



Impacts of religion on sex selection in Vietnam

Tien Manh Vu ¹ · Hiroyuki Yamada²

Received: 22 December 2023 / Accepted: 3 July 2024

© The Author(s), under exclusive licence to Springer Science+Business Media, LLC, part of Springer Nature 2024,

Abstract

We examine whether religion influences sex-selection behavior under a persistent son preference. Specifically, we investigate whether religion promotes a different sex ratio among children under 5 years of age and whether religiosity has externalities on secular households, using whole-population census data and religious establishments in Vietnam. The results show that the ratio of boys is lower among religious households in both commune fixed effects and the instrumental variable (IV) approach. Furthermore, using the 1955–1974 North–South Vietnam division that reallocated religious communities for another commune-level IV, we find that a higher pious follower ratio leads to a lower ratio of boys in the secular population.

Keywords Religion · Religiosity · Sex ratio · Sex selection · Vietnam

JEL codes J13 · J16 · N35 · Z1

1 Introduction

Sex selection leads to a skewed sex ratio (SR) at birth¹ and distorts economic outcomes. A skewed SR increases competition in the marriage market, and affects the savings motive, labor supply, and personal consumption (Grossbard, 2015). A skewed SR continues to be seen in many countries with a son preference², including

✉ Tien Manh Vu
mvu264@g.chuo-u.ac.jp

¹ Faculty of Global Management, Chuo University, Tokyo 192-0393, Japan

² Faculty of Economics, Keio University, Tokyo 108-8345, Japan

¹ The United Nations (1958) defines SR as the “ratio of the number of one sex to that of the other.” The ratio of males to females is commonly reported, although in India, the reverse is reported for children aged 0–6 years. SR is also known as the number of boys per 100 girls born in the same cohort. SR normally accounts for live births but not for stillbirths. In practice, counting the sexes from a population census among children aged <1 year (sometimes 0–4 years) is the most common proxy for SR at birth. The calculation assumes that the crude death rate is the same between sexes.

² The preference is just for a son (Vu, 2014; Almond et al., 2019).

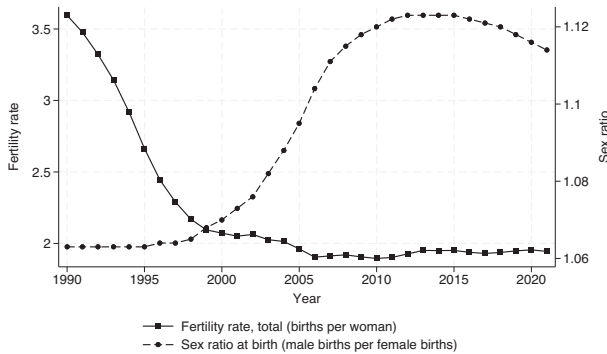


Fig. 1 Fertility rate and sex ratio at birth in Vietnam during 1990–2021. *Note:* Data are from the World Bank (The fertility rates are from <https://api.worldbank.org/v2/en/indicator/SP.DYN.TFRT.IN?downloadformat=excel>. The sex ratios are from <https://genderdata.worldbank.org/data/download/zips/sex-ratio-at-birth-male-births-per-female-births.zip>)

China (Almond et al., 2019) and Vietnam (Haughton & Haughton, 1995; Vu, 2014), despite recent progress in the economic development. Vietnam is ranked 31st in the world in terms of “economic participation and opportunity” for women, according to the 2022 Global Gender Gap Report³ after two decades of high (6.5% annually)⁴ economic growth rate. However, the report places Vietnam near the bottom, at 141st among 146 countries, in terms of the “health and survival” of women, mainly because of its high SR at birth, rather than differences in “healthy life expectancy.” As shown in Fig. 1, the SR remains persistently high (above 1.05), while the fertility rate is rather stable at about 2 over the last two decades.

Parents who engage in sex selection do so because of a son preference or for superstition. Reasons for a son preference include kinship institutions, Confucianism, and income (old age support and wage differences) (Das Gupta et al., 2003; Almond et al., 2019). Parents with a son preference might attempt both prenatal and postnatal methods of selection in order to avoid the undesired gender. The availability of ultrasound devices to predict fetal sex further facilitates the skewing of SR at birth (Chen et al., 2013). However, parents who cannot identify the sex of the fetus might commit infanticide or neglect their daughters, thereby decreasing her probability of survival after birth. Similarly, superstitious parents may prefer one gender or the other depending on the year in the Chinese Zodiac in order to avoid bad fortune (Do and Phung, 2010; Yamada, 2013), despite the lack of empirical evidence for such a linkage (Yamada, 2013).

Sex selection has received much research attention in the economies of large populations such as India and China (Das Gupta et al., 2003). In particular, Jayachandran (2017) suggested that a skewed SR might be a consequence of a son preference combined with a low fertility rate if parents can identify and manipulate the sex of the fetus as they try to keep a small family size. Family planning policies such as China’s One Child Policy can put an upper limit on the total number of

³ Source: <https://www.weforum.org/publications/global-gender-gap-report-2022/>.

⁴ Source: <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=VN>.

children per couple, giving couples an incentive to manipulate the sex of their child, even at first parity. However, this argument cannot explain well the skewed SR in cases where the fertility rate is well above the substitution level (i.e., 2.1 per woman).⁵

Previous studies found a skewed SR, which is evidence of sex selection, even before the widespread availability of ultrasound devices. Using the 1901 Census of India for Punjab, West Bengal, and Madras, Chakraborty and Kim (2010) found SR skewedness by region, caste, and religion. Similarly, Babiarz et al. (2019) found the SR in China during 1960–1987 was skewed before the introduction of ultrasound devices. The facts on persistent sex selection suggest a gap in the literature on behavior over a longer period of time from the perspectives of culture and religion.

Despite the importance of SR in societies with a son preference, prior research on the association between religion and SR is scarce. Becker et al. (2021) asserted that inadequate economic research has been conducted on non-Abrahamic religions. Iyer (2016) questioned whether religions in Asia, particularly Hinduism and Buddhism, would have the same or different impact from those in Northwest European countries and the US. Chung (2007) analyzed 6348 women in South Korea and Almond et al. (2013) investigated Southeast Asian migrants to Canada. Both studies showed that people with a religious affiliation had different attitudes toward abortion for the purpose of selecting their child's sex compared with non-affiliated people. The differences between the two groups might be the result of social norms or a religious preference (de la Croix & Delavallade, 2018; Bessey, 2018). However, the characteristics of migrant populations tend to differ from those of the main populations, in both the origin and destination countries.

Previous studies on religion and sex selection have revealed some limitations. First, most of these studies assumed an exogeneity regarding religion, which can be characterized as a debatable assumption. The differences between religion and secularism are not merely a matter of belief. For example, religion is associated with higher fertility, irrespective of region, as reported in studies on East Asia (Bessey, 2018), Vietnam and other Southeast Asian countries (de la Croix & Delavallade, 2018), India (Bhalotra et al., 2021), Europe and North America (DeRose, 2021), and the US (Mosher et al., 1992). Also, the differences can be other socio-economic characteristics such as ethnicity, education, and wealth. Second, the distribution of religious followers is not random across regions but is likely to follow geographical paths based on the historical introduction and development of those religions in the country. Third, societies with a son preference consider the sex of the fetus in decisions concerning fertility (i.e., both secular and religious individuals might abort a fetus of the unwanted gender). Fourth, religious followers and secularism might interact with each other.

Therefore, our study is an attempt to investigate the impact of religion, particularly Buddhism, on the willingness to engage in sex selection. This investigation uses the share of boys among children under the age of 5 years as a proxy for SR. We examine whether the share of boys in religious households is lower than secular households in Vietnam. In addition, we examine whether there is a close link in the

⁵ Particularly, as seen in period 2000–2020 in Fig. 1, the argument cannot explain the case of Vietnam when the fertility rate is relatively stable and close to 2.

share of boys between religious and secular households within a level 4 administrative unit (having an area of 1.99 km² and an average population of 458 people). We also distinguish pious followers from those with other religious affiliations for the major religions in Vietnam.

Specifically, we attempt to overcome the abovementioned issues using data on Vietnam's entire population in 1999 and a unique shock—the 1954 Geneva Accords. The shock divided the country into North and South during 1955–1974. Over the following 300 days after the Accords, a mass migration of religious households occurred. Compared with the previous period, North and South Vietnam applied different religious policies independently and separately during 1955–1974. Thus, the shock as well as the North–South differences in religious development may be useful for identifying a causal relationship between religion and the share of boys. Specifically, we link the 1999 Vietnam Population and Housing Census (hereafter, population census) and the 2007 Establishment Census, which embedded census records of religious establishments, including its date of establishment, and contained historical traces of religious development in each region. The population census provides information regarding religions and sexes.

Our analyses are at the household and commune levels.⁶ First, using 5.5 million households with commune (level 3 administrative unit) fixed effects, we estimate the differences in the SR proxies of different types of households regarding how (geographically) close they are to pious and moderately religious households. We also apply the instrumental variable (IV) approach suggested by Iyer (2016) and Gruber (2005) for household-level analyses. Second, we analyze commune-aggregated data and propose an IV approach for the corresponding religious variables. For each commune, we consider interactions between the number of religious establishments built during 1955–1974 and North–South differences for the construction of the IV.

Our study reveals some notable evidence. The share of boys among children under 5 years of age is lower in religious households than in secular households. The results hold regardless of the roles of the religious followers in the households. The difference is more pronounced among pious households. In addition, using the IV approach, we find that where the pious ratio among religious communities, particularly Buddhists, is high, the share of boys among children aged 0–4 in the commune is lower. This relationship also holds for the share of boys among children aged 0–4 in the secular population of the commune.

Many economic theories can potentially explain the results. First, the club goods model of religions (Iannaccone, 1992) might explain the differences between religious followers and secular people. Joining the “club” may work as an insurance measure. Thanks to the internal insurance within the club, followers might not need a boy to secure support for their old age or to worship them when they pass away. Furthermore, where commitments are at a high level, social pressure would dissuade sex selection, thereby maintaining the share of boys among religious households at close to the natural ratio.

⁶ In 1999, Vietnam was divided into 61 provinces (level 1), 614 districts (level 2), 10,474 communes (level 3), and about 166,490 sub-commune units (level 4). On average, level 4 (3) has an area of 1.99 (31.6) km² and a population of 458 (7287) people.

Second, the secularization hypothesis has potential to explain but probably does not work in the context of Vietnam. As reviewed by Iyer (2016), the hypothesis is that if wages are high, the cost of religious attendance should also be high. Meanwhile, when income is high, households might have less desire for a boy as an old-age support measure. If so, we should expect a positive relationship between the pious ratio and the share of boys in the secular population, which is the opposite of the estimation results.

Religious teachings on killing may provide an alternative explanation. A common value (precept) across the major religions in Vietnam is that killing is a sin. Historic canon laws of the Catholic Church (such as Canons 1398 and 1983) are strictly against abortion and punish violators with excommunication. Similarly, Buddhism strongly opposes abortion. Lecso (1987) and Florida (1991) noted that under the teachings of Buddhism, human life begins when sperm, egg, and consciousness are combined. Thus, the first precept—I observe, refraining from killing any living beings—applies to the fetus.

In addition, the outreach of religious followers and the involvement of religious elites in the local village's governance and activities might also explain the externalities to secular people regarding sex-selection decisions. Where the religiously affiliated portion of the population is high, religious leaders and religious elites would participate in and/or influence the village's administration. Also, by performing outreach at places such as orphanages as well as health, educational, and professional training facilities, the religious population would influence to the local secular population.

Our study contributes to the literature in four ways. First, it is among the rare analyses of the impact of religion and religiosity, particularly Buddhism, on SR using whole-population data and IV approaches. These data enable analyses at the regional and micro level with sufficient statistical predicting power. Second, our analyses at the household and commune levels are complementary and suggest a causal relationship as well as externalities—an impact from the religious (pious) community to local secular households. Third, our study is the first to explore the rare shock on the country's religions (which led to the reallocation of religious followers and changed policies on religions), and this approach can be applied to other future studies. Finally, our study provides evidence for the devolution of religion under suppression. McCleary and Barro (2019) hypothesized that without a sufficient community of religious leaders and followers, suppression leads to a generational loss in doctrines, beliefs, and practices.

The remainder of this paper is as follows. The data and main variables are described in “Data”; the identification strategy is explained in “Methods”; “Results” presents our results; and “Conclusions and discussions” discusses the mechanisms and concludes our study.

2 Data

The 1999 Vietnamese Population Census and Housing is our main data. The population census was conducted by the General Statistics Office of Vietnam (GSO) on April 1, 1999. The census covered the entire population of 76,323,173 people and

had a unique question regarding religiosity, asking whether an individual follows a specific religion (one of the six, listed in A.9). If the answer was “yes”, a follow-up question asked whether they had participated in a formal religious ritual. Specifically, the phrases/terms used to refer to this ritual in the questionnaire were “taking refuge” (“lễ quy y” in Vietnamese) for Buddhism and “baptism” (“lễ rửa tội” in Vietnamese) for Catholicism. We use this concept to construct two variables: *follower* (if an individual was a member of an organized religion) and *pious follower* (if they had also participated in such religious rituals). We define individuals who did not choose any of the six given religions as *secular*. We acknowledge that *secular* might include followers of minor religions not listed in the questionnaires. Moreover, “*pious*” is appropriate because, after participating in the ritual, followers are expected to dedicate themselves to the religion and its precepts.⁷

We link the population census with the 2007 Establishment Census, using commune identity. In the 2007 Establishment Census, the GSO collected information on the 28,066 religious establishments operating as of June 2007. The data contain the name of the establishment, the location (commune), and year of establishment. We count the total number of establishments per commune by the year of establishment in order to construct the instrumental variables as well as other necessary variables.

We aggregate data at the household and commune levels. From a census of 5,756,416 households having 7,172,242 children aged 0–4 years⁸ in 1999, we remove 5053 households where the children are coded as the household head⁹ or where the relationship to the household head is missing. We also exclude 244,850 households without information on education. Finally, we use the data on 5,506,513 households with a total of 6,817,728 children in 10,474 communes for the analyses. Furthermore, after removing 1153 communes without any followers of the six major religions, those missing geographic information, and those in Quang Tri province,¹⁰ 6250 communes remain for analysis. The corresponding statistical descriptions are provided in A.8 and A.9.

We count the sexes of individuals aged 0–4 years at the household and commune levels. The outcome is the share of boys among children aged 0–4 years at the commune and household levels, $Share(b)$.¹¹ We also subtract the number of children of religious households from the denominator and numerator to form another share of boys among children aged 0–4 years of secular households in the commune,

⁷ Pious followers are not necessarily ordained staff such as monks/priests. For example, the refuge in Buddhism has different levels, and most followers do not reach a level as high as a Buddhist monk.

⁸ This age cohort most likely lives with their parents.

⁹ The children might not have parents/adults living with them or they were orphans.

¹⁰ Quang Tri province lies on the 17th parallel north that divided Vietnam into North and South. We removed the province for the identification strategy using IVs. In addition, the only available shape file at the commune level is that corresponding with the year 2015. Accordingly, some old communes corresponding to the 1999 population census were missing geographical information.

¹¹ $Share(b) = \text{number of boys} / (\text{number of boys} + \text{number of girls})$. Boys and girls were both under 5 years of age and resided in the same household/commune. The means of $Share(b)$ did not immediately indicate skewed SR. One should refer to the corresponding confidence intervals.

$Share(b_s)$. The choice of the 0–4-year age range is made to neutralize variation in SR in auspicious years¹² as well as to account for postnatal sex selection and neglect. Thus, $Share(b)$ captures any sex selection and can be a proxy for SR.

We construct measures of religion and religiosity at the commune and household levels. At the commune level, we define the *pious ratio* as the ratio of pious followers to the total number of followers per commune. We specify the *pious ratio* for specific religions whenever possible. At the household level, we use the religion of the household head as the household's representative religion. Among households having at least one religious member, only 10.14% of the household heads are not religious. We find no households having two religions in the data. Within a commune (level 3 administrative unit), we set corresponding dummies to distinguish among five types of households: (A1) pious households;¹³ (A2) moderately religious households located within the same area (level 4 administrative unit) as A1; (A3) moderately religious households living in a different level 4 administrative unit than in A1; (A4) secular households near A1–A3 in the same level 4 administrative unit; and (A5) the rest of the secular households in the commune. We illustrate the five types of households in the figure in A.2.

3 Methods

We perform analyses on the differences in $Share(b)$ at both the household and commune levels. In addition, we use the share for secular population ($Share(b_s)$) in commune-level analyses.

3.1 Household level

We investigate the differences among households regarding religious identity (religiosity), using commune fixed effects, and apply an instrumental variable approach. First, we examine the following reduced-form equation at the household level using commune fixed effects and commune clustered robust standard errors.

$$Share(b) = Share(boy/children)_{ij} = \beta_1 \cdot religion_i + \beta_2 \cdot nearby_i + \beta_3 \cdot X_i + \mu_j + \varepsilon_{ij} \quad (1)$$

Two main dummies are *religion* and *nearby*. The *religion* dummy is 1 for religious household and 0 otherwise. β_1 indicates the $Share(b)$ differences—that is, the SR between religious and secular households. Thus, a statistically significant β_1 does not necessarily denote an association with (a causation of) skewed SR in the country.¹⁴ We also specify six dummies corresponding to six specific recorded religions. The dummy

¹² The SR may vary in Vietnam depending on whether it is an auspicious year for males or females, as determined by cultural superstitions (Do & Phung, 2010).

¹³ If the household head is a member of an organized religion, we consider the household a religious household. However, if no one belongs to an organized religion, we consider the household a secular household. In addition, the 1999 Vietnamese population census contained a unique question to classify religious followers into pious followers or other followers.

¹⁴ Correlation is not always causation. Also, implicitly letting religious households have a “normal” sex ratio is a strong assumption.

nearby becomes 1 if it is a secular household i located in a level 4 administrative unit (in Vietnamese, “tổ dân phố”/“cùm”/“thôn”/“xóm”/“ấp”/“khóm”) where there is at least one religious household (*nearby* corresponds with the A4 group mentioned in the previous section). When $nearby = 1$, the secular and religious households are geographically close to one another. A level 4 administrative unit is just 1.99 km² and has an average population of 458. The commune fixed effect (μ_j) captures all time-invariant characteristics within a commune (the average area of a commune is 31.62 km²), including access to health care, infrastructure, quality of the local education system, and availability of religious services. Also, X_i is a vector for household control variables, including average household educational level and the square of that value, dummies for co-residing generations, dummies for gender and ethnicity of the household head, dummy for public worker,¹⁵ and dummy for co-residing children aged 5–9 years. We also report an alternative specification without any controls (X_i) in all corresponding estimations for robustness checks.

We define *religion* based on the religion of the household head. We also detail three types of religious households within the level 4 administration unit according to their geographic residence. Using the above pious information from the household head, religious households are divided into A1 (with a pious head), A2 (without a pious head but located near A1), and A3 (households other than A1 or A2). The differences among coefficients of A1, A2, A3, and A4 may suggest positive externalities to the baseline (secular households) by geographic proximity. Also, we perform the examination under the condition that any household member is a follower (*any member as follower*).

Second, because the religion of the household head or any household member is endogenous, we apply an IV approach at the household level. We use an IV suggested by Iyer (2016) originating from Gruber (2005) for dealing with the endogenous variable. Measuring the supply density of the religious market, the IV is the share of (pious) followers in the population ($area4population_m$) of the level 4 administrative unit, m , namely, $dfollower_{ikm}$ and $dpiousfollower_{ikm}$. The share is specified to each household i and the household's religion k . All households' information such as the number of followers ($hfollower_{ikm}$) within the household and the household size ($household\ size_i$) should be excluded to form the share as follows.

$$dfollower_{ikm} = (follower_{km} - hfollower_{ikm}) / (area4population_m - household\ size_i) \quad (2)$$

Here, $follower_{km}$ is the number of followers of religion k in the level 4 administrative unit (m). Similarly,

$$dpiousfollower_{ikm} = (pious\ follower_{km} - hpiousfollower_{ikm}) / (area4population_m - household\ size_i) \quad (3)$$

Iyer (2016) suggested that the follower rate shows the influences of the religious community to the specific household. The larger the religious community, the stronger the influence. The reverse causality is least likely, while $dfollower_{ikm}$ can only impact the $Share(b)$ via matched $religion_i$ of the religious household. Thus, we

¹⁵ Parents working in the public sector faced harsh punishment for violating the two-child limit (Decision 162 of the Council of Ministers in 1988). Thus, they had greater incentive to engage in sex selection.

use specification (1) for the second stage. The commune (level 3 administrative unit) fixed effects are also included. Meanwhile, using similar controls as in (1), the main estimation in the first stage is as follows.

$$religion_i = \gamma_1 \cdot d_{follower_{ikm}} + \gamma \cdot X_i + \vartheta_j + \omega_i \tag{4}$$

3.2 Commune level

Household-level methods involving an IV approach have a shortcoming; that is, the resident sorting of followers might be endogenous. Followers may have flocked to a certain area (shown in A.5–7) rather than randomly scattering throughout the country. To account for this issue, we use an IV approach for the commune-level data.

Specifically, we aim to estimate the impact of the pious ratio on the share of boys aged 0–4 years at the commune level (the second stage) for commune population ($Share(b)$) or for the secular population ($Share(b_s)$). We use the *pious ratio* instead of counting the proportion of ordinary followers among the commune population. This is because the ratio denotes the piousness or quality of practicing the religion’s code of ethics. The second stage is

$$Share(b) = Share(boy/children)_c = \alpha_{1c} \cdot \widehat{pious\ ratio}_c + \alpha_{2cn} \cdot X_{cn} + \epsilon_c \tag{5}$$

where X_{cn} is a vector of commune characteristics, namely, the average education of the selected population and the square of that value, the average rainfall during 1950–1998, the elevation in 1996, the cropland ratio in 1992, and the population density per square kilometer in 1999. Average daily rainfall data are from historical records kept by the nearest weather station during 1950–1998, specifically, the Daily (Weather) Summaries by the US National Oceanic and Atmospheric Administration (NOAA). We obtained the average elevation from the United States Geological Survey Earth Resources Observation and Science Center (USGS EROS)’s Landsat Imagery in 1996. The cropland ratio is from the 1992 Global Land Cover Characterization from USGS EROS.

The ratio can influence the $Share(b)$ ($Share(b_s)$) via several channels. First, the ratio can alter or keep the share as it is thanks to pious followers loyal to their codes of ethics. The closer to 1 the ratio is, the more likely the religious population would adhere to the codes. Secondly, a pious population might transfer the codes to their family members and nearby households more consistently via role modeling and performing activities such as charity in the local community without converting people in the community to their religion.

In the first stage, we estimate:

$$Pious\ ratio_c = \gamma_{1c} \cdot North_c + \gamma_{2m} \cdot South_c + \beta_{cn} \cdot X_{cn} + \theta_c \tag{6}$$

$North_c$ ($South_c$) is the interaction between the density of religious establishments built during the 1955–1974 period per 1000 commune people (1999 population) with the North (South) dummy.¹⁶ The North–South division was based on the 17th

¹⁶ We also generate $Before1955_c$ which is the density of religious establishments established before 1955 per 1000 people in commune c . This variable could be either (a) included as a control in the main specification or (b) used as another IV. In both cases, our main results do not qualitatively change. These results are available upon request.

parallel north, chosen by the 1954 Geneva Accords.¹⁷ Because the 17th parallel north overlaps with the present-day Quang Tri province, we follow Miguel and Roland (2011) and exclude all communes in Quang Tri in the prior the estimations.

We have several arguments to justify the choice of the IVs, $North_c$ and $South_c$. First, religions can influence $Share(b)$ ($Share(b_s)$) only through their religious establishments and monks or priests as the intermediaries. The two variables would play a role in the supply intensity of the religion market. The intensity should be for the generation preceding that of the present-day parents, which is close to the suggestions for a specific IV on religions from Iyer (2016) and Gruber (2005). The present-day parents cannot decide the establishment (timing) of religious facilities because the facilities were built before 1975. Were that the case, they would have had to be at least 18 years old in 1974 (or over 44 by 1999). However, 95% of parents¹⁸ with children aged 0–4 years were 44 years of age or younger in 1999.

Second, the 1954 Geneva Accords, which were negotiated in Geneva, Switzerland from April 26 to July 20, 1954, was a shock. The negotiations took place beyond the control of the Vietnamese people, who would have been the grandparents and great-grandparents of children aged 0–4 years in 1999.

Third, although the Accords marked the start of chaos at the grassroots level, the North (South) during 1955–1974 deployed different policies towards (specific) religions compared with the time period before the Accords. Immediately after the Accords, mass flows (about 600,000 or 65%) of Catholics moved to the South (Vaupot, 2019).¹⁹ Meanwhile, the mostly secular communists moved to the North. The influx of followers increased the demand for religious activities in the South, as shown in Fig. 2 and in A.3. The differences in regional distribution between pre-existing (prior 1955 Geneva Accords) religious establishments and newly established ones during 1955–1974 are significant (see Fig. 2 and A.5–A.7). At the commune level, statistical correlations are small: 0.068 between the density of religious establishment prior 1955, $before1955$ and $North_c$; and 0.0005 between $before1955$ and $South_c$.

Religious establishments built during 1955–1974 historically recorded what had happened to followers and reflected the geographical development of religions. During that period, the North promoted atheism and loyalty to communism. The National Front, the main wing of the Communist Party, united all religions under their aim “for national salvation.” Willaime (2010) noted that the North Protestant Mission statutes read, “[The] Protestant mission is to teach believers in patriotism...in respect to people’s authorities and under the laws of the

¹⁷ The 17th parallel was chosen for the partition line and to define the demilitarized zone at the Geneva Conference (April 26–July 20, 1954, in Switzerland) by representatives of various sides, including the China, France, the State of Vietnam, the Soviet Union, the UK, the US, and the Viet Minh. The Accords led to a 300-day period for the communists and associates to regroup to the North and the other side to the South, and for people to move freely across the line. The 17th parallel later became the effective line of division between North and South Vietnam during 1955–1974.

¹⁸ We calculate the age of the household heads who had a child aged 0–4 years in the Population Census. Only 5% of them were over 42, if counting only females.

¹⁹ Pope Pius XII issued a decree in 1949 that prohibited Catholics from following communism (Vaupot, 2019).

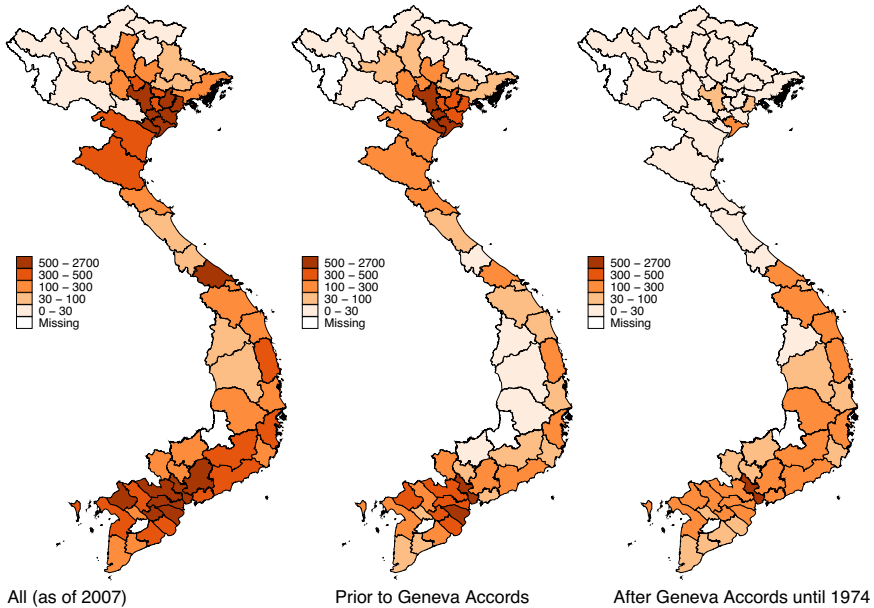


Fig. 2 Number of religious establishments by set-up timelines. *Note:* The figure does not reflect establishments that were no longer in existence by 2007. Missing areas were due to unavailable shape file corresponding to the year 1999

Democratic Republic of Vietnam.” Moreover, in 1959, land in the North belonged to the state. Thus, it was difficult to build a new religious establishment in the North. In contrast, private ownership of land was maintained in the South, which likely facilitated the growth of religious establishments during 1955–1974. In particular, during 1955–1963, the Catholic community in the South developed more quickly with the support of the Ngo Dinh Diem administration (SNIE, 1963).

These facts are reflected in the data. There were 4074 (488) newly built religious establishments in the South (North) during 1955–1974, accounting for about 35% (4.7%) of all religious establishments built in the South (North) by 1999. In contrast, during the 1504–1954 period, the number of religious establishments built in the South (North) was 5583 (7703).

The regional development of Catholicism and Buddhism during 1955–1974 differed from that before 1955. Although the Southern Highland (in Vietnamese: “Tây Nguyên”) was the last annexed territory of Vietnam, the number of newly built Catholic churches in that area from 1955 to 1974 significantly increased compared with the preceding period (see A.6). Similar to the correlation between *before1955* and *South_{it}*, the corresponding correlation between density of pre-1955 Buddhist (Catholic) establishments and the density of 1955–1974 Buddhist (Catholic) establishments was small, just 0.009 (−0.047) in the corresponding commune data. Similar correlations among corresponding variables in the North were 0.062 (Buddhism) and 0.031 (Catholicism).

4 Results

4.1 Differences in sex ratio across religious and secular households

We find that the share of boys among children aged 0–4 years is lower in religious households, as shown in Table 1. This result holds even after controlling for all time-invariant characteristics of the commune. The difference between religious and secular households is robust at about 0.0028 times lower, as shown in column 2 of Table 1. These results are consistent with those of Almond et al. (2013). Religious families are less likely to opt for sex selection. Moreover, when delving into specific religions, the difference is more pronounced and consistent in Catholic households (see columns 7 and 8 of Table 1). Also, we find a negative sign for *nearby* secular households. The p values are 0.18–0.23 for the specifications in columns 2, 4, and 8. However, one can argue that the location of religious households may coincide with locations having a low share of boys. Thus, we need to use an IV approach for the variable *religion*.

Our estimations using IV approaches produce consistent results. When the household head is a follower, the share of boys among children aged 0–4 years in the household is 0.003 times lower, while in the case of a pious household head, the impact is 0.005 times lower, as shown in columns (6) and (8) of Table 2.

4.2 Share of boys at commune level

First, we examine the correlations between the IVs and the pious ratio in Table 3. The positive correlations can be interpreted in a straightforward manner. The density of current followers is high where there are many religious establishments. The negative coefficient of *South* in Columns (1) and (2) of Table 3 can be explained as follows. We note that the Buddhists in the South were rooted in the Unified Buddhist Sangha of Vietnam (in Vietnamese: “Giáo hội Phật giáo Việt Nam Thống nhất,”) since 1963 during the North–South division period, while those in the North belonged to the Buddhist Sangha of Vietnam (in Vietnamese: “Giáo hội Phật giáo Việt Nam”) established in 1981 in the North. Buddhist Sangha of Vietnam is the only Buddhist association to be officially recognized by the Vietnamese government after reunification. This was perhaps an effort by the government to place all associations in the country (by law) under the control of the National Front—the main wing of the Communist Party. Where the number of southern Buddhist establishments increased during 1955–1974, their followers were likely to be loyal to the Unified Buddhist Sangha of Vietnam. Buddhists may have remained divided after the reunification in 1975. Those who were followers prior to 1975 may have resisted official rituals by the Buddhist Sangha of Vietnam. In addition, we acknowledge that pious followers might have migrated during the 1975–1999, either within the country or abroad (as refugees). This might have caused the different signs of the coefficients. However, because the establishments remained where they were, they would have accommodated such correlations.

Second, the results show lower shares of boys in communes having a higher pious ratio, as Table 4 illustrates in the second stage. Specifically, a 1% increase in the pious ratio is associated with a 0.000197 times lower share. This is equivalent to 1.43

Table 1 Share of boys among children aged 0–4 in the households

Variables	(1) Share(b)	(2) Share(b)	(3) Share(b)	(4) Share(b)	(5) Share(b)	(6) Share(b)	(7) Share(b)	(8) Share(b)
Head as religious follower								
A. All kinds		-0.0036*** (0.0008)						
A1. Pious follower				-0.0035*** (0.0009)				
A2. Follower nearby pious ones				-0.0027** (0.0011)				
A3. Other followers than A1 and A2				-0.0023 (0.0016)				
Any member as follower								
Buddhism								
Catholicism								
Protestantism								
Islam								
Caodaism								
Hoahaotism								
A4. Nearly secular households	-0.0009 (0.0006)	-0.0008 (0.0006)	-0.0008 (0.0006)	-0.0008 (0.0006)	-0.0003 (0.0006)	-0.0003 (0.0006)	-0.0008 (0.0006)	-0.0007 (0.0006)
Other controls	No	Yes	No	Yes	No	Yes	No	Yes
Commune fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of communes	10,474	10,474	10,474	10,474	10,474	10,474	10,474	10,474
N (Households)	5,506,513	5,506,513	5,506,513	5,506,513	5,506,513	5,506,513	5,506,513	5,506,513
R ²	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002

We used (all kinds) religion of the household head to construct the corresponding religion variables in (4). Other controls include average household education and the square of that value, dummies for number of generations, dummies for gender and ethnicity of the household head, dummy for public worker, and dummy for co-residing children aged 5–9. Robust clustered standard errors at commune level were in parentheses (*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$)

Table 2 Impacts of religion and religiosity on the share

Variables	OLS (1) <i>Share(b)</i>	IV 2nd stage (2) <i>Share(b)</i>	OLS (3) <i>Share(b)</i>	IV 2nd stage (4) <i>Share(b)</i>	OLS (5) <i>Share(b)</i>	IV 2nd stage (6) <i>Share(b)</i>	OLS (7) <i>Share(b)</i>	IV 2nd stage (8) <i>Share(b)</i>
Head as religious follower								
A. All kinds	-0.0029*** (0.0007)	-0.0042*** (0.0013)			-0.0022*** (0.0007)	-0.0030*** (0.0013)		
A.1. Pious follower			-0.0026*** (0.0006)	-0.0054*** (0.0018)			-0.0019*** (0.0006)	-0.0049*** (0.0018)
Other controls	No	No	No	No	Yes	Yes	Yes	Yes
Commune fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of communes	10,474	10,474	10,474	10,474	10,474	10,474	10,474	10,474
N (Households)	5,506,513	5,506,513	5,506,513	5,506,513	5,506,513	5,506,513	5,506,513	5,506,513
<i>Underidentification test</i>								
P-value		0.0000		0.0000		0.0000		0.0000
<i>Weak identification test</i>								
Kleibergen-Paap rk LM statistic		1.0e+05		7024.785		8.7e+04		6953.693

Other controls include average household education and the square of that value, dummies for number of generations, dummies for gender and ethnicity of the household head, dummy for public worker, and dummy for co-residing children aged 5–9. Robust clustered standard errors at commune level were in parentheses (***) $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 3 Correlations between IVs and pious ratio

Variables	All religions		Buddhism	
	Pious ratio (1)	Pious ratio (2)	Pious ratio (3)	Pious ratio (4)
Religious establishment density established during 1955–74				
<i>North</i>	0.5030*** (0.0609)	0.2572*** (0.0493)	0.9222*** (0.1185)	0.6516*** (0.1079)
<i>South</i>	-0.4944*** (0.0593)	-0.3402*** (0.0499)	-0.6035*** (0.1001)	-0.5500*** (0.0889)
Other controls	No	Yes	No	Yes
N (Communes)	6,250	6,250	5,150	5,150
R ²	0.064	0.286	0.047	0.190

All communes of Quang Tri province were excluded. Robust clustered standard errors at district level were in parentheses (** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$). Other controls are average education of the selected commune population and the square of that value (for (3) and (4), they are the education of Buddhists), 1950–1998 average rainfall, 1996-elevation, 1992-cropland ratio, and population density per km²

Table 4 Impact of pious ratio on the boy share

Variables	All religions		Buddhism	
	OLS <i>Share(b)</i> (1)	IV <i>Share(b)</i> (2)	OLS <i>Share(b)</i> (3)	IV <i>Share(b)</i> (4)
Pious ratio	-0.0005 (0.0010)	-0.0197*** (0.0052)	-0.0021** (0.0009)	-0.0120*** (0.0042)
Other controls	Yes	Yes	Yes	Yes
N (communes)	6250	6250	5150	5150
R ²	0.009		0.011	
<i>Weak identification test</i>				
Kleibergen-Paap Wald rk F statistic		74.81		75.68
<i>Over-identification test</i>				
P-value		0.5510		0.7755

All communes of Quang Tri province were excluded. IV approach used two-step generalized method of moments and robust standard errors. OLS used robust clustered standard errors at district level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Other controls are average education of the selected commune population and the square of that value (for (3) and (4), they are the education of Buddhists), 1950–1998 average rainfall, 1996-elevation, 1992-cropland ratio, and population density per km²

fewer boys in a typical commune having 7287 people—the average population in a commune in the census. The F-statistics and over-identification test supports the validity of the IVs.

In addition, we note that the pious ratio has much room for growth. For example, the pious ratio in the Buddhist community was 51.3% in the North and 13.6% in the South, as calculated in A.9; thus, the impact of pious ratio must be significant.

Third, we investigate the share of boys in the secular population of communes in Table 5. The results show a negative association between the pious ratio (particularly in Buddhists) and the share of boys in the secular population of the commune. Also, the F-statistics of the first stage and the over-identification test results support the validity of the IVs. An increase of 1% in the pious ratio would be associated with a 0.000088 lower share of boys. This would be about 0.64 boys in the secular population of 7287 people, which is approximately 45% of the association found among Buddhists.

5 Conclusions and discussions

We have examined whether religious households have a different share of boys among children aged 0–4 years and whether pious households influence the share of boys in nearby secular households. We found that religious households have a lower share compared with secular households. A high pious ratio in a commune would link to a lower share of boys in the commune, even among the secular population.

Our results suggest that codes of ethics may transfer both within households and from household members to outsiders in the local community and that pious followers, particularly Buddhists, play a role in such transmission. Specifically, the externality via geographic proximity might explain a possible mechanism. We show a lower share of boys among children aged 0–4 years in 1999 in religious households compared with secular households. The results suggest that the practice of ethics would transfer from one individual to other household members. We also find that secular households located in geographic proximity to a religious household have a slightly lower share of boys, with only a 0.18–0.23 error probability. In the IV approach, *pious ratio* would be associated with a lower *Share(b)*, and even *Share(b_s)* of the secular population. *Pious ratio* reflects the proportion of followers who had studied and met certain conditions or passed a code of ethics tests. Therefore, the evidence might suggest a transfer from religious precepts to followers, from followers to their household members, and from their households to localities. The transfer from households to localities is made possible by social interactions, backed by religious outreach in the community. The original data on 28,066 religious establishments include religious charity organizations, orphanages, and organizations supporting the disabled, homeless, and elderly.

However, we acknowledge several drawbacks, which provide directions for future research. First, we were able to analyze only Buddhism, rather than every religion, including the many unrecorded folk religions in Vietnam. More research must be conducted that considers different contexts other than Vietnam. Second, the pious ratio works only with specifications using all religions or only Buddhism.²⁰ Should a better proxy for religiosity become available, it will be included in our research

²⁰ Due to differences in religious variation by region and data limitations, we can apply the IV approach to specifications using all religions or only Buddhism. Muslim, Cao Dai, and Hoa Hao communities concentrate to some southern communes, which makes the IV approach impossible. Meanwhile, few Protestant establishments were built in the North during the 1955–1974 period. The constructed pious ratio of Catholics is almost 1 everywhere (see number of Catholics and pious Catholics in A.9). This is because the questionnaire used the word “baptism” to classify Catholics.

Table 5 Impact of pious ratio on the boy share of seculars

Variables	All religions		Buddhism	
	OLS	IV	OLS	IV
	$Share(b_s)$	$Share(b_s)$	$Share(b_s)$	$Share(b_s)$
	(1)	(2)	(3)	(4)
Pious ratio	-0.0027 (0.0021)	-0.0137* (0.0078)	-0.0023** (0.0010)	-0.0088** (0.0044)
Other controls	Yes	Yes	Yes	Yes
N (communes)	6250	6250	5150	5150
R ²	0.005		0.010	
<i>Weak identification test</i>				
Kleibergen-Paap Wald rk F statistic		74.81		75.68
<i>Over-identification test</i>				
P-value		0.6549		0.6233

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

agenda. Finally, we had to assume only minor internal/international migration between 1975 and 1999, in line with Miguel and Roland (2011).

Supplementary information The online version contains supplementary material available at <https://doi.org/10.1007/s11150-024-09721-w>.

Acknowledgements We are grateful to Shoshana Grossbard, Daiji Kawaguchi, and Charles Yuji Horioka as well as the participants of the 2020 Autumn Meeting of the Japanese Economic Association, the 2022 Australasia Meeting of the Econometric Society, and the 2023 International Symposium on Household Economics at Kobe University for their helpful comments and suggestions.

Author contributions All authors contributed to the conception and design of the study. Material preparation, data collection, and analysis were performed by Tien Manh Vu. The first draft of the manuscript was written by Tien Manh Vu and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Funding This work was supported by JSPS (Japan Society for the Promotion of Science) KAKENHI Grant Numbers 18K12784, 18K01580, 19H00619, 20H01506, and 21K01455 as well as project grants from the Asian Growth Research Institute, Chuo University, Kyushu University, and Keio Gijuku Academic Development Funds.

Compliance with ethical standards

Conflict of interest The authors declare no competing interests.

References

- Almond, D., Li, H., & Zhang, S. (2019). Land reform and sex selection in China. *Journal of Political Economy*, 127(2), 560–585. <https://doi.org/10.1086/701030>.
- Almond, D., Edlund, L., & Milligan, K. (2013). Son preference and the persistence of culture: Evidence from South and East Asian immigrants to Canada. *Population and Development Review*, 39(1), 75–95. <https://doi.org/10.1111/j.1728-4457.2013.00574.x>.
- Babiarz, K. S., Paul, M., Shige, S., & Grant, M. (2019). Population sex imbalance in China before the one-child policy. *Demographic Research*, 40, 319–358. <https://doi.org/10.4054/DemRes.2019.40.13>.
- Becker, S. O., Rubin, J., & Woessmann, L. (2021). Religion in economic history: a survey. In *The Handbook of Historical Economics*, Alberto Bisin and Giovanni Federico eds. Academic Press: Elsevier.
- Bessey, D. (2018). Religion and fertility in East Asia: Evidence from the East Asian social survey. *Pacific Economic Review*, 23(3), 517–532. <https://doi.org/10.1111/1468-0106.12209>.
- Bhalotra, S., Clots-Figueras, I., & Iyer, L. (2021). Religion and abortion: The role of politician identity. *Journal of Development Economics*, 153, 102746. <https://doi.org/10.1016/j.jdeveco.2021.102746>.
- de la Croix, D., & Delavallade, C. (2018). Religions, fertility, and growth in Southeast Asia. *International Economic Review*, 59(2), 907–946. <https://doi.org/10.1111/iere.12291>.
- DeRose, L. F. (2021). Gender equity, religion, and fertility in Europe and North America. *Population and Development Review*, 47(1), 41–55. <https://doi.org/10.1111/padr.12373>.
- Chakraborty, T., & Kim, S. (2010). Kinship institutions and sex ratios in India. *Demography*, 47(4), 989–1012. <https://doi.org/10.1007/BF03213736>.
- Chen, Y., Li, H., & Meng, L. (2013). Prenatal sex selection and missing girls in China: Evidence from the diffusion of diagnostic ultrasound. *Journal of Human Resources*, 48(1), 36–70. <https://doi.org/10.1353/jhr.2013.0003>.
- Chung, W. (2007). The relation of son preference and religion to induced abortion: The case of South Korea. *Journal of Biosocial Science*, 39(5), 707–719. <https://doi.org/10.1017/S0021932007001988>.
- Das Gupta, M., Zhenghua, J., Bohua, L., Zhenming, X., Chung, W., & Hwa-Ok, B. (2003). Why is son preference so persistent in East and South Asia? A cross-country study of China, India and the Republic of Korea. *Journal of Development Studies*, 40(2), 153–187. <https://doi.org/10.1080/00220380412331293807>.
- Do, Q.-T., & Phung, T. D. (2010). The importance of being wanted. *American Economic Journal: Applied Economics*, 2(4), 236–253. <https://doi.org/10.1257/app.2.4.236>.
- Florida, R. E. (1991). Buddhist approaches to abortion. *Asian Philosophy*, 1(1), 39–50. <https://doi.org/10.1080/09552369108575334>.
- Grossbard, S. (2015). *The marriage motive: a price theory of marriage. How marriage markets affect employment, consumption and savings*. New York, Heidelberg, Dordrecht, London: Springer. <https://doi.org/10.1007/978-1-4614-1623-4>.
- Gruber, J. H. (2005). Religious market structure, religious participation, and outcomes: Is religion good for you? *The B.E. Journal of Economic Analysis and Policy*, 5(1), 0000101515153806371454. <https://doi.org/10.1515/1538-0637.1454>.
- Haughton, J., & Haughton, D. (1995). Son preference in Vietnam. *Studies in Family Planning*, 26(6), 325–337.
- Iannaccone, L. R. (1992). Sacrifice and stigma: reducing free-riding in cults, communes and other collectives. *Journal of Political Economy*, 100(2), 271–92. <https://www.jstor.org/stable/2138608>.
- Iyer, S. (2016). The new economics of religion. *Journal of Economic Literature*, 54(2), 395–441. <https://doi.org/10.1257/jel.54.2.395>.
- Jayachandran, S. (2017). Fertility decline and missing women. *American Economic Journal: Applied Economics*, 9(1), 118–139. <https://doi.org/10.1257/app.20150576>.
- Lecso, P. A. (1987). A Buddhist view of abortion. *Journal of Religion & Health*, 26(3), 214–218. <https://doi.org/10.1007/BF01533122>.
- McCleary, R. M., & Barro, R. J. (2019). *The wealth of religions: The political economy of believing and belonging*. Princeton University Press. <https://doi.org/10.2307/j.ctvc775c4>.
- Miguel, E., & Roland, G. (2011). The long-run impact of bombing Vietnam. *Journal of Development Economics*, 96(1), 1–15. <https://doi.org/10.1016/j.jdeveco.2010.07.004>.
- Mosher, W. D., Williams, L. B., & Johnson, D. P. (1992). Religion and fertility in the United States: New patterns. *Demography*, 29(2), 199–214. <https://doi.org/10.2307/2061727>.

- SNIE. (1963). The situation in South Vietnam. *The Pentagon Papers*, 2, 729–733. <https://www.mtholyoke.edu/acad/intrel/pentagon2/doc125.htm>.
- United Nations (UN). (1958). *Multilingual demographic dictionary, ST/SOA/Ser. A/29*. New York: United Nations, Dept. of Economic and Social Affairs.
- Vaupot, S. (2019). The relationship between the state and the church in Vietnam through the history of the Society of Foreign Missions of Paris. *Bogoslovni Vestnik*, 79(3), 825–36. <https://doi.org/10.34291/BV2019/03/Vaupot>.
- Vu, T. M. (2014). One male offspring preference: Evidence from Vietnam using a split-population model. *Review of Economics of the Household*, 12(4), 689–715. <https://doi.org/10.1007/s11150-013-9183-z>.
- Willaime, J. P. (2010). Le Vietnam au défi de la diversité Protestante. *Social Compass*, 57(3), 319–31. <https://doi.org/10.1177/0037768610375516>.
- Yamada, H. (2013). Superstition effects versus cohort effects: is it bad luck to be born in the year of the fire horse in Japan? *Review of Economics of the Household*, 11, 259–283. <https://doi.org/10.1007/s11150-012-9162-9>.

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor (e.g. a society or other partner) holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.