity around sunset and leaving work earlier.

For salespersons who do not leave work earlier during Ramadan, their increased productivity earlier in a day has a smaller magnitude and is approximately equal to the productivity loss around sunset.

It is common that people need time to learn how to adapt to an external shock. It will be much more likely for experienced salespersons to have clear expectation of lower productivity around sunset and a clear knowledge of how to adapt. Consistent with that, we find that experienced Muslim salespersons, compared to inexperienced salespersons, has much more increase in productivity earlier in the day suggesting that experience can lead to more adaptive behaviours. In the mean time, experienced Muslim salespersons, compared to inexperienced colleagues, also has slightly more decrease in productivity around sunset. This is also consistent with effort reallocation in the sense that experienced Muslim salespersons may reallocate their effort away from the most negatively affected period.

Throughout our analysis, we calculate the total sales for each employee in each working hour as the measurement of productivity. To interpret total sales as a productivity measurement, we must rule out a key competing hypothesis that the change in total sales is driven by demand-side changes instead of productivity changes. We argue that this should not be a concern. First, our event-study approach can address demand shocks that are common to Muslim and non-Muslim salespersons. Second, on the subsample with customer traffic data, directly controlling the customer traffic variables do not change our results. However, there is still a concern that these salespersons may face different demand since customers might be more likely to approach salespersons who share their religion. In contrast to this hypothesis, we find that Muslim salespersons do not benefit more from increased demand in a city with a higher female Muslim ratio, based on a triple-differences approach.

Our paper contributes to a growing body of literature that investigates how religion affects economics activity and economic growth. The first generation of this study focuses on the observed correlation between religious behaviours and economic activities (McCleary and Barro, 2006). The more recent literature emphasize on identifying causal effects by studying the impact of specific religious practices, such as Ramadan fasting (Campante and Yanagizawa-Drott, 2015; Schofield, 2020), Catholic patron saint day (Montero and Yang, 2021), randomly-assigned Christian values education (Bryan, Choi and Karlan, 2021). Our paper is different from previous research from two perspectives. First, utilizing high-frequency administrative data, we are the first, to the best of our knowledge, to provide direct estimates of how religion

affect workers' productivity.[1]

Second, despite well-documented economic cost of religious activities, whether and how believers attenuate the potential costs of religion is under-emphasized in the literature. To the best our knowledge, we are the first to show clear evidence of how workers response to the potential economic cost of religion. The possible adaptation workers take may help to explain the puzzle of persistent costly religious practice. That is why religious practices are costly but many believers keep participating them (Campante and Yanagizawa-Drott, 2015; Montero and Yang, 2021). Related literature suggests spiritual benefit (Azzi and Ehrenberg, 1975), networking benefit (McCleary and Barro, 2006), access to mutual insurance (Berman, 2000), and underestimation of the cost (Wang, Wang and Ye, 2018). Our result suggest that workers may manage to attenuate the cost of religious practice by effort reallocation, which could help to explain prevalent religious participation.

Lastly, our paper also contributes to an extensive literature investigating the effects of temporary shocks on labor supply and its inter-temporary substitution.[2] Most of previous papers finding strong labor supply response to external shocks are based on occupations with flexible labor supply which may not be generalizable to most of occupations where worker are not free to set their working hours. A more relevant response for most workers is mainly adjusting their efforts conditional on labor supply or only with marginal adjustment of labor supply as in our study. We are one of the few papers emphasize the inter-temporal substitution of efforts. Also, most of previous research focuses on the wage change as external shock. In contrast, we focus on how workers response to the change of cost of exerting efforts.

The remainder of the paper is organized as follows. Section 2 describes the background information about Ramadan fasting and store operation. Section 3 describes our data. Section 4 introduces the econometric model. Section 5, 6, 7 presents our results for total output, labor supply, and productivity, respectively. Section 8 introduces discussion. Section 9 concludes the paper.

[1] Campante and Yanagizawa-Drott (2015) use macro country-year data and find longer Ramadan fasting hours slow down the employment growth but increase wage growth rate. Their indirect evidence implies that decreases in labour supply other than in productivity tend to be the story behind the negative effect of Ramadan on economic growth. Schofield (2020) finds the effects of overlapping between Ramadan fasting and cropping season on work days and working hours is negligible. Such finding can infer that the negative effects of Ramadan on agricultural output results from declines in labor productivity instead of labor supply. Nevertheless, we are shortage of direct estimate of the impact on productivity.

[2] See Camerer et al. (1997); Farber (2005, 2008); Crawford and Meng (2011) as examples of research based on taxi drivers. There are also some studies based on other occupations such as stadium vendors (Oettinger, 1999), bicycle messengers (Fehr and Goette, 2007), fisherman (Giné, Martinez-Bravo and Vidal-Fernández, 2017), or lab experiment (Abeler et al., 2011)

2. Background

2.1. Ramadan

Ramadan is the ninth month of the Islamic calendar and 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. According to Islamic law, all healthy, adult Muslims are obliged to fast, which means that they refrain from eating and drinking water from dawn to sunset during Ramadan.[3] In addition to fasting, Muslims devote more time to prayer and acts of charity, striving to improve their self-discipline during Ramadan.

In Indonesia, the most populous Muslim country,[4] most Muslims strictly observe fasting. According to a survey by the Pew Research Center (2012), 99% of Muslims in Indonesia fast during the daytime over Ramadan. This percentage is one of the highest among Islamic countries.[5] In a Ramadan day, fasting people can have a pre-dawn breakfast called Suhur and a post-sunset meal called Iftar. At the end of Ramadan, there is the fast-breaking festival of Lebaran (Eid al-Fitr) which lasts for five days.[6]

2.2. Store Operations

To study the effects of religious practice - Ramadan observance, we investigate the performance of salespersons who work at a large retailer chain in Indonesia. The firm focuses on the market of exclusive cosmetics in Indonesia. The salespersons' primary duty is selling cosmetic products to on-site customers. Their job requires sound knowledge about selling skills, makeup tips, skin care, and the features and instructions of a large number of various, high-end products.

Salespersons have strong incentive to sell products. Selling is important for them not only for earning commission but also for job security and promotion opportunity. First, they earn a commission on their sales amount. Their salary comprises a base pay and a commission. In

[3] Specifically, Muslims begin fasting at the time of the dawn prayer (Fajr), which is approximately 1 hour and 20 minutes ahead of sunrise.

[4] Approximately 87.2% of the 261 million population in Indonesia are Muslim.

[5] According to the Pew Research Center (2012), practicing fasting during Ramadan is nearly universal among Muslims in Southeast Asia, with Indonesia at 99%, Malaysia at 99%, and Thailand at nearly 100%. This number among six survey countries from the Middle East-North Africa region (Jordan, Lebanon, Iraq, Palestine, Egypt, Tunisia, and Morocco) ranges from 86% to 98%. In contrast, the annual fast is not universal among all Muslims. In six countries in Central Asia (Kazakhstan, Azerbaijan, Uzbekistan, Kyrgyzstan, Turkey, and Tajikistan), 30% to 88% (with an average number of 58%) of Muslims practice fasting during Ramadan.

[6] Lebaran is the popular name for Eid al-Fitr in Indonesia. The Lebaran holiday officially lasts for two days, but during our sample years, the government declared a three-day joint leave called Cuti bersama before and after the Lebaran. Therefore, the Lebaran holiday is five days long in reality.

general, the commission accounts for a significant proportion of their gross wage.[7] Second, contract workers' sales performance is the key factor in the renewal of their contract. Thus, they will fail to renew their contract if fall behind on sales. Third, sellers' sales ranking determines the chance of getting promoted to a senior position, which indicating a higher status and compensation.

Selling activities perform in stores that open for business 12 hours a day, from 10 a.m. to 10 p.m. Store managers schedule salespersons into two work shifts: the day shift and the night shift.[8] Day-shift salespersons work from 9 a.m. to 5 p.m. The night-shift sellers work from 2 p.m. to 10 p.m. Salespersons can earn overtime pay if they work more than the regular eight hours. Overtime pay is two times the regular basis. Salespeople can also earn commissions on sales realized in the additional working hours. On average, they work for 9.5 hours per day, which is 1.5 hours longer than the required eight hours.

Another main duty of salespersons is store maintenance. It primarily involves stocktaking, restocking the shelves, keeping store clean (such as the floor, mirror, shelves, tables, etc). The performance assessment of store managers involves these store maintenance activities besides store sales.[9] Both day-shift and night-shift workers are required to perform maintenance work. Day-shift sellers work on these tasks from 9 a.m. to 10 a.m. just before store opening. While, night-shift sellers are in charge of these tasks from 3 p.m. to 5 p.m., during which the store is still opening for business, and night-shift sellers are required to receive incoming customers if day-shift sellers are occupied by other customers.

Here, we show the daily routine of a Muslim salesperson who fasts for Ramadan (see Figure 1). She has breakfast before the time for Fajr, the dawn prayer (4:45 a.m. on average). Then, she starts fasting. If she is on the day shift, she has to work without eating or drinking water

[7]The company did not provide us the compensation data due to confidentiality. However, the company informs us that the commission accounts for, on average, approximately one-third of the salespersons' total salary, with considerable variation among salespersons.

[8]In general, there are two to six non-managerial salespersons in a store. Approximately half of them work the day shift, and the other half work the night shift. Moreover, salespersons rotate their shifts regularly. Only approximately 1% of salespersons do not switch their work shifts during Ramadan in our sample period.

[9]First, store managers need to make sure the inventory matching the number in company's system. Stealing of employees and customers is the main cause of inventory loss. Regular stocktaking is a necessary way for store manager to detect inventory loss timely and take measures to prevent further loss. Second, store managers need to comply with company's policy on story operation. Such as keeping the store clean and tidy, and no shortage of goods on the shelves, etc. The firm will send inspectors to stores without notice to check inventory and operation compliance. Together with store sales, performance on these tasks will determine store managers' merit pay and chance of promotion. Hence, store managers have strong incentive to put pressure on salespersons to fulfill these duties well besides selling. Though, salesperson' performance assessment and commission are merely sales oriented. The store managers have some veto rights on salespersons' contract renewal and promotion. Moreover, these tasks are part of their duties listed by the company.

during her official working hours from 9 a.m. to 5 p.m., the time before the average time of sunset (5:54 p.m.). If she works the night shift, she can have a rest at home and leaves for work which starts at 2 p.m. After working several hours, after sunset, she can break her fast and continue to work until 10 p.m. with replenished energy. Moreover, she may adjust her labor supply by asking for a day off, coming to work late, or leaving early based on her discretion and managers' approval.[10]

3. Data

3.1. Workplace Data

Our workplace data come from a retail chain in the cosmetics market in Indonesia. The company sells products in more than several hundred stores in nearly all major cities in Indonesia. In our sample period from 2013 to 2019, over three thousand salespersons worked in these stores, and they realized several dozen million of sales transactions.[11] Specifically, our workplace datasets include transaction data, employee clock-in/clock-out time data, employee demographic information, and customer traffic.

First, the transaction data include the sales amount, the transaction time in a date-hour-minute format, and the corresponding salesperson for the transaction. Thus, these data enable us to measure the productivity of a salesperson by her sales amount precisely and at a high-frequency level, i.e., the hourly level and the daily level. At the company, a salesperson earns a commission as a percentage of her sales amount. As a result, the salespersons have an incentive to sell more, which makes the sales amount a relatively reliable measurement of salesperson productivity. Accordingly, the company has to accurately match each sales transaction to the corresponding salesperson.[12]

Second, the clock-in and clock-out data provide us labor supply measurements not only at the extensive margin, i.e., a working day dummy, but also at the intensive margin, i.e., the hours worked on a working day. We define a given day as the working day of a salesperson if she has

[10] If anything, our estimates of the effects on labor supply should be a lower bound, given employees' possible concerns about a penalty for their absence during official working hours. If full flexibility were guaranteed, the estimates should be magnified.

[11] We do not reveal the exact number to protect the identity of the company and for confidentiality. We exclude the managers who works in stores and their sales transactions since their primary duties are managing the store and being the cashier instead of selling.

[12] The cashier records the salesperson who realizes the deal. The salesperson usually accompanies the customer to pay the cashier. If a customer walks in and takes the products to the cashier directly, the sales will be recorded under the cashier, who is generally the store manager.

a clock-in or clock-out or sales record in the day. Otherwise, she is absent. We measure the hours worked on a working day by the difference between a salesperson's clock-out time and clock-in time.

Salespeople can earn overtime pay is two times the regular basis. They can also earn commissions on sales realized in the additional working hours.[13] Therefore, salespersons have an incentive to increase their labor supply, and the company has to accurately measure their working time, rendering us a high-stake, accurate measurement of labor supply.

Third, the demographics of salespersons. It includes religion, age, gender, and time join the firm. We match together the demographic data, the transaction data, and the clock-in/out data via the employee identifier. After matching, there are over one thousand salespersons with religion information. These salespersons are aged 23 years on average,[14] and most of them (86%) are female. Muslim salespersons account for 89.3%, which is close to 87.2%, the ratio of the Muslim population in Indonesia. We have no information on education, but we control for individual fixed effects in all our regressions.

Fourth, customer traffic data. In the entrance of each store, the company installs a sensor system to capture the number of customers entering and exiting the store. We obtain the number of customer visits in every 15 minutes time interval during the business hours in each store from year 2016 to 2019. The number of customer visit can serve as a proxy for customer demand. This data help us to control for the possible effect from demand side.

3.2. Sunrise and Sunset Data

We obtain the time of sunrise and sunset at the daily level of each city in our sample between 2013 and 2019 from the United States Naval Observatory (USNO).[15] Muslims begin fasting at the time of the dawn prayer (Fajr), which is approximately 1 hour and 20 minutes ahead of sunrise. We calculate the time relative to 1 hour and 20 minutes before sunrise as a proxy of length of hours Muslim has fasted. We calculate the time relative to sunset as relative hours to the time of breaking fasting.

During Ramadan in our sample years, the average sunrise time and sunset time are 5:59 a.m. and 5:56 p.m., respectively. That is the daylight time is 12 hours averagely. Plus 1 hour

[13] On average, they work for 9.5 hours per day, which is 1.5 hours longer than the required eight hours.
[14] In total, 95% of the salespersons were aged between 19 and 29 years old.
[15] The data can be found on the website of the United States Naval Observatory (https://aa.usno.navy.mil/data/docs/RS_OneYear.php, last accessed on February 6, 2022).

and 20 minutes before sunrise, Muslim workers fast for an average of 13.3 hours per day during Ramadan in our sample period.[16]

4. Empirical Framework

Our event study approach compares the affected and unaffected salespersons, that is Muslim and non-Muslim salespersons. Equation (1) estimates the impacts on the daily level labor supply and productivity measurements, such as absences, hours worked on a working day, clock-in and clock-out times, and daily sales amount. Our main specification is as follows:

$$Y_{ist} = \sum_{w=-6}^{w=11} \beta_w Muslim_i \times RelativeWeek_w + \eta_i \times year_t + \gamma_t + store_s \times year_t + \epsilon_{ist} \quad (1)$$

where Y_{ist} is the daily labor market outcome measurement for individual i in store s on date t. The key coefficients of interest are the pattern of β_ws, and the coefficients before the interaction terms $Muslim_i \times RelativeWeek_w$. Here $Muslim_i$ is the indicator of whether individual i is a Muslim. $RelativeWeek_w$ indicates a set a dummy variables indicating the relative weeks of date t compared with the start of Ramadan in this year. Specifically, a value between -1 and -6 means the first to the sixth week before Ramadan. $RelativeWeek_w$ equals 1 to 4 if it is the first to the fourth week during Ramadan.[17] We use $RelativeWeek_w = 5$ as an indicator of Lebaran, the approximately five-day holiday right after Ramadan. Days with a $RelativeWeek_w$ value between 6 and 11 are approximately the sixth to the eleventh weeks after the beginning of Ramadan, that is, the first (6 minus 5) to the sixth (11 minus 5) week after Lebaran (the 5th week). Including six weeks after Lebaran allows us to investigate effects after Ramadan.

β_w estimates the differences between the affected and unaffected salespersons at a given week relative to the omitted category, which includes the seventh to the fourteenth weeks before Ramadan, another two months before the pre-trend period. Our results are robust to different lengths of the omitted group, such as six weeks, one month, and two weeks. We do not use a more commonly applied omitted group, the week before Ramadan, due to the concern of people preparing for Ramadan.[18]

[16] The 95% range of the average sunrise time and sunset time are from 5:32 a.m. to 6:31 a.m. and from 5:21 p.m. to 6:39 p.m., respectively. The 95% range of the daylight hours is from 11.7 hours to 12.3 hours. The fasting time is the time period of 20 minutes for the dawn prayer plus daylight hours.

[17] Since Ramadan lasts 29-30 days, week 4 includes 8 or 9 days.

[18] Muslims might decrease their caloric intake before Ramadan to be more adaptive to fasting during Ramadan. Additionally, the month before Ramadan, "Shaban", is a month when some Muslims begin fasting for a few days as documented by Buitelaar (1991). The first motivation is to make amends for missed fasting days. For

We include individual-year fixed effects $\eta_i \times year_t$ to capture individual characteristics, such as gender, religion, age, and unobserved personal characteristics, e.g., work-leisure preferences. We also include a set of dummies for each day of each year γ_t.[19] It not only captures the effects of the relative time compared to Ramadan, but also controls for daily variations, such as holidays and days of the week. Given the possible rotations of employees across different stores, individual fixed effects cannot fully capture all region or store characteristics. Therefore, we also include year specific store fixed effects, $store_s \times year_t$.

Equation (1) is applied only to the analysis of the daily level measurements. To investigate the productivity changes within a day, we slightly change the specification. We first calculate the hourly total sales for each salesperson in each hour relative to the sunset time.[20] We then run hour-by-hour regressions for each relative hour to sunset h based on equation (2):

$$\begin{aligned} Y_{ist}^h = {} & \beta_b^h Muslim_i \times BeforeRamadan_t + \beta_r^h Muslim_i \times Ramadan_t \\ & + \beta_a^h Muslim_i \times AfterRamadan_t + \eta_i^h \times year_t + \gamma_t^h + store_s^h \times year_t + \epsilon_{ist}^h \end{aligned} \quad (2)$$

where Y_{ist}^h is the total sales of employee i in store s during relative hour to sunset h on date t. For example, relative hour to sunset equals -1 means the first hour before sunset, which is the period from 5 p.m. to 6 p.m. if the sunset time is 6 p.m., and relative hour to sunset equals 1 means the first hour after sunset. Since our main focus here is the productivity change within a day instead of productivity changes across different weeks, we combine relative weeks before, during, and after Ramadan in equation (1) into three dummy variables. β_r^h is our main coefficient of interest. By comparing β_r^hs across different relative hours h, we can examine the productivity change of the affected salespersons for each hour within a Ramadan day. We include the same sets of fixed effects as equation (1).

Finally, all of our specifications report standard errors clustered at the individual level to allow for the possibility that the error terms might be correlated for an individual across times. Our results are robust to the standard errors clustered at the store level.

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people who were unable to fast for all of Ramadan in the previous year, Shaban offers the last chance to make up for these missed days. This type of fasting concerns people who were ill during the last Ramadan, but the vast majority of people who owe fasting days are women who interrupted their fast during their menstruation. The second motivation is voluntary fasting in this month. During Shaban, the Prophet himself practiced voluntary fasting more often than during any other month of the year, and some Muslims follow his example.

[19] For example, July 1, 2014 is one dummy variable

[20] For example, if the sunset time on this day in this city is 6:30 p.m., a relative hour that equals minus one indicates one hour before sunset, that is, 5:30 p.m. to 6:30 p.m.

5. The Effects on Total Output

We first investigate the impact of Ramadan on total output - total sales at the daily level. We plot the event study estimates based on equation (1) and summarize the results in Figure 2. In panel (a), we include workers who include workers who were absent from work on certain days and impute the daily sales as zero if absent on that day. In panel (b), worker-days where the worker is absent from the work are dropped from the analysis. Therefore, the aggregate effects in panel (a) reflect the change in absence, working hours, and hourly productivity while the aggregate effects in panel (b) only reflect the change in working hours (conditional on not absence) and hourly productivity. X-axis indicates the relative week compared to the start of Ramadan. The shaded area represents the Ramadan period.

First, we want to highlight that the pre-Ramadan estimates are close to zero in both panel (a) and panel (b) except for the fourth week before Ramadan, which is the first week of Shaban, the period that offers Muslims the last chance to make up for the fasts that they missed during previous Ramadan (Buitelaar, 1991). As a result, the decrease of total sales in this particular week might result from possible fasting days to compensate for their missed fasts last year.[21]

As for the during Ramadan period, compared with non-Muslim salespersons, we do not observe any significant change of total sales for Muslim salespersons. The point estimates are not statistically significant at traditional levels. The point estimates are close to zero for the first three weeks of the Ramadan. There is a small and statistically not significant increase in total sales for the fourth week of the Ramadan. It shows an increase of $8.3 per day which accounts for 5.6% increase in the daily sales during that week.[22]

There is a significant decrease in total sales in panel (a) during the Lebaran period with continuing but much smaller decrease during the one to two weeks after Lebaran. Lebaran is the important holiday for the Muslims and they will go back to hometown for family reunion during that period. In panel (b) Figure 2, once we drop worker-days with absent workers, the negative effects during the Lebaran becomes much smaller and not statistically significant. Comparing panels (a) and (b) suggests that the negative impact on total sales shortly after Ramadan is driven by the absence of Muslim salespersons during the Lebaran holiday which

[21] This situation can be especially significant in our case when the vast majority of the people who owe fasting days are women who are allowed to interrupt their fast during their menstruation (Buitelaar, 1991), and 89% of the salespersons in our sample are women. Overall, the pre-Ramadan estimates suggest a reliable parallel pre-trend to comparing Muslim and non-Muslim salespersons.

[22] All sales have been converted into U.S. dollars. The exchange rate between Indonesian Rupiah and U.S. dollars was one to 0.000068 on November 11, 2018.

featured as the time for family reunion.

As mentioned in the background section, all salespersons are divided into day shift (9 a.m.-5 p.m.) and night shift (2 p.m.-10 p.m.). However, the two shifts might be affected by Ramadan fasting to different degrees (see Figure 1). Day-shift workers are obligated to fast for the duration of their entire official working hours, from 9 a.m. to 5 p.m. In contrast, the night-shift workers can rest at home before 2 p.m. and break their fast after working for approximately three to four hours, when sun sets. Therefore, one may expect that the day shift salespersons could be more affected by the Ramadan fasting. Concerning that the aggregate limited impact may mask the heterogeneity across salespersons of different shifts, in Figure 3, we show the impacts of Ramadan on aggregate daily sales for night shift and day shift salespersons separately. Here, we drop worker-days with absent workers since we cannot assign the worker-day to a shift if the worker is absent on that day. As shown in the figure, there is also limited impact of observing Ramadan on aggregate daily sales for both day shift and night shift salespersons.

Overall, our result suggest that there is no significant effect of religious practice - Ramadan observation - on work output. There are two possible reasons to explain the limited impact on Muslim salespersons during Ramadan. Practicing Ramadan fasting may have no impacts on productivity or labor supply in the first place. Alternatively, practicing Ramadan could have an negative effects, but workers find ways to attenuate the potential cost. Distinguishing those two channels will be the focus of the next few subsections. To examine the channel, we first need to understand whether observing Ramadan has an effect on labor supply.

6. The Effects on Labor Supply

We now turn to the analysis of the changes in the labor supply of the Muslim salespersons during Ramadan compared with their non-Muslim colleagues. We explore the effects on labor supply both at the extensive margin, i.e., the probability of coming to work, and at the intensive margin, i.e., hours worked on a working day. Figure 4 presents the results from equation (1) in the event-study plots.

In Panel (a) of Figure 4, we start with an investigation of whether a salesperson comes to work on a given day.[23] We find that the the likelihood of Muslim salespersons to come to work does not change significantly during Ramadan relative to their non-Muslim colleagues

[23] We cannot distinguish a sick day from regular leave. However, we notice that the company does not provide an additional holiday to Muslim salespersons, relative to their non-Muslim colleagues, during Ramadan.

and relative to the pre-Ramadan period. This result indicates that Ramadan fasting does not affect the extensive margin of labor supply of the Muslim salespersons. This finding maybe due to an absence decision may not be fully flexible and feasible in the workplace. Specifically, permission to leave during a selling season such as Ramadan might be less favorable for store managers.

We identify that the most noticeable decrease occurs during Lebaran, the holiday following the end of Ramadan. Although Lebaran is a national holiday, it is an Islamic festival mainly celebrated by Muslims. Therefore, we can observe a significant difference in the probability of coming to work between Muslim workers and their non-Muslim colleagues. [24] Such results are consistent with the suggestive evidence by comparing panel (a) and panel (b) in Figure 2.

We now turn to the intensive margin of labor supply, namely, the hours worked on a working day. Panel (b) of Figure 4 repeats the analysis with a focus on the hours worked of the Muslim salespersons relative to their non-Muslim colleagues. The event-time analysis indicates that the impacts on hours worked drops immediately after the start of Ramadan. The drops range from 0.2 hours (12 minutes) in the third week to 0.34 hours (20.5 minutes) in the second week, with an average decrease of 0.22 hours (13.2 minutes) per working day.

Before Ramadan, similar to the pattern for the daily total sales, there are no statistically or economically significant differences between the Muslim and non-Muslim salespersons except for a marginal decrease in the fourth week before Ramadan, the first week to make up missed fasting days in previous year. After Ramadan (except Lebaran), when the Muslim workers can break fast, the hours worked by them return directly to the regular level. We also notice that the most significant drop occurs during Lebaran. As we argued above, this drop is mostly because Lebaran is an important holiday for Muslim workers.

The above results show the average effects on the hours worked by both the day-shift and the night-shift salespersons. We investigate the impacts of Ramadan on day-shift and night-shift salespersons separately and report the results in Panels (c) and (d) of Figure 4. We find that although the hours worked by day-shift workers fall significantly during Ramadan (see Panel (c) of Figure 4), the hours worked by night-shift workers remain nearly unchanged (see Panel (d) of Figure 4). During Ramadan, on average, day-shift workers decrease their working hours by 0.39 hours (23 minutes) per working day.

[24] We further find that there are significant but less decreases in the working probability for Muslim workers in the first and second weeks after the Lebaran holidays, i.e., the sixth and seventh weeks after the beginning of Ramadan. As suggested by the company manager, Lebaran and the one to two weeks after it are periods when Muslim workers return to their hometowns for family reunions, and it takes them time to return to the workplace.

We further divide working hours into clock-in and clock-out times of both the day-shift and night-shift workers. The results are summarized in Figure A.3. The results suggest that the decreases in working hours for day shift Muslim salesperson are mainly driven by their leaving work earlier. This leaving work earlier may be the results of energy deficiency or dehydration due to fasting or prepare for the fast breaking meals or attend religiou rituals. Consistent with the limited impact on hours worked for night shift Muslim salespersons, we do not find significant effects on clock-in and clock-out time for night shift salespersons.

In summary, we do not find evidence that observing Ramadan leads to more absence from the work, the extensive margin of labour supply. However, observing Ramadan significantly affect intensive margin of labour supply. Day shift Muslim leave work earlier by around 22 minutes.

Therefore, our result suggests a trade-off between religious practices and labor supply. However, the results in Section 5 suggests that such decreases in labor supply do not lead to a lower total daily output. One hypothesis to explain this phenomenon is that a 22-minute decrease of hours worked may have an impact but not statistically detectable. We argue that this hypothesis is unlikely to explain this phenomenon. As shown in panel (a) Figure 3, the point estimates for the second and fourth weeks are positive. Although the estimates for the first and third weeks are negative, they are not only statically small but also economically insignificant (representing 2.97% and 0.12% decrease of daily sales in the corresponding week). Another hypothesis is that day shift salespersons may anticipate that they will leave work earlier and, therefore, put more effort during the working period to compensate the loss. In the next subsection, we will provide evidence consistent with the second hypothesis.

7. Effort Reallocation within a Day

7.1. Main Results

In this subsection, we investigate the productivity change in each hour relative to the sunset during Ramadan with a focus on day shift salespersons. (We analyses of the productivity change within a day for night shift salespersons is not ready, and I will add it in the next version of draft.) Figure 5 presents the estimated coefficients for day shift salespersons from the hour-by-hour regressions in equation (2) on hourly productivity during Ramadan, and before and after Ramadan.

Panel (a) in Figure 5 shows the productivity change within a day during Ramadan. The productivity of the Muslim salespersons are negatively affected during the hour before and the hour after sunset, relative to that of their non-Muslim colleagues. During these two hours around sunset, they sell 6.4 and 5.6 dollars per hour less than their non-Muslim colleagues. This estimate implies a 18% and 25.7% decrease in productivity as measured by sales, given that the average sales per hour in these two hours are 34.9 and 21.8 dollars, suggesting a 21% decrease in these two hours. The effects for the hour before sunset are also statistically significant with a p-value of 0.001. The effects for the hour after sunset are marginally statistically significant with a p-value of 0.102.

Such decrease in productivity around the sunset time can be the results of multiple reasons: 1) before sunset, they experience the most energy-deficiency and dehydration in a Ramadan day. On average, Muslim workers have fasted without drinking anything for approximately 12.3 hours at this time; 2) during the hour before sunset, Muslim salespersons may be distracted by the expectation of being able to break the fast soon; 3) day shift Muslim salesperson who continues to work after sunset may take turns to eat and drink after sunset when they can break the fast.

Panel (a) in Figure 5 also documents a higher productivity earlier in a day. During the seventh to third hours before sunset, Muslim salespersons have \$3.9 to \$7.1 more sells per hour which represent an increase of 9.75% to 30.87% of increase in total sales per hour. And most of the point estimates during this five hours period are statistically significant at the 5% level. Since our event study estimates has controlled for demand side change (we will provide more evidence about it later and in the discussion section), we can interpret the change of the productivity as the change of effort. Therefore, Panel (a) in Figure 5 indicates a reallocation of effort within a day.

If such reallocation of effort can be viewed as adaptation to compensate lower productivity around sunset, we should expect the net effects throughout a day to be close to zero or slightly negative. However, if we naively sum up the coefficients throughout a day in panel (a), the "net effect" is 11.8\$. Such positive "net effects" may be due to that salespersons also want to exert more efforts earlier in a day to compensate for their leaving work earlier in addition to lower productivity around sunset. It is important to keep in mind that the loss of sales due to leaving work earlier will not be reflected in this graph since only workers who did not leave work during certain relative hours will contribute to the estimates for corresponding hours.

To provide further support of our argument, we restrict our sample to salespersons who work until two hours after sunset. Those are the salespersons who do not leave work earlier. Therefore, they do not need to exert more efforts earlier in a day to compensate for their loss due to leaving work earlier. We should expect a closer to zero "net effects" if effort reallocation can be viewed as adaptation in response to the lower productivity around sunset. The results are summarized in Figure A.4. We can observe a similar pattern of effort reallocation for workers who continue to work two hours after sunset. Moreover, if we sum up the coefficients throughout a day in Figure A.4, the "net effect" is -$0.78, which is negative and close to zero.

We want to highlight that the pattern in panel (a) Figure 5 is unique for the Ramadan period. As shown in panel (b) and (c) in Figure 5, there is no significant change before and after sunset during the pre- and post-Ramadan periods, when fasting is not required. There are also no significant differences between the sales of Muslim and non-Muslim workers in each hour during these non-Ramadan periods.

7.2. Demand Side Concerns

One major concern of our identification strategy is whether the effects we estimate is due to salespersons' productivity change or due to demand side shocks. By comparing Muslim and non-Muslim salespersons, our regressions should have already taken care of the demand sides shocks common to all salespersons. To further control the demand side change directly, we also run hour-by-hour regression based on equation (3) on the sample after 2016:

$$\begin{aligned} Y_{ist}^h = {} & \beta_b^h Muslim_i \times BeforeRamadan_t + \beta_r^h Muslim_i \times Ramadan_t \\ & + \beta_a^h Muslim_i \times AfterRamadan_t + \eta_i^h \times year_t + \gamma_t^h + store_s^h \times year_t \\ & + Entering_{st}^h + Entering_{st}^h \times Muslim_i + Exiting_{st}^h + Exiting_{st}^h \times Muslim_i + \epsilon_{ist}^h \end{aligned} \quad (3)$$

where $Entering_{st}^h$ is the number of customers entering the store s on day t during relative hour h and $Exiting_{st}^h$ is the number of customers exiting stores. By including their corresponding interactions with the Muslim indicator, we also allow for differentiated responses to the total demand changes between the Muslim and non-Muslim salespersons. Since the retail chain only started to collect the customer traffic data after 2016, we restrict the sample to the post-2016 period. The results are summarized in Figure 6.

For panel (a) of Figure 6, we still run regression based on the equation (2) (without including

customer traffic controls) but based on the sample with non-missing customer traffic data. For panel (b), we control the costumer traffic following equation (3). Comparing panel (a) and panel (b) reveals the robustness of our results to including demand side controls since they are based on the same sample.

As shown in Figure (6), panel (a) Figure 6 has a similar pattern as the full sample in panel (a) Figure 5. It suggests that our results still hold for this subsample. More importantly, including demand side controls in panel (b) produces results of a similar pattern as panel (a). The robust results further validate that our specification has already captured the change of the total demand.

Although our specification can capture demand side changes that are common to Muslim and non-Muslim salespersons, demand side change will still be a concern if Muslim salespersons and Muslim salespersons are facing different demand shocks. For example, if Muslim customers are more likely to be served by Muslims salespersons and the demand change during Ramadan is driven by Muslim customers, our results can still be driven by demand side change. In the discussion section, we provide further evidence to show that Muslim and non-Muslim salesperson do not face significantly different demand.

7.3. Experience and Effort Reallocation

It is common that people need time to learn ways to adapt to an external shock. Especially for day shift salespersons, adaptive behaviours require 1) clear expectation of lower productivity around sunset and/or clear expectation of leaving work earlier during Ramadan; 2) learning when will be a good time to start to exert more efforts earlier in a day; 3) learning how to adjust their efforts within a day. It will be much more likely for experienced salespersons to have clear expectation and a clear knowledge of how to adapt. Therefore, in this subsection, we want to investigate whether more experienced salespersons are more likely to adapt.

Here, we define experienced salespersons as salespersons who experienced Ramadan in the store. The idea is that personal experience of working as a salesperson during Ramadan can help to formulate expectation of lower productivity around sunset and learn how to adapt. The results are summarized in panel (a) Figure 7. The solid line in the figure represents the productivity change of experienced Muslim salespersons during Ramadan and the dashed line corresponds to salespersons who did not experience Ramadan in the sotre.

The figure shows that more experienced salespersons have increased productivity earlier

in a day. The positive estimates are statistically significant starting from seventh hours before sunset approximately when start to sell in a day. While for inexperienced salespersons, their sales do not increase until fifth hours before sunset. Moreover, even during the period when inexperienced salespersons also have increased productivity, the magnitudes of the increased productivity are generally higher for experienced salespersons. Taking the third hour before sunset as an example, the increases of productivity of experienced Muslim salespersons are almost three times as high as that for inexperienced Muslim salespersons.

It is worthy to highlight that the decreases of productivity for experienced salespersons are also more salient around sunset. We should interpret this difference with caution since they are not statistically significant. If we want to interpret this difference, this is also consistent with effort reallocation in the sense that experienced Muslim salespersons may reallocate their effort away from the most negatively affected period. Considering a model where the costs of efforts in each hour depend on fasting hours and total efforts exerted on that day before that hour, we should expect lower effort for experienced salesperson around sunset who exerted much more efforts earlier in a day.

In summary, compared to inexperienced salespersons, experienced salespersons has more increase in productivity earlier in the day and also more decrease in productivity around sunset, it is not obvious whether this effort reallocation strategy is beneficial or not. Moreover, we also do not have enough statistical power to statistically distinguish the productivity change experienced salespersons and inexperienced salespersons using high-frequency hourly data. Therefore, we run another triple-difference regression with daily productivity as the dependent variable and "Muslim X Ramadan X Experienced" as the main independent variable of interest. The positive point estimate of $21.8 suggests that experiencing Ramadan before and exerting more effort reallocation benefit Muslim salesperson during Ramadan. This $21.8 increase due to effort experiencing Ramadan before account for 18.6% increase in daily total sales and is statistically significant at 5% level.

In addition to comparing experienced and inexperienced salespersons, we should also expect salespersons learn how to adapt during the one-month period of Ramadan. Therefore, in panel (b) of Figure 7 for the first week and the other three weeks during Ramadan. As can be seen, effort reallocation is also more salient as Ramadan continues. The increase of productivity is also more salient for the later three weeks of Ramadan, compared to the first week of the Ramadan. This is consistent with learning the adaptation as the Ramadan continues.

8. Other Concerns

8.1. Religion proximity

One important concern regarding using the sales amount as a measurement of productivity is that the sales amount also reflects changes from the demand side. As indicated in Section 4, the event study approach can address the total demand shocks that are common to both Muslim and non-Muslim salespersons. Our results are also robust to the inclusion or exclusion of the customer traffic measurements as control variables which further validates that our specification has already captured the change in total demand.

There is a concern that the customers might tend to approach the salespersons of same religion, which we refer as "religion proximity". A customer could identify whether a female salesperson is Muslim by whether she wear a hijab.[25] Then, a Muslim customer can approach to a Muslim salesperson if she has such religious proximity preference. Moreover, Ramadan is also known for a shopping season and commercial holiday that Muslims will buy gift for themselves, family, and friends.[26] Sandikci and Omeraki (2007) indicates that "Ramadan has taken on the commercial trappings of Christmas and Hanukah and is transforming from a religious ritual to a holiday marked by consumption". Since the increasing demand during the Ramadan period maybe mainly driven by Muslim customers, religion proximity may bias our results by overestimating the productivity of Muslim salespersons.

We next want to directly test whether Muslim and non-Muslim salespersons face different demands (later referred to as "religion proximity"). If they do, we should expect Muslim salespersons to benefit more from increasing demands in cities with higher Muslim ratios. Corresponding to this prediction, we regress the hourly sales amount with a triple-differences specification by including another factor, the Muslim ratio among females in each city.[27] Religion proximity should result in a significantly positive coefficient before the triple interaction of the "Muslim X Customer Traffic X Muslim Ratio".[28]

[25] Hijab is a veil worn by Muslim women, which covers the head and chest.

[26] Our customer visits data is consistent with the observation of a shopping season. In our data, the customer visits increase significantly by 20% during Ramadan compared to the month before Ramadan (see Appendix Panel A of Figure A.1). There is only one exception that in the first week of Ramadan, the customer traffic decreased by 11% compared to the week right before Ramadan. In other Ramadan weeks, the customer traffic increases significantly and follows a rising trend. Such trend indicates a strong shopping holiday effect when close to the end of Ramadan and the begin of Lebaran.

[27] The Muslim ratio in each city is calculated from the 2010 Indonesia census data, which were accessed from IPUMS. We restrict the sample to urban females when calculating the Muslim ratio.

[28] Here, the three-way interaction represents the one-to-one correspondence with the prediction of Muslim salespersons benefiting more from increasing demands in cities with higher Muslim ratios.

The regression results are summarized in Table 1.[29] The first column shows the results based on the sample from all periods. Inconsistent with religion proximity, the coefficient of the triple interaction is negative and statistically insignificant. It might also be likely that religious identity is more salient during Ramadan, an important Muslim holiday in Indonesia. Therefore, we restrict the sample period to the Ramadan period in columns (2). The results are also not significantly different from zero which do not support religion proximity.

This test raises another concern that the company may match the ratio of Muslim salespersons to the ratio of potential Muslim customers. For example, if the company expects that nine out of ten customers for a store are Muslims, the company may set Muslim salespersons ratio in that store at 90 percent. If so, our test cannot find statistically significant results even if Muslim and non-Muslim salespersons face different demands. However,the matched ratio of salespersons cannot explain the insignificant results that we find in both the Ramadan and non-Ramadan periods. Compared with the non-Ramadan period, there are fewer Muslim salespersons and more Muslim customers during Ramadan. This means that at most, only one of the Ramadan and non-Ramadan periods can have the matched ratio of Muslim salespersons. Moreover, although city level Muslim ratio is a strong predictor of ratio of Muslim salesperson in the corresponding store, city level Muslim ratio only explains 25% of the variations in ratio of Muslim salesperson in the corresponding store. It means that the ratio of Muslim customers and the ratio of Muslim salespersons is not close to a perfect match.

8.2. Individual adaptation or store adaptation

We find that Muslim worker sells more in early the day and less later the day around sunset compared to their non-Muslim workers. We suggest such finding as an evidence of individual effort reallocation. That Muslim put more effort in selling when they are not that fatigue and less effort when the cost of unit effort is large.

However, the results could be driven by the change in productivity of non-Muslim sellers that is adaptation at store level more than individual level. Our estimate may partly capture the change in productivity of non-Muslim as the behavior of non-Muslim worker may change during Ramadan. For example, there is possible latent agreement between Muslim and non-Muslim. Non-Muslim worker tend to put less effort in early the day and share more selling

[29] We include the same set of fixed effects as our main specification. We further control the shift dummy and the relative hour fixed effects. All two-way interactions necessary for the triple-differences are included in the regressions.

opportunity when their Muslim colleagues are more energetic to receive customers in early of a Ramadan day. In later the day, non-Muslim workers enjoy more priority to sell. If such arrangement exist, our estimates of the effect of Ramadan on Muslim workers' productivity is amplified.

We plot the change in sales in each hour of Muslim and non-Muslim salespersons in both Ramadan and non-Ramadan period in Figure A.2. We find that the sales of Muslim salespersons change significantly during Ramadan period compared with non-Ramadan period. Day-shift Muslim workers sell more before 3 hours before the sunset and sell less during -2 to 1 hour relative to sunset during Ramadan day compared with a non-Ramadan day. Day-shift non-Muslim sellers

9. Conclusion

Religion and work are two of the most important things in many individuals' daily life. However, we have a limited understanding about whether and how religion affects our work performance. The causal evidence of whether religion affects worker performance is limited. Especially, there is less clear evidence on how workers response to the potential effect of religion on labor performance.

In this paper, we study the effect of religious practice on worker performance and how worker response in the context of Ramadan observance, one of the Five Pillars of Islam. To study these questions, we use high-frequency administrative data from a large retailer in Indonesia. Specifically, we compare Muslim salespersons with their non-Muslim colleagues during Ramadan, with the pre-Ramadan period as the baseline, and estimate the effects of Ramadan observance on worker performance includes productivity and labor supply.

After controlling for the demand side change, we find that there is no significant effect of religious practice - Ramadan observance - on worker performance measured by daily sales of Muslim salespersons during Ramadan. It can be practicing Ramadan has no effects on productivity or labor supply in the first place. Or Ramadan observance could have effects on labor performance but salespersons manage to attenuate the potential cost. Our findings suggest the second explanation.

Specifically, the Ramadan observance significantly decreased day-shift Muslim salespersons' labour supply - hours worked and their productivity around sunset. The result implies a trade-off between religious practices and labor supply. It also suggests a direct impact of

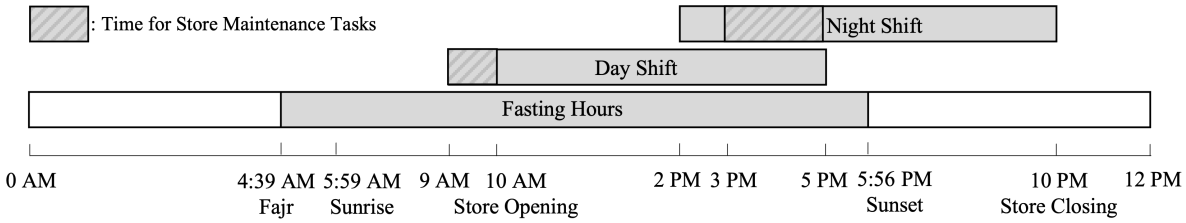
religious practices on labor productivity.

Meanwhile, Muslim workers has higher sales earlier in a Ramadan day when they are less affected by the fasting. Such results is consistent with effort reallocation to attenuate the economic cost later in a Ramadan day. Consistent with intentional effort reallocation, we find such effort reallocation is more salient among workers who have more Ramadan experience in the workplace.

Religion plays an significant role on economy. However, the mechanisms via which religion affects economy is less clear. It be important to understand the mechanisms in the sense that it may help policy makers take according measures to reduce the economic burden of religion more efficiently given its benefit. One channel that has played a particular central role is that religious practices may impact economy via affecting worker output. However, our result suggests that religious practices may not affect worker total output significantly. Policy makers may pay more attention to other channels via which religion affects economy.

In addition, our finding of workers' adaptation to religious practice may help to explain the puzzle of persistent costly religious practice. That is why religion is costly but prevalent and persists. Workers may manage to attenuate the cost of religious practice by reallocating their effort. Thus, the private cost of religion participation may be manageable.

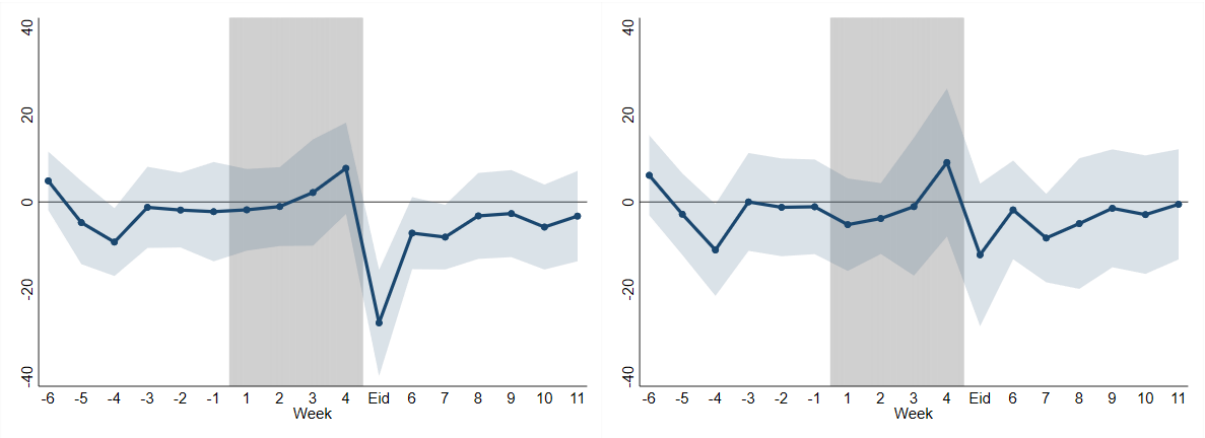
Figure 1: Fasting Hours and Official Working Hours of Day Shift and Night Shift



Fasting hours begin at the time for the dawn prayer (Fajr) and end at sunset. During Ramadan in our sample period, the average Fajr time is 4:39 a.m., and the average sunset time is 5:56 p.m. The official working hours of day-shift and night-shift workers are from 9 a.m. to 5 p.m. and from 2 p.m. to 10 p.m., respectively. Stores are opening from 10 a.m. to 10 p.m. Both day-shift and night-shift workers are required to perform maintenance work including cleaning, restocking the shelves, stocktaking, etc. Day-shift sellers work on these tasks from 9 a.m. to 10 a.m. just before store opening. While, night-shift sellers are in charge of these tasks from 3 p.m. to 5 p.m., during which the store is still opening for business, and night-shift sellers are required to receive incoming customers if day-shift sellers are occupied.

Figure 2: The Effects of Ramadan on Aggregate Daily Sales

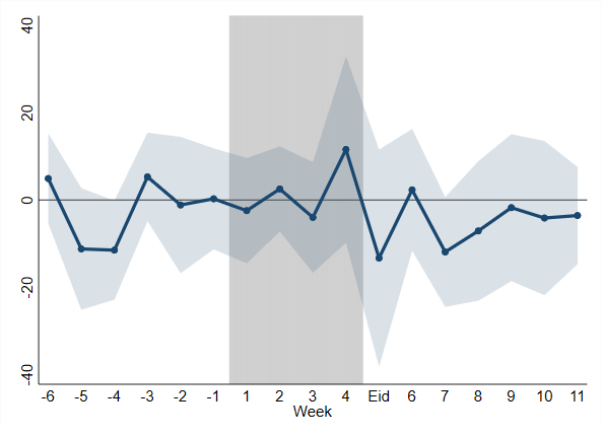
(a) Total Sales (0 if absence) **(b)** Total Sales (missing if absence)



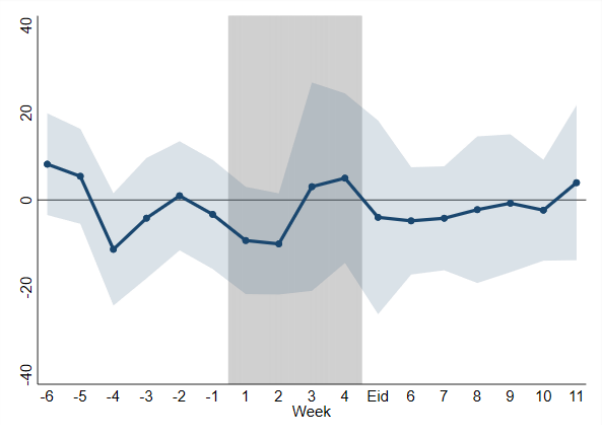
The graph plots event-study estimates of the effects on total sales, i.e., the sales amount in U.S. dollars in each week before, during, and after Ramadan for Muslim workers, along with the corresponding 95% confidence intervals. Relative week -X and X mean the X-th week before and after the starting date of Ramadan, i.e., relative week 0. "Eid" is the Lebaran holiday (Eid Al Fitr), which lasts five days right after Ramadan. The vertical gray area is the Ramadan period.

Figure 3: The Effects of Ramadan on Aggregate Daily Sales by Day Shift and Night Shift

(a) Total Sales (Day Shift)



(b) Total Sales (Night Shift)



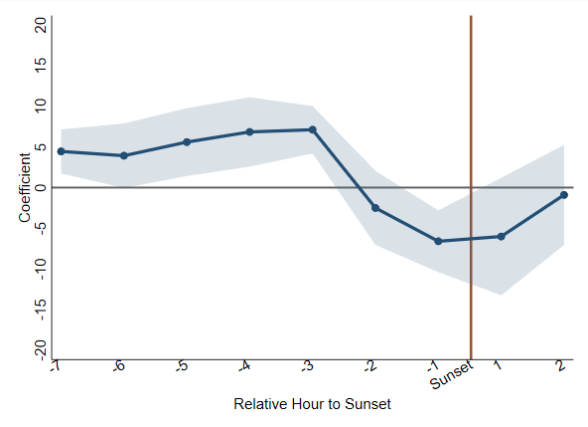
The graph plots event-study estimates of the effects on total sales, i.e., the sales amount in U.S. dollars in each week before, during, and after Ramadan for Muslim workers, along with the corresponding 95% confidence intervals. Relative week -X and X mean the X-th week before and after the starting date of Ramadan, i.e., relative week 0. "Eid" is the Lebaran holiday (Eid Al Fitr), which lasts five days right after Ramadan. The vertical gray area is the Ramadan period.

Figure 4: The Effects of Ramadan on Labor Supply

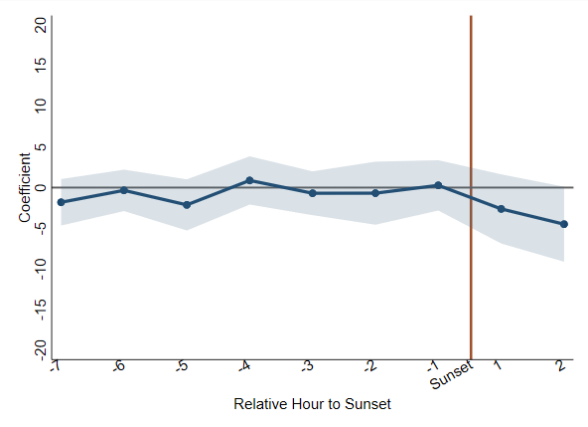
The graphs plot event-study estimates and the corresponding 95% confidence intervals. *Working Day* is a dummy variable for whether a salesperson comes to work on a given day. *Hours Worked* is the number of hours worked on a working day. The official working time of day-shift and night-shift workers is from 9 a.m. to 5 p.m. and 2 p.m. to 10 p.m., respectively. Relative week -X and X mean the X-th week before and after the starting date of Ramadan, i.e., relative week 0. "Eid" is the Lebaran holiday (Eid Al Fitr), which lasts five days right after Ramadan. The vertical gray area is the Ramadan period.

Figure 5: Hourly Productivity Before and After Ramadan

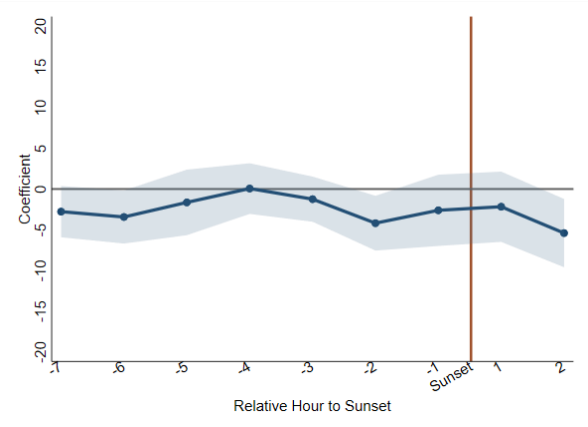
(a) During Ramadan



(b) Before Ramadan



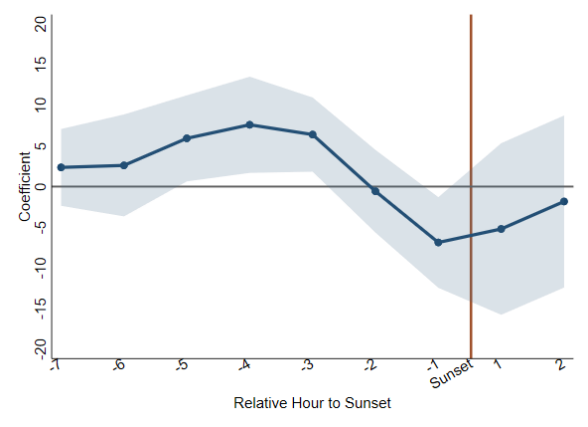
(c) After Ramadan



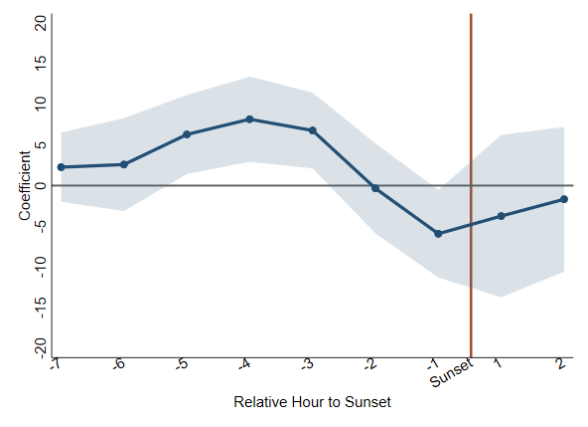
The graphs plot event-study estimates of the effects on hourly productivity of day-shift Muslim workers during Ramadan (Panel (a)), before Ramadan (Panel (b)), and after Ramadan (Panel (c)) , along with the corresponding 95% confidence intervals. The sales in *Relative Hour to Sunset* -X and X mean the sales in U.S. dollars within the X-th hour before and after sunset. For example, Relative Hour to Sunset -1 means the sales amount within the first hour right before sunset, which is the sales from 5 p.m. to 6 p.m. if the sunset time is 6 p.m. The vertical line indicates the sunset time.

Figure 6: Hourly Productivity Controlling for Customer Traffic

(a) Customer Traffic Non-missing Sample



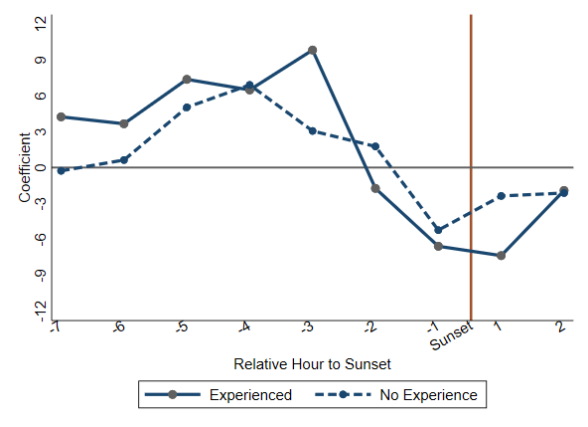
(b) Control Customer Traffic



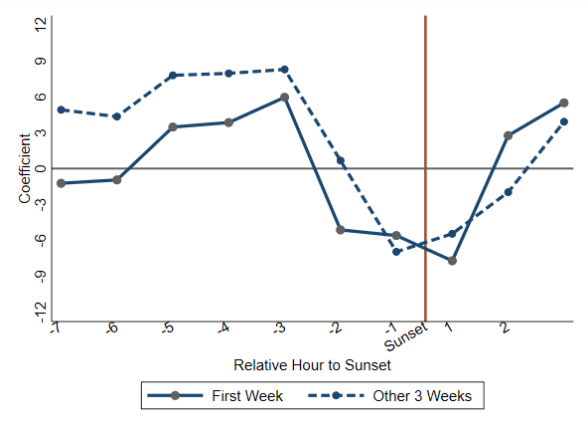
The graphs plot event-study estimates of the effects on hourly productivity of day-shift Muslim workers during Ramadan, along with the corresponding 95% confidence intervals. The sales in *Relative Hour to Sunset* -X and X mean the sales in U.S. dollars within the X-th hour before and after sunset. For example, Relative Hour to Sunset -1 means the sales amount within the first hour right before sunset, which is the sales from 5 p.m. to 6 p.m. if the sunset time is 6 p.m. The vertical line indicates the sunset time.

Figure 7: Experience and Effort Reallocation

(a) Experience vs. Inexperience Salesperson



(b) First Week vs. Other Weeks



The graphs plot event-study estimates of the effects on hourly productivity of day-shift Muslim workers during Ramadan, along with the corresponding 95% confidence intervals. The sales in *Relative Hour to Sunset* -X and X mean the sales in U.S. dollars within the X-th hour before and after sunset. For example, Relative Hour to Sunset -1 means the sales amount within the first hour right before sunset, which is the sales from 5 p.m. to 6 p.m. if the sunset time is 6 p.m. The vertical line indicates the sunset time.

Table 1: Test for Religion Proximity

Total Sales	Full	Ramadan Period
Muslim X Costumer Traffic X Muslim Ratio	-0.179	-0.045
	(0.146)	(0.220)
Costumer Traffic (Enter)	0.430***	0.465***
	(0.032)	(0.050)
Other DDD Controls	Yes	Yes
Store-Year FE	Yes	Yes
Year-Date-Shift Fe	Yes	Yes
Individual-Year FE	Yes	Yes
Hour FE	Yes	Yes
Observations	1591818	263582
R-Squared	0.248	0.315

The sample consists of employee-hour observations. Ordinary least squares estimates for all columns. Standard errors in parentheses, clustered by individual. All two-way interactions necessary for triple-differences are included in regressions. ***Significant at 1%, **significant at 5%, *significant at 10%.

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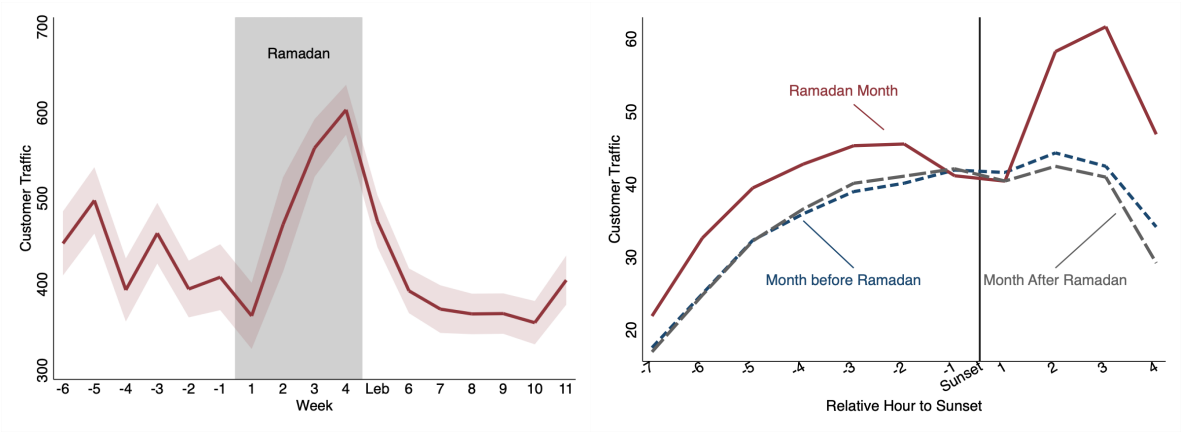
A. Appendix

Figure A.1: Customer Traffic during Ramadan and Non-Ramadan

(a) Customer Traffic By Week

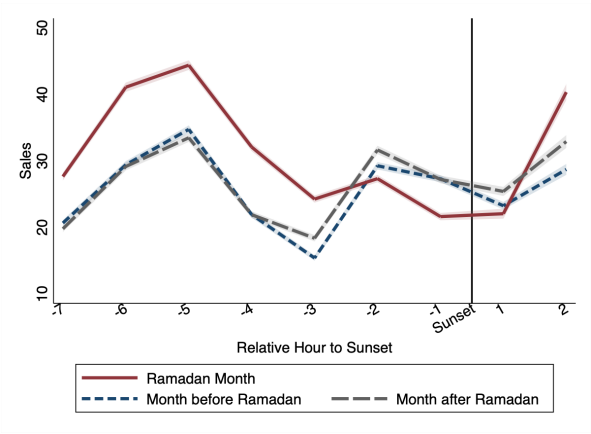
(b) Customer Traffic by Hour



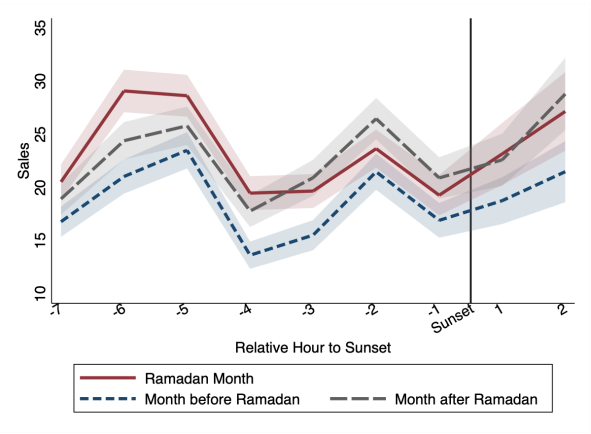
The graph summarizes the consumer demand measured by customer traffic of all stores in each week (Panel A) or each hour (Panel B) during Ramadan and before and after Ramadan in 2016 to 2019. The light color area is the corresponding 95% confidence intervals. In Panel A, relative week -X and X mean the X-th week before and after the starting date of Ramadan, i.e., relative week 1 is the first week in Ramadan. "Leb" is the Lebaran holiday, which lasts five days right after Ramadan. The vertical gray area indicates the Ramadan period.

Figure A.2: Sales in Each Hour by Workers by Shift

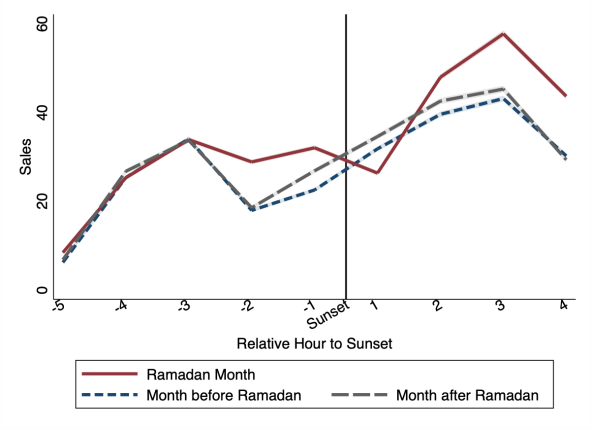
(a) Day-shift Muslim



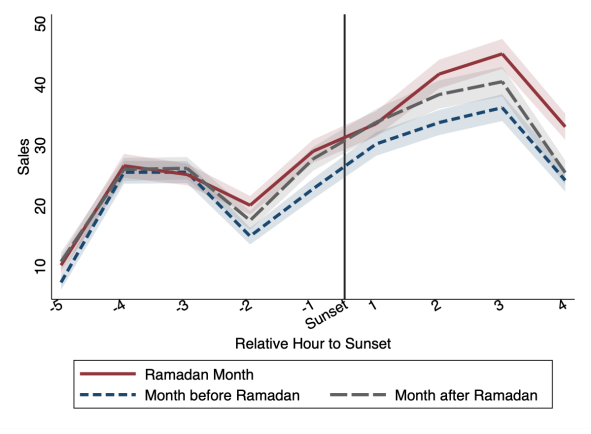
(b) Day-shift non-Muslim



(c) Night-shift Muslim



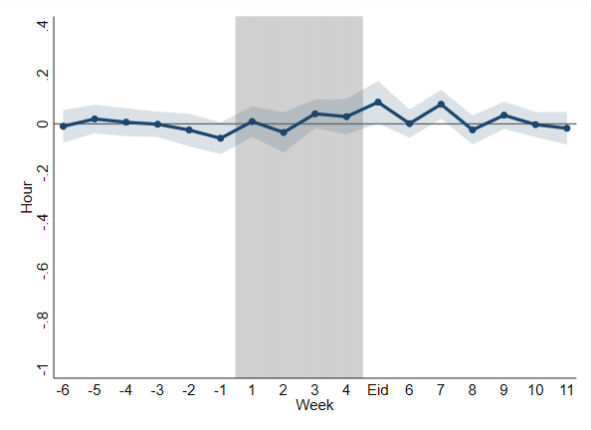
(d) Night-shift non-Muslim



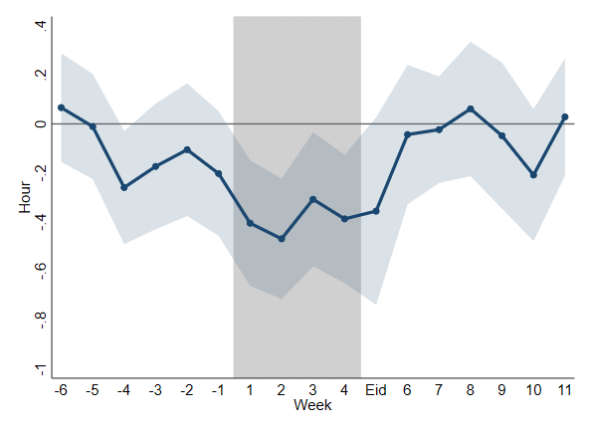
The graph summarizes the sales in each hour relative to sunset of day-shift Muslim (Panel A), day-shift non-Muslim (Panel B), night-shift Muslim (Panel C), and night-shift non-Muslim sellers (Panel D) during Ramadan and before and after Ramadan in 2013 to 2019. The light color area is the corresponding 95% confidence intervals.

Figure A.3: Time of Clock in and Clock out (in Hours)

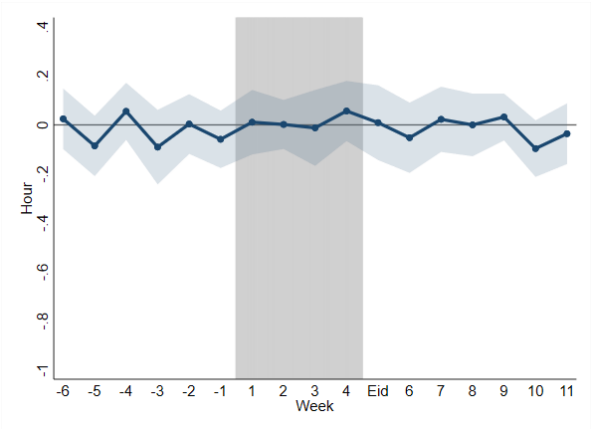
(a) Clock-in Time of Day Shift (around 9 a.m.)



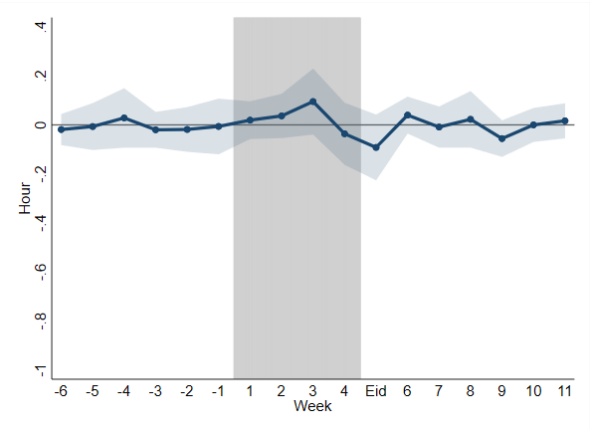
(b) Clock-out Time of Day Shift (around 5 p.m.)



(c) Clock-in Time of Night Shift (around 2 p.m.)

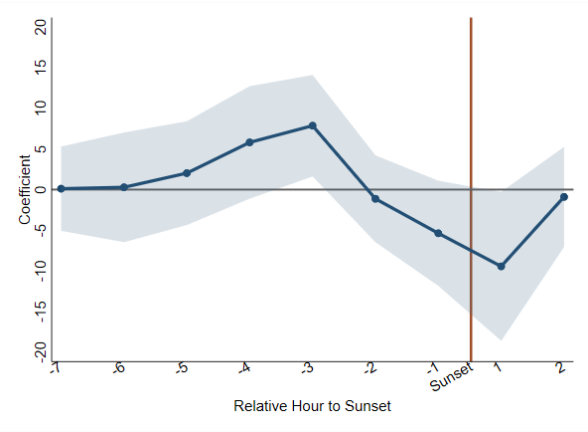


(d) Clock-out Time of Night Shift (around 10 p.m.)



The graphs plot event-study estimates and corresponding 95% confidence intervals. The official working time of day-shift and night-shift workers is from 9 a.m. to 5 p.m. and 2 p.m. to 10 p.m., respectively. *Clock-in Time* is a salesperson's clock-in time measured in hours . *Clock-out Time* is a salesperson's clock-out time measured in hours. Relative week -X and X mean the X-th week before and after the starting date of Ramadan, i.e., relative week 0. "Leb" is the Lebaran holiday, which lasts five days right after Ramadan. The vertical gray area is the Ramadan period.

Figure A.4: Worker Productivity at Hourly Level (Balance Sample)



The graph plots event-study estimates of the effects on hourly productivity, i.e., the sales amount in each hour relative to sunset, during Ramadan for day-shift Muslim workers, along with the corresponding 95% confidence intervals. The estimates are based on the the sample of day-shift salespersons who works until the second hour after sunset and later. The sales in *Relative Hour to Sunset* -X and X mean the sales in U.S. dollars within the X-th hour before and after sunset. For example, Relative Hour to Sunset -1 means the sales amount within the first hour right before sunset, which is the sales from 5 p.m. to 6 p.m. if the sunset time is 6 p.m. The vertical line indicates the sunset time. The average sunset time is 5:54 p.m. with a 95% range [5:21 p.m., 6:28 p.m.] in our sample period.