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Secularization and Low Fertility:

How Declining Church Membership Changes Couples and Their Childbearing

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Abstract

The impact of religion on family formation pattern and fertility is widely assumed to be of modest relevance in contemporary Western contexts. We argue that religious affiliation continues to play a significant role in social processes, and that secularization remains a driver of demographic trends. We examine the relationship between secularization and fertility decline in Finland from an individual and a couple perspective, amid a broader trend of declining birth rates in Western countries. We show that secularization can exert a self-reinforcing negative effect on fertility through an interplay of declining church membership, changing couple dynamics, and childbearing of religiously mixed and homogeneous couples. Using data from the Finnish administrative registers covering the period from 1995 to 2019, we are able to identify religious affiliation, as indicated by church tax payment in the secularized context of Finland. The analysis unfolds in two parts: first, we perform a demographic examination of the fertility trends of the religiously affiliated and unaffiliated groups; and, second, we use a dyadic perspective to explore the relationships between religious affiliation, couple composition, and the probability of having a first child. We conclude that the accelerated decline in church membership has contributed to the recent fertility decline. (200 Words)

***Keywords*—** Secularization, Fertility decline, Dyadic perspective, Family formation, Partner markets

1 Introduction

The contemporary declines in fertility to considerably below the replacement level across Anglo-Saxon, Nordic, and many Western European countries represent a noteworthy yet inadequately understood demographic shift (Hellstrand et al., 2021; Kearney et al., 2022; Matysiak et al., 2021; Ohlsson-Wijk and Andersson, 2022). In Finland, the setting of the empirical investigation in this study, the total fertility rate fell by 30% between 2010 and 2023, from 1.8 children per woman to a historic low of 1.26 children per woman (Official Statistics of Finland, 2024). The fertility decline in Finland was one of the most pronounced among high-income countries in this period, and was larger than the decreases in the other Nordic countries, such Sweden or Denmark, or in countries such as the US and the UK (United Nations Department of Economic and Social Affairs, 2022). These declines in the 2010s remain inadequately understood, given that they occurred across educational levels and geographic regions, and independent of migration background (Campisi et al., 2022; Hellstrand et al., 2024; Ohlsson-Wijk and Andersson, 2022). Evidence from Finland, Sweden, and the US suggests that this trend stems primarily from reductions in first-time childbearing among couples (Hellstrand et al., 2020, 2021; Kearney et al., 2022; Ohlsson-Wijk and Andersson, 2022). Fertility declines can impact population aging and the fiscal sustainability and economic growth of societies (Lee and Zhou, 2017; Preston et al., 2008), as well as climate change adaption and resource use (Jones and Warner, 2016; Molotoks et al., 2021; Scovronick et al., 2017). Moreover, the implications of substantial fertility declines extend beyond the demographic realms, and may indicate that social changes are occurring that lead to increasing constraints on the realization of desired fertility (Beaujouan and Berghammer, 2019).

The Nordic countries are often considered models of societal progress due to their low levels of socioeconomic inequality, relatively equal economic opportunities, universal and generous social security systems covering both the younger and older generations, and high levels of gender equality, and thus have often been regarded as examples demonstrating that societal development can be reconciled with relatively high fertility (Adserà, 2004; Esping-Andersen, 2009; McDonald, 1975; Myrskylä et al., 2009). However, the recent declines in fertility, notably in Finland, may cast doubt on the ability of the Nordic model to prevent fertility from declining to very low levels (Bergsvik et al., 2021). Furthermore, when fertility in the Nordic countries falls to levels below those of countries with other social models, for instance Portuguese level in 2023, the academic view of Nordic exceptionalism is called into question. It is essential to understand the reasons behind the declining birth rates and how modernization affects them. Previous research has identified many important sources of variation in fertility by studying race differences (Lichter et al., 1992; Tolnay, 1987), cohort effects and baby booms (Macunovich, 1998), regional variation (Estes, 1997; Işik and Pinarcioğlu, 2007), education and labor market change (Avellaneda and Dávalos, 2017; Brinton and Oh, 2019; Jalovaara et al., 2019), and the diffusion of fertility through social networks (Guldi and Herbst, 2015; Vitali and Billari, 2017). One line of research has focused on ideational change and social change as potential drivers of declining birth rates, including trends toward more materialism, secularism, individualism, and a focus on individual happiness (Han and Brinton, 2022; Lesthaeghe, 2020; Zaidi and Morgan, 2017).

Generally, secularization and religion are considered key factors in explaining long-term fertility trends and variation. Specifically, rapid changes in religious beliefs, teachings, and practices, including changes in levels of adherence to religious authorities and rapid religious disaffiliation, can affect family formation and childbearing patterns. Classic studies in demography by Coale and Watkins (1986) and by Goldschneider (1971) emphasized through theories and empirical evidence how secularism altered Western fertility patterns. More recent studies have confirmed the findings of these classical studies (Frejka and Westoff, 2008; Goldstein and Klüsener, 2014; Peri-Rotem, 2016). Blanc (2024) even suggested that secularization is the main driver of the historical fertility transition in France. However, few studies have addressed the role of religion in the marked fertility declines that have taken place in recent decades (Mogi et al., 2022; Schnabel, 2021). One potential reason for this loss of interest is the widespread assumption

that religion plays a limited role in explaining variation in individual and social phenomena in modern countries where the public role of religion is relatively minor. This research gap has persisted despite the evidence that in recent years, the pace of secularization has accelerated in many countries (Inglehart, 2021a). "[S]ince 2007, things have changed with surprising speed. From about 2007 to 2019, [...] 43 out of 49 [middle- and high-income countries] became less religious" (p. 212, Inglehart, 2021a; Voas and Chaves, 2016). For instance, in the United States, the proportion of individuals stating that religion is very important was high (56% to 58%) in the 2007-2013 period, but it fell rapidly thereafter, reaching a level of 41% in 2021 (Smith, 2021). UK census data suggest that an earlier and more rapid decline took place in the UK, where the proportion of individuals aged 20-59 who identified as unaffiliated rose from 17% in 2001 to 31% in 2011 and to 45% by 2021 (Office of National Statistics (ONS), 2022).

We hypothesize that the acceleration of secularization has played a significant role in the concurrent fertility declines across a number of high-income countries, and we test this hypothesis for Finland. We argue that this dynamic is driven by a self-reinforcing - a direct and a nonlinear - fertility reducing effect of secularization. The direct effect is well-established in the literature, and points to compositional change, i.e., the decline in the share of the religious group, who generally have higher fertility than non-religious individuals. However, the nonlinear effect, which is based on two propositions that are tested empirically in this study, has not been previously discussed. First, the probability of partnering with a person who does not have any religious affiliation is expected to increase as the proportion of the population with a religious affiliation declines. Moreover among the religiously affiliated who prefer to have a partner with the same religious beliefs, chances of partnering with a non affiliated individual or of remaining single increase as they are less likely to find a suitable partner. This is due to the shrinking pool of religiously affiliated potential partners in a country undergoing secularization. Second, such a change in the composition of couples is expected to reduce fertility, given that the fertility of non-religiously affiliated couples and religiously mixed couples is expected to be lower than that of religiously homogeneous couples. The combination of these two propositions is expected to result in a self-reinforcing negative effect of secularization on fertility, since it is not only the composition of the population with respect to religion that changes, but also the fertility of religious people, because they are more likely to be partnered with a non-religious individual. Our couple approach makes novel theoretical predictions that are not only different from those of an individual rational-choice perspective, but are also more comprehensive (Watts, 2014).

This study assesses the relationship between secularization and fertility in Finland in the period between 1995 and 2019 using Finnish administrative register data. We measure religious affiliation using church tax payments as an indicator of church membership. In the first part of the analysis, we assess the fertility of the religiously affiliated and unaffiliated at the population level using the total fertility rate (TFR). We compare longitudinally the TFR in both groups, and assess the impact of the changing population composition on the TFR over time using a counterfactual simulation. In the second part of the analysis, we measure the changing proportions of singles, and religiously mixed and homogeneous coresidential couples in the Finnish population. A strength of the study is the inclusion of cohabiting as well as married coresiding couples. By means of iterative proportional fitting (Breen and Salazar, 2010), we assess whether the changes over time in the composition of couples with respect to religiously affiliation were the result of the overall decline in religious affiliation. If secularization, i.e., declining church membership, also affects the size of the religiously affiliated partner pool, a decline in homogeneous religiously affiliated couples is expected to occur, *ceteris paribus*. In the third part of the analysis, we use discrete-time survival models to assess how the couple composition with respect to religious affiliation (i.e., church membership) is related to the probability of having a first birth. In particular, we assess the role of male and female religiosity separately, and examine how these characteristics interact in determining the probability of having a first birth.

This study makes the following contributions to the existing literature on fertility. First, our findings enhance our understanding of the recent declines in fertility in high-income countries. According to

our results, a substantial fraction of the so far unexplained decline in the TFR in Finland from 2010 to 2019 can be explained by the declining church membership in the country, which suggests that secularization is an important factor in the recent fertility declines. This study establishes a plausible individual-level mechanism linking these two macro-level trends. Second, the paper adopts a dyadic perspective in examining childbearing, acknowledging the importance of the joint decision-making of partners in this context (Emirbayer, 1997). Despite the repeated calls for more dyadic fertility research (Hutteman et al., 2013), this approach has, until now, remained largely unexplored with respect to religion. Third, our contribution extends the theoretical discourse on religion and fertility by introducing the concept of a self-reinforcing effect of secularization on fertility. This concept has previously been overlooked in the predominant one-sex focus of fertility research, yet it offers a novel dimension for understanding the intricate interplay of religion and fertility. Finally, our study makes innovative use of administrative register data, by measuring secularization by the cessation of state church tax payments. While acknowledging both the advantages and the limitations of this measure, we argue for its credibility given its modest measurement error compared to conventional survey-based measures (Brenner et al., 2023; Hout and Fischer, 2014; Lim et al., 2010).

2 Secularization, Couples, and Fertility Change

In this study, "*secularization* at the societal level is defined as the gradual distancing of a society from religious values and institutions, while at the individual level secularism refers to people's indifference for religious doctrine or beliefs" (p. 291, Skirbekk, 2022). This definition encompasses two important dimensions of secularization: values and institutions. The first dimension describes the change in the belief system, which becomes less dominated by an incisive religious paradigm. This dimension is rooted in the idea of secularization proposed by Max Weber (1922), who described it as the consequence of the differentiation of a society into different systems, i.e., science, art, and ethics which independently follow paths of rationalization. This process leads to the collapse of transcendent belief systems, e.g., *Entzauberung*. Evidence of this dimension of secularization is provided by surveys that demonstrate a continuing erosion in the belief in God or in a shared destiny (Inglehart, 2021a,b; Pollack, 2008). The second dimension of secularization pertains to the declining influence of religious institutions (*Église*), an idea that was originally introduced by Durkheim (1912). Following this line of thought, membership in religious institutions within countries is expected to decline gradually over time. This prediction is reflected in the declining numbers of religiously affiliated individuals in Western countries (Pew Reserach Center, 2017; Hackett et al., 2015; Skirbekk et al., 2010; Stonawski et al., 2015). Therefore, a central proposition of the secularization hypothesis is that alternative forms of beliefs and faith practices tend to emerge, as well as the decline in church membership (see for a review, Bruce (2002); Myers (1996); O'Brien and Noy (2015); Wilson (2013)).

The country we focus on in this study - Finland - is widely regarded as highly secularized. For instance, according to 2011 survey results, monthly church attendance in Finland fluctuates between 4% and 14%, and only 27% of the population believes in a Christian god (Taira, 2017). However, a substantially larger proportion of Finns belong to the Evangelical Lutheran state church. Official statistics indicate that 65% of the population was affiliated with a Christian denomination or the state church of Finland in 2022 (see Figure B.2 in the appendix). A similar cultural model has also been observed in other Nordic countries, which has even been described by the attitude of "believing in belonging" (Niemelä, 2015). At the same time, church membership is rare among those who identify themselves as non-religious. For instance, according to a survey conducted in 2015, 12% of these individuals reported belonging to the Evangelical Lutheran church and 2% reported belonging to another religious community (Taira et al., 2023). Given the relatively loose connection between church membership and religiousness *per se* in contemporary Finland, leaving the church may reflect, in addition to religious

beliefs, a tendency to have less traditional and more individualistic values overall (ibid.). In addition, the apparent contradiction of low religiousness alongside robust church membership can be understood by taking into account the strong civic role and the positive perception of the state church. The church is generally regarded as an institution that actively contributes to the public good. Moreover, church membership comes with some individual advantages. For instance, for a couple to be permitted having a church wedding or to baptize a child, at least one of the partners may have to belong to the church. Finally, church membership could even be considered part of the Finnish identity (Taira et al., 2023). These factors may have contributed to the state church's retention of a substantial membership base, despite the imposition of state church taxes, the church's polarizing conservative position regarding same-sex marriage, and the overall low level of religious practice in the country.

2.1 Religion and Fertility

Religiosity and membership in a religious institution can be related to fertility through several pathways (McQuillan, 2004; Skirbekk, 2022; Zhang, 2008). It should be noted that the different mechanisms are not mutually exclusive, and may also interact with each other in their impact on fertility. Furthermore, we are not describing the minority or the characteristics hypothesis as they do not apply to the present study (for a review of the other mechanisms, see Zhang, 2008).

First, the *particularized theology hypothesis* states that religions influence childbearing through the propagation and teaching of religious doctrines or customs regarding childbearing (Goldschneider, 1971). For example, some religions have developed moral codes or norms regarding reproductive behavior related to the use of contraception, extramarital sexual intercourse, and abortion (Agadjanian et al., 2009; Jerman et al., 2016). These rules affect the formation of couples and their sexual behavior, which may lead to fertility differences between religious groups. Moreover, Zhang (2008) showed that after controlling for denomination, religiosity, measured as the strength of religious beliefs, significantly affects childbearing. The author concluded that religion may guide general behaviors regarding partnership, sexuality, and life goals.

Second, while the particularized theology hypothesis emphasizes the significance of the propagated religious content, the *interactive hypothesis* highlights the importance of social interactions within communities that are distinguished by their religious beliefs. According to Bongaarts and Watkins (1996), social interaction relates to fertility via three distinct pathways: "the exchange of information and ideas, the joint evaluation of their meaning in a particular context, and social influence that constrains or encourages action" (p. 657, Bongaarts and Watkins, 1996). Religious communities form social networks that affect the dissemination of ideas, assess their significance, and influence action through the imposition of constraints or the encouragement of action (Bongaarts and Watkins, 1996). Consequently, religious groups exert a profound influence on reproductive behavior For instance, Goldstein and Klüsener (2014) demonstrated the role of the regional share of Catholics in the spatial spread of the fertility decline in Prussia.

In line with these expectations, existing studies point to a robust relationship between religious denomination and fertility in Finland (Kolk and Saarela, 2023). Using administrative register data, Kolk and Saarela (2023) documented substantial fertility differences across religious denominations, which are more pronounced for women than for men. Across all groups, the unaffiliated have the lowest fertility, with an average of 1.63 children. Among women, Muslims have the highest fertility (2.7 children), followed by other Protestants (2.1 children) and state-church members (two children). Therefore, the TFR gap between the unaffiliated and the state church members is approximately 0.37. Among men, the same groups as those for women have particularly high fertility, but other Protestants have the highest number of children, at about two children on average. It is noteworthy that the disparities in childlessness across religious denominations are more pronounced than the differences in overall fertility rates. Additionally,

research has demonstrated that religious beliefs are associated with higher fertility intentions in Finland (Finnäs, 1991; Miettinen and Paajanen, 2003) .

Hypothesis 1 (H1) *In a modern secularized society such as Finland, fertility remains higher among the religiously affiliated population than among the religiously unaffiliated population.*

2.2 Religion, Partnering, and Couples' Childbearing

In his seminal work, Peter M. Blau (1994; 1984; 1982) developed a theory of social structure that elucidates the genesis of relationships founded upon relative proportions within a population. He proposed that "structural constraints of size distributions affect marriage notwithstanding cultural values promoting ingroup marriages" (p. 45, Blau et al., 1982). The theory posits that minorities form a greater number of external ties than majorities due to their relatively smaller group size. As minority groups become smaller, the probability of interrelationships forming increases. Given that the proportion of the population that is religious declines as a result of secularization, this theory is pertinent to our investigation. Accordingly, the decline in the relative size size of this population implies an increase in the share of couples in which one partner is secular and the other is religious and a decline in the share of couples in which both partners religious. Therefore, secularization should have implications for the composition of couples within the population.

Hypothesis 2 (H2) *The diminishing share of religious individuals in the society increases the probability of a religious individual having a non-religious partner.*

We have outlined the mechanisms linking religion and childbearing from an individual perspective, although it should be taken into account that most childbearing decisions are made at the couple level (Hudde and Engelhardt, 2021; Rijken and Liefbroer, 2009; Vignoli et al., 2012). Given the persistence of gendered roles within households, which is often referred to as the stalled gender revolution, women still tend to do the major share of household chores and childcare (Cotter et al., 2011; England, 2010; Esping-Andersen, 2009; Goldscheider et al., 2015; Mattingly and Sayer, 2006). As women's lives are more directly affected by childbearing than those of men, women may have a greater say in childbearing within couples. Moreover, previous research indicates that the economic provision of the family is still more strongly associated with the domain of the male partner, whereas other categories may be more closely linked to the domain of the female partner (Stein et al., 2014). For instance, Vignoli et al. (2012) found that in Italy, the employment of the male partner is more important for fertility than the employment of the female partner. However, in the Nordic countries, the impact of economic characteristics is relatively similar across genders, which is likely attributable to the family-policies and cultures in these countries supporting a dual-earner model (Andersson and Scott, 2007; Jalovaara and Miettinen, 2013). The gender roles of partners in a Nordic country such as Finland tend to be more similar than those in most other countries, yet they remain differentiated to some extent. especially around the entry into parenthood (Grönlund et al., 2017; Kleven et al., 2019). Therefore, even in Finland, the religiosity of the female partner may have a more pronounced influence on the probability of having children than the religiosity of the male partner.

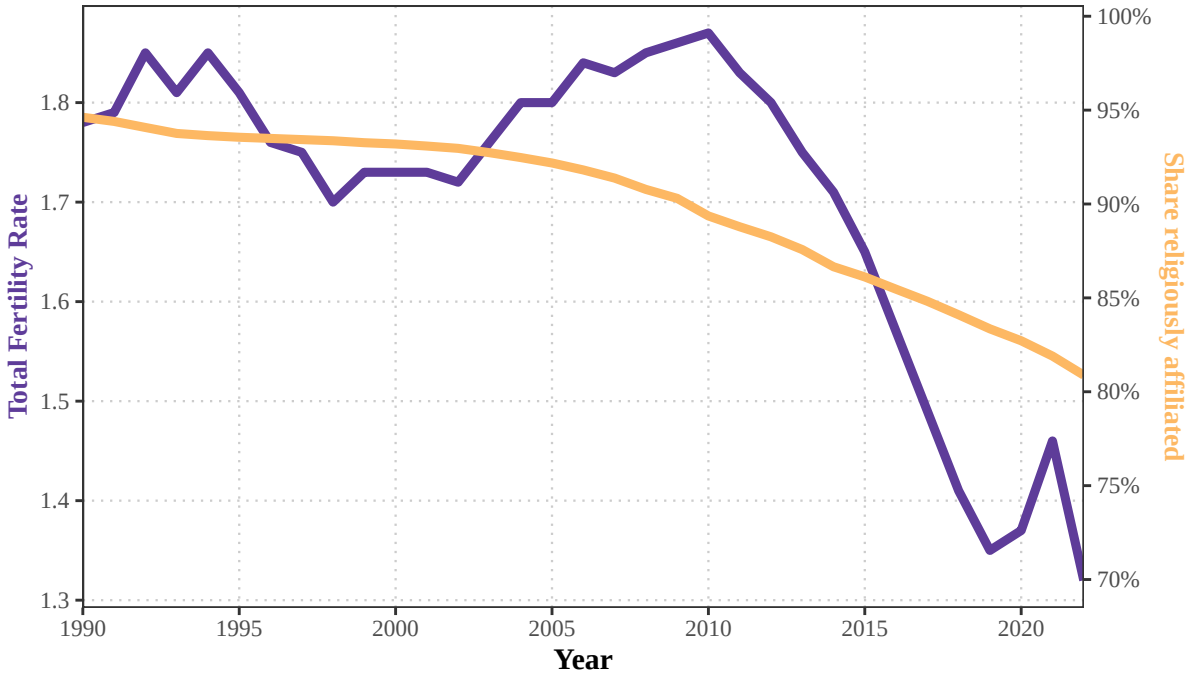
Hypothesis 3 *The religious composition of a couple affects their probability of transitioning to a first birth.*

Hypothesis 3.a (H3.a) *In a largely gender-equal society such as Finland, the religious orientation of both partners is equally important.*

Hypothesis 3.b (H3.b) *The religious orientation of the female partner has a stronger positive association with the couple's probability of having a child than that of the male partner.*

The religious affiliation of the male and the female partner may interact in their effects on childbearing, in addition to having independent effects. Because they share a significant aspect of life and beliefs, homogeneous couples may be more inclined to make long-term commitments, such as having a child. Holding similar beliefs may reduce the propensity of a couples to engage in conflict about significant matters, thereby increasing the quality and the stability of their relationship (Hudde and Engelhardt, 2021). Moreover, having a shared religious orientation might also influence a couple's religious observance. Holding similar beliefs may facilitate a couple's attendance at religious services, which could, in turn, intensify their commitment and increase their fertility. Furthermore, all of the mechanisms linking religion and fertility that operate at the individual level (see Section 2.1) may be mutually reinforcing in a homogeneous couple. This is because the partners' beliefs and practices are less likely to be a source of conflict, and are thus able to exert their full influence. Finally, when both partners are church members in a secularized context such as Finland, they are likely to have similar life values and orientations in a broader sense, which may facilitate their willingness to make long-term commitments.

Hypothesis 4 (H4) *In modern secularized countries, religiously homogeneous couples are more likely to have a child than religiously mixed and non-religious couples.*



Source: Data from Statistics Finland (2024).

Figure 1: This figure displays the total fertility rate (TFR) and the share of the religiously affiliated population in Finland in the 1990-2022 period. The purple line displays the TFR, and the purple-line's values are on the left y-axis. The orange line represents the share of the population who are members of a religious denomination, and the orange line's values are on the right y-axis. The data were obtained from Statistics Finland.

3 The Finnish Context

Figure 1 depicts the gradual decline in the proportion of the population who are religiously affiliated in Finland. Although the connection between church membership and religiousness is not particularly

strong in this context, as was previously discussed, the reduction in church membership over time is clearly reflected in self-reported religious identification. The proportion of Finns who report identifying as non-religious increased from 25% among cohorts born in the 1960s and 1970s to 34% among the Millennials, i.e., the cohorts born in the 1980s and 1990s who reached childbearing ages in the first two decades of the 2000s (Taira et al., 2023). This decline has been interpreted as reflecting, to some extent, a change in the cultural model prevalent in Nordic secularized countries, in which affiliation with the state church is important for reasons beyond purely religious motivations. The younger generations are more inclined to challenge the traditional model and are more likely to disaffiliate from the church if they do not adhere to a belief in God (Ibid.). Furthermore, non-religious individuals tend to embrace values that are less traditional and more individualized in general (Ketola and Salomäki, 2024; Taira et al., 2023). Such values may be characterized by a stronger inclination to seek fulfillment in life through avenues other than marriage and family formation.

In Finland, the number of church leavers has been exceptionally high since the beginning of the 2000s. This trend has been driven mainly by young adults born since the early 1980s (Niemelä, 2015). For instance, in 2011, 90% of 18-year-olds were church members, but 70% of women and 62% of men aged 27-30 were church members (ibid.). At age 25, roughly half of church members, but only 8% of church leavers, stated that they believe in God, which illustrates that the stayers are more religious than the leavers. In Finland, the non-state church members constitute a distinct group who hold strong secular beliefs (Saarela and Skirbekk, 2020). Among young adult Finns of today, the majority could be regarded as neither religious nor non-religious (Ketola and Salomäki, 2024). Rather their faiths tend to be "fuzzy" and religion is not important to them (see also Voas, 2008). The level of secularization has even progressed to the point that today's young Finns generally expect their peers today to be non-religious, which might, in turn, further accelerate cultural change (Ketola and Salomäki, 2024).

In Finland, a church tax is levied on members of the Evangelical Lutheran church, the Orthodox church of Finland, and Finnish German church at rates based on taxable income subject to municipal taxation.[1] The tax rates vary between 1% and 2.1% across parishes. Members can formally leave the church by mail or via a personal consultation at an administrative council, becoming exempt from the church tax in the following year.[2] The existence and the popularity of websites that translate a simple questionnaire into a termination note demonstrate the low barriers to leaving the church, which may have also contributed to the accelerated decline in church membership. [3] Nevertheless, studies have indicated that the primary motivations for individuals to leave the church in Finland are largely associated with the broader process of secularization within society, with the financial aspect representing a relatively minor factor (Lyytikäinen and Santavirta, 2013). Accordingly, Niemelä (2015) identified the most significant self-reported reasons for leaving the church among young adults in Finland as a lack of identification with the religious identity, a lack of belief in the teachings of the church, and a lack of personal meaning derived from the church as an institution.

Until recently, fertility in Finland was higher than that in many other European countries. In 2010, the TFR was 1.87 compared to 1.57 in the entire European Union. However, since 2010, the TFR has gradually fallen below 1.4, which is the record low for period fertility in Finland (see the purple line in Figure 1). The recent decline in fertility reflects further postponement of childbearing, but it may also result in forgone childbirths and a decline in the eventual numbers of children born to women and men in Finland - as well as in countries with comparable strong declines (Hellstrand et al., 2020). Importantly, it was found that reductions in first births accounted for the largest part of the decline in Finland and other Nordic countries (Hellstrand et al., 2021), which may lead to increases in eventual childlessness. Levels of childlessness are relatively high in Finland compared to those in other high-income countries (Jalovaara et al., 2019; Konietzka and Kreyenfeld, 2021). A fifth of women and more than a quarter of men born in the early 1970s in Finland have remained childless (Jalovaara et al., 2022).

While childbearing was strongly connected with marriage in the past, the connection is gradually weakening (Lesthaeghe, 2020; Lesthaeghe and Van de Kaa, 1986). In Finland, the share of all births

that are out of wedlock increased from 33% in 1985 to 45% in 2019, and the shares are larger in the case of first births (Hellstrand et al., 2021). Today, approximately two-thirds of first births are born to women in their first coresidential union (regardless of whether they are or are not married at the time of the birth), and more than 95% of births are to parents in any form of coresidential union (Andersson, 2023). One explanation for the trend is the institutionalization of cohabitation, which has led to a partial replacement of marriage (Rotkirch and Miettinen, 2017). Nonetheless, married couples continue to hold higher fertility intentions and more family-oriented attitudes than cohabiting couples. Hellstrand et al. (2021) studied the contribution of couple formation and couple childbearing to the recent fertility decline in Finland. Reductions in first births among cohabiting and married couples accounted for the largest share of the fertility decline. However, increases in dissolutions of coresidential unions and, to a lesser extent, decreases in union formation also had some effect. Rahnu and Jalovaara (2023) showed that entry into parenthood has declined substantially among partnered women born from the 1970s onward, while the risk of experiencing union dissolution has increased concurrently.

4 Data & Methods

The empirical analysis uses Finnish population and other registers for the period between 1995 and 2019. The data are a complete record of the registered population residing in Finland at the end of each year. The registered population overlaps strongly with the resident population, because being registered is legally required and essential for many daily purposes and processes. Therefore, the micro-level data can be aggregated to accurately estimate population level rates and shares. We restrict our sample to individuals living permanently in Finland who either were born in Finland or were born abroad with a Finnish background (95.83% of the total population). We do so, because our indicator for religious affiliation does not capture denominations beyond the state-church. Therefore, migrants, who are often members of other churches or religious denominations, would not be appropriately captured.

We infer religiosity from state church tax payments and municipality tax payments, which are included in the population income register, and indicate state church membership. People who do not belong to the state church are not obliged to pay the church tax. Therefore, people who did not pay any church tax, but who paid municipality income tax, are not members of the state church (p. 1184, Lyytikäinen and Santavirta, 2013). The amount of the church tax paid by church members varies across municipalities, but has an average rate of 2.5% of annual individual income, which is about 650€ (704.45 US-$ using conversion rates from 09.07.2024). There are several reasons for why this variable is a good indicator for religious affiliation. First, the state church tax involves monetary costs, which makes it a more objective assessment of religious affiliation than survey statements (Brenner et al., 2023; Hout and Fischer, 2014; Lim et al., 2010). Second, the income registers draw on high-quality, objective, and reliable information, which minimizes measurement error.

An inherent limitation of our measurement approach of religious affiliation is the challenge posed by imperfect classification, particularly with regard to a group of individuals who cannot be definitively categorized as either affiliated or unaffiliated. This ambiguity arises when individuals have made neither church tax payments nor municipality tax payments, rendering their religious affiliation indeterminate. Approximately 6% of our dataset falls into this category. Notably, this group has certain characteristics, including lower levels of education and income, and a higher incidence of single status compared to the overall population. To address missing values, we employed a step-wise procedure leveraging the available data. Initially, when an unidentified spell occurred for an individual with consistent information before and after that spell, we utilized the available information to impute their religious affiliation. This approach enabled us to impute more than 95% of the initially missing data points, with relatively weak assumptions. Subsequently, the remaining cases with missing information were excluded from the data set.

Fertility information was derived from the birth registers and the multigenerational registers containing the parent-child links for the entire population. We estimated the timing of births and number of births by linking the demographic information of the parent and the child to the multigenerational register. The difference between the birth year of the child and the birth year of the parent is used as the age at childbirth.

4.1 Demographic Analysis

The study examines the relationship between secularization and fertility in Finland. First, we investigate the temporal dynamics of religiosity across the population. For the 1996-2019 period, we estimate the annual share of the state church members in Finland of reproductive age. Second, we estimate the TFR for the affiliated and unaffiliated population and compare their trends over time. The TFR is a period measure of the average number of children a person would have if the fertility regime remained unchanged and the person survived through their reproductive period (Preston et al., 2008). We estimate the TFR separately for the two groups in Finland for the 1996-2019 period. As a means of ensuring the reliability of the results, we also estimate the male TFRs for both groups, given that the fertility indicators for men differ from those for women (Dudel and Klüsener, 2021; Schoumaker, 2019). Moreover, state-church membership might be selective with respect to sex (Xia et al., 2023). As illustrated in in Figure B.3 in the appendix, the religious groups exhibit a female-skewed sex ratio that appears to be relatively stable.

Second, we employ counterfactual simulation as a further means of quantifying the impact of declining church membership on the fertility rate in Finland (for details, see A.1). In the field of demography, counterfactual simulation is a methodology used to assess the contribution of a specific component, which is set to a hypothetical, counterfactual value, while the remaining components are included as they were observed. Consequently, the discrepancy between the observed and the counterfactual outcome serves to quantify the impact of the component that is being evaluated. We estimate the counterfactual TFR for the scenario in which the composition of the population with respect to state church membership and age remained constant over the entire observation period. If the model is correctly specified, any discrepancies between the observed and the counterfactual TFR can be attributed to changes in the population composition, i.e. secularization.

4.2 Couple Formation and Composition

The second part of the analysis examines the impact of secularization on couples. While most research has used an individual perspective to study the effect of secularization on fertility, the effect may also operate at the couple level, as was argued in Section 2. Furthermore, Section 3 demonstrated that the primary factor contributing to the recent decline in childbearing is the reduction in first-time childbearing among couples. This underscores the significance of considering the couple perspective, as previously highlighted by (Hellstrand et al., 2021).

First, we examine the change in the composition of couples and seek to ascertain whether a shift has occurred with regard to the religious affiliation of these couples. In order to investigate the effect of secularization on partner markets and couple formation, we quantify the composition of the population of reproductive age with respect to singlehood, and couple and partner choice with respect to religion over time. A nonparametric approach is employed to estimate population shares with respect to the interaction of union status and religion. The advantage of a nonparametric approach is that it reduces the risk of bias and captures sudden changes; however, this is at the cost of increasing variation in the estimate. The data are stratified by sex (men and women) and state church membership (members and non-members of a religious church). Using detailed register data [4], we categorize every person in the target population as 1) single, 2) coresiding (i.e., married or cohabiting) with a religiously unaffiliated person, or 3) coresiding with a religiously affiliated person. Given that the results might be affected by changes in the population

age structure, we employ age standardization as a means of ensuring the robustness of our findings (for details, see Appendix A.3).

Second, we examine whether the shrinkage of the religious opposite-sex partner pool contributes to changes in the composition of couples using iterative proportional fitting (IPF, for additional details on the algorithm, see A.4 or Breen and Salazar, 2010; Leesch and Skopek, 2023). We use IPF, which is an algorithm that scales a contingency table to a counterfactual contingency table that has a pre-defined marginal distribution. The algorithm is employed to estimate a counterfactual couple composition with respect to religious affiliation. This entails maintaining the distribution of the contingency table observed in the original year of 1995, while scaling the absolute numbers in accordance with evolving marginal distributions, such as the changing population distribution of religious affiliation among men and women. The method, however, assumes that partnering preferences with respect to religion remained constant (Breen and Salazar, 2010). The method is relevant for our example because it neutralizes the impact of changing preferences by holding them constant, and it quantifies the impact of the changing population distribution with respect to religious affiliation on couple composition, under the assumption that preferences remain unchanged. As a means of ensuring the robustness of the results, we conducted a simulation of random couple distributions, which yielded comparable outcomes while assuming no preferences, as opposed to constant preferences (for details on the matching algorithm, see Appendix A.5).

4.3 Regression Approach

Beyond describing the association between the declining share of the religiously affiliated population and the change in the couple composition, we also study the impact of couple composition on childbearing. We create a set of annual panel data on childless couples for the 1996-2019 period from the cohabitation, tax, population, and birth registers. The data processing is displayed in Figure B.5. Based on these data, we estimate the impact of couple composition with respect to religious affiliation on the transition to first childbirth in a discrete-time survival model using generalized additive models with a binomial outcome distribution (Hastie et al., 2009; Wooldridge, 2012). This model harnesses the ordering of events to identify the causal effect. The process-time is union duration in years, which is modelled with a smoothing spline that interacts with a smoothing spline for age at union formation to allow full flexibility in the hazard distribution (Ellison et al., 2022). The risk set contains all childless spells of coresidential unions (married or cohabiting) in the years between 1995 to 2019 for women aged 18 or older. Thus, some individuals may enter the risk set with different unions, and they might enter some time after the start of the union if it was formed before 1995. The outcome variable is the transition to the first birth. Reasons for right-censoring are union dissolution, death or out-migration of one of the partners, or the couple being childless at the end of the observation period, i.e., the year 2019. We include the religious affiliation of the woman, the religious affiliation of the man, and an interactive term to evaluate the impact on childbearing of all variations of couple composition.

$$log\left[\frac{P(Y_{i,t}=1)}{1-P(Y_{i,t}=1)}\right] = \beta_1 + \beta_2 religious^{f}_{i,t-1} + \beta_3 religious^{m}_{i,t-1} + \beta_4 religious^{both}_{i,t-1} + \boldsymbol{\beta_5 X}_{i,t-1} \quad (1)$$

where Y is the indicator for the occurrence of childbirth to couple i in year t, $religious^{f}_{i}$ is a dummy variable for the woman being a state church member, $religious^{m}_{i}$ is a dummy indicator for whether the man is a state church member, and $religious^{both}_{i,t-1}$ is the interaction of both partners being state church members. $\boldsymbol{X}$ is a matrix of control variables, including the income of the woman (quantile), the income of the man (quantile), education of the female and the male partner, the activity status of both partners, and whether the couple lives in an urban, semi-urban, or rural area. The data are summarized in Table C.5. We include the income of both partners as both are associated with childbearing, given the positive

gradient for both men and women in recent cohorts (Jalovaara, 2013; Vignoli et al., 2012). Education is found to be a key determinant of first childbirth in Finland as well, with positive gradients for both genders (Fasang and Raab, 2014; Jalovaara et al., 2019). Activity status is included to account for the negative impacts on childbearing of periods of unemployment and enrollment in education (Blossfeld, 2009; Miettinen and Jalovaara, 2020). Finally, we re-estimate the models controlling for the regional church tax rate to account for any bias arising from financial incentives to join or leave the church.

The data for the discrete-time hazard model have a couple-year structure, in which every spell refers to a year nested within a couple. All variables are time-varying and are measured at the end of the year. They are all lagged by one year to reduce any problems arising from reversed causality (Hoem and Kreyenfeld, 2006). Every couple observation consists of a variable that indicates the religious affiliation of the woman and the man. In about 73% of the couples, the religious composition is constant from the beginning of the coresidential union until the last observed spell. However, changes are rare when regarded as year-to-year transitions, with changes occurring in only 0.5% of the spells. The most frequent transition is when only the male is religiously affiliated initially, and the female later becomes religiously affiliated as well. This occurs in 7.4% of the transitions of couples in which the male is religious.

4.4 Robustness Checks

We performed several robustness checks to ensure the stability of the results and to better understand the underlying process. First, in our robustness checks, to reduce endogeneity of religious affiliation, we hold the couple composition constant from the first observation of the couple. The reasoning behind this choice is that some couples may join the church in anticipation of childbirth or marriage in order to be able to baptize a child or to have a church wedding. The results are presented in Table C.9.

Second, we account for selection into state church membership and inheritance through parents by estimating a same-sex twin fixed effects model on whether the couple has a child within the first five years of the union (for details on the model and the data processing, see Section A.7). Exploiting discordant twins with respect to religiosity allows us to better identify the causal effect of religiosity while controlling for family background and inheritance of state church membership. The latter is particularly relevant because state church membership is inherited in most cases, which means that group comparisons may be subject to selection bias. Given that twins are born to the same parents at the same time, they inherit the same religious affiliation from birth. Thus, the comparison exploits only twin constellations who experienced active change, which in this case is that either of the twins joined or left the state church. The results are presented in Tables C.14 and C.13.

Moreover, we ensure the robustness of our main findings by exploiting the regional variation in the progress and the speed of secularization in Finland. We create a region-year panel data set that consists of 69 regions (*finnish* Seutukunta) observed over the 1995-2020 period, including information on the regional TFR, the TFR of the religiously affiliated population, and the TFR of the unaffiliated population. Progress in secularization is measured by the lagged population share of the religiously affiliated in the region. We estimate several panel regression models (including first-difference and two-way fixed effects models) to account for endogeneity, time-series auto-correlation, and period effects. We test in Hypothesis 1 by measuring the effect on the TFR of the change in the population share of religiously affiliated. Moreover, we test the nonlinear effect by estimating the effect of secularization on the fertility rate of the religiously affiliated population (the combination of Hypotheses 2, 3.b, and 4).

5 Results

5.1 Demographic Analysis

State church membership in the Finnish population of reproductive age gradually declined from 1995 to 2019. Figure B.4 in the Appendix B depicts the trend in the share of religiously affiliated people in the population of reproductive age. Whereas the share of affiliated individuals was 91% in 1996, it had decreased 15 percentage points by 2019, to 76%. We see a gradual decline of church membership in the 1990s, but the decline accelerated in the post-2010 period.

The TFR for the state church population and the TFR for non-state church population in Finland is displayed in Figure 2. This measure indicates the fertility behavior in both groups, while ignoring the population composition with respect to state church membership. Throughout the entire period, the TFR of the religiously affiliated population was substantially higher than the TFR of the unaffiliated population. The gap between the two groups also widened over time, particularly in the first decade of the century, when TFR of the affiliated group increased modestly in line with the overall country trend. A key explanation for the widened of the gap is that the TFR of the religiously unaffiliated population had already been gradually declining since the early 2000s, and even dropped below an average of 1.1 in the year 2019. In contrast, the TFR of the religiously affiliated population remained fairly high, despite a pronounced decline in the most recent period. The decline in the 2010s was fairly similar in the two groups, indicating that other factors also contributed to the recent fertility decline or nonlinearity.

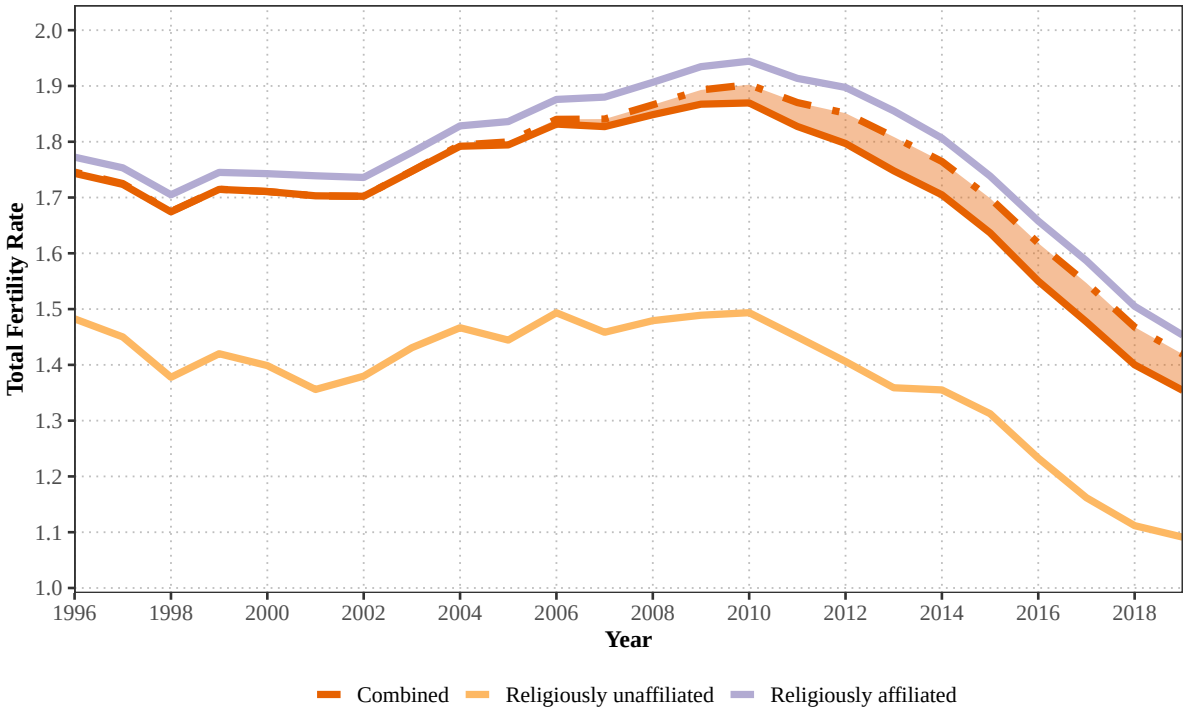


Figure 2: Time-trend of the TFR of the religious, the non-religious and the entire Finnish population between 1990 and 2019. The dotted line represents the counterfactual trend of the population TFR if the population remained constant with respect to the religiously affiliated share.

The results from the counterfactual simulation (dotted purple line in Figure B.7) indicate that the TFR in Finland would be almost 0.1 points higher in 2019, if the population composition with respect to religion had stayed constant from 2000 onward. As depicted in Figure B.7, the trends of the observed and

the counterfactual TFR started to diverge in the late 2000s. Therefore, we can conclude that the fertility decline was partially the result of declining state church membership. The results are confirmed by our results from the Horiuchi et al. (2008) decomposition displayed in Figure B.14. Both approaches show that the decline in state church membership is a key component of the fertility decline between 1995 and 2019, *ceteris paribus*. However, the fertility decline was not only the consequence of compositional change, as it remained even after holding the population composition constant. Hence, factors other than compositional change played a role as well.

5.2 Couple formation and composition

Figure 3 shows the changing couple composition in the population of reproductive age stratified by sex and religious affiliation, i.e., state church membership. Across all strata, the share of individuals with an affiliated partners declined over time, even among people who were affiliated themselves. This pattern mirrors the overall decline of state church membership, which is also apparent in Figure B.4. This conclusion is additionally supported by the parallel increase in the share of homogeneous unaffiliated couples. Thus, the religiously affiliated partners have been substituted to some extent by unaffiliated partners. In the contemporary period, the likelihood that both partners are not members of the state church is higher than at any point in the past. However, the substitution accounts only partially for the decline in religiously affiliated partners. The parallel increase in singlehood indicates that the substitution is incomplete. Hence, couples have not just been secularized, but singlehood has also become more common. In short, a growing share of the population at reproductive age are either in a couple with an unaffiliated partner or are single. These trends hold even after accounting for changes in the age structure through standardization (see Figure B.17) or when looking at the absolute numbers (see Figure B.18).

Given that the share of state church members is declining, the increase in couples with mixed religious and couples with no religious affiliation may result from the shrinking pool of potential partners who belong to the state church (Hypothesis 2). To evaluate this hypothesis, we use iterative proportional fitting, which assumes constant partner preferences to disentangle the impact of the changing population composition. The results depicted in Figure 4 illustrate the observed couple composition (solid red line) and the simulated couple composition (dashed blue line). Overall, the simulation results deviate only slightly from the observed trend, which points to the relevance of declining state church membership for the couple composition. For instance, the share of homogeneous couples increases gradually in the observed and in the simulated data. The same pattern applies to the share of mixed couples. Even the decline in homogeneously affiliated couples is captured by the simulation. Therefore, the trends in couple composition may be explained by the overall secularization of the population. However, the simulated and the observed distribution differ slightly, as the trend toward more mixed-couples is even more pronounced in the simulated data. This suggests that changing partner preferences and clustering in social groups or geographic regions has some impact. For instance, the declining salience of religion for mating observed in the United States could help to explain these trends (Kalmijn, 1991). The finding is confirmed by the random matching algorithm (see Figure B.9 in the appendix).

5.3 Regression approach

The results from the couple discrete-time survival model are displayed in Table C.9. The results are presented as odds ratios, so that a value higher than one can be interpreted as a positive association with the transition to first-birth, and a value below one can be interpreted as a negative association with childbirth. For average marginal effects, please see Table C.8 in the appendix. Model 1 includes only female religiosity, model 2 includes only male religiosity, model 3 includes the religious affiliation of both the woman and the man, and model 4 includes the full specification. We find that both the independent and the interactive terms of religiosity improve the model performance, as the coefficients are significant.

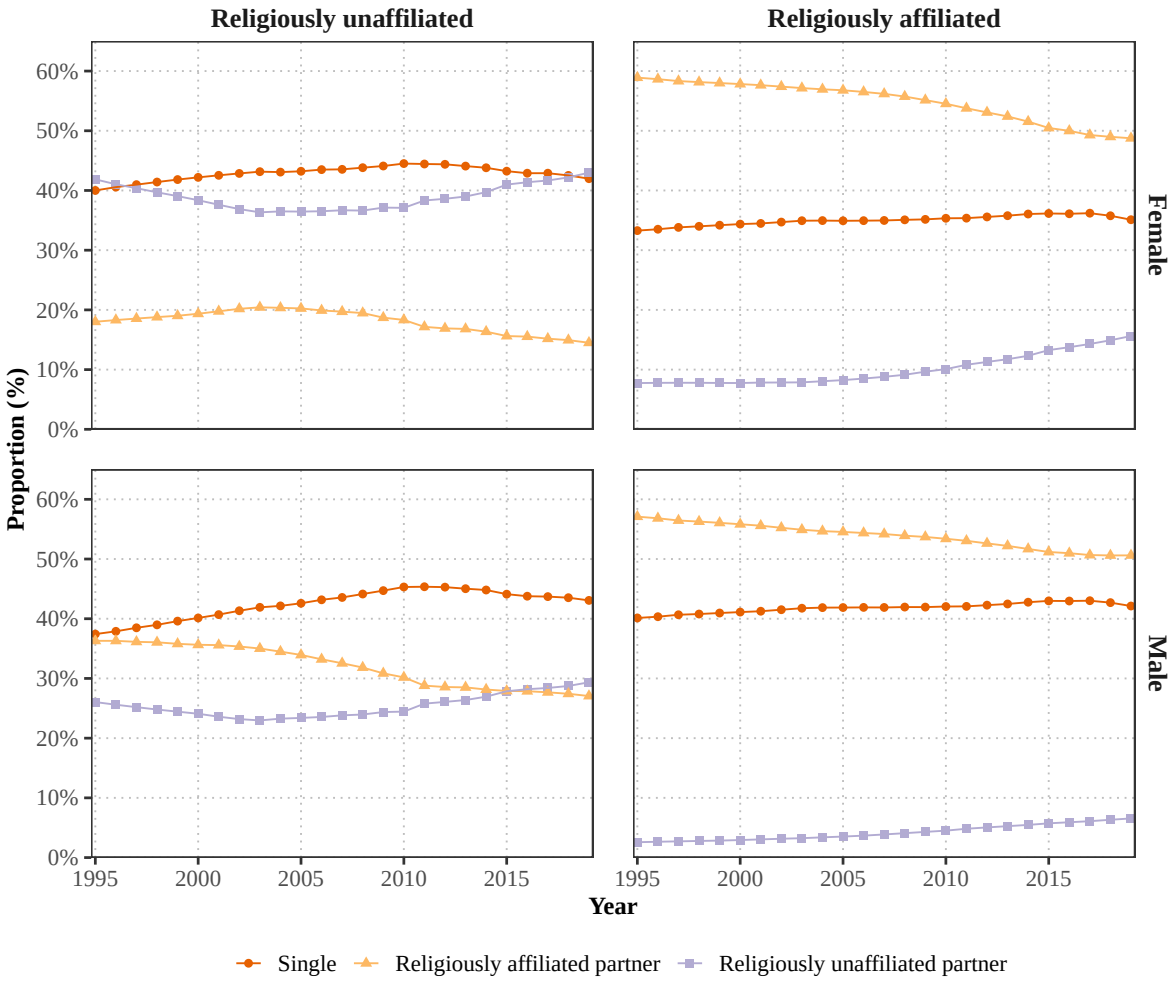


Figure 3: This figure shows the couple composition by sex and religiosity in the Finnish population of reproductive age over time.

We compared the model fit via the Akaike's Information Criterion. These results are presented in Table C.7 in the appendix C. We find that the model including all terms (male + female + interaction) maximizes the model fit. Therefore, both partners' religiosity and their combined religiosity are associated with the couple's fertility.

Across the four models in Table C.9, we find that the religious affiliation of the women is positively and more robustly associated with subsequent childbearing than the religious affiliation of the man, which is in line with Hypothesis 3.b. In all model specifications, female religiosity has the expected positive effect on childbearing. For men, this is the case in all models except the Model 4, where the odds of having a child are slightly lower if the man is affiliated, unless the woman is also affiliated. Therefore, we conclude that the female partner has more say in the childbearing decisions. Hence, the woman's beliefs and values have a stronger impact than those of the male partner.

From the results in Table C.9 it becomes evident that the decision to have a child is made by the couple, which emphasizes the relevance of a couple approach. The odds of a first childbirth are 4.3% higher in couples in which both partners are religiously affiliated than in other types of couples. The interaction term is statistically highly significant, demonstrating that the combined effect is more than the sum of the individual effects. Figure 5 further illustrates the high risk of having a first birth for couples in

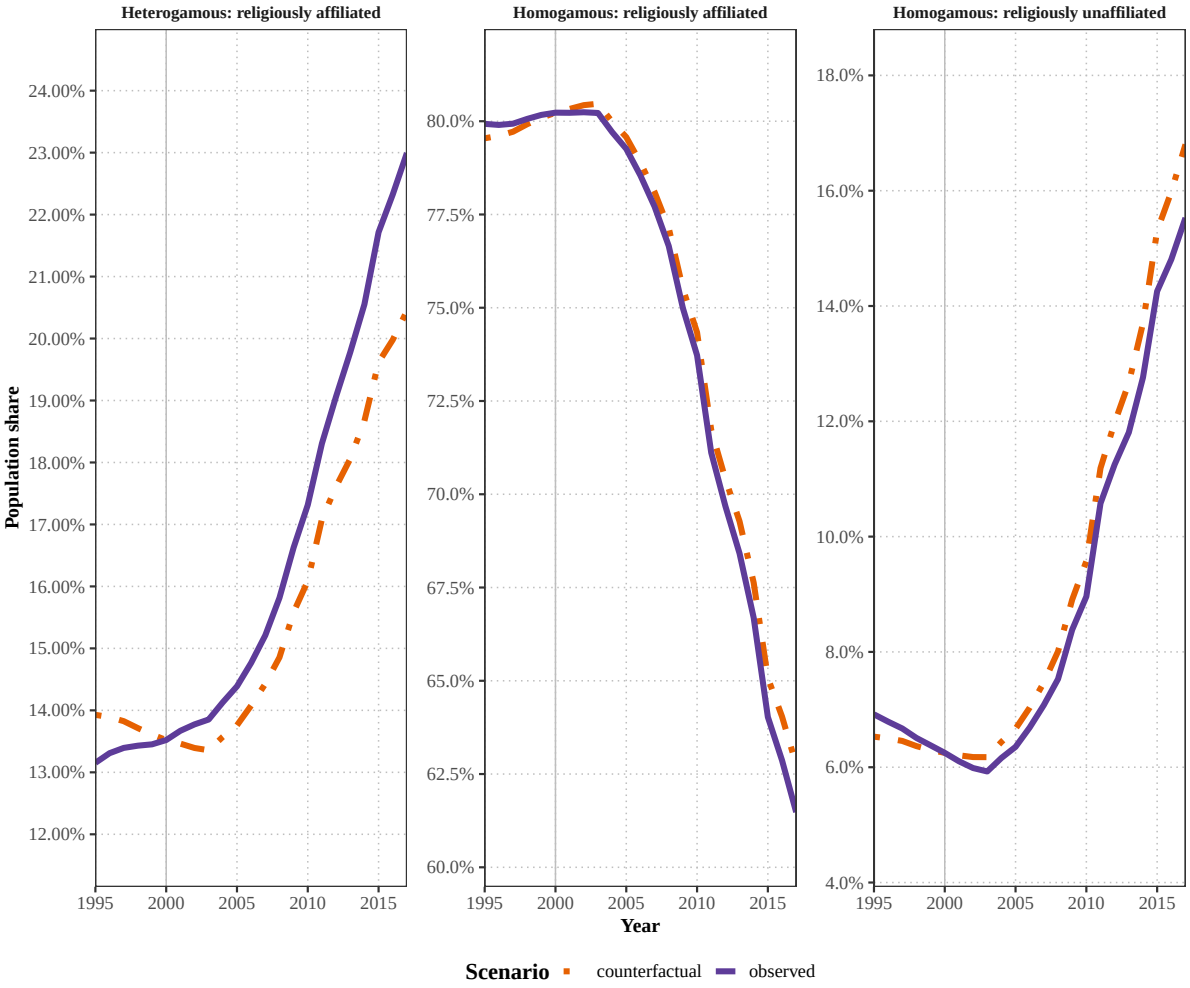


Figure 4: This figure shows the observed couple composition (blue line) and the counterfactual couple composition (red line) estimated by the iterative proportional fitting over time. The counterfactual figures follow the observed trend, which points to a strong impact of the changing population composition. Note that the values of the y-axis vary across panels.

Table 1: Results from a discrete-time survival analysis using logit-binomial models on the probability of childbirth. Results are displayed as odds ratios. The couple composition with respect to religious affiliation is time-varying. The age splines (at couple formation), the couple duration splines, and the interactive age-duration splines were omitted for readability.

	First childbirth			
	(1)	(2)	(3)	(4)
Religiously affiliated	1.239***		1.17***	1.144***
Religiously affiliated male		1.21***	1.152***	1.116***
Both religiously affiliated				1.043***
Activity: unemployed	0.761***	0.761***	0.762***	0.762***
Activity: education	0.659***	0.657***	0.658***	0.658***
Activity: other	1.474***	1.473***	1.474***	1.474***
Activity male: unemployed	1.006	1.008	1.008	1.009
Activity male: education	0.809***	0.81***	0.809***	0.809***
Activity male: other	0.844***	0.844***	0.845***	0.845***
Education: medium	0.961***	0.964***	0.961***	0.961***
Education: high	1.597***	1.605***	1.596***	1.596***
Education male: medium	0.905***	0.904***	0.904***	0.904***
Education male: high	1.075***	1.071***	1.072***	1.072***
Income quantile: 2	0.916***	0.917***	0.914***	0.914***
Income quantile: 3	0.651***	0.653***	0.649***	0.649***
Income quantile: 4	0.502***	0.503***	0.501***	0.501***
Income quantile male: 2	1.282***	1.283***	1.281***	1.281***
Income quantile male: 3	1.584***	1.588***	1.581***	1.581***
Income quantile male: 4	1.744***	1.758***	1.747***	1.747***
Settlement: intermediate	1.489***	1.489***	1.481***	1.481***
Settlement: rural	1.555***	1.548***	1.536***	1.535***
Period: 2000-2004	1.166***	1.164***	1.166***	1.166***
Period: 2005-2009	1.293***	1.292***	1.298***	1.298***
Period: 2010-2014	1.232***	1.235***	1.248***	1.249***
Period: 2015-2019	1.032***	1.037***	1.053***	1.053***
Intercept	0.011***	0.012***	0.011***	0.011***
N	5047249	5047249	5047249	5047249
R^2	0.083	0.083	0.083	0.083
AIC	2546997	2546944	2546056	2546043

*p < .05; **p < .01; ***p < .001

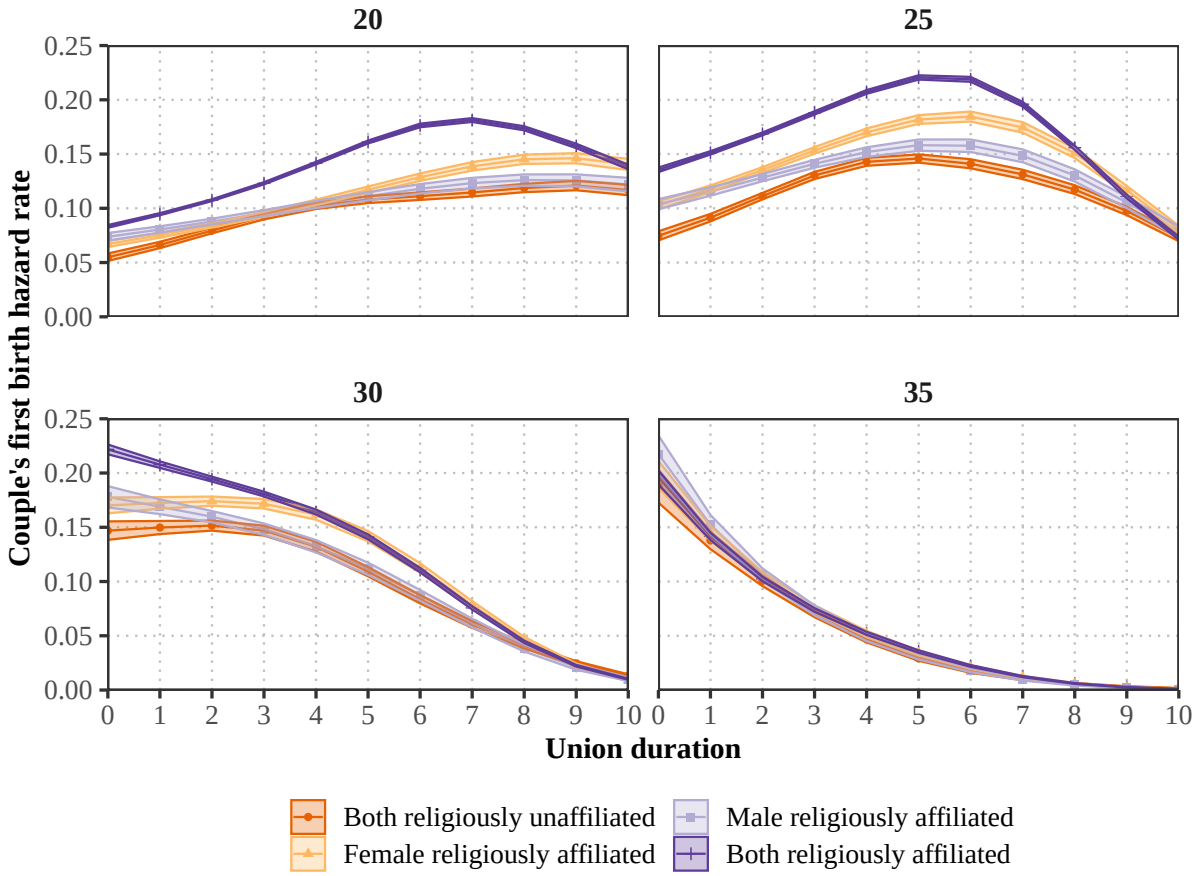


Figure 5: Predicted first birth rates for childless couples with different religious compositions using age-splines in a logistic-binomial regression. The different panels show the different starting ages of the union; the x-axis shows the union duration; the colors indicate the religious composition of the couple; and the y-axis shows the risk of having a first birth.

which both partners are religiously affiliated. This highlights the role of homogeneity within the couple in the probability of having a first birth.

In order to better evaluate the age-specific transition risk of the different couple compositions, we predicted the first-birth hazard rate across couple compositions in Figure 5. Similar to the results in Table C.9, the homogeneous religious couples have a considerably younger onset of fertility and higher fertility intensities. Moreover, we see that couples in which only the female is a church member have higher and earlier first birth rates than couples in which only the male is a church member. In terms of timing, the youngest mean age at first birth is observed in couples in which both partners are church members (29 years), followed by in couples in which neither partner is affiliated with the church (29.8 years), although their overall first birth rate is lower. The mean age at first birth is highest in couples in which only one partner is affiliated (female 30 years and male religiously affiliated 30.2 years). Thus, heterogeneity within couples seem to delay childbearing.

We further illustrate the implications of these results for the recent fertility trends in Figure 6. It shows the impact of the changing couple composition with respect to religiosity on the time-trend of the couple first birth rate (TFR1) using counterfactual simulation. The couple TFR1 would have declined less and remained higher after 2007 if the couple composition with respect to religious affiliation had not changed since 2000 (purple dashed line). If only the religious affiliation of the male partner had remained constant over the observation period, visualized by the dashed orange line, the couple fertility would not deviate much from the observed pattern. This highlights the limited impact of the male religiosity on childbearing. However, the impact of female religiosity on couple childbearing is clearly evident in the dashed light purple line. Overall, the decline in the couple TFR in the counterfactual scenario is only about 5% of the observed decline if the couple composition had not changed from accelerated secularization.

5.4 Robustness checks

The findings of the discrete-time survival model persist across several robustness checks, except that measuring religious affiliation as a time-constant characteristic from the beginning of the union does not show a positive interactive effect of religious affiliation on the transition to childbirth (see below). We estimated the main regression model with a control for the regional tax rate, which did not affect the results much (see Table C.10). The results remain largely unchanged, which indicates that monetary incentives do not bias our result. Therefore, we have confidence in the robustness of our results.

A contrasting finding is observed for the discrete-time model, in which the couple composition with respect to religious affiliation is held constant from the beginning of the union. In this model specification, the interactive term changes to being just below one (see Table C.9 in the appendix), as opposed to a positive effect observed in the main results measuring religious affiliation as a time-varying characteristic. The discrepancy in the interactive term between the time-constant and the time-varying models highlights the significance of the dynamic of the couple composition. It is plausible that some couples in which one partner is religious and the other is not may seek to harmonize their affiliation before childbearing for the purposes of getting married in a church.

Using only twin-pairs in the data from the discrete-time survival model allows us to perform a twin comparison that holds the family background and the inheritance of the state church membership constant. Results displayed in Table C.13 and C.14 support the main finding, namely that both partners in a couple being religiously affiliated has a positive effect on the transition to first birth within unions. The effect of religious affiliation for the male and the female partner ranges from a 1% to a 5% increase in the probability of having a child after five years in a union.

Moreover, we ensured the robustness of our main findings by exploiting the regional variation in the progress and the speed of secularization in Finland. We did so by creating a region-year panel data set covering 69 provinces (*Finnish* Seutukunta) observed over the 1995-2020 period that contains information

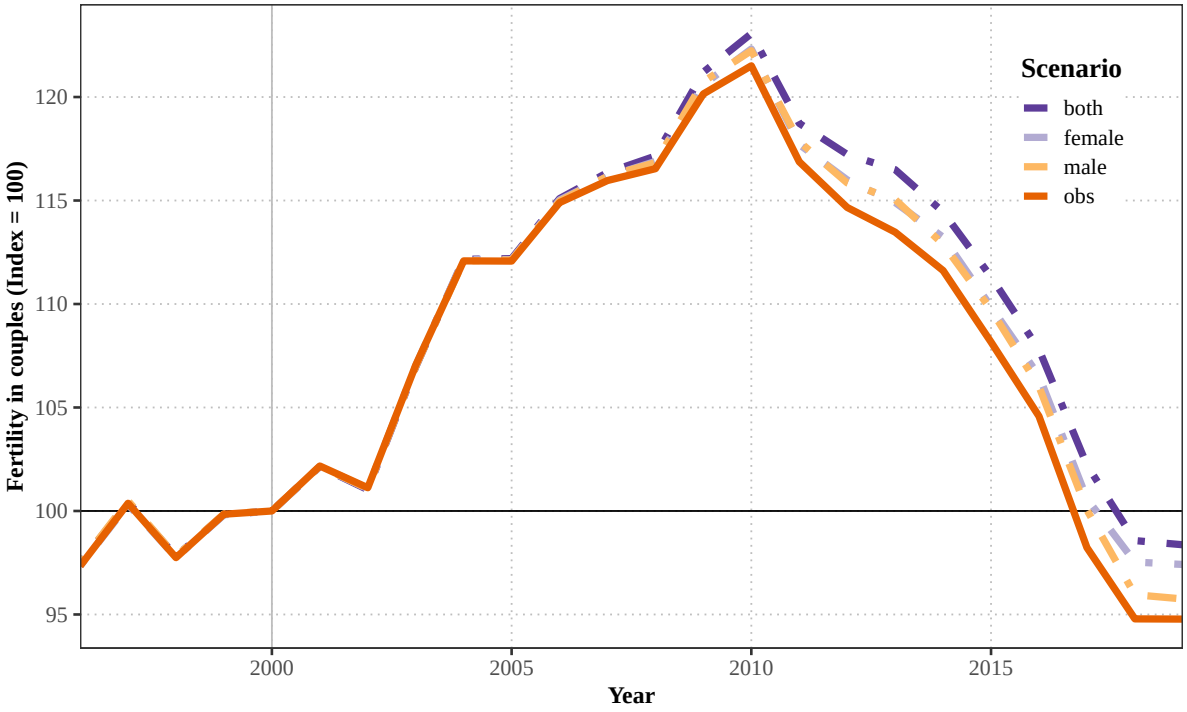


Figure 6: Observed and counterfactual development of couple TFR1 in 1995-2019, with the 2000 value scaled to 100. The counterfactual simulation draws on age-specific and religiously specific couple first birth rates and the counterfactual couple composition, which holds the female share, the male share, or the overall couple composition with respect to religious affiliation constant from 2000 onward. Couple first birth rates are estimated by aggregating the age-specific birth probabilities for different couple types and dividing them by the number of couple observations in the same age- and couple group.

on the regional TFR, the TFR of the religiously affiliated population and the unaffiliated population, and the share of religiously affiliated individuals in the regional population. We estimated several panel regression models (including region fixed effects and two-way fixed effects models) of the regional TFR on the change in the share of the religiously affiliated in the population in the year before. Across the models displayed in Table C.11, a reduction in the share of the religiously affiliated has an effect on the TFR in the year, after ruling-out time-constant regional confounding factors. According to results from the first-difference model (Model 2), a decline of 10 percentage points in the share of the religiously affiliated is associated with a decline in the TFR of 0.28 children per women (CI: 0.15 and 0.42). In order to support our claim about the nonlinear effect, we estimated another model, changing the outcome to the TFR of the religiously affiliated population only. Thus, if there remains an effect, the reduction in the TFR is not solely related to the changing population composition, but also to changes in the fertility behavior of the religiously affiliated population, which aligns with the self-reinforcing effect. The effect of the changing population share persists even when looking only at the religiously affiliated population (see Table C.12). According to results from the first-difference model (model 2), a decline of 10 percentage points in the share of the religiously affiliated is associated with a decline in the TFR by 0.21 (CI: 0.18 and 0.24). The two-way fixed effects models yield insignificant results.

6 Discussion

This study examined the role of secularization, as indicated by the decline in state church membership, in recent fertility trends in Finland. State church membership gradually declined between 1995 and 2019, with the decline accelerating after 2008, although it remained at high levels (76% in 2019). We have shown that the TFR of state church members was significantly higher than the fertility of non-members, and that the gap between these groups widened from 0.3 children (1995) to 0.5 children (2019). Counterfactual simulations of the TFR for the Finnish population showed that it would have remained 5% (0.08) higher in 2019 if the composition of the population with respect to religious affiliation had remained stable since 2000. Thus, the decline in state church membership is a relevant factor in explaining the recent decline in Finnish fertility. We also found that secularization affected the composition of couples. The decline in church membership led to an increase in the share of mixed couples in which only one partner was religiously affiliated and of couples in which neither partner was religiously affiliated, while the share of couples in which both partners were religiously affiliated decline. Our hypothesis that the declining pool of church-member partners can explain the declining probability of forming a union with a state church member is supported by our results based on iterative proportional fitting and random matching. Finally, we showed that the couple composition with respect to religious affiliation was associated with the transition to first birth. This finding is of great significance, as the decline in first births within couples represents the primary driver of recent fertility declines, as evidenced by Hellstrand et al. (2020). The lower probability of having a first birth among couples with mixed religious affiliation than among couples with homogeneous religious affiliation suggests that the decline in fertility among religious affiliated individuals may be related to the increased likelihood of having a non-religious partner. Collectively, these findings indicate that declines in state church membership and potentially related shifts in life values, such as reduced emphasis on traditional values and an increase in individualism, were significant contributors to the fertility decline in Finland during the 2010s.

State church membership remains high in Finland, although it has declined since 1995, with an acceleration from 2005 onward. Inglehart (2021a) and Hout and Fischer (2014) observed similar accelerations trends in the United States based on survey results, although data quality may have impacted their findings (Brenner et al., 2023; Hout and Fischer, 2014; Lim et al., 2010). The maps in Figures B.12 and B.13 in the appendix show the geographic pattern of secularization in Finland. We validated our estimates of the religiously affiliated population share using two different sources. The size of the share is

similar to the reported in official statistics from Statistics Finland and is close to the data of the European Social Survey (see Figure B.8 in Appendix B).

We found that fertility was higher in the state church population than among non-state church members, and that the gap widened over time. This finding lends support to Hypothesis 1. While state church members had a TFR of 1.9 in 1996, which was just 0.3 points higher than the TFR among non-state church members, their level of fertility declined by only 0.3 points to 1.6 in 2019, whereas the TFR among non-state church members dropped by 0.5 points to a level of 1.1 children per woman over the same period.

Furthermore, we found that the composition of couples had an impact on couple fertility that extended beyond the sum of the individual characteristics of the couple members, which is consistent with the relational approach and studies on couple childbearing behavior (Doepke and Kindermann, 2019; Hudde and Engelhardt, 2021; Rijken and Liefbroer, 2009; Vignoli et al., 2012). While previous studies have largely focused on the extent to which the influence of labor market attachment on childbearing is gendered, our study is novel in that it used a dyadic perspective to examine the influence of religion. Our findings highlight the significance of the religious orientation of the female partner in influencing the childbearing decisions of couples in the Nordic context (confirming Hypothesis 3.b). Additionally, we observed that religiously homogeneous couples had the highest probability of childbearing (confirming Hypothesis 4). Yet, some caution is needed in interpreting this finding, as the interactive term declined in the model using the couple's religious composition as a time-constant measure.

These findings have a number of sociological implications. First, they underscore that the decision to have children is influenced by both partners' preferences and characteristics, and it is based on joint decision-making. Partners who have more similar life values and orientations may feel most ready to commit to having a child and to parenting the child together, thus supporting a broader relational perspective on decision-making (Emirbayer, 1997). Second, our findings suggest that there are distinct domains that may be more influenced by either the woman's or the man's characteristics. In our case, the religious orientation of the female partner emerged as a key factor, confirming Hypothesis 3.b. This implies that partners may draw on values, attitudes, or resources from specific domains associated with their gender to influence the decision-making process regarding childbearing. This prompts us to advocate for further research into other domains that may be dominated by a specific gender in order to shed light on additional factors that might shape couples' fertility decisions in contemporary societies.

This paper argued for a novel self-reinforcing effect of secularization on fertility. Secularization changes the couple composition with respect to religion. The couple composition, in turn, affects the transition to first birth. Despite the separation of church and state in modern societies, our study revealed that religious affiliation continues to exert a significant influence on fertility levels and trends. Specifically, we found that the diminishing proportion of church members had both linear and nonlinear effects on the overall level of fertility. Given the interaction with partner market dynamics and the role of the religious composition of the couples, the decline in state-church membership may have had a self-reinforcing effect on declining fertility. Couples in which the partners had different religious orientations may have also differed with respect to their life values and preferences for having children, which may have led them to have. While existing research has predominantly focused on the individual effects of church membership (Frejka and Westoff, 2008; Goldscheider and Uhlenberg, 1969; McQuillan, 2004; Skirbekk, 2022; Westoff and Frejka, 2007; Zhang, 2008), our unique dyadic perspective provides novel insights. This approach helps us to better understand the recent decline in fertility in Finland, and potentially sheds light on similar trends in the United States and other high-income countries.

The findings presented in this paper seamlessly align with established research, particularly with the socio-structural theory posited by Blau (1994). According to this theory, there is a proportional relationship between the reduction in group size and an increased likelihood of inter-group relationships. This mathematical consequence, rooted in socio-structural dynamics, has been empirically demonstrated in studies investigating partner market imbalances and their repercussions for marriage patterns (Crowder

and Tolnay, 2000; Lichter et al., 1995; Qian and Lichter, 2018). It is noteworthy, however, that the observed trend is not solely characterized by the replacement of religiously homogeneous religious couples with secular or religiously mixed couples; there is also a discernible decline in couple prevalence overall. This is evidenced by the increasing prevalence of singlehood, a phenomenon that has been previously documented in the context of Finland (Andersson, 2023; Hellstrand et al., 2021; Jalovaara and Andersson, 2023). Thus, our study extends beyond the realm of inter-group dynamics to shed light on how secularization drives broader trends in couple formation, childbearing, and singlehood.

While our findings highlight the significant impact of secularization on the declining fertility rates in Finland, it is crucial to acknowledge that other factors have likely contributed to this phenomenon as well. Beyond secularization, various alternative explanations for the recent fertility declines merit consideration, including the influences of economic uncertainty (Hellstrand et al., 2024; Vignoli et al., 2020) and broader global uncertainty (Comolli et al., 2021), weakened preferences for having children (Golovina et al., 2023), as well as changes in attitudes (Jalovaara and Andersson, 2023; Kearney et al., 2022; Lesthaeghe, 2020; Rahnu and Jalovaara, 2023). Further research is needed to quantify the impact of these factors and to explore alternative explanations that may contribute to our understanding of the dynamics influencing fertility trends in Finland and beyond.

6.1 Strengths and Limitations

We inferred religious affiliation from state church membership as measured by the payment of state-church taxes. This approach has both strengths and limitations. The financial component of state church taxes links the membership to costs, which incentives individuals to leave the church when they have lost their faith. Compared to surveys on religiosity, our measure is less affected by social desirability, by misreporting (e.g., recall bias), or by non-response and attrition. Moreover, the data exist longitudinally, which allowed us to perform longitudinal compositional and survival analysis. A unique strength of the study is that it was able to identify and follow couples who were living together, and to measure both partners' religious affiliation.

However, the measure of religious affiliation may be subject to three limitations.

First, using state church tax paymenty may introduce some measurement error. Measurement error may result from the fact that individuals who made state church tax payments may not have done so based on their religious beliefs and values alone, but also for other reasons, such as their level of thriftiness, civil engagement, and even their family situation. For instance, state church membership may also indicate support for the church because it is an actor in civil society or because it fulfills humanitarian and civic roles. Similarly, Kolk and Saarela (2023) have argued that in Finland, those who do not pay state church tax constitute a distinct group who may hold particularly strong secular beliefs. An indication for such an error is the high proportion of church membership despite the overall high degree of secularization in the society.

Second, using state church tax payments as an indicator of religious affiliation somewhat restricts the generalizability of the results. Given that only members of the Lutheran, German, and orthodox Christian churches are eligible for paying state-church taxes, we had to restrict our sample to the population with a Finnish background. Therefore, migrants were excluded from the sample to minimize measurement error. However, migrants constituted only full population of reproductive age (4.2%). Moreover, our results may not be directly generalizable to countries that do not have a system of state church taxes. Such a system is not typical for modern societies due to the widespread principle of separation of church and state. Nonetheless, state church taxes are also collected in Austria, Germany, Sweden, Denmark and Iceland.

Third, our indirect measure of religiosity is conceptually simplistic. State church tax payments indicate religious affiliation, which is likely to capture factors other than the strength of religious faith, such as whether a person has more conservative life values or supports the civic and humanitarian roles

and positions of the church. Religiosity is a complex construct that encompasses various dimensions, of which religious affiliation represents only one. In addition to affiliation, strength of spiritual beliefs, religious practices, and membership in a like-minded community are important dimensions of religiosity. However, these dimensions are subjective, and are therefore not observable in the administrative register data utilized in this study.

Notes

[1]Orthodox and Finnish German church members represent a small minority in the total groups of all church tax payers ($< 1.5\%$ in 2020). From here onward, we refer to these religious communities when using the term state church membership, if not stated otherwise.

[2]The legislation governing church membership was reformed in 2003 (revised law of freedom of conviction, 6.6.2003/453), enabling individuals to terminate their church membership with ease via mail. Prior to this point, the only avenue for leaving the church was through a personal consultation with the administrative council.

[3]See for example `https://eroakirkosta.fi/dynamic/index.php/`, *engl.* `optoutfromchurch.fi`

[4]The register data set contains information about opposite-sex couples living together at the turn of the year. The coresiding couples are identified based on information from various register sources. For instance, to qualify as a cohabiting couple, the opposite-sex persons need to have lived together for at least 90 days.

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A Methodological Appendix

A.1 Counterfactual simulation of the total fertility rate (TFR)

We estimate the counterfactual TFR in the following way. First, we estimate the observed TFR as the cumulative sum of the weighted age-specific fertility rates. Second, the counterfactual scenario is estimated by multiplying the group-specific fertility rates with the weights from the year 2000. The estimation follows,

$$TFR = \sum f_i(x) \times w_i(x)^{counterfactual}, \tag{2}$$

where f is the age-specific fertility rate for the age x and the religious group i, w is the population share of group i in age-group x. Thus, the counterfactual simulation replaces the observed $w_i(x)$ with the counterfactual from year 2000.

A.2 Decomposition of the TFR

The TFR is defined as the sum of age specific fertility rates ($f(x)$), which is the ratio of number of births to the person-years exposed to the event,

$$f(x) = \frac{births(x)}{exposure(x)}. \tag{3}$$

Therefore the age-specific fertility rate can be rewritten into the population subgroups (p) that contribute to it, so that the population age-specific fertility rate is the sum over all subgroups p,

$$f(x) = \sum_{x=15}^{55} \left[\frac{\sum_i^p births_i(x)}{\sum_i^p exposure_i(x)} \right]. \tag{4}$$

Since the estimation is additive, we can rewrite the equation as weighted average:

$$TFR = \sum_{x=1}^{55} \sum_{i=1}^{p} \underbrace{f_i(x)}_{Behavioral} \times \underbrace{weight_i}_{Composition} \tag{5}$$

The equation above can be used to decompose the difference in the TFR into the behavioral component stemming from a difference in $f_i(x)$ and a compositional component $weight_i$.

$$\Delta TFR = \sum_{x=1}^{55} \underbrace{\frac{dTFR}{df(x)} \cdot (f_i(x) - f_j(x))}_{\Delta Rate} + \underbrace{\frac{dTFR}{dweight} \cdot [weight_i(x) - weight_j(x)]}_{\Delta Composition}, \tag{6}$$

which is the observed rate difference between the two groups multiplied with the initial response of the TFR to a change in the age-specific fertility rate, and the initial change in the TFR to a change in the weight of a group.

A.3 Estimation and standardization of the population share

The estimation of the population share of a sub-group (m) of the population (p) follows:

$$p(m) = \frac{Population_m}{\sum_{i=1}^{3} Population_i} \tag{7}$$

However, shifts in the age structure may affect the total population shares. Standardization is used to account for structural differences in the population composition, i.e. in the age-structure, when

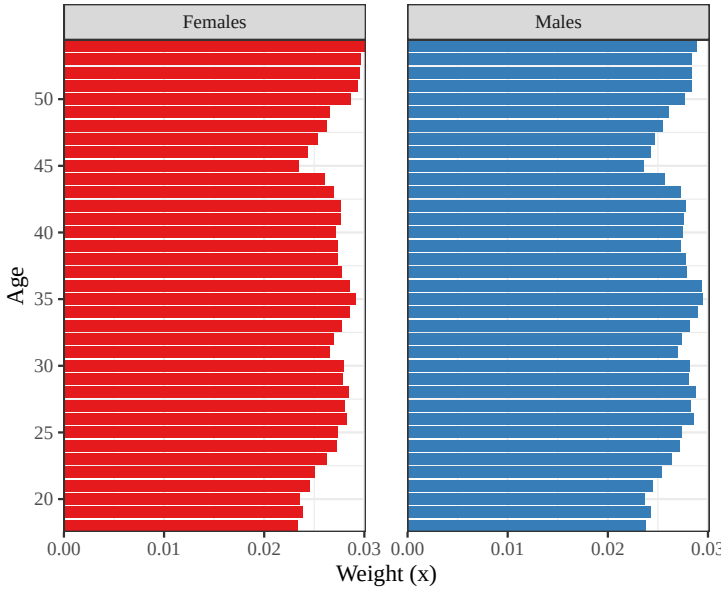

Figure A.1: This figure displays the standard population in Finland in the year 2019, which is used in the standardization.

comparing aggregate indicators over time or across populations (Preston et al., 2008). We apply the direct standardization approach, which uses a reference population. As a "standard", we chose the Finnish population in the year 2019. The age-sex distribution for this group is displayed in Figure A.1 below.

In standardization, we sum the product of population share and the weight. The standardized population shares is known in epidemiology as *standardized prevalence*. The estimation follows:

$$p(m)_{standardized} = \sum_{x} p_x(m) \times w_x, \tag{8}$$

where x stands for the age group, $p_x(m)$ is the population share of group m in the age group x in a specific year, and w_x is the weight, which is the share of the age-group in the year 2019. The weight is estimated as the population share of the group x in the year 2019:

$$w_x = \frac{pop_x}{\sum_{x=18}^{50} pop_x}. \tag{9}$$

A.4 Iterative Proportional Fitting (IPF)

Iterative proportional fitting (also known as Stephen-Rephson algorithm) is an iterative method used in the marriage-market literature (homogamy-heterogamy) to assess the impact of changing population shares with respect to certain characteristics on mating pattern along these dimensions. The method disentangles the impact of preferences and availability through holding the preferences constant from a certain reference point. The method requires a contingency table for the reference year and a contingency table for any other year under investigation t. The contingency table from the reference year is iteratively scaled to fit the margin-totals of the contingency table of the year t, while maintaining the cell distributions, until the difference is below a certain threshold.

Given the contingency table in Table A.2 for the reference year 2000 and the observed contingency table in Table A.3 for the year 2010, where * shows that this is the year under investigation.

We scale the values a, b, c, d from the first table so that they yield the same marginal distribution as in the second table (a^*, b^*, c^*, d^*). We reach this aim through iteratively performing two steps, which scale according to the row totals (I.) and according to the column totals (II.).

		Men Religiously unaffiliated	Men Religiously affiliated
Women	Religiously unaffiliated	a = 42405	b = 23127
Women	Religiously affiliated	c = 69420	d = 525118

Table A.2: Table for the reference year 2000.

		Men Religiously unaffiliated	Men Religiously affiliated
Women	Religiously unaffiliated	a^* = 52990	b^* = 26833
Women	Religiously affiliated	c^* = 77711	d^* = 424938

Table A.3: Table for the year 2010, which is the year under investigation.

$$a+b=a^*+b^* \tag{10}$$
$$c+d=c^*+d^* \tag{11}$$
$$a+c=a^*+c^* \tag{12}$$
$$b+d=b^*+d^* \tag{13}$$

I. We reach this goal by multiplying the reference contingency table cell values with the relative difference of the target row-sums to the reference contingency table, which yields a new reference table:

$$a_{i=1,1}=a\times\frac{(a^*+b^*)}{(a+b)} \tag{14}$$
$$b_{i=1,1}=b\times\frac{(a^*+b^*)}{(a+b)} \tag{15}$$
$$c_{i=1,1}=c\times\frac{(c^*+d^*)}{(c+d)} \tag{16}$$
$$d_{i=1,1}=d\times\frac{(c^*+d^*)}{(c+d)} \tag{17}$$

II. We reach this goal by multiplying the reference contingency table cell values with the relative difference of the target row-sums to the reference contingency table, which yields a new reference table:

$$a_{i=1,2}=a_{i=1,1}\times\frac{(a^*+b^*)}{(a+b)} \tag{18}$$
$$b_{i=1,2}=b_{i=1,1}\times\frac{(a^*+b^*)}{(a+b)} \tag{19}$$
$$c_{i=1,2}=c_{i=1,1}\times\frac{(c^*+d^*)}{(c+d)} \tag{20}$$
$$d_{i=1,2}=d_{i=1,1}\times\frac{(c^*+d^*)}{(c+d)} \tag{21}$$

Step I. and II. form one iteration of the algorithm, which is repeated several times. The algorithm stops either after a certain number of iterations (max-iterations) or after the difference between the observed column totals for year t and the counterfactual column as well as the observed row totals for year t and the counterfactual column totals is below a certain threshold value. For our example, the counterfactual values are displayed in table A.4:

		Men Religiously unaffiliated	Men Religiously affiliated
Women	Religiously unaffiliated	a^* = 59277.25	b^* = 20571.51
Women	Religiously affiliated	c^* = 71423.75	d^* = 431199.49

Table A.4: Counterfactual table for the year 2010, which is the year under investigation.

A.5 Random matching algorithm

The primary objective of the simulation is to assess the probability that the increase in mixed religious couples is entirely the result of changing population distributions, given random matching. Using our random pairing algorithm summarized in algorithm A.5, we create random matches. In the next step, we estimate the share of religious composition. This random matching is repeated 100 times to account for the Monte Carlo error, e.g. the between simulation variability. We can conclude that the partner availability may account for changing couple formation, if the trends of the randomly formed matches parallels the trend of the observed data.

We carry out annual simulations of the randomly matched couples for the period from 1995 to 2019. To create such a simulated population of couples, we start with the population of reproductive age and present in Finland and keep only those who are in a union ($n_{couples}$), thus removing all singles. Then, we virtually separate the male partners from the female partners and assign them to a randomly chosen new partner. So we have $n_{couples}$ simulated couples. Then we estimate the proportion of the religious composition of the population of simulated couples. We repeat this simulation 150 times. (We draw the Finnish couple population, separate the original couples, and randomly assign new partners). In this way, we create a probability distribution for the religious affiliation of the partners if the couples were randomly matched.

Algorithm 1 Simulation of the random matches based on register data for different cohorts.

1. Obtain the distribution of religiosity in couples in a specific year. Get $N_{m,r}$, $N_{f,r}$, $N_{m,n}$, $N_{m,n}$. The subscripts m and f indicate the sex, and r and n stand for religious and non-religious.
2. Use the random sort process to form matches between men and women.
3. Estimate the share of couples with the following composition: religious$_f$-religious$_m$, religious$_f$-non religious$_m$, non religious$_f$-religious$_m$, non religious$_f$- non religious$_m$
4. Compare the observed distribution of matches and the expected distribution of matches given random matching.

A.6 Estimation of first birth and couple hazard rates

We estimated first-birth and couple hazard rates using a Poisson model with splines. The model specification follows below:

$$log(\lambda \mid \boldsymbol{X}) = \beta_1 religious_m + \beta_2 religious_f + \beta_3 religious_{both} + \boldsymbol{\beta_4 X} + log(pop) + \varepsilon_{i,t}, \qquad (22)$$

where λ is the rate, which is the ratio of the number of events to the exposures. In order to get the events and exposures, we aggregated the spell data by summing events per religious-age combination and counting the spells.

A.7 Estimation of the twin model

We estimate twin fixed effects models to account for selection on family-related time-constant unobserved factors, such as religious background, education, neighbourhood, childhood living and family network. For these models, we reduced the data to females or males having a twin of the same sex. Twins are identified in the registers through the parental ids and the same birthday. Removing all none twin pairs from the data leaves us with 1,700 individuals clustered within 431 twin groups.

Using this data, we estimate whether the religious composition of the couple affects whether the couple transitions to first-birth within the first 5 years, condensing the multi-spell data to a single-spell data file. If the couple has a child within the period, the outcome is one, if the couple is dissolved or did not transition to childbirth, the outcome is zero.

We estimate the twin-fixed effects model in the following way, where r indicates the dummy for religious affiliation,

$$(Y_{ij} - \bar{Y}_{ij}) = \beta_1(r^f_{ij} - \bar{r}^f_i) + \beta_2(r^m_{ij} - \bar{r}^m_i) + \beta_2(r^b_{ij} - \bar{r}^B_i), \tag{23}$$

where i is the index for the twin group and j refers to the individual within the twin group. $\bar{Y}_{ij}$, $\bar{r}^f_i$ and $\bar{r}^m_i$ refer to the twin-group averages of childbirth-occurrence, female religious and male religious partner.

A.8 Regional panel regression models

We use macro-data at the regional level in Finland in our robustness checks to ensure the robustness of the main findings. We have a balanced panel of 69 regions ($i = 1, ..., N$ units) observed over 19 years ($t = 1, ..., T$ years), the data contains 1254 observations. Essentially, we exploit regional variation in secularisation to estimate the impact on fertility. Panel regression models remove the impact of time-constant unobserved variables c_i through first-differences.

$$y_{i,t} - y_{i,t-1} = (x_{i,t} - x_{i,t-1})\beta + (c_{i,t} - c_{i,t-1}) + u_{i,t} - u_{i,t-1}, \tag{24}$$

which drops the impact of c_i through differencing. First differencing is less efficient than standard fixed effects regression using demeaning, because it loses the observations for the first year, yet, the pooled regression on first-differenced data removes serial autocorrelation and provides valid statistics, including F statistics based on sums of squared residuals (p. 281 Wooldridge, 2012). The first differencing, similar to the fixed effects model, assumes the exogeneity of x_{it} conditional on the unobserved effect.

B Additional Figures

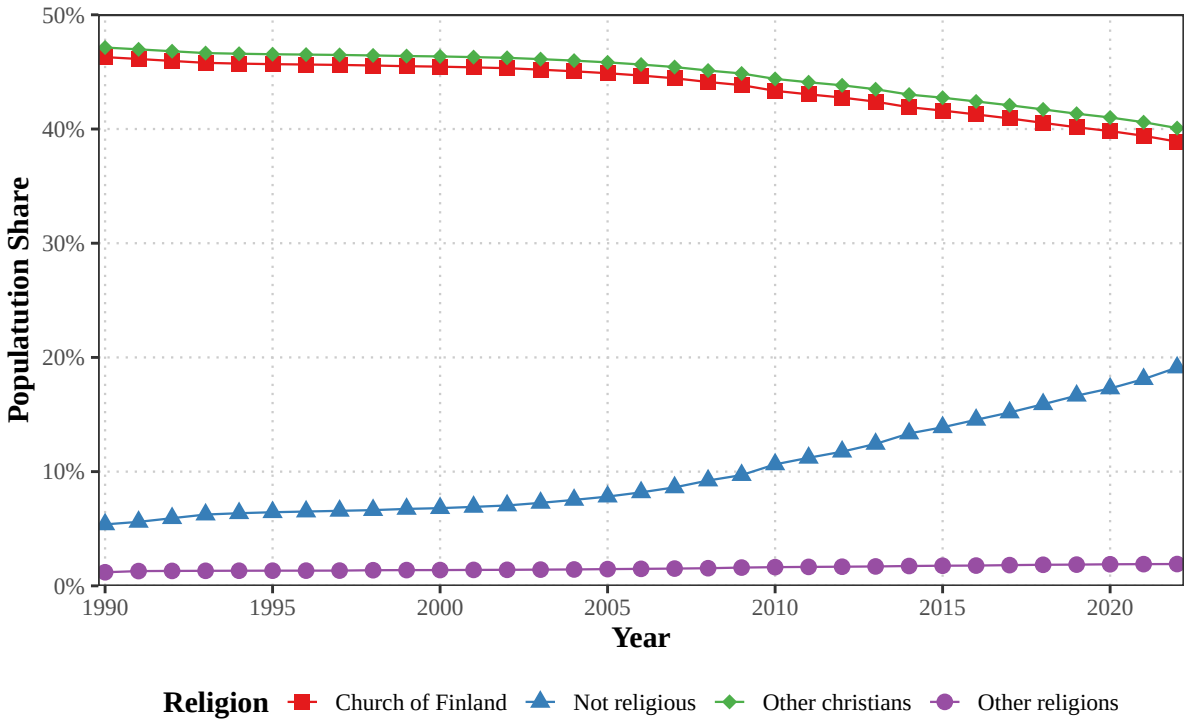

Figure B.2: The share of religious groups according to official statistics provided by Statistics Finland.

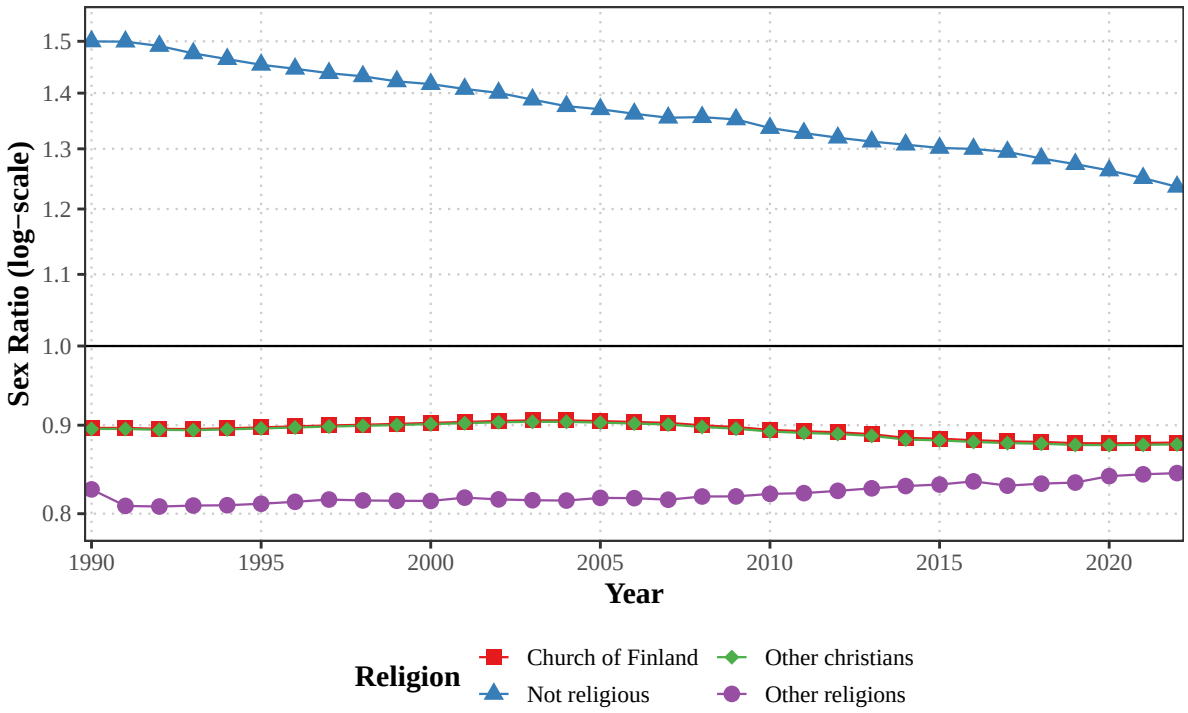

Figure B.3: The sex ratio in the main religious groups in Finland in the period between 1990 and 2022. Note: the y-axis is log transformed to create symmetrical distributions around 1.

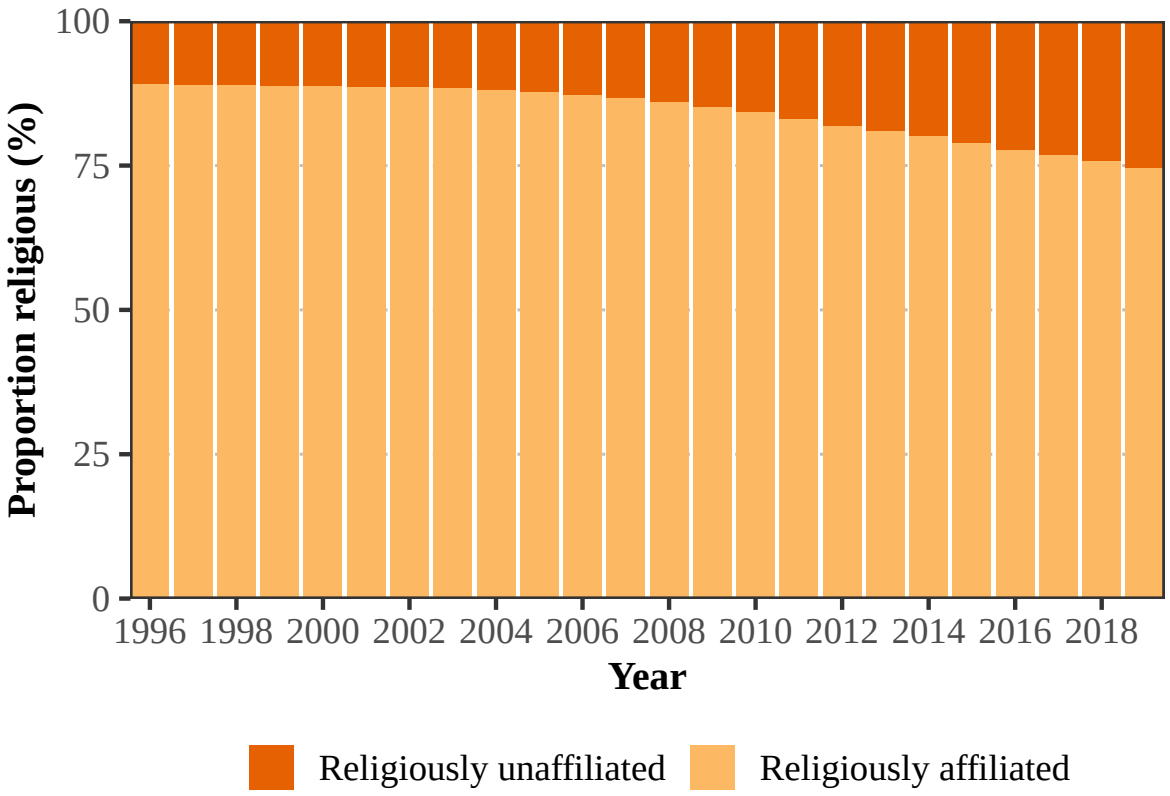

Figure B.4: Time-trend of the population share of the religious and non-religious groups in Finland between 1990 and 2020. Source: own calculations based on Finnish population register data.

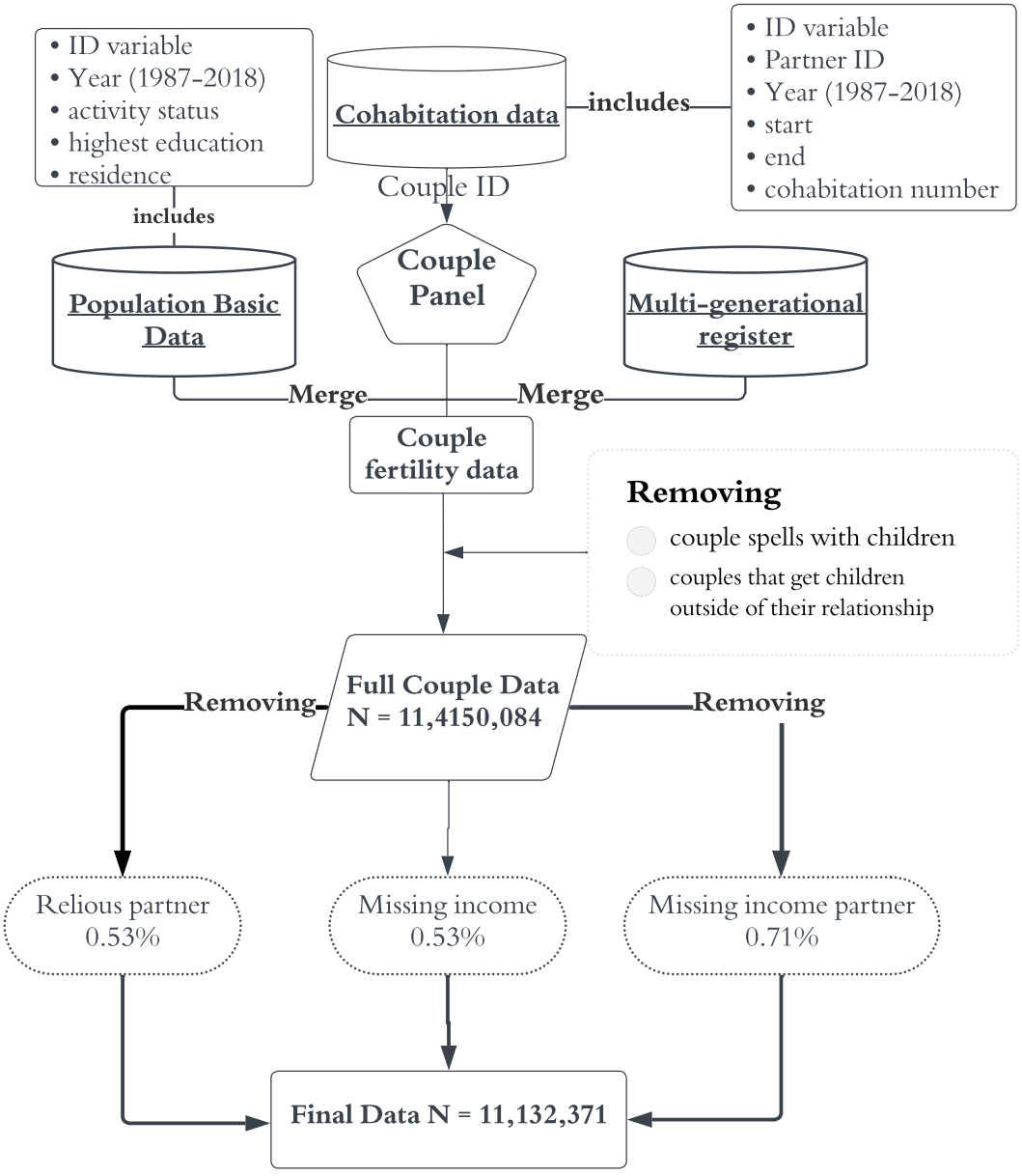

Figure B.5: This figure displays the share of missing information in the register data that have been removed from the analysis.

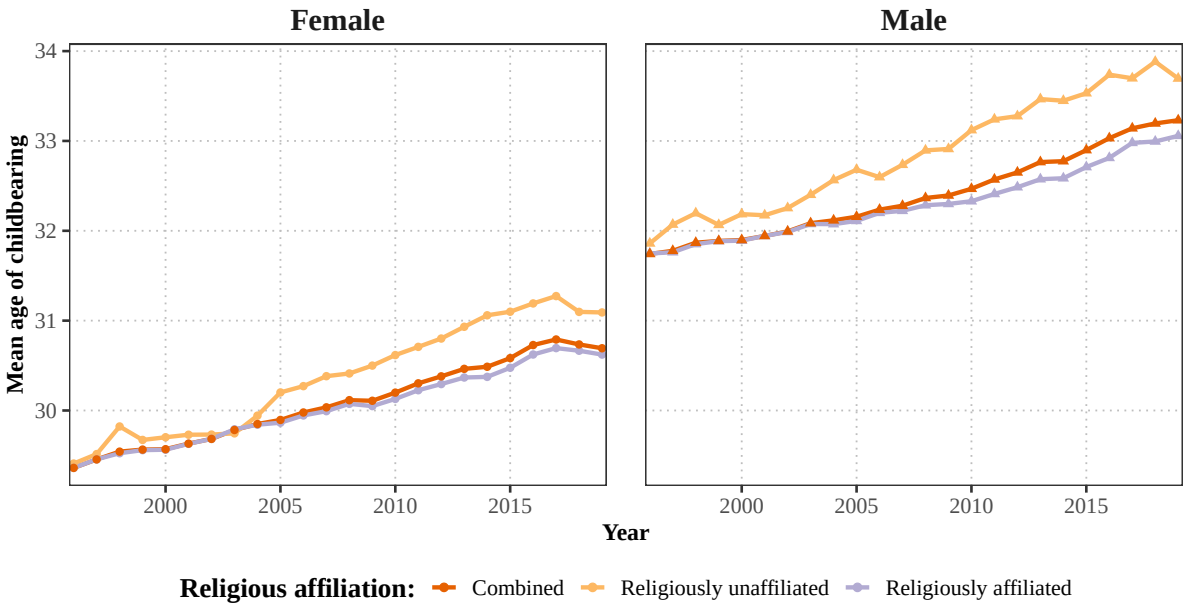

Figure B.6: The mean age of childbearing for men and for women in the period between 1995 and 2019.

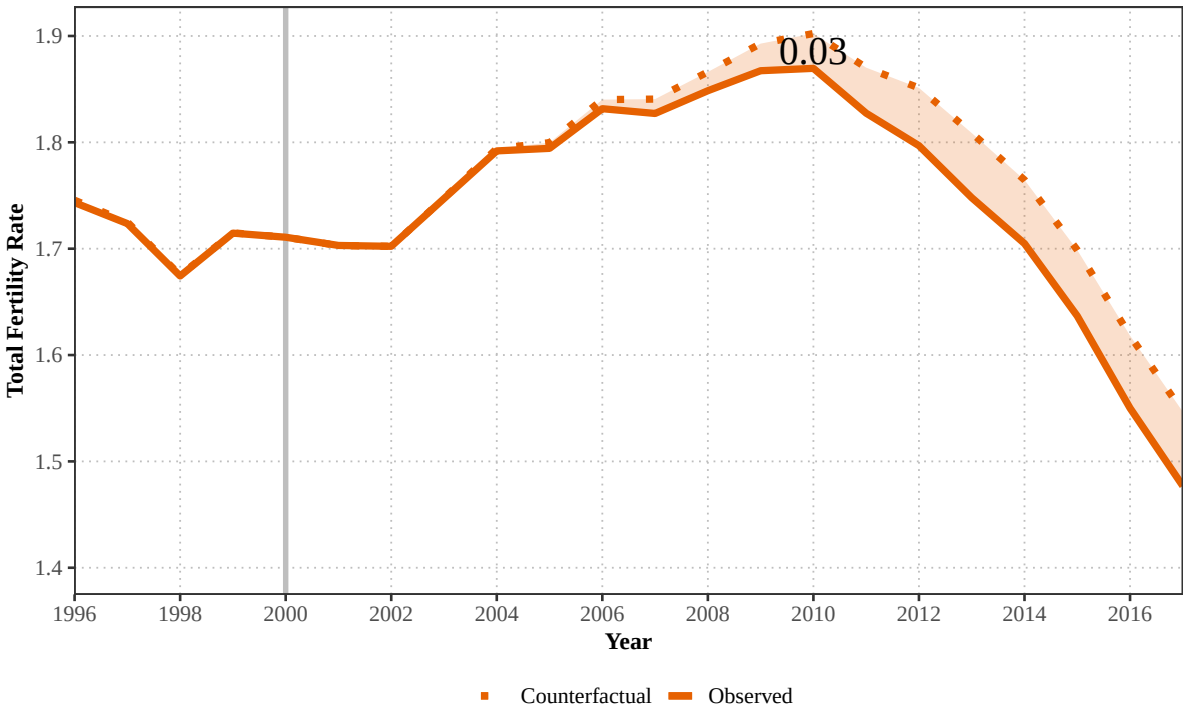

Figure B.7: Time-trend of the observed and counterfactual total fertility rate (TFR) of the Finnish population between 1990 and 2019. The dotted line marks the Finnish TFR if the composition of the population remained constant from 2000 onward. The solid line represents the observed TFR for the same period. The shaded area marks the difference between the counterfactual and observed TFR. The numbers are the difference between counterfactual and observed TFR ($TFR_{counterfactual} - TFR_{observed}$).

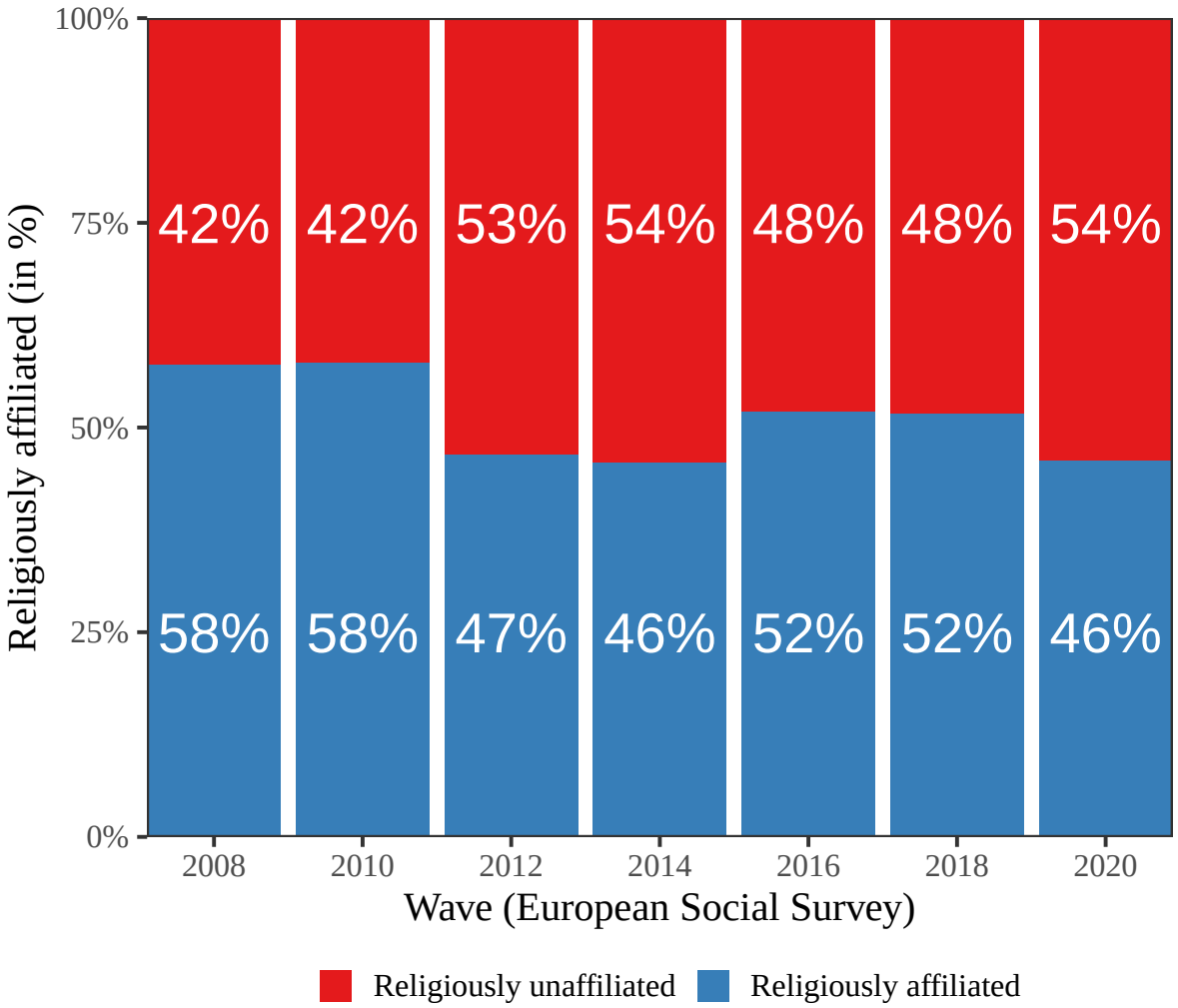

Figure B.8: Share of religious population in Finland across waves 4-10 in the European Social Survey. The bars represent the weighted (pspwght - design and post-stratification weight) share of the population answering ”not applicable” to the question: ”Religion or denomination belonging to at present. Which one?” (Variables: rlgdnfi and rlgdnafi). Source: own calculations based on the European Social Survey.

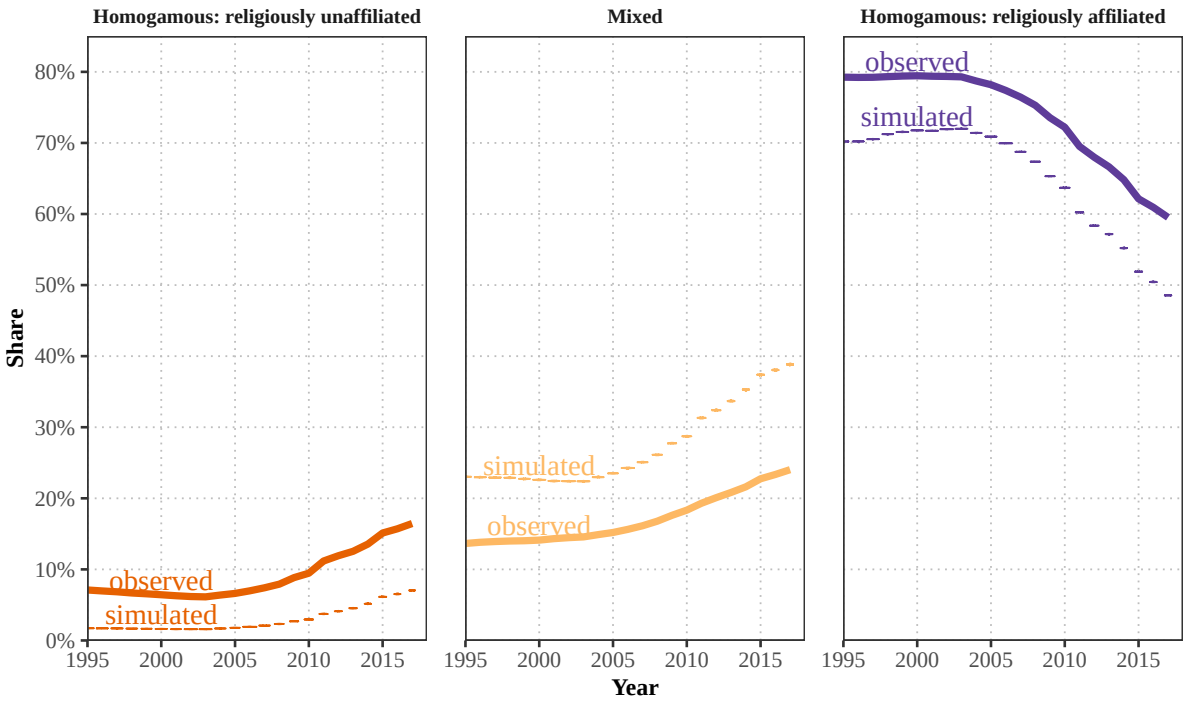

Figure B.9: This figures is illustrates the simulation results described in Section A.5. The line represents the observed share of the partnership type in the Finnish population of reproductive age. The annual boxplots represent the distribution of simulated shares.

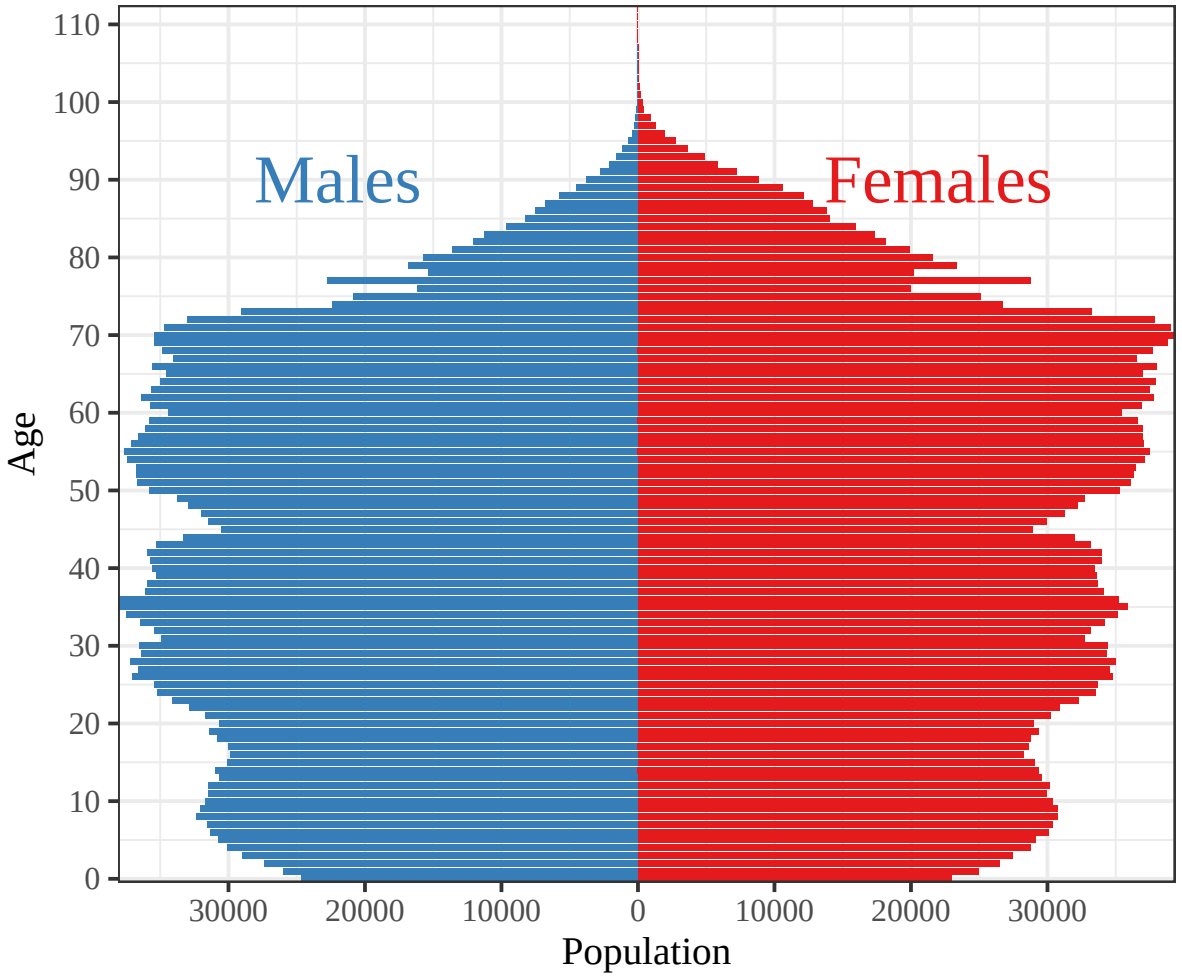

Figure B.10: This graphs displays the population pyramid for the year 2019, which is used to estimate the standard population. It serves as input data for estimating the standard population.

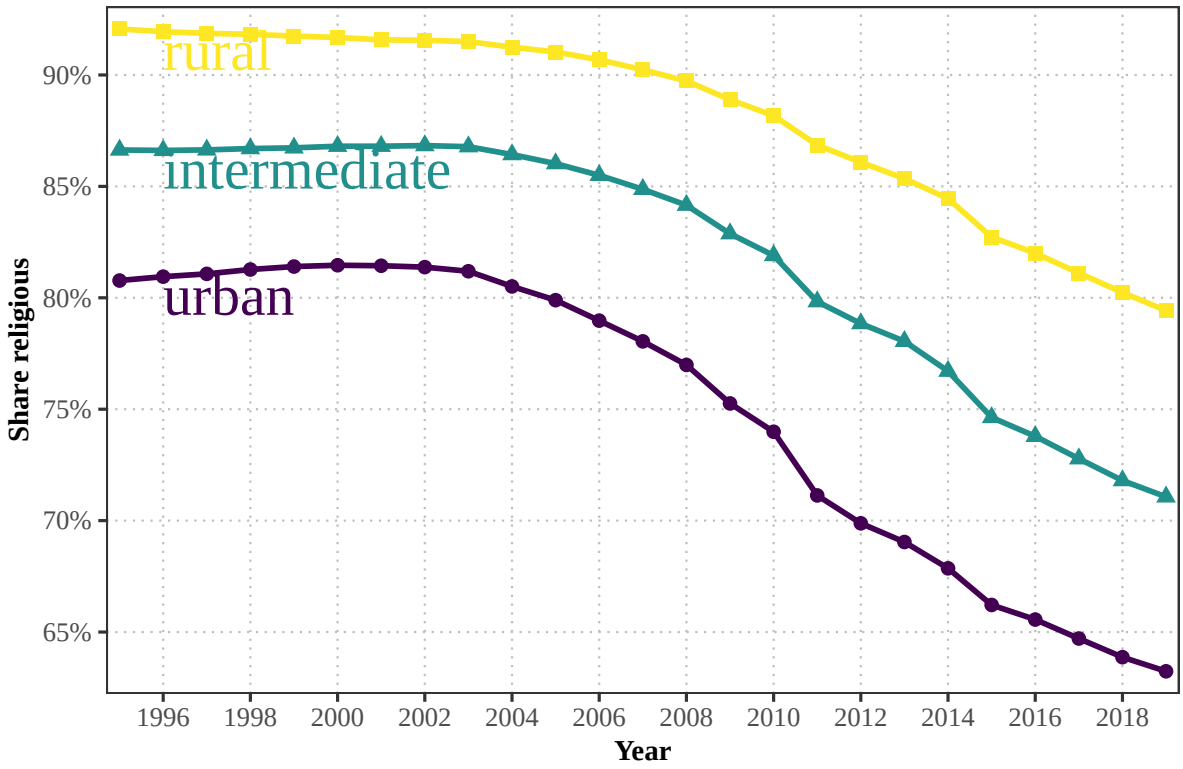

Figure B.11: Trend in state-church membership across different urban classifications.

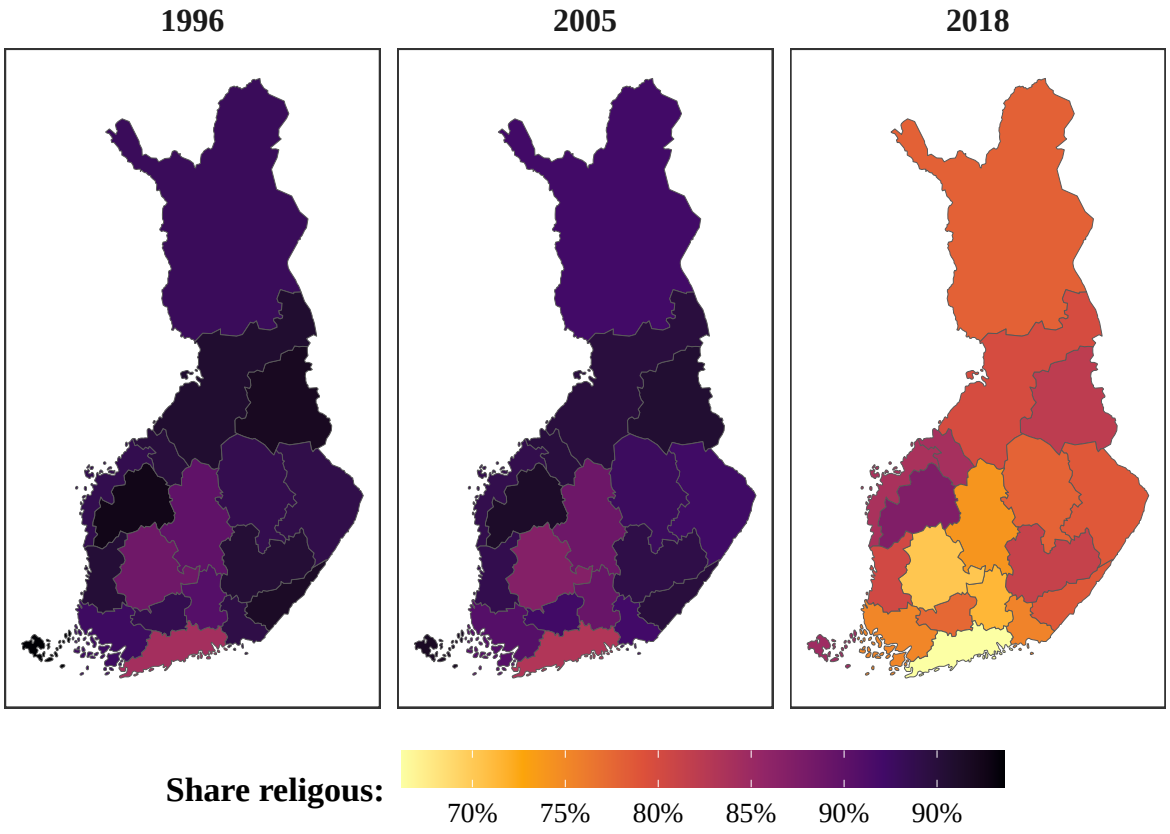

Figure B.12: Map of the regional share of state-church members in Finland in the years 1996, 2005 and 2019.

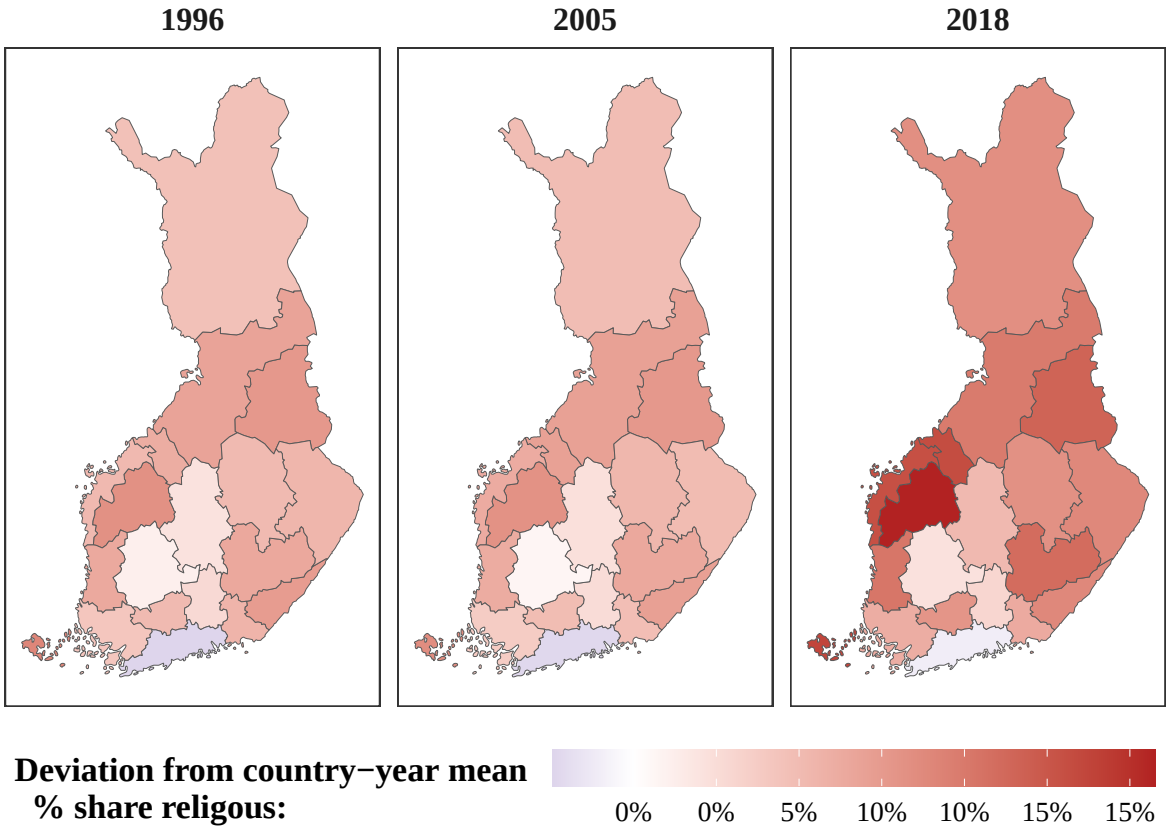

Figure B.13: Absolute difference of share of religious people to the average of the regional share of state-church members in Finland in the years 1996, 2005 and 2019.

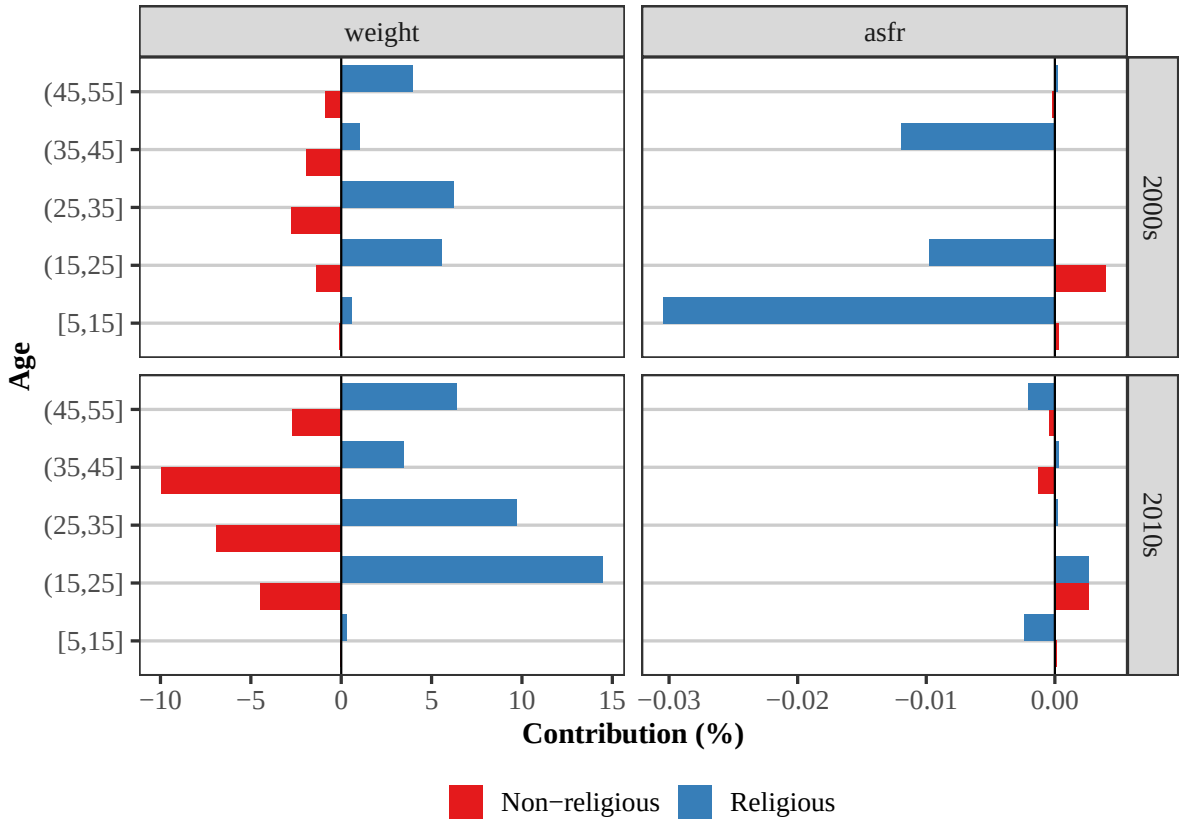

Figure B.14: This figure illustrates the results from the decomposition analysis, which serves as robustness check to the counterfactual simulation.

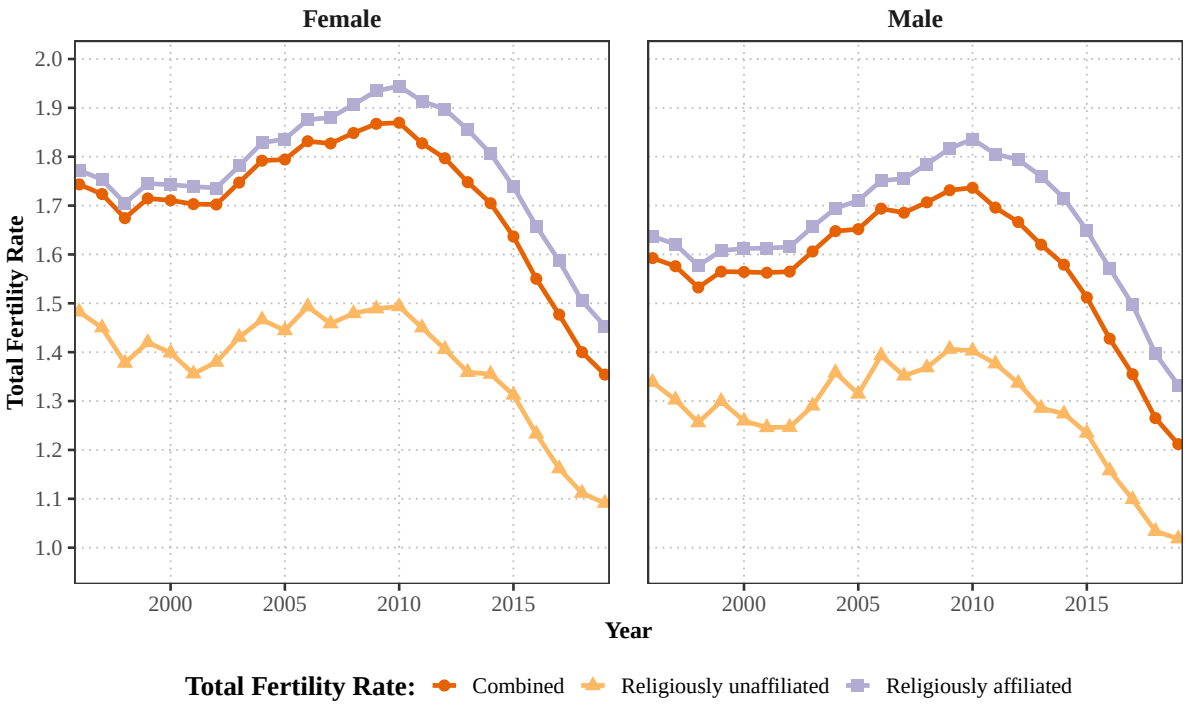

Figure B.15: Female and male TFRs for the religious, non-religious and the entire Finnish population in the period between 1995 and 2019. The left panel displays the rates for females and the right panel displays the corresponding numbers for males.

Figure B.16: Counterfactual and observed female and male TFR for the Finnish population between 1995 and 2019 if the population structure would have remained constant from 2000. The left panel displays the rates for females and the right panel displays the results for males.

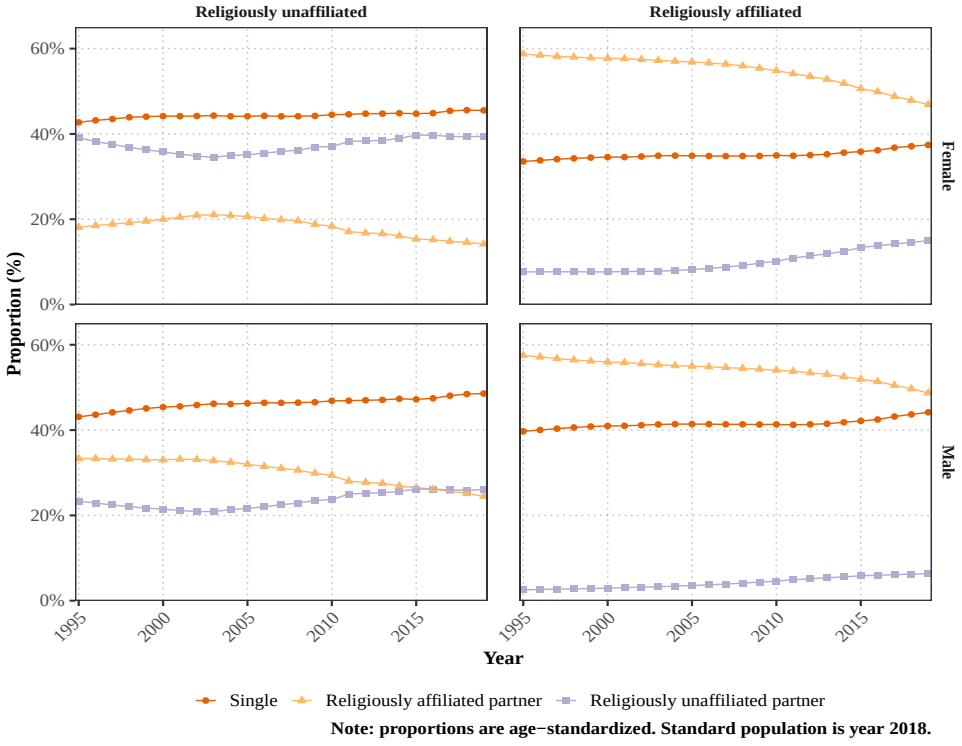

Figure B.17: This graph illustrates the age-standardized prevalence of partnership status by sex and religious status.

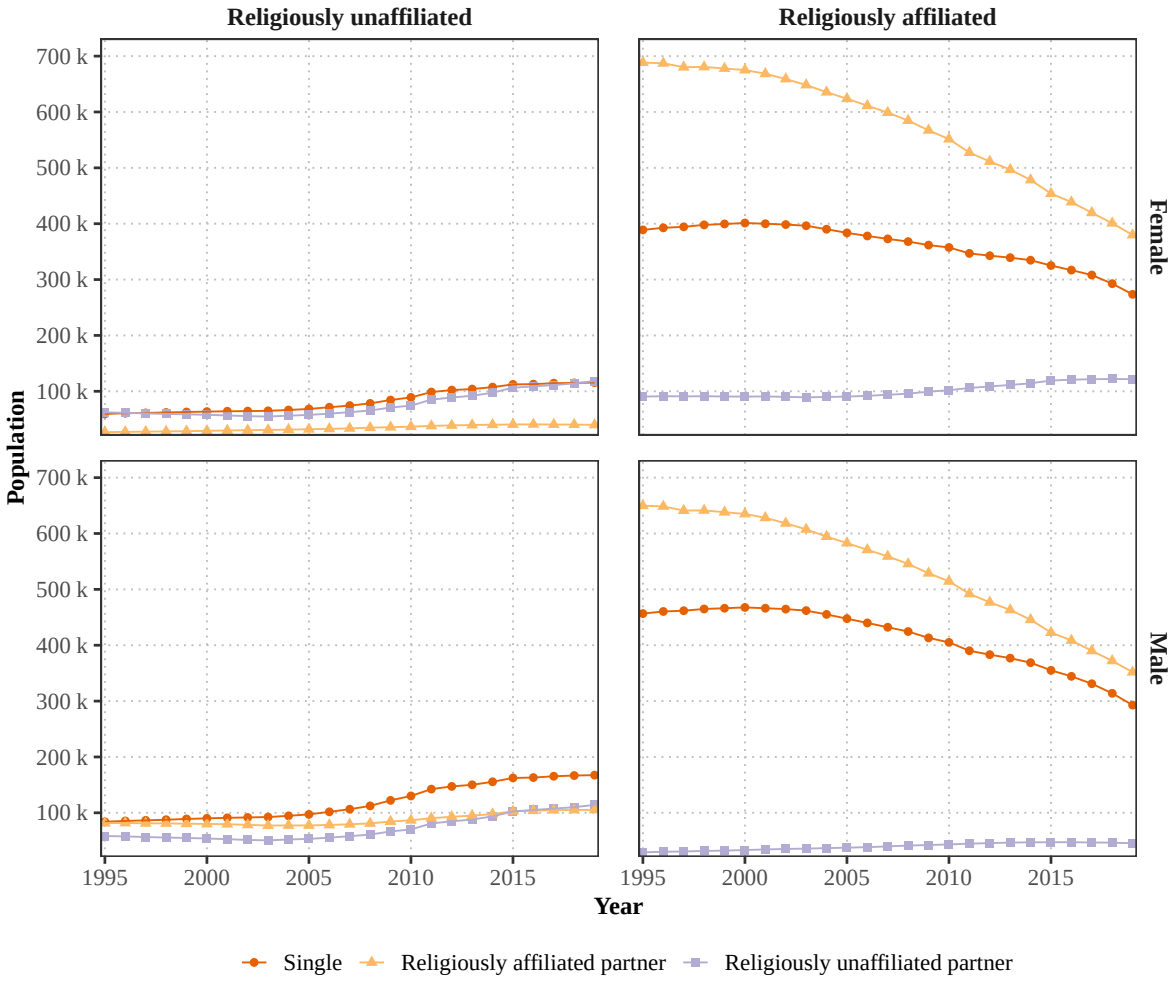

Figure B.18: This graph illustrates the population counts of people with a certain partnership status stratified by sex and religious status.

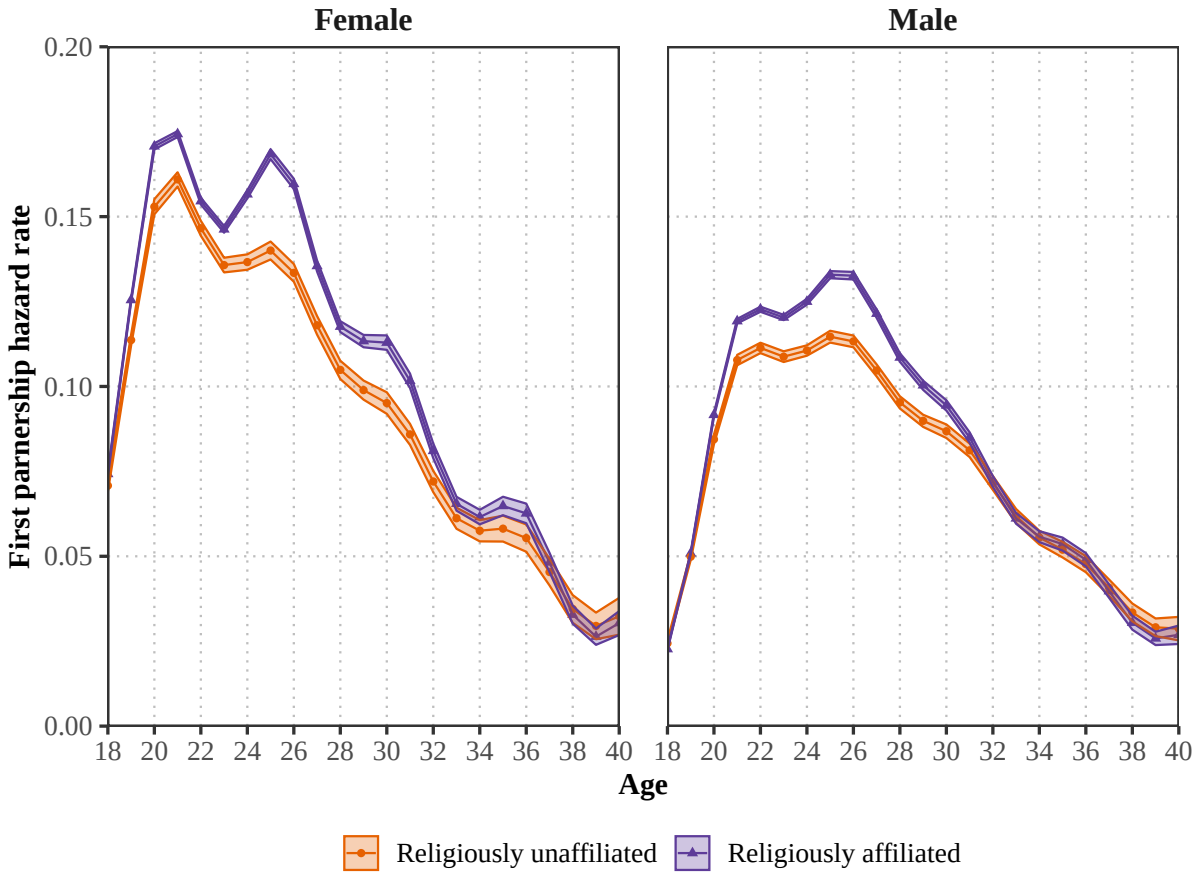

Figure B.19: Predicted first partnership rate from poisson-regression with age splines for males and females separately. The shaded area illustrates the 95%-confidence intervals.

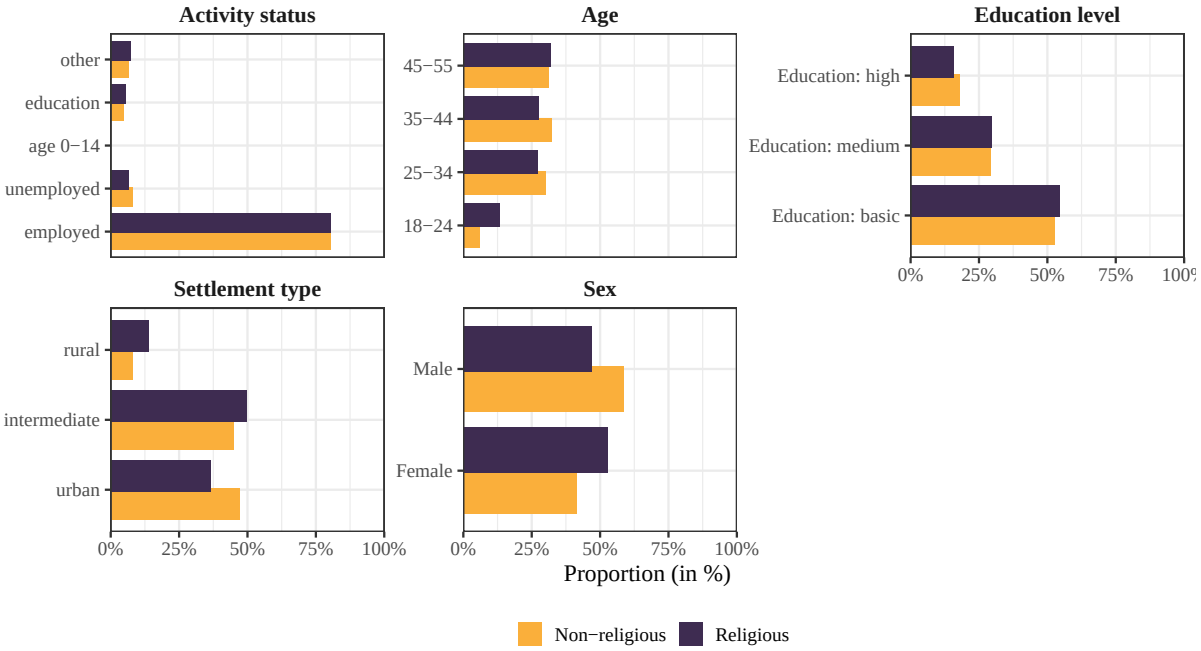

Figure B.20: The distribution of socio-economic characteristics in the religious and non-religious population.

C Additional Tables

Table C.5: Summary statistics of the nominal and ordinal variables in the couple panel data set used in the discrete-time survival model.

Variable	Expression	Count	% Share
Birth	Childbirth	578.455	5.284
Birth	Censored	10.368.059	94.716
Religious affiliation (female)	unaffiliated	1.368.230	12,499
Religious affiliation (female)	affiliated	9.578.284	87.501
Religious affiliation (male)	unaffiliated	2.067.243	18.855
Religious affiliation (female)	affiliated	8.879.271	81.885
Activity status (female)	employed	8.908.923	81.386
Activity status (female)	unemployed	899.050	8.213
Activity status (female)	education	611.614	5.587
Activity status (female)	other	526.927	4.814
Activity status (male)	employed	9.229.950	84.319
Activity status (male)	unemployed	820.423	7.495
Activity status (male)	education	389.892	3.562
Activity status (male)	other	506.249	4.265
Income quantile (female)	0-25%	1.492.243	13.623
Income quantile (female)	25-50%	2.104.846	19.228
Income quantile (female)	50-75%	4.236.582	38.703
Income quantile (female)	75-100%	3.112.843	28.437
Income quantile (male)	0-25%	1.003.922	9.171
Income quantile (male)	25-50%	1.342.447	12.264
Income quantile (male)	50-75%	2.999.389	27.401
Income quantile (male)	75-100%	5.600.656	51.164
Education (female)	basic	1.685.912	15.144
Education (female)	intermediate	5.001.980	44.924
Education (female)	high	4.445.361	39.932
Education (male)	basic	2.212.150	19.871
Education (male)	intermediate	5.305.261	47.656
Education (male)	high	3.614.960	32.473
Settlement structure	rural	1.714.478	15.662
Settlement structure	intermediate	5.561.172	50.803
Settlement structure	urban	3.670.846	33.353
Period	1995-2000	3.620.765	33.077
Period	2000-2005	2.931.603	26.781
Period	2005-2010	2.101.932	19.202
Period	2010-2015	1.443.848	13.19
Period	2015-2019	488.366	7.75

	Male religiously unaffiliated	Male religiously affiliated
Female religiously un-affiliated	21.56%	36.82%
Female religiously affiliated	31.41%	37.38%

Table C.6: Distribution of Unions ending in first birth by religious affiliation of both partners.

Model	AIC
$Y = \beta_1 religious_f + \boldsymbol{\beta_3 X} + \varepsilon_{i,t}$	2546997
$Y = \beta_1 relgious_m + \boldsymbol{\beta_4 X} + \varepsilon_{i,t}$	2546944
$Y = \beta_1 relgious_m + \beta_2 religious_f + \boldsymbol{\beta_3 X} + \varepsilon_{i,t}$	2546056
$Y = \beta_1 relgious_m + \beta_2 religious_f + \beta_3 religious_{both} + \boldsymbol{\beta_4 X} + \varepsilon_{i,t}$	2546043

Table C.7: Summary of the different discrete-time survival model specifications and their Akaike's Information Criterion (AIC). Lower AIC indicates that the model contains more information. The left column shows the model specification. The vector of control variables consists of female education, female income, couple education homogeneity, couple income, age and age^2. The right column contains the model specific Akaike's Information Criterion as measure of model fit.

Table C.8: Average marginal effect of the discrete-time survival model on the transition to first birth. The numbers can be interpreted as population level effect. The number indicates the average increase in the probability of childbirth if the predictor value was to increase by one unit.

term	AME Model 1	AME Model 2	AME Model 3	AME Model 4
Religious affiliation female: dY/dX	0.015 (0.01, 0.02)		0.012 (0.007, 0.017)	0.016 (0.01, 0.022)
Religiously affiliated male: dY/dX		0.014 (0.009, 0.018)	0.012 (0.007, 0.016)	0.013 (0.009, 0.018)
Age at onset: dY/dX	-0.001 (-0.001, 0)	-0.001 (-0.001, 0)	-0.001 (-0.001, 0)	-0.001 (-0.001, 0)
Union duration: dY/dX	0.002 (0.001, 0.003)	0.002 (0.001, 0.003)	0.002 (0.001, 0.003)	0.002 (0.001, 0.003)
Activity: unempl. - empl.	-0.015 (-0.02, -0.009)	-0.015 (-0.021, -0.01)	-0.015 (-0.021, -0.009)	-0.015 (-0.021, -0.009)
Activity: edu. - empl.	-0.004 (-0.01, 0.002)	-0.004 (-0.01, 0.002)	-0.004 (-0.01, 0.002)	-0.004 (-0.01, 0.002)
Activity: other - empl.	0.087 (0.072, 0.102)	0.085 (0.07, 0.1)	0.086 (0.071, 0.101)	0.086 (0.071, 0.101)
Activity male: unempl. - empl.	-0.005 (-0.012, 0.001)	-0.006 (-0.013, 0.001)	-0.006 (-0.012, 0.001)	-0.005 (-0.012, 0.001)
Activity male: edu. - empl.	-0.012 (-0.019, -0.004)	-0.012 (-0.019, -0.005)	-0.012 (-0.019, -0.005)	-0.012 (-0.019, -0.005)
Activity: other - employed	-0.029 (-0.039, -0.02)	-0.03 (-0.039, -0.02)	-0.03 (-0.039, -0.02)	-0.029 (-0.039, -0.02)
Education : medium - basic	0.013 (0.009, 0.017)	0.013 (0.01, 0.017)	0.013 (0.009, 0.017)	0.013 (0.009, 0.017)
Education : high - basic	0.043 (0.037, 0.05)	0.045 (0.038, 0.051)	0.044 (0.038, 0.051)	0.044 (0.038, 0.051)
Education male: medium - basic	0.004 (0, 0.008)	0.004 (0, 0.007)	0.004 (0, 0.008)	0.004 (0, 0.008)
Education male: high - basic	0.02 (0.015, 0.026)	0.02 (0.014, 0.026)	0.02 (0.014, 0.026)	0.02 (0.015, 0.026)
Income quantile: 2 - 1	0.007 (0.001, 0.012)	0.006 (0, 0.012)	0.006 (0, 0.011)	0.005 (0, 0.011)
Income quantile: 3 - 1	-0.004 (-0.009, 0.002)	-0.005 (-0.01, 0.001)	-0.005 (-0.011, 0.001)	-0.005 (-0.011, 0.001)
Income quantile: 4 - 1	-0.023 (-0.029, -0.017)	-0.024 (-0.031, -0.018)	-0.024 (-0.031, -0.018)	-0.025 (-0.031, -0.018)
Income quantile male: 2 - 1	0.008 (0.002, 0.015)	0.008 (0.001, 0.014)	0.008 (0.002, 0.014)	0.008 (0.002, 0.014)
Income quantile male: 3 - 1	0.019 (0.013, 0.025)	0.019 (0.013, 0.025)	0.019 (0.013, 0.025)	0.019 (0.013, 0.025)
Income quantile male: 4 - 1	0.02 (0.014, 0.026)	0.02 (0.014, 0.027)	0.02 (0.014, 0.026)	0.02 (0.014, 0.026)
Settlement: intermediate - urban	0.018 (0.015, 0.021)	0.018 (0.015, 0.022)	0.018 (0.014, 0.021)	0.018 (0.014, 0.021)
Settlement: rural - urban	0.031 (0.024, 0.037)	0.031 (0.025, 0.038)	0.03 (0.024, 0.037)	0.03 (0.024, 0.036)
Period: 2000-2005 - 1995-2000	0.018 (0.013, 0.022)	0.018 (0.013, 0.022)	0.017 (0.013, 0.022)	0.018 (0.013, 0.022)
Period: 2005,2010 - 1995-2000	0.024 (0.019, 0.029)	0.024 (0.019, 0.028)	0.024 (0.019, 0.028)	0.024 (0.019, 0.029)
Period: 2010-2015 - 1995-2000	0.013 (0.008, 0.018)	0.013 (0.008, 0.018)	0.014 (0.009, 0.019)	0.014 (0.009, 0.019)
Period: 2015-2020 - 1995-2000	-0.005 (-0.01, 0)	-0.005 (-0.01, -0.001)	-0.004 (-0.009, 0)	-0.004 (-0.009, 0.001)

Table C.9: Results from discrete-time survival analysis using logit-binomial models on the probability of childbirth. Results are displayed as odds ratios. The couple composition with respect to religious affiliation is held constant. The age-splines (at couple formation), couple duration-splines and age-duration-splines were omitted for readability.

	First childbirth			
	(1)	(2)	(3)	(4)
Religiously affiliated	1.196***		1.156***	1.212***
Religiously affiliated male		1.167***	1.133***	1.2***
Both religiously affiliated				0.929***
Activity: unemployed	0.761***	0.76***	0.761***	0.761***
Activity: education	0.658***	0.657***	0.658***	0.658***
Activity: other	1.475***	1.474***	1.475***	1.476***
Activity male: unemployed	1.004	1.006	1.007	1.006
Activity male: education	0.809***	0.81***	0.809***	0.809***
Activity male: other	0.843***	0.844***	0.844***	0.844***
Education: medium	0.962***	0.964***	0.961***	0.962***
Education: high	1.6***	1.606***	1.597***	1.598***
Education male: medium	0.905***	0.904***	0.904***	0.904***
Education male: high	1.075***	1.071***	1.072***	1.072***
Income quantile: 2	0.917***	0.918***	0.915***	0.915***
Income quantile: 3	0.652***	0.654***	0.651***	0.65***
Income quantile: 4	0.503***	0.504***	0.501***	0.501***
Income quantile male: 2	1.284***	1.284***	1.281***	1.281***
Income quantile male: 3	1.587***	1.589***	1.583***	1.583***
Income quantile male: 4	1.747***	1.755***	1.746***	1.745***
Settlement: intermediate	1.494***	1.494***	1.486***	1.487***
Settlement: rural	1.564***	1.559***	1.547***	1.548***
Period: 2000-2004	1.164***	1.162***	1.163***	1.162***
Period: 2005-2009	1.285***	1.282***	1.286***	1.285***
Period: 2010-2014	1.217***	1.216***	1.225***	1.224***
Period: 2015-2019	1.017**	1.019**	1.03***	1.029***
Intercept	0.01***	0.01***	0.01***	0.009***
N	5047249	5047249	5047249	5047249
R^2	0.082	0.082	0.083	0.083
AIC	2547745	2547753	2547045	2547006

*p < .05; **p < .01; ***p < .001

Table C.10: Logit-binomial regression of being childless at age 45 on life-time partner market exposure measured by the availability ratio. The models control for the regional church tax rate. This table is displaying logit coefficients, which represent the average response in the log-odds of childlessness to a value change of 1.

	Childless at age 45			
	(1)	(2)	(3)	(4)
Intercept	-4.419***	-4.393***	-4.473***	-4.459***
Religiously affiliated	0.214***		0.157***	0.135***
Religiously affiliated male		-0.273***	0.141***	0.11***
Both religiously affiliated				0.042***
Activity: unemployed	-0.418***	-0.419***	-0.272***	-0.272***
Activity: education	0.388***	0.388***	-0.418***	-0.418***
Activity: other	0.006	0.008	0.388***	0.388***
Activity male: unemployed	-0.212***	-0.211***	0.009	0.009
Activity male: education	-0.169***	-0.169***	-0.212***	-0.212***
Activity male: other	-0.039***	-0.037***	-0.169***	-0.169***
Education: medium	0.468***	0.473***	-0.04***	-0.04***
Education: high	-0.1***	-0.101***	0.468***	0.467***
Education male: medium	0.073***	0.069***	-0.101***	-0.101***
Education male: high	-0.088***	-0.087***	0.07***	0.069***
Income quantile: 2	-0.429***	-0.427***	-0.09***	-0.09***
Income quantile: 3	-0.689***	-0.688***	-0.432***	-0.432***
Income quantile: 4	0.249***	0.249***	-0.692***	-0.692***
Income quantile male: 2	0.46***	0.462***	0.247***	0.247***
Income quantile male: 3	0.556***	0.564***	0.458***	0.458***
Income quantile male: 4	0.398***	0.398***	0.558***	0.558***
Settlement: intermediate	0.44***	0.437***	0.394***	0.393***
Settlement: rural	0.154***	0.152***	0.432***	0.432***
Period: 2000-2004	0.257***	0.256***	0.153***	0.153***
Period: 2005-2009	0.209***	0.211***	0.26***	0.26***
Period: 2010-2014	0.031***	0.036***	0.222***	0.222***
Period: 2015-2019	0.001	0	0.051***	0.051***
Church tax	-4.419***	-4.393***	-0.002	-0.002
N	5047249	5047249	5047249	5047249
R^2	0.083	0.083	0.083	0.083
AIC	2546998.586	2546946.018	2546057.539	2546043.99

*p < .05; **p < .01; ***p < .001

C.1 Regional panel fixed effects regression

Table C.11: Regression model of the regional TFR on the percent-share religious in a specific region (*finnish* Seutukunta) in the period between 1996 and 2019. The first model is an OLS regression. The second model is a first-difference model, which equals a fixed effects model, which accounts for omitted time-constant regional factors. The third model is a twoway fixed effects model, which accounts for time and region idiosyncrasies.

	TFR^{+}	ΔTFR	
	(1)	(2)	(3)
	Pooled OLS	Province fixed effects	Twoway fixed effects
% religiously affiliated	0.024***		
Δ % religiously affiliated		0.028***	0.027***
Constant	-0.034		
N	1254	1188	1188
R^2	0.178	0.037	0.317
Adjusted R^2	0.176	0.035	0.278

*p < .05; **p < .01; ***p < .001
$^{+}$ Standard errors are clustered at the province level.

Table C.12: Regression model of the regional TFR of the religiously affiliated on the percent-share religiously affiliated in a specific region (*finnish* Seutukunta) in the period between 1996 and 2019. The first model is an OLS regression. The second model is a first-difference model, which equals a fixed effects model, which accounts for omitted time-constant regional factors. The third model is a twoway fixed effects model, which accounts for time and region idiosyncrasies.

	TFR^{+}	Δ TFR	
	(1)	(2)	(3)
	Pooled OLS	Province fixed effects	Twoway fixed effects
% religiously affiliated	0.014***		
Δ % religiously affiliated		0.023***	0.003
Constant	0.785***		
N	1254	1188	1188
R^2	0.113	0.044	0.261
Adjusted R^2	0.111	0.042	0.219

*p < .05; **p < .01; ***p < .001
$^{+}$ Standard errors are clustered at the province level.

C.2 Results from the Twin Models

Table C.13: Female twin FE comparison for the effect of religious affiliation on fertility.

Dependent Variable:	Childbirth				
Model:	(1)	(2)	(3)	(4)	(5)
Female religiously affiliated		-0.043		-0.048	-0.087
		(0.0182)		(0.0291)	(0.0538)
Male religiously affiliated			0.0155	0.0271	0.0034
			(0.0340)	(0.0328)	(0.0456)
Both religiously affiliated					0.0556
					(0.0656)
Twin fixed-effects	Yes	Yes	Yes	Yes	Yes
Observations	1,277	1,277	1,277	1,277	1,277
R^2	0.501	0.502	0.501	0.503	0.503
Within R^2	0.101	0.104	0.101	0.105	0.106

Clustered (twin_id) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table C.14: Male twin FE comparison for the effect of religious affiliation on fertility.

Dependent Variable:	Childbirth				
Model:	(1)	(2)	(3)	(4)	(5)
Female religiously affiliated		0.0577		0.0685*	0.0947**
		(0.0373)		(0.0383)	(0.0467)
Male religiously affiliated			-0.0368	-0.0459	0.0124
			(0.0282)	(0.0293)	(0.0670)
Both religiously affiliated					0.0725
					(0.0779)
Twin fixed-effects	Yes	Yes	Yes	Yes	Yes
Observations	1,700	1,700	1,700	1,700	1,700
R^2	0.468	0.469	0.469	0.47	0.471
Within R^2	0.08	0.08	0.08	0.08	0.08

Clustered (twin_id) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*