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Parental Religiosity, Educational Attainment, and Gender Equality

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Abstract
This study examines how parental religiosity influences children's education. Using Turkish census data for primary-school completion outcomes of individuals born in 1924-1984 and withinyear variations in fasting duration across provinces as a proxy, I find that a 30-minute increase in daily fasting during the enrollment year reduces primary school completion by 0.37 to 0.80 percentage points, with stronger effects for females. These results are not driven by income or teachers' beliefs. Cumulative exposure to Ramadan before school enrollment confirms these findings. Parental religiosity has consequences for gendered outcomes, including fertility and labor market participation.

Keywords
parents; religiosity; human capital; primary school; gender equality; Islam

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1 Introduction

Can parents' religiosity determine their children's educational outcomes? Parents are essential agents of the skills subsequent generations develop (Becker, 1991). They can shape the next generations' abilities in many ways, such as genes (Plug and Vijverberg, 2003; Bjorklund et al., 2006), parental input (Borjas, 1992; Fagereng et al., 2021), neighborhoods inhabited (Chetty et al., 2014, 2016), transmitted economic preferences (Dohmen et al., 2012; Alan et al., 2017) and personal or cultural traits (Bisin and Verdier, 2000, 2001; Lindbeck and Nyberg, 2006) to the next generation. However, the economics literature has not empirically elaborated on the role of religious beliefs carried by parents, as it is challenging to isolate them from other factors. Furthermore, beliefs shaped by religious teachings may contribute negatively to gender equality through education. Although education levels are improving globally, gender disparity in education is still prevalent, especially among developing countries (UNESCO, 2010). Indeed, recent studies such as Jayachandran (2015, 2021) suggest that social norms may be as important as levels of economic development in affecting the substantial variance in gender inequality across countries. Notably, the prevalence of Muslim people negatively correlates with females' education level (Norton and Tomal, 2009; Cooray and Potrafke, 2011; Kuran, 2018) and most Muslim-majority countries persistently rank at the bottom of the Global Gender Gap Index.

To empirically analyze the effects of parental religiosity, I obtain primary school completion outcomes for individuals born between 1924 and 1984 using micro-level census data from 1985, 1990, and 2000. As an identification strategy, I exploit variation in fasting hours during Ramadan across Turkish provinces during individuals' enrollment years. This variation arises from the annual timing of Ramadan combined with the latitude of each locality, while controlling for year-fixed effects. For instance, believers in the southernmost provinces fast 600 minutes more than the national average when Ramadan coincides with the winter solstice, while those in the northernmost provinces fast 600 minutes less. The pattern reverses when Ramadan occurs near the summer solstice and disappears entirely during equinox days. Although similar approaches have been used in Campante and Yanagizawa-Drott (2015); Aksoy and Gambetta (2022); Hornung et al. (2023); Mehmood et al. (2023), I apply this method innovatively to capture parental religiosity. A 0.5-hour increase in daily fasting duration is unlikely to directly affect cognitive abilities or other outcomes typically associated with abstaining from food or drink. Instead, this variation induces exogenous differences in the time parents dedicate to religious activities, hence a variation in their level of religiosity. Furthermore, the compliance rate for Ramadan fasting is exceptionally high, as it is both one of the pillars of Islam and a visible, easily screenable religious practice.

To complement the analysis, I digitized census reports and historical national primary

education statistics to generate factors related to the supply and demand for education. These data confirm that within-year differences in fasting duration are orthogonal to provinces' observable predetermined characteristics. After controlling for birth year and birthplace fixed effects, as well as supply-and-demand factors for education, my estimates show that a half-hour increase in average daily fasting duration decreases girls' probability of completing primary school by 0.6 percentage points and boys' probability by 0.3 percentage points. Considering the unconditional variation in fasting duration—up to three standard deviations—females' completion rates could decline by as much as 18 percentage points and males' by up to 9 percentage points. These findings demonstrate that increases in parental religiosity adversely affect children's educational outcomes, with the impact being more pronounced for girls.

For robustness, I exploit the idiosyncratic variation in Ramadan dates over time, as in Van Ewijk (2011); Colussi et al. (2021), to construct treatment and control groups. Specifically, I compare birth cohorts whose parents made enrollment decisions before Ramadan occurred (control group) with those whose parents experienced Ramadan before making such decisions (treatment group). I find that the adverse effects for both girls and boys are driven entirely by the treatment group, confirming that the results stem from parental religiosity influencing enrollment decisions. Additionally, literacy outcomes exhibit similar patterns, supporting the conclusion that the effects on primary school completion originate from enrollment decisions. Furthermore, I use fasting duration at age 13—when children typically transition to junior high school—as a placebo treatment. Since parents' religiosity levels at this later stage should not influence decisions to enroll children in primary school (unless the variations capture unobservable factors), no significant effects were found for boys or girls, as expected. Finally, my findings remain robust across various model specifications. For instance, controlling for family fixed effects, which account for preexisting beliefs about education and religion, yields qualitatively and quantitatively similar estimates.

A further analysis investigates the mechanisms behind the main results and shows that they are not driven by income. In contrast to the findings of Campante and Yanagizawa-Drott (2015), which examine the effects of a substantially larger variation in average daily sunlight duration across countries due to their global-scale research, I find that fasting an additional half-hour does not significantly affect provincial income per capita, although the direction of the effect is positive. I also test whether the findings are driven by teachers by analyzing the impact of fasting duration on students' performance. The rationale is that if fasting influences teachers' behaviors, it would affect the school environment, ultimately leading to changes in performance. To test this, I digitized enrollment data by grade and gender and calculated grade advancement ratios and graduation rates for male and female students. The analysis finds that fasting duration does not significantly affect students' performance for either gender. Additionally, I examine whether changes

in household arrangements drive the main findings by analyzing the differential effects of fasting with respect to the ages of siblings, as older siblings are often tasked with greater household responsibilities than younger ones. However, I find no evidence of differential effects of fasting duration based on sibling age.

To further analyze heterogeneities and determine which parent's religious beliefs have the greatest impact, I use an alternative instrument that captures mothers' and fathers' cumulative exposure to Ramadan fasting from puberty to the time they make decisions about their offspring's education. Using the Demographic and Health Survey of Turkey, I first show that experiencing longer fasting durations throughout life makes women more likely to pray and wear headscarves. Furthermore, the results suggest that religious fasting is practiced broadly and not exclusively by religiously conservative individuals, as overall exposure does not significantly influence fasting behavior. I also examine fertility behaviors, given that religious women tend to have higher fertility rates. An analysis of census data for mothers reveals that women with lower exposure to Ramadan fasting are less likely to become child mothers, while those with higher exposure are more likely to have additional births after age 40. I find that fathers' religious beliefs have a more significant impact than mothers', likely due to their greater bargaining power within the household. Mothers' religiosity has the least effect when the child is a boy, while girls are more adversely affected by their parents' religiosity overall. Moreover, the adverse effects of fasting during the enrollment year are more pronounced when the father exhibits higher preexisting religiosity during that year.

Finally, I discuss how parental religiosity during earlier life stages influences fertility and labor market participation, with broader implications for gender equality. Parental religiosity during the enrollment year reduces female labor force participation in adulthood, with no significant effect on males. Cumulative maternal religiosity further lowers labor participation for both genders, with stronger effects on females. For fertility, parental religiosity shows no association with becoming a mother or having fewer children but increases the likelihood of having more than three children, consistent with average fertility rates. These findings highlight how parental religiosity reinforces traditional gender roles, limiting women's economic participation while encouraging higher fertility.

This paper contributes to the literature on the role of parents in shaping the lifelong economic outcomes of their offspring. Previous studies have shown that parents influence the next generation through various channels, including genetics (Plug and Vijverberg, 2003; Bjorklund et al., 2006), parental input (Borjas, 1992; Fagereng et al., 2021), neighborhoods (Chetty et al., 2014, 2016), and the transmission of economic preferences (Dohmen et al., 2012; Alan et al., 2017) or cultural traits (Bisin and Verdier, 2000, 2001; Lindbeck and Nyberg, 2006). However, this study is the first to isolate the role of religious beliefs and demonstrate their significance. My findings highlight that fathers' religious beliefs, rather than mothers', play a greater role. Social norms interact

with these beliefs in the decision-making process, as traditional gender roles make boys' educational outcomes less sensitive to maternal religiosity. In contrast, mothers' beliefs significantly constrain girls' access to basic education.

These results contribute to the economics of religion.[1] Previous studies discuss the origins of educational and occupational disparities across religious communities, such as Botticini and Eckstein (2007) for Judaism, Becker and Woessmann (2008, 2009) for Protestantism, West and Woessmann (2010); Squicciarini (2020) for Catholicism, which all reflect today's correlational differences in economic attitudes across religious groups documented by Guiso et al. (2003). The most comparable studies to this work, such as Becker and Woessmann (2008); Norton and Tomal (2009); Cooray and Potrafke (2011), identify correlations between religion and gender equality, particularly in education, within Protestant and Islamic contexts. This study extends the literature by showing that Muslim parents' religiosity significantly hinders their offspring's education, with disproportionately adverse effects on girls.

As noted by Iyer (2016), the nexus between religion and demography remains underresearched in economics. Measuring religiosity, especially in historical contexts, poses challenges. Recent studies such as Andersen and Bentzen (2022) and Berkes et al. (2023) use religious naming patterns as proxies for religious participation, particularly in Christian contexts. This study introduces an alternative approach by demonstrating that cumulative time devoted to Ramadan fasting serves as a robust measure of religiosity in Islamic settings, where religious participation rates are comparatively higher (Guiso et al., 2003). Despite existing studies using Ramadan fasting, such as Campante and Yanagizawa-Drott (2015); Oosterbeek and van der Klaauw (2013); Mehmood et al. (2023), they do not isolate the physiological effects of fasting. Future studies can approach Ramadan in experiments in an innovative way that mitigates its physical implications.

This paper also contributes to understanding the role of religion in education within Turkey. Previous studies, such as Meyersson (2014); Gulesci and Meyersson (2015); Erten and Keskin (2019); Sakalli (2019), focus on changes in educational provision or institutional contexts. In contrast, this study examines how religiosity affects the demand for primary education while controlling for supply-side factors associated with educational attainment. These findings have critical policy implications: augmenting religiosity is likely to exacerbate Turkey's already dire gender inequality, with effects persisting across generations.[2] Furthermore, the findings suggest that education policies augmenting religiosity may lead to a trap where the system must continually increase religious content

[1] Iannaccone (1998) and Iyer (2016) offers an overview of the literature on the economics of religion. Basedau et al. (2018) also reviews the studies on the causal effects of religion on socioeconomic outcomes. Kuran (2004) discusses the role of Islam in the underdevelopment of the Middle East and Kuran (2018) reviews and discusses the recent findings on Islam with their methodologies and aspects of future research.

[2] Erdoğan's nation-building policies aim to Islamize society (Yilmaz, 2019). He has frequently expressed his desire to raise a "pious and revengeful generation."

to satisfy parents' expectations perpetuated by the policies themselves.

The remainder of this paper proceeds as follows. Section 2 outlines the education system in the late Ottoman period and after the proclamation of the republic and discusses the phenomenon of pious people's resistance to the reforms and the current education system in Turkey. Section 3 starts with the data used in this study with detailed information on how I construct the main variables of interest and how I integrate the data from different sources. After that, the identification strategies employed in this study are explained. This section ends with the empirical strategy employed in this work. Section 4 illustrates the main findings. Finally, Section 5 presents the concluding remarks.

2 Background

After the proclamation of the republic, Turkey implemented numerous educational reforms as part of its modernization efforts, building on ideas rooted in the *Tanzimat* Edict, before which Muslim girls were limited to primary education.[3] Although primary education—whether religious or secular—was made compulsory for children of all religious backgrounds after the *Tanzimat*, literacy rates remained low. According to the 1927 census, only 12.9 percent of men and 3.7 percent of women could read Arabic letters. Even in Istanbul, the former capital exempted from the 1923 population exchange with Greece, literacy rates were 45.5 percent among men and 36.9 percent among women.[4] The mass execution and deportation of non-Muslim populations in the 1910s exacerbated the shortage of skilled laborers. Consequently, transforming the remaining population from a pre-modern to a modern society became a priority (Pamuk, 2018). Political elites believed that community-based education fostered distinct national identities, fueling secessionist movements, while the cultural divide between schooled and unschooled Muslim generations created conflicting values (Çiçek, 2012). As a result, education policies became central to Atatürk's nation-building agenda.[5] After abolishing the Sultanate, a series of top-down policies, including educational reforms, were implemented.[6]

Five months after the proclamation of the republic, Turkey's education system was

[3] After the *Tanzimat*, liberal schools for girls were established, although coeducation in these schools was uncommon and occurred only when a single school existed in a neighborhood (Somel, 2001). The first female lower-middle school, *İnas Ruşdiye*, opened in 1859. Upper-middle schools (*İnas İdadî*), high schools (*İnas Sultanîye*), and a women's university (*İnas Darülfunun*) followed in 1911, 1913, and 1915, respectively.

[4] Istanbul accounted for only 5 percent of Turkey's population at the time.

[5] Alesina et al. (2021) discusses states' internal motives to homogenize populations through mass primary education.

[6] The secularization of the West is widely documented in the economics literature. Increased religious competition after the Protestant Reformation (Ekelund et al., 2002; Cantoni et al., 2018), the conflict-reducing effect of Ottomans in Europe (Iyigun, 2008), Martin Luther's translation of the Bible to German and its encouragement of literacy (Becker and Woessmann, 2009), the diffusion of printing technologies during the Protestant Reformation (Rubin, 2014), and the power shift during the post-Reformation period from religious elites to secular ones (Cantoni et al., 2018) are some examples given in the literature.

restructured to become unified, centralized, national, and secular. Authority over schools was transferred to the Ministry of National Education, and all religious education institutions were abolished. A new law mandated five years of primary education for all children aged six, regardless of gender.[7] Coeducation was permitted in primary schools (Earle, 1925), and by 1927, gender-mixed education was introduced in all secondary schools (Başgöz, 2005). Initially, the primary education curriculum included some religious courses, but these were removed by 1933 (Özdalga, 2018). From 1938 to 1950, religious courses were omitted entirely from the regular curriculum and later became voluntary in primary schools.

'Compulsory' Schooling. Angrist and Krueger (1991) identifies several mechanisms that enhance the effectiveness of compulsory schooling laws: i) monitoring or outlawing child labor, ii) enforcing effective class attendance policies, and iii) holding parents accountable through parental responsibility laws. In the early years of the Turkish Republic, labor regulations (Gazette, 1937) did not entirely prohibit child labor but introduced restrictions, such as limiting children under 16 to a maximum of eight working hours per day and banning them from heavy and hazardous tasks. However, the combination of low state capacity, the agrarian nature of the economy, and the widespread use of child labor posed significant challenges to enforcing education laws. By the early years of the republic, the share of females and males with at least primary education was approximately 20 percent and 50 percent, respectively (Figure 1). Achieving universal schooling, however, was not a new challenge; it had persisted since the Ottoman era, where literacy rates for Muslims remained below 10 percent despite primary education being de facto compulsory.

For instance, in both census coding and birth certificates, individuals with unclear birth years were often assigned years ending in 0 or 5.[8] As shown in Figure 1, the size of birth cohorts coded as born in those years was disproportionately larger, particularly for girls during the early years of the republic and continuing into the 1970s. Furthermore, the completion rates for these individuals were lower than those of their peers born in adjacent years, highlighting the state's limited effectiveness in registering its citizens and ensuring their education.

Pious People's Resistance to the Reforms. By the late 1920s, Islamic elements were largely removed from state institutions. Sharia courts were abolished, and a new civil code was introduced that prohibited polygamy, mandated secular marriage laws,

[7] A regulation introduced later allowed village schools to provide at least three years of schooling, but this was quickly revised to align with the five-year mandate. As this study focuses on parents' enrollment decisions for compulsory education, and village schools could last for five years under the law, I assume primary education at this time to be five years.

[8] This practice is typically known as age heaping, where ages of individuals with unclear information rounded to these common milestones.

outlawed unilateral divorce, and recognized gender equality in inheritance and guardianship. While many early republican language reforms aimed to increase literacy, they also sought to create a culture aligned with state ideology.[9] Although the reforms achieved partial success, these cultural policies, however, were not widely accepted. For example, longer exposure to secular education and values significantly reduced religious preferences in Turkey (Meyersson, 2014; Gulesci and Meyersson, 2015; Cesur and Mocan, 2018). At the same time, they deepened resistance in some areas. For instance, Sakalli (2019), where religiosity is proxied by the historical presence of Armenians, finds that secularist policies in these regions further enhanced religious identity, reduced educational attainment and labor productivity, and increased support for pro-Islamist parties. Although the new civil codes emancipated women from traditional Islamist interpretations, resilient societal norms hindered the full implementation of women's rights (Toprak, 1995; Arat, 2010). For instance, conservative families view schools as a threat to their daughters' modesty, favoring early marriage over education (Rankin and Aytaç, 2006). Poorer and more religious families, in particular, were hesitant to send daughters to school without a headscarf (Çarkoğlu and Toprak, 2007).[10] Similarly, Meyersson (2014) finds that Islamic rule increased female secondary education in poorer, more religious regions, reduced adolescent marriages, and enhanced female political participation.

Education System in Turkey During Erdogan's Era. One of the most significant changes was the introduction of the 4+4+4 education system in 2012. This reform implemented several measures to promote a more religious generation and address the concerns of pious families. These measures included abolishing restrictions on religious education, introducing religious "elective" courses in secondary schools, permitting headscarves in schools starting from fifth grade in 2014, and expanding Imam Hatip Schools within the compulsory education framework. Erten and Keskin (2019) finds that the reform increased high school attendance rates for girls, but this effect was confined to more religiously conservative regions. Additionally, the reform significantly reduced the percentage of girls not enrolled in school, training programs, or the labor force, while having no substantial impact in other regions. Although the success of these reforms in creating a more pious generation has not been evaluated, it is likely that Turkey will soon see a cohort of parents whose piety stems from exposure to Erdoğan's educational policies, thus potentially influencing their preferences for their children's education.

[9] Efforts to Turkify the language—such as converting the alphabet and numbering systems from Arabic to Latin, translating the Quran into Turkish, and reciting the call to prayer in Turkish—were examples of social engineering designed to diminish Arab cultural influences (Assouad, 2020).

[10] Veiling as a strategic choice to engage with economic opportunities while maintaining community reputation is analyzed theoretically by Carvalho (2013) and empirically by Aksoy and Gambetta (2016); Shofia (2021).

3 Empirical Framework

In this section, I present the data used in this study, detailing their sources and the construction of the main variables of interest. Next, I explain how these data from various sources are integrated. Finally, I describe the identification strategies employed to estimate the causal effects of parental religiosity on girls' and boys' educational attainment, with a discussion of the assumptions underlying these strategies. These assumptions are further evaluated in subsequent sections presenting the main findings.

3.1 Data

I measure individuals' educational outcomes using data pooled from Turkish population censuses conducted in 1985, 1990, and 2000. These censuses were carried out under one-day nationwide curfews on October 20, 1985, October 21, 1990, and October 22, 2000, respectively. The dataset consists of a 5 percent random sample of the population, stratified by province, ensuring representativeness across subgroups. The data allow me to observe whether individuals completed primary school, using responses to two universally asked questions: age at the time of the census and province of birth, categorized by the administrative boundaries of the respective census year.[11] Additionally, the dataset enables me to observe parental or household member characteristics when both the child and parent are randomly selected into the sample, as the selection occurs at the individual rather than household level.

Although the data source includes individuals born between 1895 and 2000, I focus on those born between 1924 and 1984 for the following reasons. First, individuals born before October 1923, the proclamation of the Turkish Republic, experienced their childhood during wartime. Additionally, as discussed in the Background Section, they were exposed to an entirely different education system, making them less comparable to later cohorts. Second, I exclude individuals who were still within the schooling age (6–14 years old) during the census years, as primary school completion for this group may be selective. Furthermore, individuals born after 1984 experienced a different compulsory schooling system due to the introduction of the "Basic Education Law" in 1997. This policy increased compulsory education from 5 to 8 years by merging primary and junior high schools, with the explicit goal of reducing school attrition among religiously conservative groups (Gulesci and Meyersson, 2015). Consequently, parents of this cohort faced additional considerations when making educational decisions for their children. Lastly, individuals born in 1985 are excluded due to ambiguity in their treatment status (Kırdar

[11] The census does not include information on the year of school enrollment or completion.

et al., 2016).[12]

Female respondents constitute 48 percent of the total sample, with the average birth year for both males and females being 1958 (Table A.1). Among the respondents, 88 percent of men and 67 percent of women completed primary school, while 36 percent of men and 20 percent of women completed at least junior high school. I was able to match 27 percent of male and 29 percent of female respondents with their mothers, and 22 percent of male and 21 percent of female respondents with their fathers. Since the data do not explicitly collect parental information, individuals matched with their parents are those who reside with them, making this group younger on average.[13] Among the matched individuals, approximately 20–25 percent of parents reside in the province where they were born.

Demographic characteristics. To account for the demographic characteristics of provinces at the time individuals began primary school—factors that may influence both the supply and demand for education—I digitized various demographic indicators from census reports spanning 1927 to 1990. Specifically, I collected data for each census year on total population size, population distribution by gender, and the number of male and female literates aged six and older. Additionally, I calculated the prevalence of Muslims in each province using data from Livny (2020). To assess the economic structure of the provinces, I digitized employment statistics from the same census reports, including total employment figures and sector-specific data for agriculture and industry, to capture urbanization patterns and their potential effects on educational decisions.[14] Since the number of administrative units increased over time, ensuring data comparability across periods presented a key challenge. To address this, I used the 58 historical administrative units identified by Aşık et al. (2023) and aggregated data from existing provinces into these historical units to calculate the main variables of interest.[15] Figure B.1 illustrates national-level demographic trends between 1930 and 1990. As summarized in Table A.1, at the time individuals began school, the average female share of the population in their birthplace was 49.5 percent, 99 percent of individuals were Muslim, 65 percent worked in agriculture, and 9 percent were employed in manufacturing. Additionally, when these

[12] Including this cohort would require collecting demographic data from 1995 to measure characteristics relevant to their enrollment year, which presented practical challenges. However, including this cohort does not change the main findings: the estimated effects for girls and boys, calculated using the baseline model, remain statistically significant at the 99% confidence level, with coefficients of -0.078 and -0.038, respectively.

[13] The exogenous variation exploited in this study is orthogonal to the sample selection, as there is no observed correlation between fasting duration during the enrollment year and the likelihood of individuals being matched with their parents.

[14] Although census data include information on urban and rural population divides, definitions of these categories have varied significantly over time.

[15] Turkey's administrative boundaries expanded from 67 provinces in 1985 to 81 in 2000. At the founding of the republic, there were 57 administrative units, which increased to 58 with the annexation of Hatay in 1939.

individuals were born, 54 percent of males and 26 percent of females in their provinces could read and write in Turkish.

School characteristics. To account for predetermined characteristics related to the provision of education in provinces when individuals began schooling, I collected data from historical records on primary education published by the Central Statistical Office of Turkey and its successor institutions. These records were digitized to capture the number of primary schools, male and female primary school teachers, and male and female students enrolled in primary schools, disaggregated by grades 1 through 5. To reflect changes in population over time, particularly among the school-aged population, I also digitized provincial-level statistics from census reports on the number of males and females by single-year age groups. To minimize measurement error, I used statistics from the closest census year to the relevant academic year. As with demographic characteristics, the collected data were aggregated within historical provinces before calculating the variables of interest. Figure B.2 provides an overview of the raw data at the national level.

The school information was collected only for census years and their preceding years for two main reasons. First, demographic characteristics are only measurable during census years, so school-related data were aligned with these same years to maintain consistency in the data. Second, including the preceding year's data helps track student progress over time. For instance, students who enrolled in first grade in 1940 would ideally complete fifth grade by 1944, assuming they advanced each year without repeating. Additionally, as birth records often show slight increases in years ending with 0 and 5 due to late registration of births, statistics for children starting primary education in years ending with 6 or 1 may be overestimated, and these years are excluded from this analysis. Figures B.3 and B.2 illustrate the improvement in primary school graduation rates over time, reflecting enhancements in the quality of education.

Fasting duration. To generate fasting duration, I first determined the dates that Ramadan month happened in the years from 1930 to 1990 using Islamic Philosophy Online, following Campante and Yanagizawa-Drott (2015) and then retrieved the coordinates of provinces that existed in 1985, 1990, and 2000 census years from the layers retrieved from the year-specific GIS Boundary Files of IPUMS International.[16] After gathering this piece of information, I used the *datetime* package of Python to calculate the daylight duration for every day from 1930 to 1990. Finally, I calculated the total duration from sunrise to sunset for each province throughout the Ramadan months that occurred in the years from 1930 to 1990 to proxy the total duration of religious fasting, as used by Campante and Yanagizawa-Drott (2015).

[16] As the coordinates may differ over time due to changes in their boundaries, I calculate them separately for each census year.

Maximum temperature during Ramadan. I calculate the maximum temperature experienced in each province during Ramadan using the CHELSAcruts historical temperature and precipitation dataset provided by Karger and Zimmermann (2018). The CHELSAcruts dataset provides global monthly maximum temperatures dating back to 1901. After retrieving the mid coordinates of province polygons using QGIS and employing the 2000's GIS file of IPUMS-International, I first calculated the maximum temperature experienced for each province and each month of the years from 1920 to 1990. Figure B.4 displays these maximum monthly temperatures for each province by month and their changes over time. Finally, I determined the maximum temperature specifically for each province during Ramadan.

Economic conditions. To consider the economic conditions in the enrollment year across provinces, I use provincial income per capita estimates calculated by Aşık et al. (2023). For each historical province, they generate an index starting in 1913 to show the evolution of spatial disparities in Turkey using Ottoman statistics and other data sources for the decades before World War I, as well as official statistics and other data from modern Turkey since the 1920s.

Integration of different data sources. I integrate historical data into contemporary census data using individuals' birth year and birthplace information, assuming that parents made enrollment decisions based on conditions in their birthplace, where they likely resided until their child reached the age of six—the typical age for starting primary school. To merge provincial-level data with individual-level data, I subtracted six years from the data collection year for all historical variables, including demographics, school characteristics, income, and related factors. Additionally, I assumed no significant differences within a historical province in terms of demographics, educational resources, or other observed characteristics. Since the data are available only for specific benchmark years, I applied linear interpolation to estimate characteristics for intermediate years, assuming that the changes between the consecutive years have occurred uniformly.

3.2 Identification

The role of religion and religiosity in economic outcomes and its effects on their decisions have been long debated in the literature; however, identifying a causal effect is challenging as the extent to which individuals participate in religious activities—defined here as religiosity—is a choice to allocate their limited time among religious and secular activities

while maximizing their lifetime and afterlife utility (Azzi and Ehrenberg, 1975).[17] As Iyer (2016) pointed out, empirical analysis with the standard survey questions on religious affiliation and individuals' religiosity is subject to the endogeneity problem in many ways. Therefore, an analysis to reveal the impact of religiosity requires an exogenous instrument that increases religiosity. In this regard, Ramadan constitutes a relevant natural experiment.

The use of Ramadan as a natural experiment in the economics literature is not new; previous studies have exploited it to address research questions ranging from economic growth, health, and education to political economy. When methodologically classified, one can group them into two types: studies using the rotating nature of the Islamic calendar, hence the varying dates of Ramadan, and those using fasting hours, which change with Ramadan dates and latitude. Among the first group of studies, Ramadan months are exploited as a treatment to minority salience in Germany (Colussi et al., 2021), as exposure to prenatal malnutrition (Van Ewijk, 2011; Almond et al., 2015; Schultz-Nielsen et al., 2016; Greve et al., 2017), as a treatment to hunger (Gulek, 2024), and to reveal per se effects of Ramadan fasting on student performance in the Netherlands (Oosterbeek and van der Klaauw, 2013). Studies in the latter group use fasting hours to evaluate their impact on economic growth and subjective well-being (Campante and Yanagizawa-Drott, 2015), student performance (Hornung et al., 2023); Quran course participation and support for Islamist parties in Turkey (Aksoy and Gambetta, 2022), and judicial behavior in Pakistan (Mehmood et al., 2023). In this study, I mainly leverage the latter strategy and exploit the timing of Ramadan to generate treatment and control groups.

In Figure 2a, I show the varying time between sunrise and sunset in the northernmost (Sinop) and southernmost provinces (Hatay) throughout the month of the Ramadan months for the years from 1930 to 1990. As the latitude of provinces solely determines the variation within a year, I show the pattern only for the two provinces. Figure 2a clearly expresses that the timing of Ramadan determines the total duration of fasting, as well as which province will be religiously fasting longer. When Ramadan month coincides with the winter solstice, the fasting duration is shorter than the times that it occurs in the summer solstice. More importantly, when Ramadan month happens on the winter solstice, the northern provinces fast shorter, and vice versa. Or when Ramadan coincides with the equinox dates, the variation in fasting duration across provinces disappears. The duration difference over time can reach up to 190 hours, an equivalent of 11,250 minutes, meaning that people may religiously fast 6 hours more on a daily basis. Given that the duration difference is substantial to the extent that it may affect cognitive abilities, an

[17] Iyer (2016); Basedau et al. (2018); Iyer (2019) review the literature on the effects of religion on economic development and demographics. Kuran (2018) focuses on the same stream of the literature, specifically studying Islam. Bentzen (2019) discusses why some societies are more religious than others, presenting the existing approach on religiosity in theoretical frameworks. The demand- and supply-side factors that cause differences in religiosity across societies are also presented.

estimate comparing the differences in outcomes across different years may show the effects of religious fasting, of which results may be attributed to the physical and social changes that it brought. Considering this, my identification comes from the variation within a year, meaning that after controlling for year-fixed effects.

Figure 2b displays the variation in the duration of daylight in each province in comparison to the average duration of daylight for that particular year. The total length of daylight during Ramadan month is shown in minutes, with each dot representing a specific province. The southernmost and northernmost provinces are presented in orange and blue. It reveals that within-year variation can reach up to 1000 minutes, meaning that people may religiously fast around 0.5 hours more on a daily basis than people living in different places.

As the treatment I exploit for increasing religiosity is assigned based on individuals' birthplace and birth year, some children's parents spend more time on religious practices than others. As evidenced in Aksoy and Gambetta (2022), increases in the cost of religious activities further strengthen religiosity.[18] Therefore, the instrument plausibly satisfies the relevance assumption. Since Turkey is a country where 99 percent of individuals self-identify as Muslim, religious fasting during Ramadan is one of the five pillars of Islam, and religious fasting is easily observable, the compliance rate is quite high. For instance, Çarkoğlu and Toprak (2007) estimates that three-fourths of individuals observe religious fasting.[19] As discussed in Aksoy and Gambetta (2022), religious fasting is difficult to fake due to religious penalties for breaking the fast and reputational risks, all of which discourage insincere participation and reinforce genuine commitment. Furthermore, as evidenced in Aksoy and Gambetta (2022), increases in the cost of religious activities, measured by the duration of Ramadan fasting, increase people's participation, contrary to the law of demand, through a commitment mechanism in addition to the screening mechanism suggested in the club good model by Iannaccone (1992). Consequently, decreases or increases in its duration are unlikely to encourage or discourage participation among different groups.

The identification assumes that the instrument should not be influenced by omitted variables that affect the outcome. To provide evidence, I conduct an exogeneity test using demographic and school characteristics that I collected from census reports and education statistics. These factors, observed during the enrollment year, may determine children's schooling outcomes, affecting both the supply and demand for education. These factors include age categories of individuals (as they may complete primary school through external studies), the natural logarithm of the total population, female and Muslim shares

[18] I will discuss this later with some empirical analysis examining the interaction effect of fasting duration and the temperature experienced during the Ramadan month.

[19] Given that elderly people with chronic diseases may need medical treatment and children are not obliged to fast, the vast majority of adults, especially parents of school-aged children, participate in religious fasting.

in the total population, the share of agriculture and industry in total employment, male and female literacy rates in the birth year of individuals, the natural logarithm of the number of primary schools, the number of school-aged children (6–14) per school and teacher, and the teacher-to-school ratio, in addition to the female share in the total number of primary school teachers. I regress them separately on the standardized fasting duration in the enrollment year, controlling for province- and year-fixed effects. I cluster the standard errors at the province x birth year level, given that the treatment is assigned by province and year. Figure 3 shows exogeneity tests conducted at the individual level, separating women and men, as well as at the province level, because individual-level analysis may overweight densely populated areas. To adjust for the estimates at the province level, I weight them by the adult population size in the enrollment year, since places with denser populations have a larger group of treated adults. The results show that fasting duration is not correlated with observable factors significant for educational attainment.

3.3 Empirical Strategies

This section outlines the empirical strategy used to estimate the causal effect of parental religiosity during the enrollment year on decisions regarding their children's educational attainment. The analysis is conducted separately for boys and girls, given the fact that families' decision-making mechanisms often differ by the child's gender. Such disparities are evident in the substantial gender gap in school completion rates, as shown in Figure 1: the average rate for males is 88 percent, compared to 67 percent for females.

Baseline Model. The causal effect of parental religiosity on an individual's probability of completing at least primary school is estimated using the following two-way fixed effects model:

$$\mathrm{Y}_{i,p,t} = \beta_1 \textit{Fasting Hours}_{p,t+6} + \theta_p + \lambda_t + \varepsilon_{i,p,t} \tag{1}$$

Where $Y_{i,p,t}$ denotes the educational status of individual i, born in province p in year t, indicating whether they completed primary school or a higher level of education as reported in the census year. Since the focus is on the effects of fasting duration during the primary school enrollment year (typically at age 6), $\textit{Fasting Hours}_{p,t+6}$ represents the main variable of interest, capturing fasting duration in province p when individual i enrolled in primary school in year $t + 6$. This variable is standardized for ease of interpretation and to normalize its distribution.[20] The province-fixed effect θ_p accounts for time-invariant differences across provinces, such as cultural attitudes toward education or disparities in access. Similarly, birth-year fixed effects λ_t control for time-invariant

[20] The results remain qualitatively unchanged when using the natural logarithm of fasting duration.

factors specific to birth cohorts, including changes in school curricula (as such variations are effectively captured by the year-fixed effect given the centralized education system) or macroeconomic conditions. This fixed effect also helps isolate the variation due to fasting duration over time.

The main parameter of interest, β_1, captures the causal effect of parental religiosity, under the assumption that no confounders influence the relationship, as supported by the balance tests shown in Figure 3. Standard errors are clustered at the province x birth-cohort level to account for the treatment assignment mechanism, resulting in a total of $81 \times 61 = 4941$ clusters.

Benchmark Model. In the benchmark model, I include additional predetermined covariates to account for variations in educational attainment across generations. These covariates help reduce the unexplained variance in the outcome after controlling for fixed effects, thereby improving the precision of the estimates. The benchmark model is presented as follows:

$$\mathrm{Y}_{i,p,t} = \beta_2 \textit{Fasting Hours}_{p,t+6} + \textit{Demography}_{p,t+6} + \mathrm{X}_i + \textit{School}_{p,t+6} + \theta_p + \lambda_t + \varepsilon_{i,p,t} \quad (2)$$

where $\textit{Demography}_{p,t+6}$ includes provincial characteristics that influence educational attainment, such as the natural logarithm of the total population, female and Muslim shares in the total population, the share of agriculture and industry in total employment, as well as male and female literacy rates in the birth year of individuals. Including these variables also helps account for varying parental education levels or preexisting attitudes toward education across provinces and generations. X_i captures predetermined individual characteristics. Given that many observable characteristics in the census data may be endogenous to educational outcomes, I avoid the inclusion of other controls as they are likely to be bad controls. Therefore, I control only for individuals' age categories, as older individuals have had more time to complete primary school through external studies. $\textit{School}_{p,t+6}$ represents supply-side factors that influence educational attainment, such as the natural logarithm of the number of primary schools, the number of school-aged children (6–14) per school and teacher, the teacher-to-school ratio, and the female share among total primary school teachers. Interpreting the results from Figure 3, the supply of education appears unaffected by fasting duration, which is reasonable given that schools are long-term investments, teachers hold permanent contracts, and fasting duration does not influence parental decisions about family size. However, including these factors reduces variance in outcomes across generations and improves the precision of the estimates. Finally, β_2 captures the causal effect of fasting duration, with standard errors clustered at the province-by-birth cohort level as described above.

4 Empirical findings

This section begins by presenting the main findings on the causal effects of fasting duration during the enrollment year on the probability of completing primary education for men and women. I then conduct several robustness checks to validate these results. In the final part, I introduce an alternative measure of parental religiosity, based on the cumulative exposure of mothers and fathers to Ramadan fasting from puberty to the age at which they make school decisions for their children, and discuss which parent has the greater influence on these decisions. The section concludes by examining the implications of parental religiosity for children's later-life outcomes beyond education, such as fertility and labor force participation decisions, which are key factors in maintaining gender equality.

4.1 Main Findings

I present the main findings in Figure 4, which reports only the coefficient estimates and their 95 percent confidence intervals, and in Table A.2 in the Appendix, which provides the regression results for the same estimations. The first column shows the results for girls and boys, estimated using Equation 1. These results indicate that a one standard deviation increase in the average duration of daylight during Ramadan, in the year individuals enroll in primary school, decreases the probability of completing primary school by 8 percentage points for girls and 4 percentage points for boys. Since a half-hour increase—the maximum variation observed within a year—corresponds to one-tenth of a standard deviation, an increase of one half-hour in the average daily fasting duration reduces girls' probability of completing primary school by 0.8 percentage points and boys' probability by 0.4 percentage points.

In the benchmark model shown in Equation 2, I control for time-varying characteristics of provinces as well as personal characteristics of individuals. Table A.2 presents results where groups of covariates are added one-by-one. Including these covariates, particularly the demographic characteristics of provinces, slightly reduces the coefficient estimates for both girls and boys and substantially narrows the standard errors. Based on the estimates from the benchmark model, I find that a half-hour increase in the average daily fasting duration decreases the probability of girls completing primary school by 0.6 percentage points and boys' probability by 0.3 percentage points. Considering the unconditional variation in fasting duration, which can range up to three standard deviations, I estimate that this variation could reduce females' completion rates by up to 18 percentage points and males' completion rates by up to 9 percentage points. Consequently, increases in parents' religiosity, strengthened by fasting an additional 30 minutes per day, negatively affect educational outcomes for both girls and boys, with the impact being more pronounced for girls.

Family characteristics. In this exercise, I control for preexisting family characteristics, including their beliefs about education and religion, by incorporating family fixed effects. This approach allows me to analyze parents' differential responses toward their children of different ages. To address concerns about birth order, I keep the controls specified in Equation 2 while adding family-fixed effects. Additionally, since parents' attitudes toward gender may vary, I estimate the effects separately for girls and boys. Consequently, the preferred specification enables a comparison of education outcomes among siblings of the same gender, conditional on provinces' observable characteristics during the years of their enrollment.

Before discussing the results, an important issue should be highlighted. As shown in Column 5 of Table A.2, including family fixed effects significantly increases the explanatory power of the model: for girls, the model explains 76 percent of the variation compared to 34 percent with the benchmark model, and for boys, it explains 66 percent, up from 20 percent. These results are derived from individuals conditional on living in the same household and being included in the sample. In other words, while the within-family model explains much of the variance in the outcome, it does so at the cost of a significant reduction in sample size. Despite these differences, living with family or siblings is not correlated with the variation of interest (i.e., fasting duration). Additionally, as individuals conditional on living with siblings tend to be younger—and consequently their parents are younger—the estimated effects are likely conservative.

The coefficient estimates remain stable even after controlling for family characteristics; however, including these controls increases the standard errors. This is likely due to several factors. First, variation within families is typically smaller than variation across families, leaving less variation to leverage. Second, the high number of clusters for girls and boys—approximately 40 percent of their total observations—contributes to larger standard errors, leading to less precise estimates. Finally, the age differences among siblings, often around 5–7 years, may cause the fixed effects to capture fasting duration variations among siblings. Despite these challenges, the estimated effect for girls remains statistically significant at the 95 percent confidence level, while the effect for boys is significant at the 90 percent level.

Enrollment as a mechanism. The exogeneity assumption requires that my instrument is uncorrelated with the error term. To validate this assumption and demonstrate that the observed effect arises from enrollment decisions, I exploit the rotating nature of Ramadan to create control and treatment groups. My main variation of interest reflects the total fasting duration during individuals' enrollment year, regardless of when Ramadan occurs within that year. Some birth cohorts' parents, referred to as the control group and shown with their children's corresponding birth years in Figure 2b, make enrollment decisions before Ramadan, meaning their decisions should not be influenced by the fasting duration.

Conversely, parents in the treatment group make enrollment decisions after experiencing Ramadan, meaning they should derive the effect, particularly if the instrument does not capture unobservable factors

The uneven sizes of the control and treatment groups, stemming from the experimental design, result in slight imbalances in observable characteristics between the groups. The control group predominantly captures older generations (see Table A.3), who experienced slightly worse living conditions on average compared to the treatment group and the overall sample. Consequently, the unconditional share of individuals who completed primary school or higher is slightly lower in the control group—65 percent for females and 95 percent for males—compared to 67 percent and 88 percent for females and males, respectively, in the treatment group and overall sample. Balance tests, shown in Figure A.1, for which I regress each observable characteristic on fasting duration and its interaction with treatment status after controlling for province- and year-fixed effects, show that the assignment of treatment, regarding how much parents engage in religious practices, is largely random across the treatment and control groups. This analysis focuses on individuals whose enrollment-year characteristics are observable in census reports, as using linear interpolation could introduce spurious correlations between the covariates and fasting duration. To account for slight differences, I rely on the estimation expressed in Equation 2, which includes controls for these characteristics to estimate the effect. The results in Figure 4 and Table A.2 indicate that fasting duration has no significant effect on the control group, whereas the effect is entirely driven by parents in the treatment group who receive the assignment before making enrollment decisions.

Another exercise to support the exogeneity assumption involves generating a placebo treatment. Specifically, I calculate fasting duration for the year individuals turn 11, the typical age of enrollment in junior high school. Since parents' religiosity levels at the time of enrollment in an upper educational degree should not influence decisions regarding primary school enrollment—unless the variation captures other unobservable factors—there should be no significant effect on the probability of completing primary school. As seen in the last columns of Figure 4 and Table A.2, there are no significant effects of the placebo treatment for boys and girls.

Lastly, I repeat the previous analyses using literacy status as an alternative outcome variable to assess whether the observed effects are driven by parents' enrollment decisions. Since individuals typically acquire literacy skills in the first grade, one should find the same effects if the effect comes from enrollment decisions. As shown in Figure A.2, the coefficients remain consistent across all empirical analyses.

4.2 Other robustness checks

In this section, I present additional analyses conducted to ensure the robustness of my main findings.

Treatment assignment. In the main analysis, I assume that individuals did not move from their birthplace until they reached the age of six, the typical age for starting primary school. While migration for children's education is uncommon in Turkey, it is possible that some families moved, potentially leading to incorrect treatment assignment. To address this, I focus on individuals who remained in their birthplace until the census year, as they are more likely to be locals who never migrated. Before analyzing this subset, I first examine whether migration status is orthogonal to the main variation. I identify migrants using three alternative definitions: (1) individuals are defined as migrants if they reside in a province other than their reported birthplace in the census; (2) individuals born in a newly established province that emerged from historically existing provinces are defined as migrants if they reside outside the historical boundaries of their birthplace's original province; and (3) individuals are defined as migrants if their parents reside in a province different from their birthplace. The first three columns of Panel A and Panel B in Table A.4 demonstrate that the treatment assignment is not influenced by an individual's migration status, regardless of how migration is defined. When I restrict the analysis to local individuals identified using the three definitions mentioned earlier, the results for both females and males, estimated following Equation 2, remain consistent with my main findings. Consequently, even when restricting the analysis to groups with correctly assigned treatment, the results remain qualitatively unchanged.

Sample weightings. Due to the nature of the data, I apply weighting factors in my regression analysis to address unequal representation across observations. Using both analytical and frequency weightings, as shown in Table A.5, leads to slight reductions in standard errors. However, these adjustments do not alter the interpretation of my main findings.

Clustering standard errors. To account for heterogeneity within provinces, I cluster the standard errors at the district-by-year level, increasing the number of clusters from 4,939 to 8,149. As shown in Table A.5, clustering at this more granular level reduces the standard errors and improves the precision of the estimates.

Family resources as a potential channel. My instrumental variable approach assumes that fasting duration affects the dependent variable only through its impact on parents' religious beliefs. While it is unlikely that an additional half-hour of fasting per

day would significantly influence family resources, I provide evidence supporting this assumption by examining the relationship between fasting duration and provincial income per capita. The income data, sourced from Aşık et al. (2023), is constructed as detailed in Section 3.1. Since income data is only available for census years in Turkey, and imputation might introduce spurious relationships, I restrict my individual-level analysis to those who began their education in these specific years and estimate the effects using Equation 1. Additionally, to address potential biases arising from the disproportionate representation of provinces with larger populations in individual-level data, I replicate the analysis at the provincial level. For this, I cluster standard errors to account for spatial correlation across provinces, following the approach of Colella et al. (2023), assuming spatial dependence within a 100-km radius. As shown in Table 1, fasting duration is positively associated with provincial income per capita, contradicting Campante and Yanagizawa-Drott (2015), whose findings are based on global-scale comparisons with much larger variation in average daily sunlight duration. Moreover, the within-year variation in fasting duration across provinces has no significant impact on provincial income per capita. These results suggest that income is an unlikely channel for the observed effects.

Household arrangements as a potential channel. Another concern regarding the exclusion restriction assumption is the possibility that believers adopt a certain lifestyle during Ramadan, such as changes in meal times that might lead to females taking on greater household responsibilities. However, this hypothesis seems implausible, particularly when fasting durations differ by only 30 minutes. Nonetheless, I test this hypothesis by analyzing the differential effects of fasting duration concerning the ages of siblings, given that older siblings typically assume more household responsibilities than younger ones. If household arrangements were a potential channel, one would expect to observe differential effects based on sibling age. Therefore, I focus on individuals living with their siblings and identify the eldest and youngest siblings (both sisters and brothers) based on their ages. In the first columns of Table 2, I present results obtained using Equation 2, with an additional interaction term for fasting duration and a dummy variable indicating whether the individual is the eldest sibling in the household. Given the greater household responsibilities often carried by females and the gender disparity in time spent on household chores, I first estimate the effects within same-gender siblings. The results indicate that while the eldest sister's probability of completing primary school is lower, fasting duration does not have a differential effect compared to her younger sisters. To further investigate the potential role of household arrangements, I analyze how age differences between siblings interact with fasting duration, specifically employing differences from both the eldest sibling of the same gender and the overall eldest sibling. The results consistently show that fasting duration does not differentially affect educational outcomes based on sibling age, reinforcing the conclusion that household dynamics are unlikely to

explain the observed effects.

Cost of religious activity. This section examines the relevance assumption in my analysis by investigating whether increases in the cost of religious activities strengthen religiosity, despite the evidence presented in Aksoy and Gambetta (2022) regarding my latent first-stage estimation. Beyond fasting duration, temperature on a Ramadan day could further increase the cost of religious activity, as staying dehydrated for an additional thirty minutes, particularly during hot seasons, can be especially strenuous. To analyze this, I construct temperature data using CHELSAcruts, which provides global monthly maximum temperatures, as described in Section 3.1. I then estimate its effects using the equation presented below:

$$\mathrm{Y}_{i,p,t} = \beta_2 \textit{Fasting Hours}_{p,t+6} + \textit{Demography}_{p,t+6} + \mathrm{X}_i + \textit{School}_{p,t+6} + \theta_p + \lambda_t \quad (3)$$

$$+ \sum_{j=1}^{k} \gamma_j (\mathrm{Temperature}^j_{p,t+6}) + \varepsilon_{i,p,t} \quad (4)$$

As in the benchmark model, the first line includes variables capturing time-invariant differences across provinces and time-variant observable characteristics. While fasting duration compares outcomes across provinces at different latitudes, the temperature variable, $\textit{Temperature}_{p,t+6}$, captures variations in weather conditions between localities within the same latitude. Since I am interested in the marginal effect of temperature during hot weather, $\textit{Temperature}_{p,t+6}$ represents the maximum temperature experienced during the Ramadan month of year $t+6$, with temperatures below 21 degrees Celsius (commonly referred to as room temperature) coded as zero. To account for nonlinearity, I include polynomial terms for temperature up to the second degree. I cluster standard errors at the province x birth cohort level and focus on individuals in the treatment group, as both temperature and fasting duration effects should be significant when Ramadan occurs before enrollment. As shown in Figure 5 and Table B.1, the effect of temperature on girls' and boys' probability of completing primary education is in the same direction as the effect of fasting duration, suggesting that religious activities defy the law of demand.

Religiosity or Parental Religiosity? As previously discussed, I argue that the religious beliefs influencing the observed effects are those of the parents, not the children or other actors. Children, by nature, do not actively participate in religious practices. While some families may encourage their children to fast as part of familiarizing them with religious traditions, this participation is typically limited to symbolic involvement, such as fasting until lunchtime. Consequently, the within-year variation in fasting duration should not significantly affect children's beliefs.

Another potential group of concern includes teachers and school principals. However, these professions are generally aligned with Kemalist values, which emphasize secularism, coeducation, and equal education rights for boys and girls across all socioeconomic groups. Besides, behavioral changes due to fasting would contradict their professional principles.

To empirically examine this potential mechanism, I analyze students' performance data. If fasting duration did influence teacher or school principal behavior, we would expect corresponding changes in the school environment, potentially leading to measurable underperformance or overperformance among students. Several measures for performance come from the digitized enrollment statistics by grade. Specifically, they consist of the grade advancement ratio (the fraction of students advancing from grade a to grade $a+1$) and the on-time graduation rate (the fraction of students who entered first grade in year t and reached fifth grade by year $t+4$). As shown in Figure B.3, graduation rates were around 10 percent in the 1930s, with a substantial gender disparity against girls. Over time, however, student performance improved significantly, and the gender gap diminished. So, I estimate the impacts on grade advancement ratios, controlling for predetermined demographic and school characteristics observed during grade a. Additionally, I analyze the effects of fasting duration during the first grade and the average fasting duration experienced by students from grades 1 through 4 on the graduation rate, controlling for observable predetermined characteristics from the first grade. As shown in Table 3, fasting duration has no significant impact on student performances across these various measures.

4.3 Discussion: Being born to a religious family

In this part of the analysis, I introduce a new instrument to measure parental religiosity: the cumulative exposure of parents to Ramadan fasting before making school decisions for their children. This instrument is used to first validate my previous findings and then examine which parent has the greatest influence on educational decisions. Before presenting these results, I discuss and demonstrate the validity of this new instrument.

An alternative instrument. The intuition behind this instrument is that cumulative exposure to longer durations of Ramadan fasting over one's lifetime enhances religiosity. To validate the relevance of this instrument, I draw on data from the Demographic and Health Survey of Turkey for the years 2008 and 2013, which includes measures of women's religiosity, such as prayer frequency, wearing a headscarf, and observing fasting. I estimate the following two-way fixed effects model:

$$\textit{Religious Women}_{i,p,c,t} = \beta_4 \sum_{c=13}^{\text{c}} \textit{Fasting Duration}_{p,c} + \text{X}_i + \theta_p + \lambda_t + \varepsilon_{i,p,t} \qquad (5)$$

where *Religious Women*$_{i,p,c,t}$ is a dummy variable indicating whether woman i, born in province p and year t, at age c, regularly or irregularly engages in the respective religious behavior. The term *Fasting Duration* represents the cumulative fasting duration experienced by woman i in her birthplace p from the age of 13 (when believers begin fasting) up to her current age c. θp and λ_t capture province-specific and cohort-specific variations in religiosity outcomes, respectively. Although the main variation introduces a higher value for older individuals—thus reflecting the fact that they tend to be more religious—I disentangle the age effect by including age-fixed effects in X_i. This term also incorporates other predetermined personal characteristics of woman i, such as her education level, parental literacy status, and ethnicity. The coefficient β_4, therefore, represents the effect of total fasting exposure on observable religious behaviors. The results, presented in Table 4, reveal two key findings. First, experiencing longer fasting durations over a lifetime is associated with a higher likelihood of praying and wearing a headscarf. Second, the findings suggest that religious fasting is not exclusively practiced by religiously conservative individuals, as cumulative exposure does not significantly influence fasting behavior.

Given the absence of religiosity measures on census data, I use the information on the fertility behavior of women there, plausibly assuming that religious women tend to give birth more considering that the most religious societies have the highest fertility rates (Iyer, 2016). Focusing on individuals who can be matched with their mothers allows me to observe the age difference between the mother and her offspring, and thus infer women's fertility cessation behavior.[21] As seen in the right-skewed density distribution of age differences between mothers and their children from Figure 6, most women give birth at around 25, or more precisely, go on giving births as the average number of children that they have is around three. After age 40, it is less frequent as much as giving birth during childhood.[22] In order to illustrate the religiosity levels of mothers proxied by fertility behaviors, the figure also shows the distribution of mothers' total exposure to Ramadan fasting across different age differences between mothers and their children. As the association presented here is from raw data and the cumulative exposure from the years following puberty involves the age effect, I hereby use the adjusted cumulative duration to mothers' age calculated by taking the arithmetic average of their cumulative exposure from the years following their puberty. In the absence of the religiosity effect, the distribution of fasting duration among the women with the same age difference should be uniform. However, Figure 6 reveals that the women whose adjusted cumulative duration is shorter than the average tend to be missing among young mothers. Also, the women

[21] I find the same results for fathers. I can share the graph upon request.

[22] Mothers with an age difference from their children exceeding 50 years are excluded, as this scenario is biologically implausible due to natural reproductive limitations. Human fertility typically declines significantly after a certain age, with most women experiencing menopause around the age of 50. Nevertheless, those observations follow a similar pattern to what is shown in the figure. I can gladly include them in the analysis if argued so.

whose adjusted cumulative duration is longer than the average constitute the vast majority of the women giving birth after 40.

Parents' religious beliefs and children's education opportunities. This section explores the roles of fathers' and mothers' religious beliefs in shaping their children's chances of receiving a basic education, leveraging variation in cumulative fasting exposure among parents. In this context, c in Equation 5 represents the age of the mother (m) or father (f) when their child is 6 years old—the typical age for school enrollment decisions. Consequently, children whose age difference with their parents is exactly 39 years will have parents with identical exposure levels across all regions. This means that substantial variation in parental fasting exposure within the same birth cohort primarily arises when the age difference between children and their parents is either less than or greater than 39 years. Practically, this variation largely comes from the first-born children in the family. Importantly, as shown in Table A.4, parents do not migrate based on fasting durations. Therefore, once parental age differences are controlled for, the analysis isolates the idiosyncratic geographic variation in cumulative fasting exposure to assess its impact on children's educational outcomes. As such, I estimate the effect while additionally controlling for the age difference between the parent and the child and replacing the instrument with the new one, which allows me to separately analyze how mothers and fathers influence children's education outcomes. Results in Table 5 highlight three important conclusions. First, fathers' religious beliefs have a greater impact on children's schooling decisions than mothers', potentially due to their stronger bargaining power. Second, the influence of mothers' beliefs diminishes significantly if the child is a boy, likely reflecting prevailing traditional gender norms. Third, girls are more adversely affected than boys. Within the same birth cohort, variation in cumulative fasting exposure can reach up to one standard deviation (approximately 2,495 hours, or three and a half months). Such a difference in the fasting duration experienced by fathers is associated with a 3.3 percentage point decrease in girls' probability of completing primary school and a 1.5 percentage point decrease for boys.

Heterogeneity analysis with respect to parents' preexisting religiosity reveals notable gender differences. For mothers, the results suggest that their religiosity during adulthood does not exacerbate the effects of increased religiosity during the enrollment year on boys' education decisions. However, mothers' preexisting religiosity significantly compounds the adverse effects of the religiosity treatment that parents receive during the enrollment year on girls' likelihood of obtaining basic education. When it comes to fathers, the results suggest that the treatment fathers receive during their adulthood exacerbates the effects of the religiosity treatment that parents experience during the enrollment year on children's probability of attaining basic education. However, the adverse effects of preexisting religiosity and the impact of increases in parents' religiosity in the enrollment

year are more pronounced for girls. At the same time, fathers with a greater degree of preexisting religiosity show a stronger negative reaction to the treatment that parents receive in the enrollment year.

4.4 Implications for Later Life

This section examines the implications of parental religiosity on key later-life outcomes, specifically labor force participation and fertility. The objective is not to establish a direct causal relationship between religiosity-induced education losses and labor market participation, as education impacts a wide range of interrelated socioeconomic factors. Consequently, the observed estimates may partially capture spillover effects, which are inherently challenging to disentangle. Instead, this analysis examines the economic outcomes of treated individuals to assess their implications for gender equality.

Labor force participation. This analysis focuses on labor market participation, excluding the 2000 census data due to significant policy changes in retirement regulations, as evaluated in Asik (2024). The sample is restricted to the working-age population (ages 15 to 65). I estimate the effect of parental religiosity, proxied by fasting duration as specified in Equation 2, while controlling for the fixed effects of provinces where individuals reside during the census year to account for demand-side differences across regions. Standard errors are clustered at the province x birth year level. The results in Table 6 indicate that parental religiosity during the enrollment year is associated with a lower likelihood of female children participating in the labor force as adults. However, the effect on males' labor market participation is statistically insignificant and close to zero, suggesting that traditional norms persist, as increased religiosity from one-time exposure does not disrupt the entrenched breadwinner role of males.

I further explore the implications of parental religiosity for labor market participation by examining cumulative parental exposure to Ramadan fasting. While the ideal analysis would consider overall exposure at the time females make entry or exit decisions from the labor market, constructing such measures is not feasible with the available datasets, as the census lacks detailed historical information on labor market decisions and the year of education completion. Instead, I use the previously introduced instrument to capture the differential religiosity experienced by children during early childhood. For this analysis, I apply the same sample restrictions used in prior exercises. The results in Table 6 indicate that mothers' religiosity is associated with a lower likelihood of labor force participation for both males and females, with a significantly larger effect for females. In contrast, the estimates for fathers' religiosity are smaller and the association between fathers' religiosity and women's labor force participation becomes statistically insignificant, likely due to larger standard errors. This may reflect insufficient variation in fathers' exposure to fully

capture its influence on labor market entry or exit decisions.

Fertility. Here, I evaluate the implications for fertility decisions, focusing on women, as fertility-related questions are only addressed to them. Given the nonlinearity in the number of children, I construct outcomes indicating whether a woman has given birth to a certain number of children or more. To estimate the association, I follow the same strategy for labor force participation, except for residing province fixed effects. As expected, there is no association with being a mother, as shown in Figure 7 where the number of children corresponds to zero. The association is still either small or statistically insignificant until the number of children born reaches 3. Considering the sample's average number of children per woman is 3.5, increases in parental religiosity during the enrollment year are associated with a higher likelihood of having one or two more children than the average. This finding aligns with the patterns observed in Figure 6.

5 Concluding Remarks

This study investigates the gender-differential effects of parental religiosity on educational access and its broader implications for gender equality. The findings indicate that parental religiosity, both during the enrollment year and cumulatively before children begin school, negatively affects access to basic education. Girls, in particular, experience a disproportionately greater impact. Further analysis reveals that fathers' religiosity has a more pronounced influence than mothers', likely reflecting traditional gender norms that prioritize boys' education and limit women's bargaining power within households.

The long-term consequences are significant: female children exposed to greater parental religiosity are less likely to participate in the labor force and tend to have higher fertility rates in adulthood. Furthermore, parents' educational choices may serve as signals of their religiosity and commitment to the community. Addressing community perceptions toward the values instilled through basic education is crucial, particularly if these values are perceived as misaligned with societal expectations for fostering moral and socially responsible women and men. While integrating religious courses into school curricula may help adjust these perceptions, these findings highlight potential trade-offs, particularly regarding gender equality and labor productivity. Finally, the ongoing debate within religious communities about what constitutes morality is vital, and diverse viewpoints must be encouraged. The observed outcomes for females may reflect societal expectations of a pious woman—greater focus on childbearing and domestic engagement rather than active participation in social and professional spheres—underscoring the need for broader conversations about gender roles and values in religious contexts.

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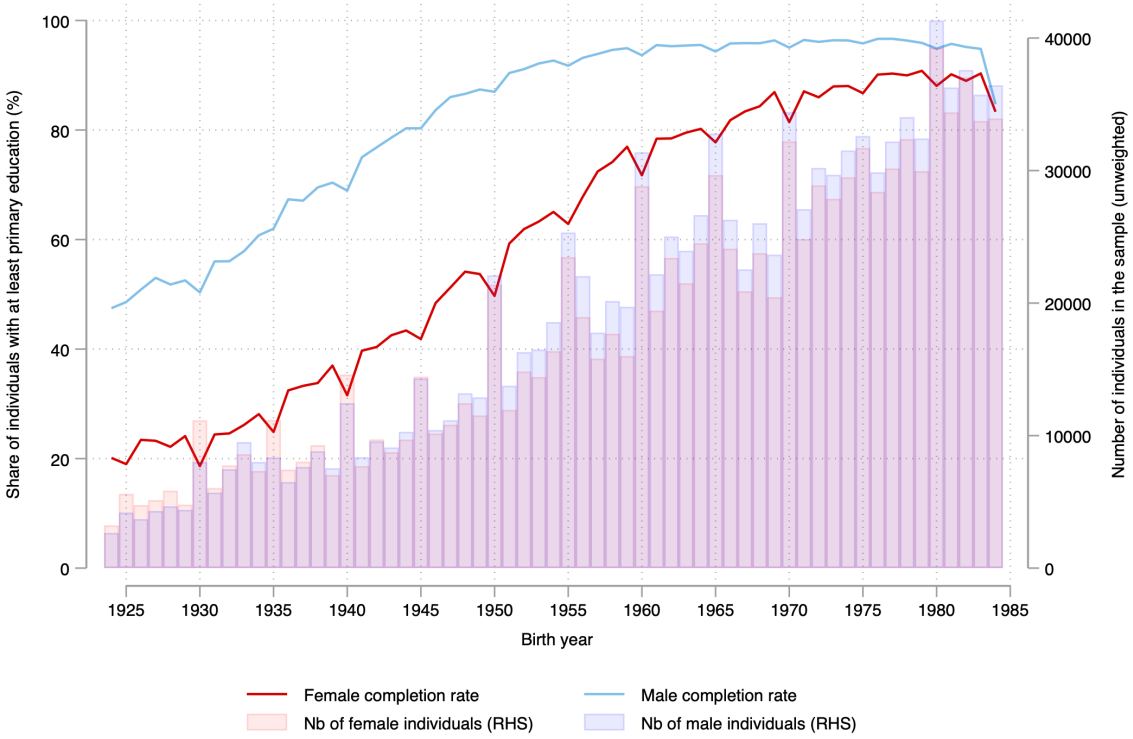
6 Tables and Figures

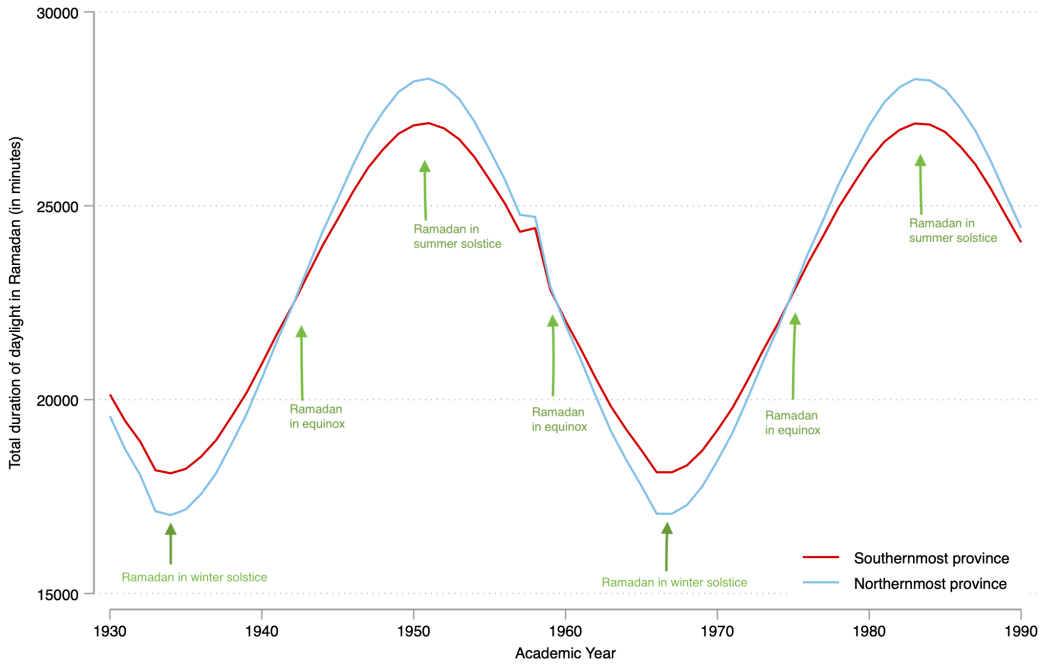
Figure 1: Primary school completion rates and birth cohort sizes



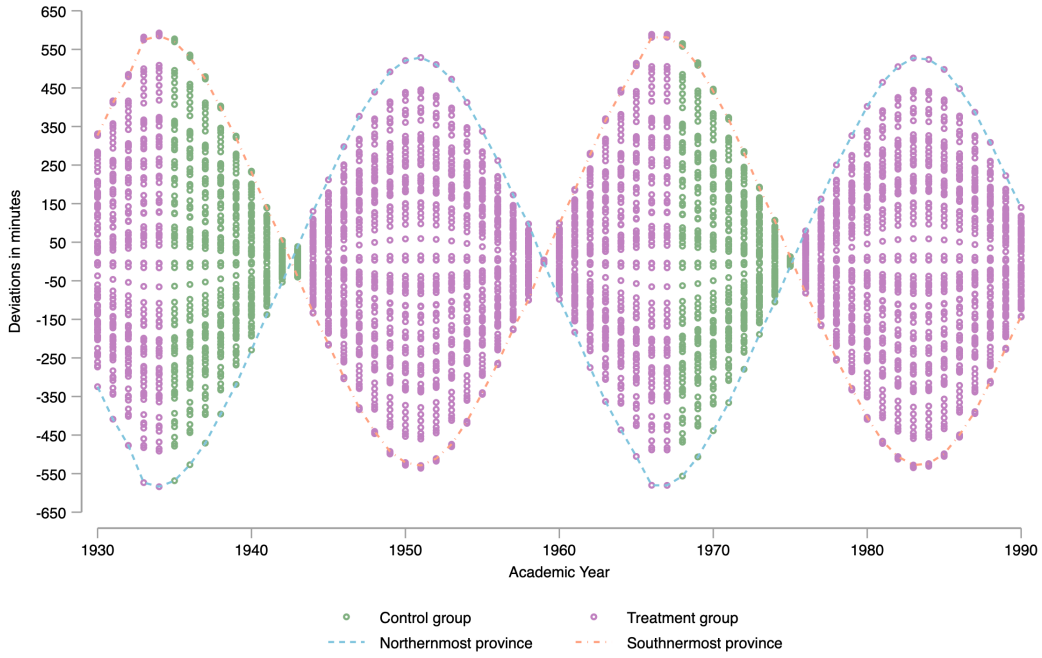
Source: Turkish census data from 2000, provided by the Integrated Public Use Microdata Series (IPUMS) project (Ruggles et al., 2024a).

Figure 2: Identification Strategy

(a) Fasting duration in farthest provinces and the timing of Ramadan over time



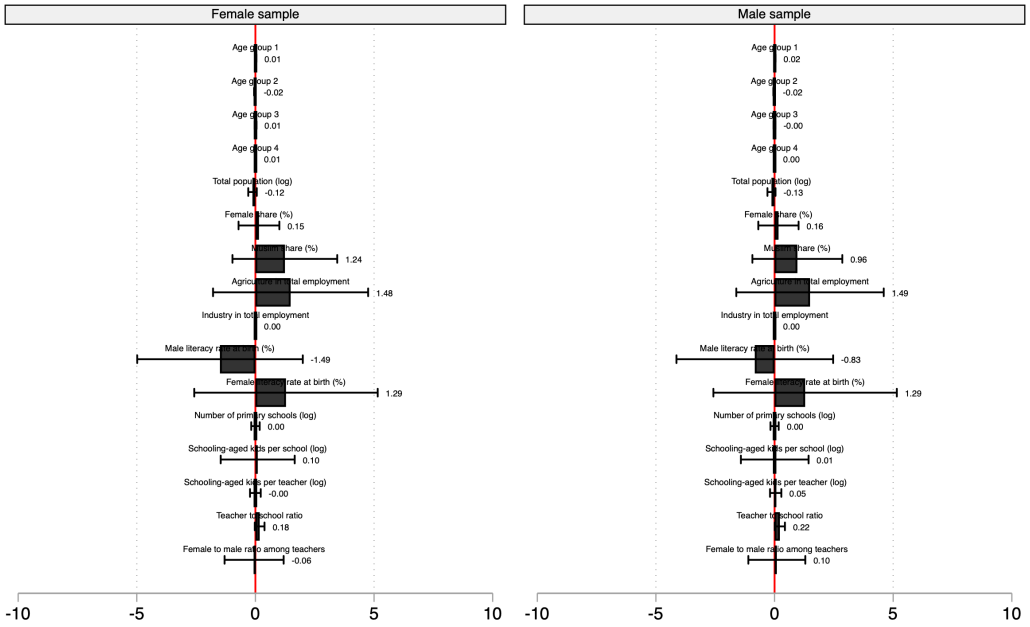
(b) Variation across provinces within the same enrollment year for control and treatment groups



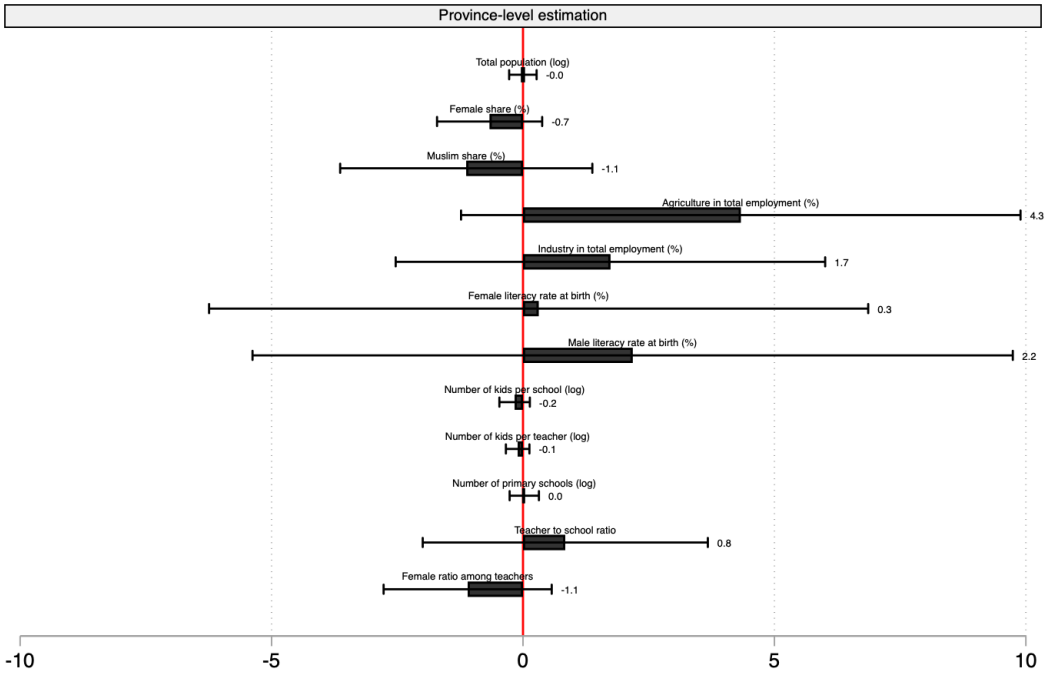
Source: IPUMS-International; Islamic Philosophy Online. **Notes:** Figure 2a shows the total duration between sunrise and sunset throughout the month of Ramadan from the years 1930 to 1990. Northernmost and southernmost provinces, namely Sinop and Hatay, are only presented because duration differences within a year are determined by the latitude of provinces. Figure 2b displays the variation in the duration of daylight in each province in comparison to the average duration of daylight for that particular year. The southernmost and northernmost provinces are presented in orange and blue, respectively. The green color highlights the years when Ramadan occurs after enrollment month, i.e., September, October, and November.

Figure 3: Test results on exogeneity assumption

(a) Testing at individual level and separately for females and males

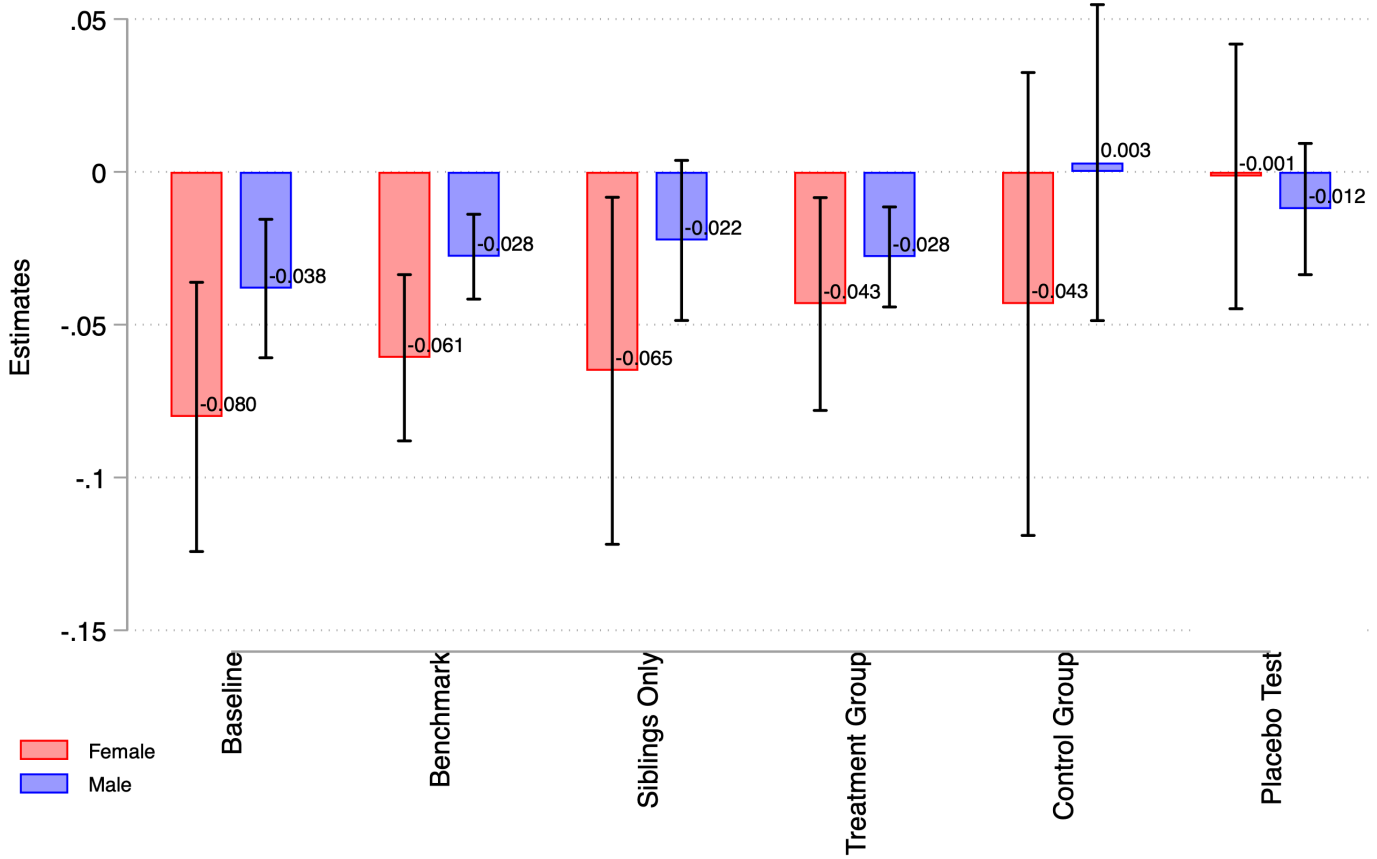


(b) Testing at province level



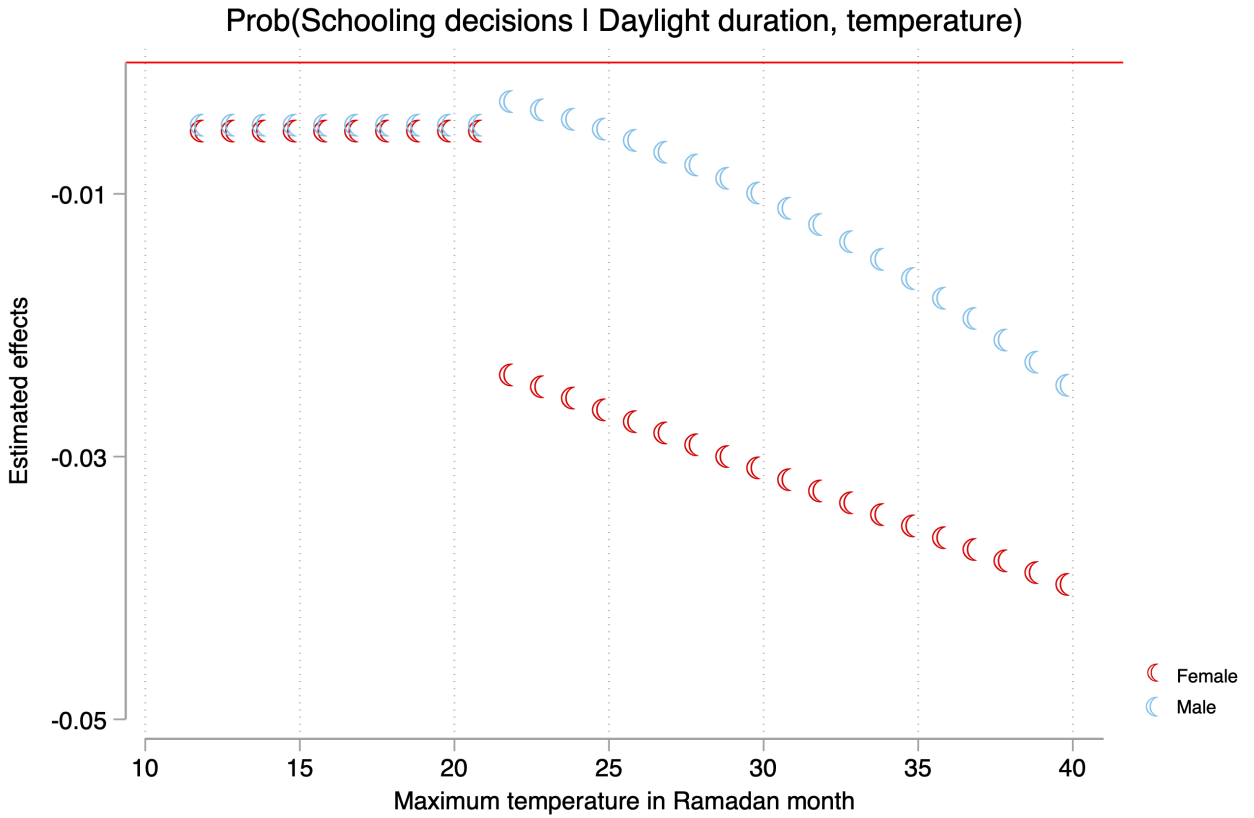
Source: National Education Statistics & Census Reports **Notes:** This figure presents the results of separate regression analyses where each observable characteristic is regressed on the standardized fasting duration in the province of birth during the enrollment year, controlling for birth-year and province-fixed effects. Standard errors are clustered at the province x birth-year level. The estimated coefficients are represented by bars and reported to the right side of the spikes, which display the estimates within a 95% confidence interval. The unit of observation in the regressions displayed in Figure 3a is individual, whereas the latter figure shows the results estimated at the province level. Province-level estimates are estimated using population size in the enrollment year for weighting since places with more dense areas have a larger group of treated adults.

Figure 4: Fasting duration estimates on the probability of completing primary school separately for girls and boys



Notes: This figure presents the results of separate regression analyses where each of them shows the estimated effects of fasting duration on females and males' probability of completing at least primary school. The estimated coefficients are represented by bars and reported to the right side of the spikes, which display the estimates within a 95% confidence interval. Their regression results are reported in the appendix, Table A.2.

Figure 5: Conditional probabilities of completing primary school on daylight duration and maximum temperature during Ramadan



Source: CHELSAcruts and IPUMS-International **Notes:** This figure shows probabilities of females' and males' for completing primary school, conditional on the daylight duration and the maximum temperature experienced in Ramadan. The regression results are reported in Table B.1. As the second degree of the temperature is insignificant for females, the function is assumed to be linear. While calculating the conditional probabilities, I use one-tenth of one standard deviation of fasting duration. Although this figure does not show the estimates with their confidence intervals, all of them are statistically significant, at least at a 90 percent confidence interval.

Table 1: Discussion on the exclusion restriction assumption I: Income

Outcome: Provincial income per capita (standardized)

	(1) Female sample	(2) Male sample	(3) Province-level
Fasting duration (std)	0.1614	0.2130	0.2807
	(0.2824)	(0.2622)	(0.2868)
Observations	476,693	542,243	637
R-squared	0.8669	0.8674	0.0016
Year FE	Yes	Yes	Yes
Province FE	Yes	Yes	Yes

Notes: Income data is retrieved from Aşık et al. (2023). Since the availability of the income data is only restricted to the years when census data has been collected in Turkey, and imputation may cause a spurious relationship, I restricted my individual-level data to the ones who started their education in the respective census years. The estimations are obtained following Equation 1. The province-level estimates are obtained with the corrected standard errors against spatial correlation across provinces following Colella et al. (2023) where I assume spatial correlation exists between provinces no farther than 100 km from each other. *** p<0.01, ** p<0.05, * p<0.1.

Table 2: Discussion: Household chores and age of siblings

	Female			Male		
	(1)	(2)	(3)	(1)	(2)	(3)
Fasting duration	-0.0640**	-0.0601**	-0.0604**	-0.0216*	-0.0198	-0.0199
	(0.0272)	(0.0271)	(0.0271)	(0.0125)	(0.0126)	(0.0126)
Being the eldest sibling with the same gender	-0.0054***					
	(0.0021)					
Fasting duration X Being the eldest siblings with the same gender	0.0021					
	(0.0020)					
Fasting duration X Age difference from eldest sibling with the same gender		-0.0008				
		(0.0005)				
Fasting duration X Age difference from eldest sibling			-0.0004			-0.0003
			(0.0004)			(0.0002)
Being the eldest brother				0.0030**		
				(0.0013)		
Fasting duration X Eldest brother				0.0012		
				(0.0011)		
Fasting duration X Age difference from eldest brother					-0.0003	
					(0.0002)	
Observations	182,976	182,976	182,976	326,111	326,111	326,111
R-squared	0.7635	0.7635	0.7635	0.6601	0.6601	0.6601

Notes: The estimates are obtained from the individuals living in the same household and relying on the estimation strategy shown in Equation 2. Being the eldest sibling is a dummy showing the eldest sibling with the same gender in the household. Age difference from the eldest sibling refers to the age differences as described. In the second and third columns, per se effects of age differences are not reported, even though the estimations includes them. *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Discussion on student performances

Outcome: Grade advancement ratio	from Grade 1 to 2		from Grade 2 to 3	
	Female	Male	Female	Male
Fasting duration (std)	0.0148	-0.0227	0.0514	-0.0003
	(0.0442)	(0.0426)	(0.0614)	(0.0489)
Observations	635	635	635	635
R-squared	0.1921	0.0486	0.0597	0.0683
Year FE	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes
Demographic characteristics	Yes	Yes	Yes	Yes
School characteristics	Yes	Yes	Yes	Yes

Outcome: Grade advancement ratio	from Grade 3 to 4		from Grade 4 to 5	
	Female	Male	Female	Male
Fasting duration (std)	0.0590	-0.0300	0.0189	0.0187
	(0.0645)	(0.0569)	(0.0569)	(0.0476)
Observations	635	635	635	635
R-squared	0.1139	0.0456	0.0978	0.0332
Year FE	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes
Demographic characteristics	Yes	Yes	Yes	Yes
School characteristics	Yes	Yes	Yes	Yes

Outcome: Graduation rate	Female	Male	Female	Male
Duration of fasting in the first grade	-0.0208	-0.0037		
	(0.0538)	(0.0520)		
Average duration of fasting in the last four years			-0.0578	-0.0314
			(0.0456)	(0.0437)
Observations	690	688	690	688
R-squared	0.5090	0.3391	0.5100	0.3396
Year FE	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes
Demographic characteristics	Yes	Yes	Yes	Yes
School characteristics	Yes	Yes	Yes	Yes

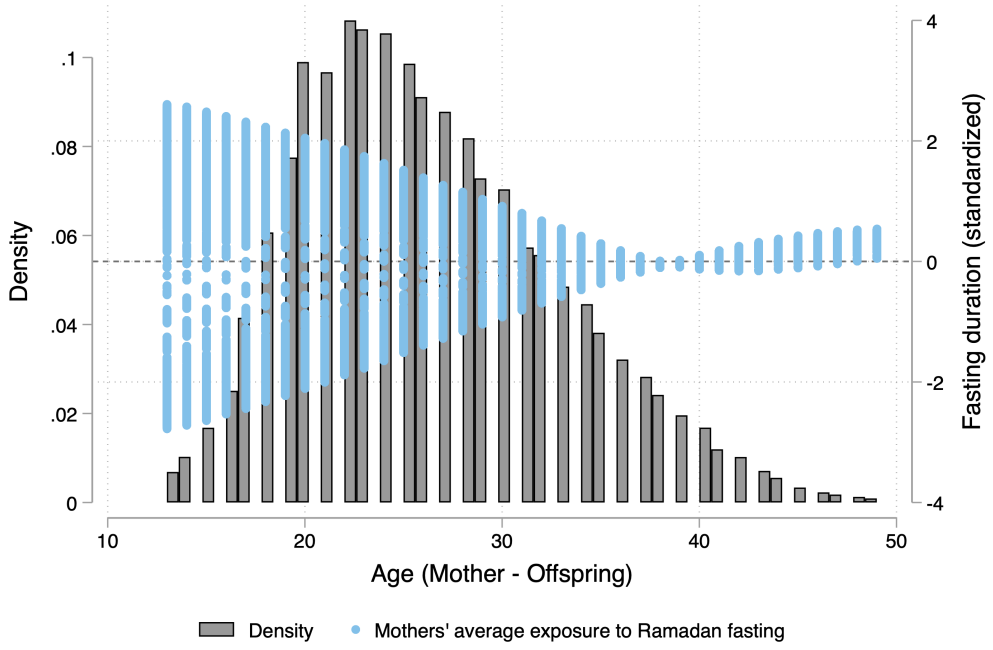
Notes: Data is retrieved from the national statistics of education. The estimations are obtained following Equation 1. The province-level estimates are obtained with the corrected standard errors against spatial correlation across provinces following Colella et al. (2023) where I assume spatial correlation exists between provinces no farther than 100 km from each other. Estimates are weighted by the population size as populated areas are more affected. *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Total exposure to Ramadan and women's religiosity

	Fast	Pray regularly	Headscarf
Total exposure to Ramadan fasting	0.0420	0.3408**	0.1330**
	(0.0790)	(0.1332)	(0.0611)
Birth-year FE	Yes	Yes	Yes
Province FE	Yes	Yes	Yes
Personal characteristics	Yes	Yes	Yes
Observations	12,043	12,043	19,839
R-squared	0.0701	0.1189	0.1989

Source: Turkish Demographic and Health Survey, 2008 and 2013. Notes: Outcome variables take the value of 1 if the respondent carries out the respective religious behavior either regularly or irregularly. Exposure to Ramadan reflects the ex-ante cumulative exposure of the individual to Ramadan fasting since puberty, and the variable is normalized. Personal characteristics include education level, literacy status of their parents, ethnicity, and age categories in single years.

Figure 6: Overall exposure to Ramadan fasting and women's fertility behavior



Source: IPUMS-International. **Notes:** It illustrates both the density distribution of age differences between mothers and their children and the distribution of mothers' total exposure to Ramadan fasting across different age differences between mothers and their children. The total exposure to fasting is adjusted for the mothers' age by calculating the arithmetic average of their cumulative exposure from the years following puberty.

Table 5: Beliefs of mothers and fathers, and their offspring's education

	Mother's religiosity				Father's religiosity			
	(1) Boy	(2) Girl	(3) Boy	(4) Girl	(1) Boy	(2) Girl	(3) Boy	(4) Girl
Overall exposure of parent to Ramadan	-0.0079***	-0.0238***	-0.0019	-0.0271***	-0.0148***	-0.0325***	-0.0269***	-0.0682***
	(0.0029)	(0.0054)	(0.0045)	(0.0072)	(0.0031)	(0.0056)	(0.0044)	(0.0068)
Fasting duration in enrollment year			-0.0392***	-0.0900***			-0.0318***	-0.0940***
			(0.0062)	(0.0146)			(0.0062)	(0.0146)
Overall exposure of parent X Fasting duration			0.0004	-0.0024***			-0.0023***	-0.0087***
			(0.0005)	(0.0008)			(0.0005)	(0.0008)
Observations	678,033	433,897	672,448	429,372	570,152	391,349	570,152	391,349
R-squared	0.0618	0.1611	0.0617	0.1604	0.0590	0.1663	0.0591	0.1669
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Personal characteristics	No	No	No	No	No	No	No	No
Demographic characteristics	No	No	No	No	No	No	No	No
School characteristics	No	No	No	No	No	No	No	No
Birthyear FE								

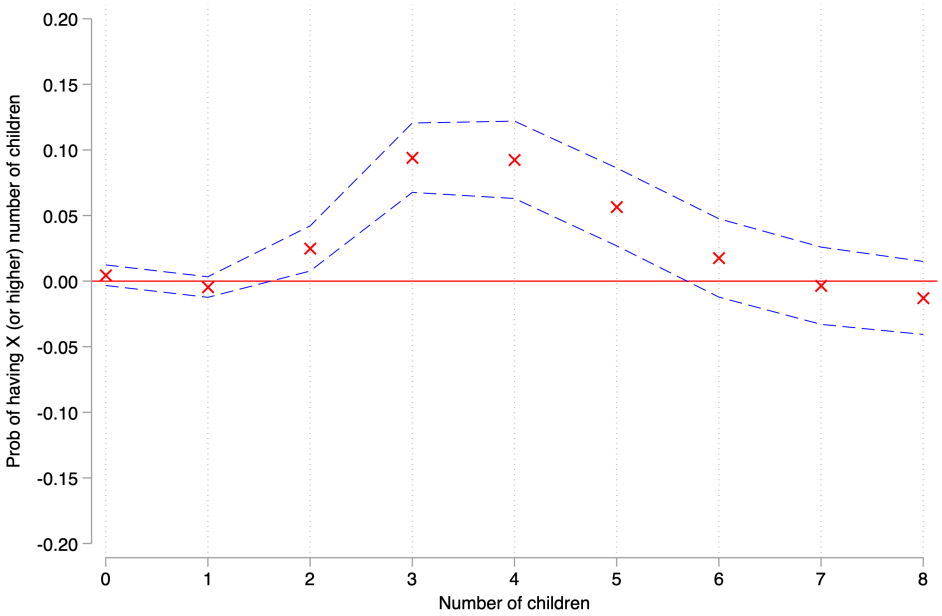
Notes: Fasting duration in the enrollment year refers to how long believers in the birthplace of individuals have engaged in religious practices when individuals are at 6. Overall exposure of parents to Ramadan refers to their cumulative Ramadan fasting duration from their puberty age to the age that they decide on their kids' enrollment. Fasting duration at age 6 and total fasting durations are standardized. I estimate the effects relying on Equation 2 but additionally controlling for the age difference between the parent and the kid. Standard errors are clustered at the province x birth-cohort level. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Parental religiosity and labor force participation decisions

	Male	Female	Male	Female	Male	Female
Fasting duration in enrollment year	0.0012	-0.0426***				
	(0.0158)	(0.0142)				
Overall exposure of mother			-0.0781***	-0.0951***		
			(0.0083)	(0.0173)		
Overall exposure of father					-0.0221**	-0.0238
					(0.0111)	(0.0179)
Observations	1,575,273	1,462,572	371,455	232,730	313,884	214,467
R-squared	0.1305	0.1102	0.1351	0.0828	0.1281	0.0851
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Personal characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Demographic characteristics	Yes	Yes	Yes	Yes	Yes	Yes
School characteristics	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The results from the first bloc come from the entire working-age population observed in the 1985 and 1990 censuses. The second and third blocks are restricted to the individuals whose parents are matched with them. The province fixed effects reflect the fixed effects of the birth province and the province where individuals live in the census year. Standard errors are clustered at the residing province x birth-cohort level. *** p<0.01, ** p<0.05, * p<0.1.

Figure 7: Parental religiosity and women's fertility behavior



Notes: The red cross-marks show the coefficient estimates, and the blue dashed lines indicate the estimates within 95 percent confidence intervals. The estimates are obtained from separate regression analyses where the respective outcomes reflect whether the woman has given birth to the respective number of children or higher.

Appendix

Table A.1: Summary statistics by gender

	Male					Female				
	Obs	Mean	SD	Min	Max	Obs	Mean	SD	Min	Max
Education outcomes.										
Individual-level outcomes.										
Completed at least primary school	2,759,765	0.88	0.33	0	1	2,586,074	0.67	0.47	0	1
Completed at least junior high school	2,759,765	0.36	0.48	0	1	2,586,074	0.20	0.40	0	1
Completed at least high school	2,759,765	0.24	0.43	0	1	2,586,074	0.14	0.34	0	1
Completed a higher education	2,759,765	0.07	0.26	0	1	2,586,074	0.03	0.18	0	1
Province-level outcomes.										
Graduation rate	690	44.86	26.36	1.66	142.9	688	57.24	20.63	7.27	134.0
Grade advancement ratio (1 to 2)	638	73.35	17.27	0	140.35	638	81.76	12.35	0	207.37
Grade advancement ratio (2 to 3)	636	86.18	18.77	0	317.79	638	91.73	13.25	0	235.19
Grade advancement ratio (3 to 4)	636	82.64	17.80	0	229.25	636	90.77	17.21	0	231.42
Grade advancement ratio (4 to 5)	636	77.24	15.51	0	159.11	636	82.80	12.48	0	173.69
Personal characteristics.										
Year of birth	2,759,765	1958.03	14.84	1924	1984	2,586,074	1957.89	15.14	1924	1984
Age between 16 and 24	2,759,765	0.29	0.45	0	1	2,586,074	0.29	0.46	0	1
Age between 25 and 32	2,759,765	0.22	0.41	0	1	2,586,074	0.21	0.41	0	1
Age between 33 and 44	2,759,765	0.24	0.43	0	1	2,586,074	0.23	0.42	0	1
Age between 45 and 76	2,759,765	0.25	0.43	0	1	2,586,074	0.26	0.44	0	1
Matched with father	2,759,765	0.23	0.42	0	1	2,586,074	0.16	0.37	0	1
Matched with mother	2,759,765	0.27	0.45	0	1	2,586,074	0.17	0.38	0	1
Matched with parents	2,759,765	0.21	0.41	0	1	2,586,074	0.15	0.36	0	1
Migrated mother	743,218	0.23	0.42	0	1	445,159	0.25	0.43	0	1
Migrated father	621,490	0.22	0.41	0	1	407,248	0.24	0.43	0	1
Demographic characteristics.										
Population size in log	2,756,208	13.25	0.66	11.34	15.69	2,582,909	13.25	0.67	11.34	15.69
Female share (%)	2,756,208	49.57	1.74	33.59	58.00	2,582,909	49.58	1.76	33.59	58.00
Muslim share (%)	1,335,398	99.16	2.77	71.26	100.00	1,236,499	99.08	3.02	71.26	100.00
Literacy rate of males at their birth year (%)	2,523,007	54.31	19.97	3.48	93.33	2,702,213	53.97	19.83	3.48	93.33
Literacy rate of females at their birth year (%)	2,523,007	27.09	19.38	0.13	81.03	2,702,213	26.65	19.20	0.13	81.03
Agriculture in total employment (%)	2,580,653	64.29	20.93	4.90	94.77	2,753,826	64.99	20.71	4.90	94.77
Industry in total employment (%)	2,580,653	9.35	7.74	0.53	42.01	2,753,826	9.22	7.63	0.53	42.01
School characteristics.										
Number of school in log	2,756,674	6.15	0.76	2.40	7.62	2,583,235	6.15	0.77	2.40	7.62
Teacher to school ratio	2,756,674	3.48	2.69	0.24	31.06	2,583,235	3.52	2.74	0.24	31.06
Female share among teachers	2,754,876	7.14	4.70	0.00	28.49	2,581,625	7.25	4.73	0.00	28.49
Number of schooling aged kids per school in log	2,579,666	3.24	0.85	-1.69	6.06	2,752,752	3.24	0.85	-1.69	6.06
Number of schooling aged kids per teacher in log	2,581,276	2.15	0.73	-1.43	5.14	2,754,550	2.17	0.72	-1.43	5.14

Source: Turkish census data from 1985, 1990, and 2000, provided by the Integrated Public Use Microdata Series (IPUMS) project (Ruggles et al., 2024b); "50 Years of National Education, 1923-1973" (DIE, 1973); National Education Statistics for the following school years: 1927-1930, 1929-1930, 1930-1931, 1934-1935, 1939-1940, 1944-1945, 1945-1946, 1949-1950, 1950-1951, 1954-1955, 1955-1956, 1959-1960, 1960-1961, 1964-1965, 1965-1966, 1969-1970, 1970-1971, 1974-1975, 1979-1980, 1980-1981, 1984-1985, 1985-1986, 1989-1990, 1990-1991 (IUM, 1933, 1935, 1937a, 1942, 1943, 1947a,b, 1950a, 1953; DIE, 1963, 1965, 1967, 1969a, 1977a,b, 1981, 1983, 1986, 1987, 1991, 1993a); the census results on social and economic characteristics of the population collected in 1927, 1935, 1940, 1945, 1950, 1955, 1960, 1965, 1970, 1975, 1980, 1985, and 1990 (IUM, 1928, 1929, 1937b, 1944, 1950b; DIE, 1961a,b, 1969b,c, 1974, 1982, 1984, 1989, 1993b); Livny (2020).
Notes: Individual-level education outcomes and personal characteristics are derived from 5 percent microdata samples of the censuses. The sample includes individuals born after the proclamation of the Republic in 1923 and those aged 6 to 15. Quartiles determine age group thresholds. The statistics presented in the demographic and school characteristics sections originally exhibit province- and time-based variation. They are matched with individual-level data using their birth years, corresponding to the year they have started primary schooling, typically at age 6. Despite having province-level variation, slight differences in the statistics for male and female subsamples arise due to gender distribution across provinces. As for the observations between the two collection years, linear interpolation is applied. Finally, the statistics presented here are calculated after excluding the observations, resulting in substantial differences in observation counts. One source of differences in the number of observations is the absence of statistics for Hatay province before 1940, as this province was annexed to Turkey on July 7, 1939. Nevertheless, the observations with missing values are included in the empirical analysis by first assigning the average value of the variable for the missing ones and then adding a dummy variable that takes the value of 1 for those missing observations in order to control for the synthetic variations generated by their inclusion.

Table A.2: Main results on probability to complete primary education or higher

Panel A: Effects of fasting duration on primary education completion for females.

	(1) Baseline	(2) Baseline + I	(3) Baseline + II	(4) Benchmark	(5) Within HH	(6) Treatment	(7) Control	(8) Placebo
Fasting duration at age 6	-0.0802***	-0.0801***	-0.0627***	-0.0609***	-0.0651**	-0.0433**	-0.0433	
	(0.0225)	(0.0225)	(0.0166)	(0.0139)	(0.0290)	(0.0178)	(0.0386)	
Fasting duration at age 11								-0.0016
								(0.0221)
Mean	0.67	0.67	0.67	0.67	0.86	0.68	0.65	0.67
Observations	2,586,074	2,586,074	2,586,074	2,579,666	182,976	1,763,966	815,700	2,586,074
R-squared	0.3257	0.3258	0.3329	0.3370	0.7635	0.3091	0.3980	0.3255
Birth-year and birthplace FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Personal characteristics	No	Yes	Yes	Yes	Yes	Yes	Yes	No
Demographic characteristics	No	No	Yes	Yes	Yes	Yes	Yes	No
School characteristics	No	No	No	Yes	Yes	Yes	Yes	No
Family FE	No	No	No	No	Yes	No	No	No

Panel B: Effects of fasting duration on primary education completion for males.

	(1) Baseline	(2) Baseline + I	(3) Baseline+II	(4) Benchmark	(5) Within HH	(6) Treatment	(7) Control	(8) Placebo
Fasting duration at age 6	-0.0382***	-0.0380***	-0.0321***	-0.0277***	-0.0224*	-0.0278***	0.0030	
	(0.0116)	(0.0115)	(0.0085)	(0.0071)	(0.0133)	(0.0083)	(0.0263)	
Fasting duration at age 11								-0.0123
								(0.0110)
Mean	0.88	0.88	0.88	0.88	0.93	0.88	0.85	0.88
Observations	2,759,765	2,759,765	2,759,765	2,752,752	326,111	1,896,946	855,806	2,759,765
R-squared	0.1875	0.1878	0.1939	0.1964	0.6601	0.1668	0.2420	0.1875
Birth-year and birthplace FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Personal characteristics	No	Yes	Yes	Yes	Yes	Yes	Yes	No
Demographic characteristics	No	No	Yes	Yes	Yes	Yes	Yes	No
School characteristics	No	No	No	Yes	Yes	Yes	Yes	No
Family FE	No	No	No	No	Yes	No	No	No

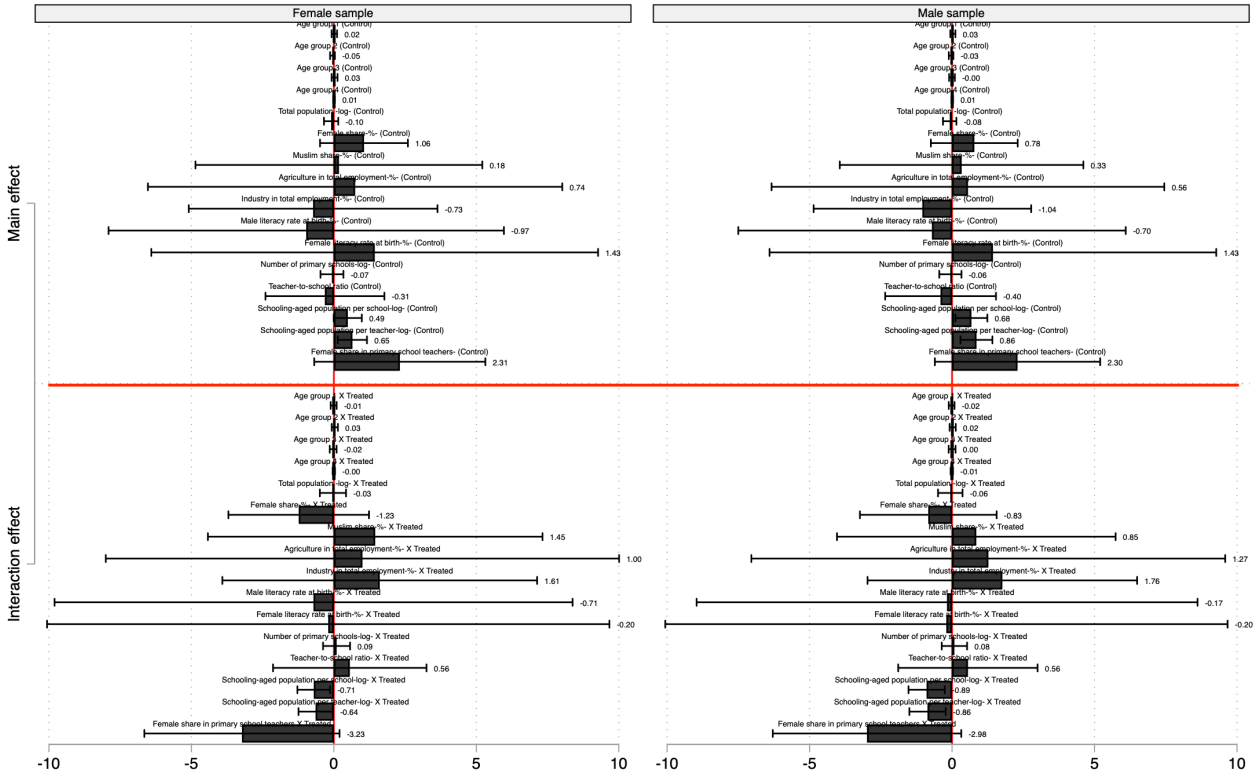
Notes: Fasting duration at age 6 refers to how long believers in the birthplace of individuals have engaged in religious practices when individuals enroll in primary school. The first column shows the results obtained following Equation 1. The second and third columns include the other covariates that are in Equation 2 one by one. Fasting duration at age 6 and age 13 are standardized. Standard errors are clustered at the province x birth-cohort level. *** p<0.01, ** p<0.05, * p<0.1.

Table A.3: Summary statistics by treatment status and gender of individuals

	Male		Female	
	Control	Treatment	Control	Treatment
Age cate 1	0.3	0.2	0.3	0.2
	(0.5)	(0.4)	(0.5)	(0.4)
Age cate 2	0.2	0.3	0.2	0.3
	(0.4)	(0.4)	(0.4)	(0.4)
Age cate 3	0.2	0.3	0.2	0.3
	(0.4)	(0.5)	(0.4)	(0.5)
Age cate 4	0.3	0.2	0.3	0.2
	(0.5)	(0.4)	(0.5)	(0.4)
Total population	696711.2	768415.0	704157.1	778603.2
	(610146.5)	(862738.5)	(621554.7)	(878750.8)
Female (%)	49.6	49.5	49.6	49.5
	(1.9)	(1.6)	(1.9)	(1.6)
Muslim (%)	99.0	99.2	99.0	99.1
	(1.9)	(1.9)	(2.1)	(2.1)
Share of agriculture in employment (%)	62.0	66.4	61.2	65.7
	(21.5)	(20.2)	(21.7)	(20.4)
Share of industry in employment (%)	8.7	9.4	8.9	9.6
	(7.1)	7.9	(7.2)	(8.0)
Female literacy rate at birth year	23.6	28.3	23.9	28.9
	(17.0)	(19.7)	(17.2)	(19.9)
Male literacy rate at birth year	50.9	55.6	51.1	56.1
	(20.3)	(19.2)	(20.4)	(19.3)
Number of kids per school	26.4	36.7	26.3	37.5
	(21.5)	(29.4)	(22.6)	(31.0)
Number of kids per teacher	8.4	12.5	8.3	12.6
	(8.5)	(10.5)	(9.0)	(11.2)
Number of schools	612.4	582.3	613.3	584.9
	(355.0)	(349.1)	(357.7)	(352.9)
Teacher to school ratio	3.4	3.5	3.4	3.6
	(2.2)	(2.9)	(2.3)	(2.9)
Females' share in teachers (%)	7.5	7.0	7.6	7.1
	(4.3)	(4.8)	(4.3)	(4.9)

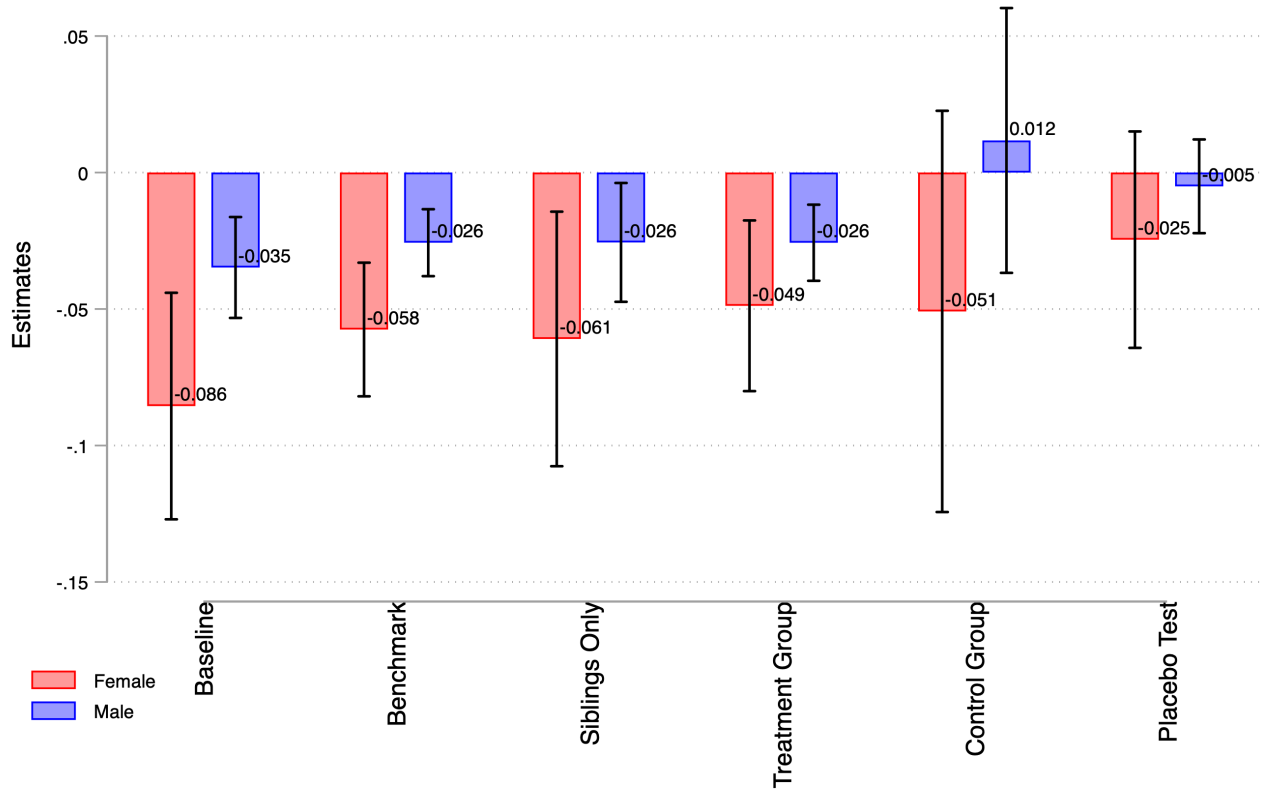
Mean and standard deviations are reported. The numbers in parentheses reflect their standard deviations.

Figure A.1: Balance test



Notes: Each coefficient is from a separate regression where observable characteristics are regressed on fasting duration and its interaction with the dummy showing whether the cohorts are in treatment or control group. Estimates are obtained after controlling for province- and year-fixed effects. Standard errors are clustered at the province level. The estimated coefficients are represented by bars and reported to the right side of the spikes, which display the estimates within a 95% confidence interval.

Figure A.2: Main results with another educational outcome: Being able to read and write in Turkish



Notes: This figure presents the results of separate regression analyses where each of them shows the estimated effects of fasting duration on females and males' probability of being literate. The estimated coefficients are represented by bars and reported to the right side of the spikes, which display the estimates within a 95% confidence interval.

Table A.4: Treatment assignment and migration decisions

	Outcome: Being an immigrant			Outcome: Completed primary school		
	Unrestricted sample			Non-immigrants only		
Immigrant definitions:	Immigrant-I	Immigrant-II	Immigrant-III	Immigrant-I	Immigrant-II	Immigrant-III
Panel A: Sample, Female individuals						
Fasting duration (std)	-0.0162	-0.0141	-0.0182	-0.0476***	-0.0469***	-0.0590***
	(0.0107)	(0.0106)	(0.0227)	(0.0153)	(0.0152)	(0.0141)
Observations	2,586,074	2,586,074	388,116	1,818,015	1,836,365	2,444,296
R-squared	0.0818	0.0826	0.4760	0.3733	0.3732	0.3319
Panel B: Sample, Male individuals						
Fasting duration (std)	-0.0168	-0.0155	0.0227	-0.0303***	-0.0296***	-0.0240***
	(0.0124)	(0.0123)	(0.0172)	(0.0082)	(0.0082)	(0.0071)
Observations	2,759,765	2,759,765	578,901	1,792,312	1,809,927	2,553,866
R-squared	0.1016	0.1026	0.5019	0.2225	0.2226	0.1983
Year & Province FEs	Yes	Yes	Yes	Yes	Yes	Yes
Time-variant covariates	No	No	No	Yes	Yes	Yes

Notes: Standard errors are clustered at the province X birth-cohort level (N=4,941). *Immigrant-I* reflects whether the individual lives in a different province than their birthplace. *Immigrants-II* refers to individuals who live outside the historical boundaries of their birth province. *Immigrants-III* defines immigrants from the information on birth and residing places of their parents. The first three columns' results are obtained relying on Equation 1 whereas the rest relies on Equation 2. *** p<0.01, ** p<0.05, * p<0.1.

Table A.5: Robustness checks-I: Clustering standard errors and weighting estimates

Panel A: Female individuals. Outcome: Completed primary school or higher									
	Analytical weighting			*Frequency weighting*			*Clustered at district x birth-year level*		
	Overall	Control	Treatment	Overall	Control	Treatment	Overall	Control	Treatment
Fasting duration (std)	-0.0609***	0.0348	-0.0503***	-0.0609***	0.0348	-0.0503***	-0.0608***	-0.0432	-0.0433***
	(0.0139)	(0.0813)	(0.0174)	(0.0139)	(0.0813)	(0.0174)	(0.0129)	(0.0407)	(0.0162)
Observations	2,579,614	516,386	2,063,228	51,592,280	10,327,720	41,264,560	2,579,666	815,700	1,763,966
R-squared	0.3370	0.3927	0.3225	0.3370	0.3927	0.3225	0.3370	0.3980	0.3091
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Locality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Personal characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Demographic characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
School characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

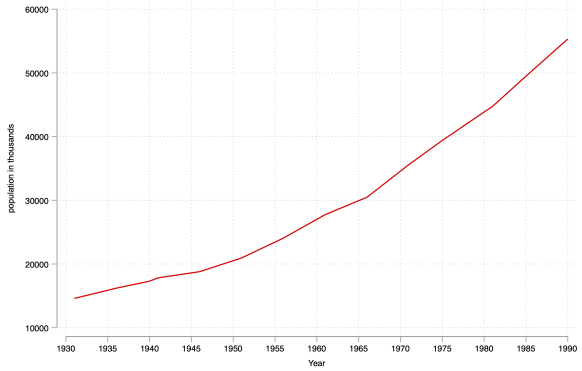
Panel B: Male individuals. Outcome: Completed primary school or higher									
	Analytical weighting			*Frequency weighting*			*Clustered at districtxbirth-year level*		
	Overall	Control	Treatment	Overall	Control	Treatment	Overall	Control	Treatment
Fasting duration (std)	-0.0278***	0.0168	-0.0339***	-0.0278***	0.0168	-0.0339***	-0.0278***	0.0030	-0.0278***
	(0.0071)	(0.0583)	(0.0082)	(0.0071)	(0.0583)	(0.0082)	(0.0070)	(0.0252)	(0.0081)
Observations	2,752,684	555,549	2,197,135	55,053,680	11,110,980	43,942,700	2,752,752	855,806	1,896,946
R-squared	0.1964	0.2566	0.1723	0.1964	0.2566	0.1723	0.1964	0.2420	0.1668
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Personal characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Demographic characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
School characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Standard errors are clustered at the province x birth-cohort level except the last column. In the last column they are clustered at district x birth-cohort level. The number of clusters in this case is equalivant to 8,149. *** p<0.01, ** p<0.05, * p<0.1.

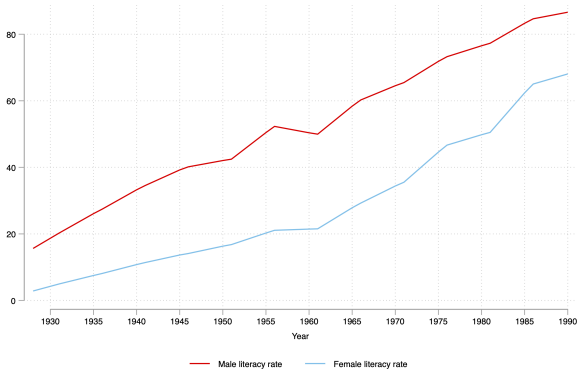
Data Appendix

Figure B.1: Statistics on demographic characteristics

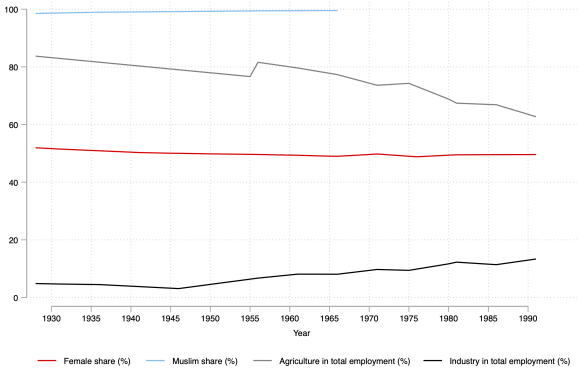
(a) Total Population



(b) Literacy rates by gender

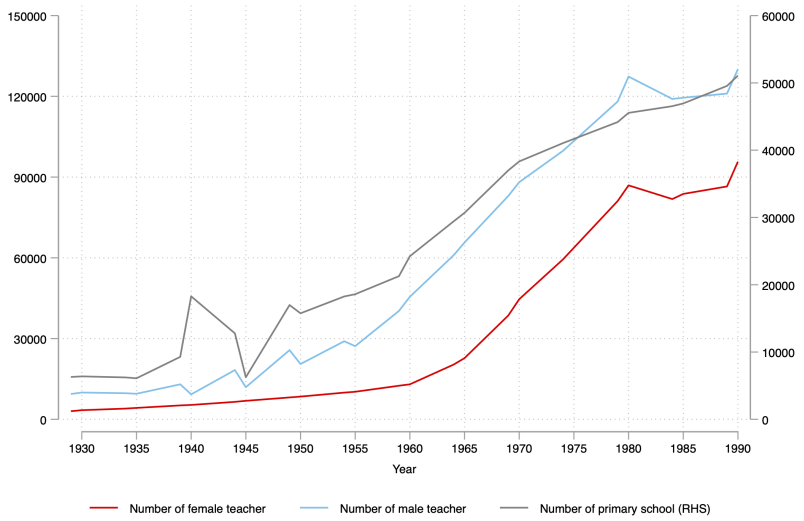


(c) Gender, religion, and employment Statistics



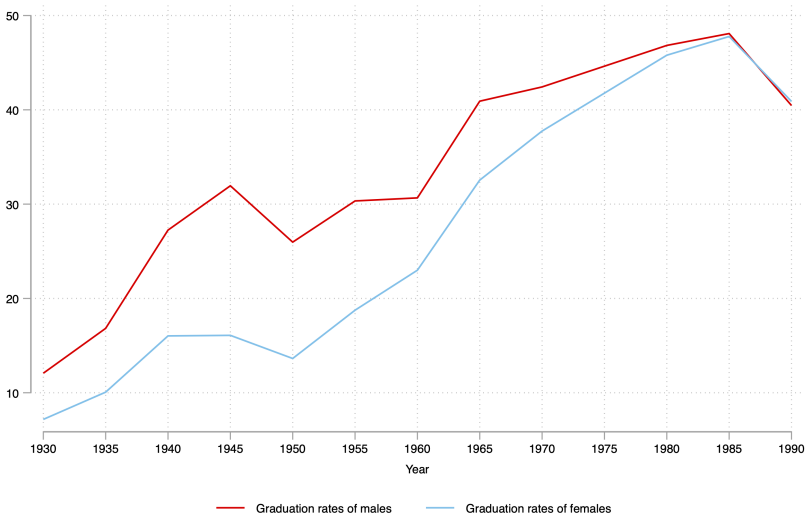
Source: Turkish census results on social and economic characteristics of the population collected in 1927, 1935, 1940, 1945, 1950, 1955, 1960, 1965, 1970, 1975, 1980, 1985, and 1990 (IUM, 1928, 1929, 1937b, 1944, 1950b; DIE, 1961a,b, 1969b,c, 1974, 1982, 1984, 1989, 1993b); Livny (2020). **Notes:** The statistics presented here, except the total population, reflect the arithmetic average of province-level rates calculated for each census year. The statistics on the prevalence of Muslims are no longer collected after the 1965 census year. **Definitions:** Total population refers to the population size in the census year. The shares of Muslims and females refer to their proportion in the total population. Sectoral share of agriculture and manufacturing in the total employment are presented here. Literacy rates refer to the percentage share of literates in the population above 6.

Figure B.2: Statistics on school characteristics



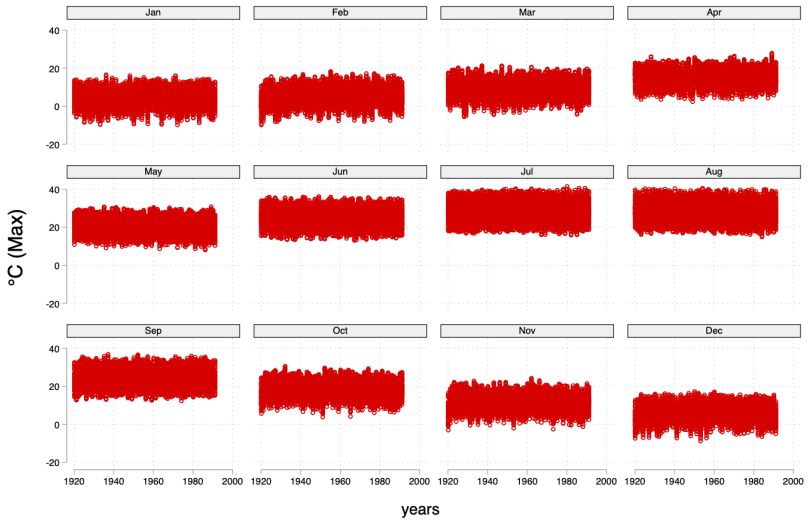
Source: National Education Statistics for the following school years: 1927-1930, 1929-1930, 1930-1931, 1934-1935, 1939-1940, 1944-1945, 1945-1946, 1949-1950, 1950-1951, 1954-1955, 1955-1956, 1959-1960, 1960-1961, 1964-1965, 1965-1966, 1969-1970, 1970-1971, 1974-1975, 1979-1980, 1980-1981, 1984-1985, 1985-1986, 1989-1990, 1990-1991 (IUM, 1933, 1935, 1937a, 1942, 1943, 1947a,b, 1950a, 1953; DIE, 1963, 1965, 1967, 1969a, 1977a,b, 1981, 1983, 1986, 1987, 1991, 1993a). **Definitions:** The statistics indicate the total number of female and male teachers working in primary schools and the total number of primary schools in the years from 1930 to 1990. **Notes:** The statistics for primary schools are presented on the right side of the y-axis.

Figure B.3: Statistics on graduation



Source: National Education Statistics for the following school years: 1927-1930, 1929-1930, 1930-1931, 1934-1935, 1939-1940, 1944-1945, 1945-1946, 1949-1950, 1950-1951, 1954-1955, 1955-1956, 1959-1960, 1960-1961, 1964-1965, 1965-1966, 1969-1970, 1970-1971, 1974-1975, 1979-1980, 1980-1981, 1984-1985, 1985-1986, 1989-1990, 1990-1991 (IUM, 1933, 1935, 1937a, 1942, 1943, 1947a,b, 1950a, 1953; DIE, 1963, 1965, 1967, 1969a, 1977a,b, 1981, 1983, 1986, 1987, 1991, 1993a). **Definitions:** The statistics indicate the ratio of female and male students who have achieved to be in the last grade of primary education without repeating any grade.

Figure B.4: Monthly maximum temperatures of provinces in 1920-1990



Source: CHELSAcrut. **Notes:** The CHELSAcruts dataset provides the global monthly maximum temperatures dating back to 1901. I calculate the maximum temperature experienced for each province and each month by using the mid coordinates of province polygons obtained from 2000's GIS file of IPUMS-International.

Table B.1: Regression results on the effects of sunlight duration and maximum temperature experienced during Ramadan

	Female	Male
Fasting duration	-0.051648**	-0.047037***
	(0.020906)	(0.009726)
Temperature	-0.000885*	0.000778***
	(0.000470)	(0.000266)
Temperature X Temperature	0.000017	-0.000033***
	(0.000019)	(0.000011)
Observations	1,763,966	1,896,946
R-squared	0.309116	0.166788
Year FE	Yes	Yes
Province FE	Yes	Yes
Personal characteristics	Yes	Yes
Demographic characteristics	Yes	Yes
School characteristics	Yes	Yes

Notes: The results are obtained relying on the model expressed in Equation 3. The first and second columns show the effects for girls and boys on their probability of completing primary school, respectively. Standard errors are clustered at the province x birth-cohort level. *** p<0.01, ** p<0.05, * p<0.1.