Heaven Can Wait: Future Tense and Religiosity*

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ABSTRACT. This paper identifies a new source of differences in religiosity: the type of future tense marking in language. We argue that the rewards and punishments that incentivise religious behaviour are more effective for speakers of languages without inflectional future tense. Consistent with this prediction, we show that speakers of languages without inflectional future tense are more likely to be religious and to take up the short-term costs associated with religiosity. What is likely to drive this behaviour, according to our results, is the relatively higher appeal of the religious rewards for these individuals. Our analysis is based on within country regressions comparing individuals with identical observable characteristics who speak a different language.

JEL classification: D83, Z12, Z13.

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1. Introduction

Different languages organise reference to the future in different ways. Many languages require speakers to use a distinct verb form when talking about future events (inflectional future tense). Other languages do not distinguish as clearly between future and present events, and speakers can talk about the future in much the same way in which they talk about the present (no inflectional future tense).[1] This difference extends to religious discourse, e.g. scriptures, prayers, etc.[2] Does this grammatical contrast have implications for speakers' religious convictions and behaviour? In this paper, we argue that the answer is: yes, whether a speaker's language contains or lacks inflectional future tense has consequences for his/her level of religiosity.

At first, the idea that a mere grammatical difference may matter for cognition and behaviour may seem far-fetched. But there is substantial evidence that there is in fact a connection between the language we speak and how we think and act. There are two different pathways along which linguistic features can be relevant to our behaviour. First, linguistic features are often a manifestation of deeper cultural traits. For instance, in Japanese there are numerous second-person pronouns, marking varying levels of politeness. Here, language is a reflection of a culture characterised by high levels of social hierarchy (Kashima and Kashima, 1998). Second, linguistic features can have a direct effect on cognition and behaviour. This claim is commonly known as the *Linguistic Relativity Hypothesis* or *Whorfism* (see e.g. Lucy, 1997; Casasanto, 2015). For example, Russian forces its speakers to distinguish between light and dark blue, as it lacks a generic term corresponding to the English "blue". This lexical difference influences speakers' cognition; Winawer et al. (2007) have shown that Russian speakers are better at discriminating different shades of blue. Finally, there may be a complex interplay between the cultural and the cognitive pathway—e.g. certain cultural traits may first become embodied in language, their linguistic manifestation

[1] See Section 2 for a more detailed explanation of the two different future tense systems.

[2] For instance, the following famous passage from the Second Epistle to Timothy is in inflectional future tense in the French bible (1.), whereas the Finnish bible lacks inflectional future tense (2.).

> 'And the Lord will rescue me from every evil attack and will bring me safely to his heavenly kingdom.' (2 Timothy 4:18)
>
> 1. *Le Seigneur me **délivrera** de toute oeuvre mauvaise, et il me **sauvera** pour me faire entrer dans son royaume céleste*
>
>   And the Lord me **deliver**$_{\textbf{future}}$ of all works evil, and he me **save**$_{\textbf{future}}$ to me make enter into his kingdom heavenly.
>
> 2. *Ja Herra **on vapahtava** minut kaikesta ilkivallasta ja **pelastava** minut taivaalliseen valtakuntaansa*
>
>   And the Lord **is freeing**$_{\textbf{present}}$ me from all wickedness, and **saves**$_{\textbf{present}}$ me in his heavenly kingdom.

may then contribute to spreading, amplifying, or preserving these traits (Mavisakalyan and Weber, 2017).

How do the two channels of influence relate to the case of future tense and religiosity? In a nutshell, the connection is the following. First, speaking a language that lacks inflectional future tense, such as Finnish or German, is associated with higher long-term orientation, reflected in lower time discount rates, i.e. speakers of languages without inflectional future tense tend to discount future costs and rewards less than users of inflectional future tense (Galor et al., 2016). Second, by talking about the future as if it were the present, speakers of languages without inflectional future tense subjectively perceive future outcomes as temporally less distant (Chen, 2013). Both factors matter for speakers' religiosity, since the appeal of being religious depends to a large extent on the promise of a vast future pay-off for the faithful: *an afterlife in heaven*. Speakers of languages without inflectional future tense, we propose, value this future good more highly and locate it closer to their own temporal position than do users of inflectional future tense. As a result, they are more likely to be religious.

Based on data from a collection of nationally-representative surveys from 83 countries, we show that there is a positive and significant association between speaking a language that lacks inflectional future tense and the probability of being religious. Relative to individuals who use inflectional future tense, absence of inflectional future tense is associated with a 6.4 percentage points increase in the probability of being religious in the most extensive model specification. In addition to individual characteristics, our analysis controls for wave, country, language family and ethnicity fixed effects thereby mitigating the potential confounding effects of geography, culture, history, institutions, and socio-economic conditions. Moreover, we show that speakers of languages without inflectional future tense derive more comfort from being religious and have a higher propensity to accept the costs associated with being religious, such as attending religious services, praying and complying with religious norms.

The link between language, culture and behaviour is the focus of a growing literature in economics (for reviews see Mavisakalyan and Weber, 2017; Ginsburgh and Weber, 2020). Three linguistic features have received particular attention. First, the literature has established a connection between *personal pronoun* systems and various cultural traits such as individualism, collectivism and social distance (Kashima and Kashima, 1998; Licht et al., 2007; Tabellini, 2008; Davis and Abdurazokzoda, 2016; Davis and Williamson, 2016). Second, it has demonstrated that linguistic *gender* systems affect gender inequalities in a number of domains including labour markets (Mavisakalyan, 2015; van der Velde et al., 2015;

Gay et al., 2017), corporate and political leadership (Santacreu-Vasut et al., 2014; Hicks et al., 2016; Jeny and Santacreu-Vasut, 2017), household division of labour (Hicks et al., 2015) and education (Davis and Reynolds, 2018; Galor et al., 2020). Third, and directly relevant to our study, the literature has shown that *absence of inflectional future tense* affects speakers' inter-temporal preferences (Sutter et al., 2018) and induces more future-oriented behaviours including higher saving (Chen, 2013; Guin, 2015), higher investment in health (Chen, 2013) and education (Galor et al., 2020), higher propensity to become entrepreneurs (Campo et al., 2020), and raised environmental concern and action (Mavisakalyan et al., 2018) at the level of individuals and/or countries. At the corporate level, lack of inflectional future tense is associated with higher precautionary cash holdings (Chen et al., 2017), higher investment in research and development (Chi et al., 2020), and higher loan spreads and higher collateral use in loan contracts (Godlewski and Weill, 2019). We extend this literature by considering a novel outcome: religiosity.

Studies on the economics of religion have shown that religiosity has implications for economic behaviours and outcomes (see Iannaccone, 1994, 1998; Lehrer, 2004; Hoffmann, 2013; Iyer, 2016, for reviews). Religious and non-religious individuals are different from each other in a number of important ways, including how much they work (e.g. Spenkuch, 2017) and study (e.g. Mohanty, 2016), pre-disposition to risky behaviours (e.g. Fletcher and Kumar, 2014), fertility (e.g. Hayford and Morgan, 2008), health (e.g. Maselko and Kubzansky, 2006), happiness (e.g. Lelkes, 2006), economic and political preferences (e.g. Scheve et al., 2006; Renneboog and Spaenjers, 2011). At the macro level, there is evidence linking religion with economic growth (e.g. Barro and McCleary, 2003; McCleary and Barro, 2006). What are the sources of differences in religiosity? The literature has identified important determinants of differences in religiosity including income (Becker and Woessmann, 2013; Buser, 2015) and education (Cesur and Mocan, 2013; Hungerman, 2014). Adverse life events such as natural disasters (Sinding Bentzen, 2019), rainfall risk (Ager and Ciccone, 2017), unemployment and marital separation (Clark and Lelkes, 2006), financial crisis (Chen, 2010), shocks to income (Dehejia et al., 2007) and to social mobility (Binzel and Carvalho, 2017) also influence religious beliefs. The main idea behind some of these findings is that of social insurance existing on the basis of religious obligation (e.g. Dehejia et al., 2007) or of 'religious coping' whereby individuals are better at dealing with challenging situations by drawing on religious beliefs (e.g. Sinding Bentzen, 2019). Our study adds to this literature by offering a novel explanation for differences in religiosity.

In the next section, we discuss the potential mechanisms which mediate the effect of language on religiosity. Section 3 presents our data and empirical approach. Section 4 presents the results. We conclude with a discussion of the implications of our findings in Section 5.

2. Background

2.1. **Future tense.** Languages differ in how they encode reference to the future. Following Dahl and Velupillai (2013), we categorise languages into two groups: languages that require speakers to use a designated verb form when talking about the future; these are languages *with inflectional future-tense*. Other languages *lack inflectional future tense*; these languages either do not mark the future at all, or do so by other means, for instance, with the help of a present-tensed auxiliary verb.[3] For instance, when talking about tomorrow's weather, speakers of a language without inflectional future tense, such as Finnish, use the same verb form in which they speak about today's weather (Dahl and Velupillai, 2013):

(1) Tänään **on** kylmää.
today **is** cold.
'It is cold today.'

(2) Huomenna **on** kylmää.
tomorrow **is** cold.
'It will be cold tomorrow.'

On the other hand, speakers of French, an inflectional future tense language, use a dedicated future verb form when expressing the same information:

(1) Il **fait** froid aujourd'hui.
It **do**$_{\textbf{present}}$ cold today.
'It is cold today.'

(2) Il **fera** froid demain.
It **do**$_{\textbf{future}}$ cold today.
'It will be cold tomorrow.'

As pointed out above, linguistic features can affect economic outcomes through at least two different channels: first, they can have a direct effect on cognition and behaviour; second, they can serve as indicators of more fundamental cultural factors. Both the cognitive and the cultural channel of influence seem operative in the case of future tense. We will further

[3] Our classification of languages is in line with that of Galor et al. (2016, 2020). However, unlike Galor et al. we stick to the original terminology of Dahl and Velupillai (2013) and speak of languages with "no inflectional future tense", rather than languages with "periphrastic future tense". The reason is that the term "periphrastic future tense" commonly refers to languages, such as English, which mark the future with an auxiliary (e.g. *will*), and not to languages that do not require any future tense marking at all, such as Finnish.

elaborate on both points. For an extensive discussion of the problem of causality in this domain see Mavisakalyan and Weber (2017); Ginsburgh and Weber (2020).

First, as Chen (2013, §2) has suggested, lack of inflectional future tense may lead speakers "to perceive future events as less distant" (Chen, 2013, p. 695). Since languages without inflectional future tense do not distinguish future from present events as sharply, they locate future events subjectively closer to the agent's own temporal position. Absence of inflectional future tense decreases, while presence of inflectional future tense increases *subjective temporal distance*. Why does the perceived temporal distance of an outcome matter for decision making? It matters because of the well-known and wide-spread tendency, known as *time discounting* (Frederick et al., 2002), to value future rewards or costs less than present ones—we rather have $100 now than in a year's time.

This brings us to the second, cultural channel of influence mentioned above. Future tense is a marker of economically relevant cultural traits. In particular, lack of inflectional future tense is associated with higher long-term orientation (Galor et al., 2016). Higher long-term orientation, in turn, is reflected in smaller time discount rates: higher "Long Term Orientation predict[s] a stronger tendency to wait for larger payoffs" (Wang et al., 2016, p. 116).[4]

Both channels of influence, the linguistic and the cultural one, work in the same direction—both predict that speakers of languages without inflectional future tense engage more in future directed actions and are more willing to accept short-term costs in return for long-term rewards. This finding has been corroborated for a whole range of significant economic outcomes (e.g. Chen, 2013; Guin, 2015; Chen et al., 2017; Mavisakalyan et al., 2018; Godlewski and Weill, 2019; Chi et al., 2020).

In case language plays an active causal role, can we expect an individual's level of religiosity to change, if s/he were to acquire a new language? Can we, for instance, expect that a French speaker (a language with inflectional future tense) *ceteris paribus* to become more religious upon becoming fluent in Finnish (a language without inflectional future tense)? While this may seem surprising, this is indeed what a causal influence of future tense predicts. In fact, there is growing evidence that such effects within individuals are real. For instance, Athanasopoulos (2007) finds that with regards to behaviours related to plural marking, Japanese speakers with an advanced knowledge of English behave more like monolingual English speakers, while Japanese speakers who have only an intermediate level of English behave like monolingual speakers of Japanese. For similar behavioural

[4] Typically, time discounting is represented by a discounting function involving a discounting factor δ determined by an agent's discount rate r. Smaller discount rates result in a discounting factor closer to 1.

effects of other linguistic features in bilingual individuals see Kousta et al. (2008); Athanasopoulos (2009); Kurinski and Sera (2011); for an overview see Athanasopoulos and Aveledo (2012). There is also evidence on the specific case of future tense and intertemporal choice. Ayres et al. (2020) show that bilingual individuals that speak both a language without inflectional future tense and one with inflectional future tense make different intertemporal choices depending on the language in which a future-directed task is presented to them: "[...] participants who are addressed in languages in which the present and the future are marked more distinctly tend to value future events less than participants who are addressed in languages in which the present and the future are similarly marked." (Ayres et al., 2020, p. 3). In the face of these findings, it does not seem implausible to assume that future tense may have some level of causal influence on religious behaviour, rather than being a mere surface phenomenon. That notwithstanding, our analysis will remain neutral between the two different channels of influence.

2.2. **Future tense and religiosity.** How do the foregoing points bear on the case of religiosity? Our central conjecture is that differences in religiosity between speakers of languages that contain or lack inflectional future tense can be partially explained by the fact that being religious has higher expected utility for speakers who do not use inflectional future tense. As just mentioned, the two groups of speakers differ in their assessment of future-directed actions. Both the linguistic and the cultural channel lead speakers of a language without inflectional future tense to assign higher expected utility to actions that promise future rewards. Importantly, this applies to an agent's decision of being religious: here, the relevant future reward is *an afterlife in heaven*. We can summarize this point as follows:

> HYPOTHESIS: Being religious has a higher expected utility for speakers of a language without inflectional future tense compared to similar speakers of a language with inflectional future tense.

Before considering the expected costs and benefits that determine an agent's choice, we want to address a general concern with the present approach. One might worry that it is artificial to conceptualise religiosity as a conscious choice. However, we are not alone here—the decision-theoretic approach to religiosity has a long history, reaching back at least to Pascal (1670). It is furthermore important to note that we are comparing individuals within a given religious denomination. Our approach is therefore compatible with treating having a certain religious denomination as a cultural trait, outside of individuals' conscious decisions. The main outcome of interest is whether or not an individual gives an affirmative answer to the question of whether they are a religious person. We take this to capture whether or not they

actively embrace the religious denomination they may find themselves with. Furthermore, our analysis extends to intentional actions, such as the frequency of praying and attending religious ceremonies. Both can naturally be understood as resulting from deliberate choices.

Let us take a closer look at the relevant decision matrix. The basic choice an agent faces is between *Being Religious* and *Not Being Religious*. By *Being Religious* we are referring to the option of endorsing a religion which is available in the agent's context. By *Not Being Religious* we are referring to the option of not endorsing any of the contextually available religions. It is helpful to distinguish between *short-term costs and benefits* and *long-term costs and benefits* associated with being religious. Being religious involves more than merely accepting a certain set of religious doctrines on a cognitive level. It has significant *practical consequences*, many of which incur short-term costs. For instance, active members of a religion typically engage in certain rituals, such as prayers and religious ceremonies. More importantly, religions impose demanding behavioural norms on their followers. Most religious codes prohibit theft, abortion, homosexuality, prostitution, etc. These norms often conflict with agents' narrow and short-term self-interests. On the other hand, there are also short-term benefits associated with being religious. Many believers derive psychological comfort from being religious, which may e.g. help mitigate the fear of death and the distress caused by the realization that human existence is finite.

With regards to the amount of negative utility associated with *Being Religious*, it seems plausible that both groups of speakers will have to bear the same short-term costs, such as complying with a religious code, sacrificing time and other resources to attend religious ceremonies, etc. However, there may be certain differences in short-term benefits that distinguish users of a language without inflectional future tense from users of a language with inflectional future tense. As pointed out above, the former have on average a higher concern for the future. As a result, they may dread death more and may derive a higher level of psychological discomfort from the thought that their existence is finite. In turn, they may receive a higher psychological pay-off from the belief that a positive afterlife awaits them.

If being religious incurs significant short-term costs, often outweighing their short-term benefits, why might rational agents nevertheless decide to be religious? The crucial factor which mitigates these short-term costs is a highly appealing long-term benefit: a rewarding future afterlife in heaven. But there is also a potential long-term cost: most religions also contain the threat of a negative or hellish afterlife for those who do not comply with the respective religious norms. Importantly, the long-term benefit and the long-term cost do not simply cancel each other out. According to most theologies, one can minimise the risk of

incurring the long-term costs by not sinning. And indeed, most people expect that they will go to heaven rather than to hell (YouGov, 2015). Hence, *Being religious* can have an overall positive expected utility for the faithful.

Granting that the expected pay-off of *Being religious* significantly depends on the perceived long-term benefit of heaven and the perceived long-term cost of hell (and that the former often outweighs the latter), the above assumptions predict two significant differences between speakers of languages without inflectional future tense vs speakers of languages with inflectional future tense. First, speakers of languages without inflectional future tense value the good of a positive afterlife higher and perceive it as temporally closer. Second, they also assess the disvalue of a negative afterlife higher and again perceive it as more proximate. As a result, they are more likely to bear the associated short-term costs of being religious, such as engaging in religious practices. They also have a stronger reason to comply with the relevant religious norms and can therefore be expected to judge transgressions more harshly. In the next section, we explore these predictions empirically.

3. Empirical approach

3.1. **Baseline model.** Our estimation framework exploits variations in grammar of the languages spoken by similar individuals within the same country in order to identify the effects of future tense. To test our central hypothesis, we consider a basic model in which propensity for being religious, $Religious^*_{ict}$ for an individual i in country c at time t, is assumed to depend on the absence of inflectional future tense $NoInflectFT_{ict}$ in the language spoken by the individual, together with (1) series of individual characteristics $\mathbf{X_{ict}}$ which might affect their choice of being religious (these include standard demographic and socio-economic characteristics, as well as the religion available in the individual's context); and (2) country and wave-of-interview fixed effects $\mathbf{K_c}$ and $\mathbf{W_t}$ to account for confounding effects of geography, institutions, and socio-economic conditions. Unobserved factors ε_{ict} further contribute to the propensity for being religious, leading to an equation of the form:

$$Religious^*_{ict} = \beta NoInflectFT_{ict} + \mathbf{X_{ict}}'\delta + \mathbf{K_c}'\gamma + \mathbf{W_t}'\psi + \varepsilon_{ict} \tag{1}$$

Observed religiosity status $Religious_{ict}$ is assumed to relate to latent propensity through the criterion $Religious_{ict} = 1(Religious^*_{ict} \geq 0)$, so that the probability of being religious under an assumption of normality for ε_{ict} becomes:

$$\begin{aligned} Pr(Religious_{ict} = 1 | NoInflectFT_{ict}, \mathbf{X_{ict}}, \mathbf{K_c}, \mathbf{W_t}) = \\ = \Phi(\beta NoInflectFT_{ict} + \mathbf{X_{ict}}'\delta + \mathbf{K_c}'\gamma + \mathbf{W_t}'\psi) \end{aligned} \tag{2}$$

with marginal effects of language future tense derived from the estimated model thus:

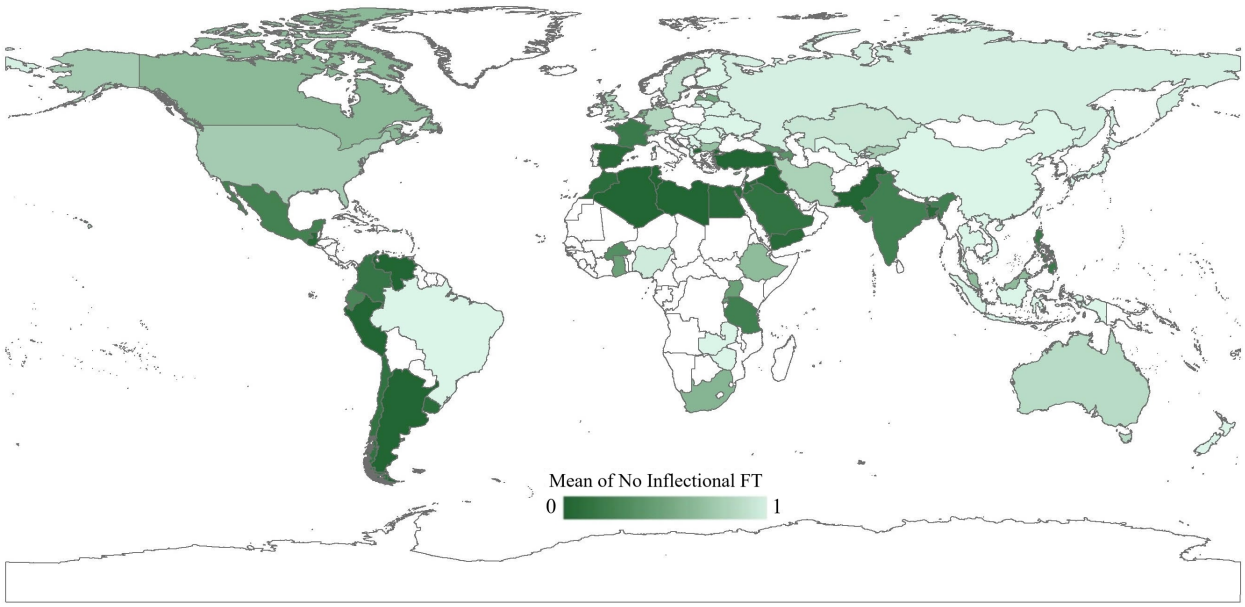
$$\frac{\partial Pr(Religious_{ict} = 1 | NoInflectFT_{ict}, \mathbf{X_{ict}}, \mathbf{K_c}, \mathbf{W_t})}{\partial NoInflectFT_{ict}} = \\ = \beta\phi(\beta NoInflectFT_{ict} + \mathbf{X_{ict}}'\delta + \mathbf{K_c}'\gamma + \mathbf{W_t}'\psi) \quad (3)$$

While this estimation approach allows us to isolate the effects of language from those of socio-economic conditions, institutions and geography, it still has two potential problems. First, the languages used to study the link between future tense and religiosity may not be independent given the geographical and historical relatedness of languages. As Roberts et al. (2015) argue, this is particularly a problem with cultural traits since 'languages and cultures inherit traits from common historical ancestors and borrow traits from neighbouring cultures' (p. 2). So it is possible that we observe the same traits in two cultures because they inherited them from the same ancestor culture, rather than because of causal dependencies between the traits. To account for cultural relatedness, we follow Roberts et al. (2015) to introduce controls for language families, since grouping languages in the same family signifies that they have evolved from a common ancestor, a proto-language.

Second, although the proposed approach accounts for many significant factors that may affect individual's behaviour— socio-economic conditions, institutions, and the broader cultural context—the effect of future tense may still reflect additional cultural effects due to the ethnic ancestry of the individual. To mitigate this possibility, we additionally include ethnicity fixed effects in a robustness check. This approach effectively exploits variations in structures of the languages spoken by individuals with the same ethnicity to identify the effect of language future tense. As we have stressed throughout, our empirical approach explicitly allows for future tense to work either through a linguistic-cognitive or a cultural channel, without disentangling them.

In addition to studying the link between the lack of inflectional future tense and religiosity, we (1) assess the validity of the assumptions underlying this relationship; and (2) implications for taking up costs associated with religiosity. To tackle (1), we explore whether the effectiveness of the incentives and disincentives associated with religion varies depending on the presence of inflectional future tense in an individual's language. Exploring (2) leads us to look at the implications of the lack of inflectional future tense for taking up costs associated with religiosity: involvement in religious practices and compliance with religious norms. We provide the details on our approach to these issues in an extended analysis which we present in §4.2.

Figure 1: Global distribution of speakers of languages that lack inflectional future tense



Note.— NO INFLECTIONAL FT is a binary variable for absence of inflectional future tense in an individual's language. It is averaged over all individuals surveyed in the World Values Survey in a country. Lighter shades indicate higher shares of NO INFLECTIONAL FT language speakers in a country. Countries not in the sample are in white.

3.2. **Data.** Our analysis is based on the World Values Surveys (WVS), a collection of nationally-representative individual-level repeated cross-sectional surveys conducted in nearly 100 countries which contain almost 90% of the world's population. The survey has started in 1981–1984 and contains rich information on the beliefs (including religious beliefs) and values of people throughout the world, alongside standard background demographic and socio-economic characteristics. Since wave 3, conducted in 1995–1998, the surveys include information on the language spoken at home by the individual, which makes it possible to link the observed behaviour of individuals in the surveys to the future tense system in their language. We thus utilise the four waves of WVS conducted in 1994–1998 (wave 3), 1999–2004 (wave 4), 2005–2009 (wave 5) and 2010–2014 (wave 6) which jointly include information on 310,388 individuals interviewed in 100 countries.

The operational sample used in the baseline analysis, however, is limited to 148,847 individuals in 83 countries. This is due to two key factors. First, data on grammatical structure for some of the languages spoken by individuals in WVS is missing. Data on the grammatical marking of future tense in languages, as defined in §2.1, comes from the World Atlas of

Table 1: Descriptive statistics

Variable	Definition of Variable	Mean
RELIGIOUS	0-1 binary variable; equals 1 if respondent is 'a religious person'	0.695 (0.461)
NO INFLECTIONAL FT	0-1 binary variable; equals 1 if respondent's language lacks inflectional future tense	0.509 (0.500)
DENOMINATIONS:		
CHRISTIAN	0-1 binary variable; equals 1 if respondent has Christian denomination	0.489 (0.500)
MUSLIM	0-1 binary variable; equals 1 if respondent has Muslim denomination	0.244 (0.430)
JEWISH	0-1 binary variable; equals 1 if respondent has Jewish denomination	0.005 (0.070)
HINDU	0-1 binary variable; equals 1 if respondent has Hindu denomination	0.023 (0.150)
EAST ASIAN	0-1 binary variable; equals 1 if respondent has Buddhist or other East Asian religious denomination	0.043 (0.205)
OTHER	0-1 binary variable; equals 1 if respondent has other or no denomination	0.195 (0.396)
BASELINE CONTROLS:		
MALE	0-1 binary variable; equals 1 if respondent is male	0.485 (0.500)
AGE	Respondent's age	41.130 (16.170)
MARRIED	0-1 binary variable; equals 1 if respondent is married or cohabiting	0.641 (0.480)
NO CHILDREN	0-1 binary variable; equals 1 if respondent has no children	0.287 (0.452)
PRIMARY	0-1 binary variable; equals 1 if respondent has primary-level education	0.211 (0.408)
SECONDARY	0-1 binary variable; equals 1 if respondent has secondary-level education	0.268 (0.443)
TERTIARY	0-1 binary variable; equals 1 if respondent has tertiary-level education	0.522 (0.500)
EMPLOYED	0-1 binary variable; equals 1 if respondent is employed	0.526 (0.499)
INCOME GROUP 1	0-1 binary variable denoting self-assessed income standing	0.203 (0.402)
INCOME GROUP 2	0-1 binary variable denoting self-assessed income standing	0.272 (0.445)
INCOME GROUP 3	0-1 binary variable denoting self-assessed income standing	0.298 (0.457)
INCOME GROUP 4	0-1 binary variable denoting self-assessed income standing	0.166 (0.372)
INCOME GROUP 5	0-1 binary variable denoting self-assessed income standing	0.062 (0.241)

Note.— Standard deviations in parentheses. $N = 148,847$.

Language Structures (WALS) Online (Dahl and Velupillai, 2013). The WALS is a large database of linguistic structures compiled by a team of 55 authors and has been the main source of data on linguistic structures in the literature (Dryer and Haspelmath, 2013). While, on average, information for around 400 languages is presented for each linguistic feature (information on future tense forms is available for 222 languages), this is still less than 10% of the world's languages (Comrie et al., 2013). As a result, at times, information on a given linguistic feature in WALS might be available for only a subset of languages spoken by individuals represented in large survey datasets such as WVS (Mavisakalyan and Weber, 2017). Second, our identification approach, as discussed in §3.1, exploits the presence of multilingual countries with sufficient linguistic diversity to allow for within-country comparisons. Hence, countries lacking such diversity are excluded from the sample.[5] Additionally, a small number of observations with missing values on key variables are dropped. Figure 1 describes the prevalence and geographic distribution of the structure of future tense in our sample, highlighting wide variations within countries and regions in the shares of speakers of languages without inflectional future tense. Across the entire sample, half of the individuals speak a language that lacks inflectional future tense (Table 1).

We study how NO INFLECTIONAL FT—a dummy for lack of inflectional future tense—affects religiosity, RELIGIOUS, defined by the response to the question of whether the subject is a religious person. Nearly 70% of individuals in our estimation sample consider themselves religious persons. We examine the decision of embracing a contextually available religion. To proxy for contextually available religions, we include dummies for religious denominations distinguishing between those whose formal denomination is Christian, Muslim, Jewish, Hindu, East Asian (Buddhist or other East Asian denomination) and others. We regard denomination as exogenous in our context. Furthermore, we ascertain that it is statistically unrelated to absence of inflectional future tense—Table A1 in the Appendix presents the results. Nearly half of the individuals in the sample are of Christian denomination. Muslims constitute nearly quarter of the sample. The rest of the denominations represent relatively small shares with 4% East Asian, 2% Hindus and 0.5% Jews. The remaining individuals have either other or no denomination at all.[6] Our analysis additionally controls for a

[5]For example, Italy drops out of the sample since the only language spoken at home reported within the WVS sample is Italian (alongside 'other' language which cannot be identified). On the other hand, Germany remains in the sample due to the presence of individuals speaking a language other than German (e.g. Turkish, Russian).

[6] Splitting this group into two—those with other and those with no denomination—has no implication for the results.

range of background characteristics of individuals. These include gender, age, family status, educational attainment, employment and income. These variables are described in Table 1.

4. Results

4.1. **Baseline results.** We start by undertaking a probit estimation of religiosity and absence of inflectional future tense. Table 2 presents the marginal effects from this estimation described in equation 3. First, we present a parsimonious specification looking at the relationship between No inflectional FT and Religious in a given religion and country context (column 1). Consistent with our central hypothesis, there is a significant and positive relationship between absence of inflectional future tense and the probability of being religious. Additionally, as can be expected, individuals belonging to one of the major religious denominations are more likely to be religious relative to the rest. In column (2) we introduce controls for 13 major language families to account for the relatedness of languages as discussed in §3.1. The estimated significant positive relationship between No inflectional FT and Religious is robust to this change in specification, and also to introducing additional controls for demographic characteristics of individuals (column 3). According to these results, males are less likely to be religious. On the other hand, marriage and presence of children is associated with higher probability of endorsing a religion. As seen in columns (4) and (5), the estimated relationship between No inflectional FT and Religious remains robust to further controlling for socio-economic characteristics of individuals. Religiosity decreases with educational attainment, however, controlling for educational attainment, employment and income status of individuals do not appear to significantly affect religiosity in these results. When the full set of baseline controls are included (column 5), speaking a language without inflectional future tense is associated with a 3.7 percentage points increase in the probability of being religious, in line with our central hypothesis in §2.2.

To identify the relationship between No inflectional FT and Religious, we exploit the presence of multilingual countries with sufficient linguistic diversity to allow for within-country comparison. In some countries in the sample, however, only a small group of observations contribute to such diversity. In column (1) of Table 3 we restrict the sample to individuals belonging to country-language pairs with at least 200 observations. The results are robust to this change in estimation sample.

Next, in column (2) of Table 3 we consider whether the results might be driven by languages that are prominent globally: Arabic, English, Russian and Spanish. This results in a significant reduction in the sample size; still we estimate significant positive marginal effect

Table 2: Baseline regressions — probit marginal effects

	(1)	(2)	(3)	(4)	(5)
	Dependent variable: RELIGIOUS				
NO INFLECTIONAL FT	0.032*	0.039**	0.035**	0.037**	0.037**
	(0.019)	(0.017)	(0.017)	(0.016)	(0.017)
CHRISTIAN	0.440***	0.440***	0.423***	0.422***	0.422***
	(0.027)	(0.036)	(0.028)	(0.025)	(0.029)
MUSLIM	0.452***	0.455***	0.450***	0.447***	0.447***
	(0.031)	(0.041)	(0.032)	(0.028)	(0.032)
JEWISH	0.249***	0.249***	0.234**	0.233**	0.232**
	(0.090)	(0.090)	(0.093)	(0.091)	(0.091)
HINDU	0.430***	0.427***	0.419***	0.418***	0.418***
	(0.041)	(0.045)	(0.041)	(0.039)	(0.041)
EAST ASIAN	0.306***	0.311***	0.298***	0.297***	0.297***
	(0.048)	(0.050)	(0.051)	(0.051)	(0.051)
MALE			-0.095***	-0.092	-0.092***
			(0.007)	(0.000)	(0.007)
AGE			0.001	0.002*	0.002*
			(0.001)	(0.001)	(0.001)
AGE^2			0.001	0.000	0.000
			(0.001)	(0.001)	(0.001)
MARRIED			0.013**	0.013**	0.014***
			(0.005)	(0.005)	(0.005)
NO CHILDREN			-0.019**	-0.017**	-0.016**
			(0.008)	(0.007)	(0.007)
PRIMARY				0.033***	0.033***
				(0.010)	(0.011)
SECONDARY				0.012**	0.012**
				(0.006)	(0.005)
EMPLOYED				-0.005	-0.006
				(0.005)	(0.005)
INCOME GROUP 1					0.006
					(0.013)
INCOME GROUP 2					-0.007
					(0.011)
INCOME GROUP 3					0.001
					(0.009)
INCOME GROUP 4					0.006
					(0.008)
Language families	No	Yes	Yes	Yes	Yes
Countries	Yes	Yes	Yes	Yes	Yes
Waves	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.218	0.219	0.233	0.233	0.233
Mean of dependent variable	0.695	0.695	0.695	0.695	0.695
N	148,847	148,847	148,847	148,847	148,847

Note.— Robust standard errors clustered by country and language are in parentheses. *Denotes significance at 10 percent; **at 5 percent; ***at 1 percent levels.

Table 3: Robustness checks — probit marginal effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: RELIGIOUS							
NO INFLECTIONAL FT	0.059**	0.067***	0.063***	0.052***	0.021*	0.047***	0.058***	0.064***
	(0.024)	(0.021)	(0.024)	(0.014)	(0.012)	(0.015)	(0.015)	(0.008)
Ethnicities	No	No	No	No	No	No	No	Yes
Denominations	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Language families	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Countries	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Waves	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.242	0.297	0.270	0.263	0.224	0.214	0.218	0.250
Mean of dependent variable	0.692	0.669	0.689	0.704	0.744	0.720	0.737	0.694
N	111,039	71,423	59,601	83,866	35,116	28,365	16,506	148,531

Note.— The sample is restricted to: individuals belonging to country-language pairs with at least 200 observations (column 1); individuals who are not speakers of one of the four global languages: Arabic, English, Russian and Spanish (column 2); individuals who are not speakers of one of the languages of the Indo-European family (column 3); individuals outside Europe (column 4); individuals based in geographically homogenous countries defined as those below the median of country-level geographical 'spread' index - please refer to the main text for definition of the index (column 5); non-immigrants (column 6); individuals who do not speak the majority language in the country (column 7). Column (8) is based on the baseline sample definition, excluding missing values on additional terms. Robust standard errors clustered by country and language are in parentheses. *Denotes significance at 10 percent; **at 5 percent; ***at 1 percent levels.

of NO INFLECTIONAL FT on RELIGIOUS. Moreover, this sample restriction significantly increases the estimated size of the association with the marginal effect at 6.7 percentage points.

In column (3) we furthermore explore whether the results might be driven by speakers of Indo-European languages, while in column (4) we test the sensitivity of the results to the presence of residents of European countries in the sample. As our estimates highlight, neither the speakers of Indo-European languages nor the Europeans are driving the results.

Review papers by Mavisakalyan and Weber (2017) and Ginsburgh and Weber (2020) highlight the challenges around causal identification of the effects of language. One possible source of unobserved heterogeneity, as these studies note, is geographic characteristics of countries. In particular, as shown by Galor et al. (2016), the absence of inflectional future tense is positively correlated with higher crop yield and higher long-term orientation. It is possible that the same factors also affect religiosity. By comparing behaviour of individuals within a country, our estimation framework mitigates the confounding effects of geographic characteristics. We are not able to control for within-country differences in geographic conditions directly, but we address the associated issues indirectly, by restricting the sample to relatively geographically-homogenous countries where there might be less variation in the consequences of geographic and climatic characteristics, such as crop yield. We do so

by constructing an index representing the geographical 'spread' of each country. Using the maximum and minimum latitude and longitude of countries, the 'spread' index is calculated as the length of the vector connecting two furthest points of a country's coordinates. The results based on the sub-sample restricted to countries below the sample median of this index are reported in column (5) of Table 3.[7] As we see, the positive significant relationship between NO INFLECTIONAL FT and RELIGIOUS is still present within this relatively geographically-homogenous sub-sample of countries.

A significant source of linguistic diversity in our sample is likely to come from the presence of immigrants. Information on the place of birth of a respondent is not available across all waves of the WVS. Nevertheless, we make an attempt at avoiding conflating the differences in individuals' languages with differences between natives and immigrants, by dropping the immigrants from the sample at the cost of reducing the sample size to just over 28,000 observations. In spite of this reduction in sample size, we estimate a significant positive marginal effect on NO INFLECTIONAL FT (column (6)).[8]

The work of Nunziata and Rocco (2016, 2018) shows that minorities bring out "typical traits" more strongly, because members of minorities are surrounded by a majority that is different. In a study of the effect of religious adhesion on entrepreneurship, Nunziata and Rocco (2016) note: "Since the individual's degree of adhesion is not observable, we turn to the share of residents who follow the individual's religion. In particular, we focus on minorities among whom we expect to find relatively large proportions of individuals with strong attachments to their faiths, and on majorities among whom we expect to find the opposite" (p. 205). Applied to our context of 'linguistic adhesion', this might imply that the

[7] The countries in this sub-sample include: Albania, Andorra, Armenia, Azerbaijan, Bangladesh, Bulgaria, Cyprus, Estonia, Georgia, Ghana, Guatemala, Hungary, Jordan, Latvia, Lebanon, Lithuania, Macedonia, Moldova, Palestine, Puerto Rico, Rwanda, Serbia, Singapore, Slovakia, Slovenia, Switzerland, Trinidad and Tobago, Uganda, Uruguay.

[8] Some analyses on the link between language structures and outcomes have instead explicitly focused on a sample of immigrants (e.g. Gay et al., 2017; Galor et al., 2020), adopting "epidemiological approach" by comparing migrants descending from different countries within the same country of residence, in the hope that it might help to isolate the causal effect of speaking a language (although as a recent study by Beblo et al. (2020) suggests, studying immigrants may not overcome the concerns over causality since individuals who select into migration are more likely to reject the norms of their country of origin and may transmit their traits to their children). These studies, however, have used large single country datasets such as the US Census and American Community Survey, where detailed information on the background of individuals and their families is available. This exercise faces significant constraints within WVS where information on immigrant background is limited, and not available (and consistently defined) across all waves. We made an attempt at imitating a version of epidemiological approach on our dataset based on wave 3 (1994-1998) of WVS where information on the places of birth of the respondents, defined by broad continents, is available. The estimated marginal effect of NO INFLECTIONAL FT on RELIGIOUS in a regression which includes dummies for continent of origin of immigrants in addition to baseline controls and host country dummies in a sample of immigrants (N=2,405) is statistically indistinguishable from 0. The results are available on request.

Table 4: Heterogeneity by denominational context — probit marginal effects

	(1)	(2)	(3)	(4)
	Dependent variable: RELIGIOUS			
NO INFLECTIONAL FT	0.044**	0.066*	0.026**	0.017
	(0.020)	(0.036)	(0.013)	(0.037)
Denominations	Yes	Yes	Yes	Yes
Baseline controls	Yes	Yes	Yes	Yes
Language families	Yes	Yes	Yes	Yes
Countries	Yes	Yes	Yes	Yes
Waves	Yes	Yes	Yes	Yes
Pseudo R^2	0.289	0.177	0.109	0.187
Mean of dependent variable	0.647	0.734	0.807	0.380
N	66,885	81,958	109,840	38,983

Note.— The sample is restricted to: individuals in countries below the median of the country-level religious fractionalization based on Alesina et al. (2003) (column 1); individuals in countries above the median of the country-level religious fractionalization based on Alesina et al. (2003) (column 2); individuals within monotheist (Christian, Muslim, Jewish) denomination groups (column 3); individuals outside monotheist denomination groups (column 4). Robust standard errors clustered by country and language are in parentheses. *Denotes significance at 10 percent; **at 5 percent; ***at 1 percent levels.

extent of proficiency in one's own background language or the use of that language (both of which bear implications for the degree of manifestation of the relevant linguistic forms) is more prevalent among the linguistic minorities. On the other hand, according to Lazear (1999), when a society has a very large majority of individuals from one culture, individuals from minority groups will be assimilated more quickly. To engage with the implications of such considerations in our context, we restrict the sample to individuals who do not speak the majority language in the country in the regression reported in column (7) of Table 3. We estimate a positive highly significant marginal effect on NO INFLECTIONAL FT in this subsample of linguistic minorities. Given our estimation framework that achieves identification through the presence of individuals speaking different languages within a country, we are not able to run a regression on individuals belonging to the linguistic majority group.[9]

[9] Also, in unreported results, we include the size of one's own language share in the population and its interaction with NO INFLECTIONAL FT as additional regressors in the baseline specification of our model. These are not statistically significantly related to the probability of being religious. Hence, the positive statistically significant association between NO INFLECTIONAL FT in one's language and RELIGIOUS does not appear to vary by the share of the population speaking the language.

While our identification strategy, described in §3.1, accounts for many significant factors that may affect an individual's propensity to endorse a religion—broad geographic, institutional and cultural context—it is possible that the estimated marginal effect of NO INFLECTIONAL FT still reflects cultural effects related to ethnic ancestry. To deal with this possibility, we directly control for ethnicity fixed effects in the final column of Table 3. Speaking a language without inflectional future tense is associated with a 6.4 percentage points increased probability of being religious in this specification with more extensive list of controls.

Religiosity and religious denomination may interact in important ways as some denominations are more demanding on believers than others. We explore some of the implications of such interactions in Table 4. In particular, it is possible that in countries with more denominational choice, religiosity is higher because there is a bigger variety of options catering for various preferences—something for every taste. On the other hand, religiosity may be diminished in more homogenous countries where denominational choice is limited. We explore the heterogeneity in the results by the extent of religious fractionalization in a country of residence of an individual, drawing comparisons between individuals in countries below and above the median of the religious fractionalization distribution (source: Alesina et al. (2003)). The estimated marginal effects of NO INFLECTIONAL FT on RELIGIOUS are positive and significant in both sub-samples (while the size of the effect is slightly higher in the sub-sample of individuals based in relatively less fractionalized countries).

The proposed intuition behind the link between future tense and religiosity is particularly applicable to monotheist religious contexts (Christianity, Islam and Judaism) where the future rewards and penalties associated with religiosity appear to be particularly large. Could the results be specific to monotheist religion contexts then? We address this question by splitting the sample into two parts. First, in column (1) of Table 3 we limit the sample to individuals in monotheist religious contexts, which comprise nearly 74% of the sample. The estimated marginal effect on NO INFLECTIONAL FT is positive and significant. The results in column (2), on the other hand, are based on individuals in non-monotheist religion contexts—under 39,000 observations in total. The marginal effect of NO INFLECTIONAL FT is positive, but statistically insignificant. Hence, we restrict the remainder of the analysis that focuses on the rewards and penalties associated with religiosity to individuals in monotheist religious contexts.

4.2. **Further implications.** To motivate the connection between future tense and religiosity, we assume that religion offers large future incentives, both positive and negative. Both

are hypothesized to be more effective for speakers of a language without inflectional future tense, since they value them more and perceive them as more imminent (see §2.2 for discussion). Is this in fact the case?

The ultimate long-term penalty associated with religion is the threat of a negative future afterlife in hell. In the absence of information on the disutility that individuals attach to hell in WVS, we use the responses to a question on whether they believe in hell to proxy for the perceived threat of hell (asked in waves 3, 4, 6 of the survey). 64% of individuals in the sample say they believe in hell.

The ultimate long-term reward, on the other hand, is a positive afterlife in heaven. While WVS doesn't contain information on individual valuation of heaven, it asks in waves 3 and 4 whether individuals believe in heaven or not. 76% of respondents do have such belief.

Furthermore, as we propose, there are short-term benefits to be gained from endorsing a religion. We proxy for these by a binary variable that is based on individual responses to a question on whether they get comfort and strength from religion (asked in waves 3 and 4). 81% of the respondents do so.

To assess whether the set of religious incentives are more effective for speakers that do not use inflectional future-tense, we look at the propensity to respond to punishments and rewards associated with religion for individual i in country c at time t as follows:

$$ReligIncentives^{*}_{ict} = \zeta NoInflectFT_{ict} + \mathbf{X_{ict}}'\eta + \mathbf{K_c}'\theta + \mathbf{W_t}'\upsilon + \omega_{ict} \tag{4}$$

Assuming $ReligIncentives_{ict} = 1(ReligIncentives^{*}_{ict} \geq 0)$ (where $ReligIncentives_{ict}$ presents the observed responsiveness to penalties and rewards associated with religion) and normality of the error term, the probability of responding to incentives associated with religion can be described as a probit model (with marginal effects used for interpretation).

Table 5 reports the results. First, we undertake probit estimation of BELIEF IN HELL on NO INFLECTIONAL FT. As column (1) shows, we estimate a positive marginal effect on NO INFLECTIONAL FT, however it is statistically insignificant.

What about the rewards from religion? Are they more effective for speakers that do not use inflectional future-tense? The results of our probit estimation of BELIEF IN HEAVEN on NO INFLECTIONAL FT are reported in column (2) of Table 5. The estimated marginal effect confirms a significant and positive relationship between speaking a language without inflectional future tense and the probability of believing in heaven. Relative to individuals who use inflectional future tense, lack of inflectional future tense is associated with a 5.4 percentage points higher probability of believing in heaven.

Table 5: Regressions with alternative dependent variables: incentives to endorse religion — probit marginal effects

	(1)	(2)	(3)
	Dependent variables:		
	BELIEF IN HELL	BELIEF IN HEAVEN	COMFORT FROM RELIGION
NO INFLECTIONAL FT	0.064	0.054**	0.034***
	(0.058)	(0.022)	(0.011)
Denominations	Yes	Yes	Yes
Baseline controls	Yes	Yes	Yes
Language families	Yes	Yes	Yes
Countries	Yes	Yes	Yes
Waves	Yes	Yes	Yes
Pseudo R^2	0.209	0.239	0.216
Mean of dependent variable	0.703	0.812	0.874
N	70,327	41,267	44,622

Note.— The sample is restricted to individuals within monotheist (Christian, Muslim, Jewish) denomination groups. Robust standard errors clustered by country and language are in parentheses. *Denotes significance at 10 percent; **at 5 percent; ***at 1 percent levels.

Not only may absence of inflectional future tense be correlated with individuals' perception of long-term rewards associated with religion, we also surmised that it may be associated with a higher short-term pay-off from being religious (as we posit in §2.2). To assess whether this is the case, we undertake a probit estimation of equation 4 using COMFORT FROM RELIGION as our left-hand-side variable (column (3) of Table 5). The results are consistent with our conjecture. The marginal effect of moving from a language with inflectional future tense to a language without inflectional future tense on the probability of getting comfort and strength from religion is positive at 3.4 percentage points. The explanation for this may be, as we hypothesised in §2.2, that users of languages without inflectional future tense, because of their higher concern for the future (including their own death), derive a comparatively higher psychological pay-off from the belief in a positive afterlife.

Different religious denominations differ in the details of their respective pay-off structure. Might this have implications for the results reported in Table 5? Engagement with the nuances of the alternative reward systems of various denominations is outside the scope of our current research. But, using a case study approach here, we draw comparisons between the two major traditions of Christianity: Catholicism and Protestantism.[10] The former stresses good works more strongly as a factor by which one can influence God's goodwill and hence influence whether the afterlife will be in heaven or hell. The classical form of Protestantism, as taught by Luther, on the other hand emphasizes God's grace alone. While good works are reflective of an attitude that is likely to find God's favour, Protestants are less certain

[10]We thank an anonymous referee for suggesting this example.

Table 6: Regressions with alternative dependent variables: incentives to endorse religion among Protestants and Catholics — probit marginal effects

	(1)		(2)		(3)	
	Dependent variables:					
	BELIEF IN HELL		BELIEF IN HEAVEN		COMFORT FROM RELIGION	
	Protestants	Catholics	Protestants	Catholics	Protestants	Catholics
NO INFLECTIONAL FT	-0.028	0.105	0.030**	0.074**	0.025**	0.066***
	(0.052)	(0.077)	(0.015)	(0.034)	(0.011)	(0.010)
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes
Language families	Yes	Yes	Yes	Yes	Yes	Yes
Countries	Yes	Yes	Yes	Yes	Yes	Yes
Waves	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.206	0.068	0.243	0.097	0.267	0.133
Mean of dependent variable	0.678	0.616	0.809	0.825	0.780	0.855
N	8,482	21,136	6,251	12,826	6,225	12,993

Note.— Robust standard errors clustered by country and language are in parentheses. *Denotes significance at 10 percent; **at 5 percent; ***at 1 percent levels.

about the link between good actions and heavenly rewards. We re-estimate equation 4 separately on the sub-samples of Catholics and Protestants. The results reported in Table 6 are consistent with these observations. In both subsamples, we find that NO INFLECTIONAL FT is positively and statistically significantly associated with BELIEF IN HEAVEN and COMFORT FROM RELIGION. However, the magnitudes of these relationship are larger in the Catholics' sub-sample.

It appears that the incentives, in particular future rewards, offered by religion are more effective for speakers of languages that lack inflectional future tense. Are they then also more willing to take up the short-term costs associated with endorsing a religion? First, we explore whether and how involvement in religious practices varies with the absence of inflectional future tense in an individual's language. To that end, we utilise information on the frequencies of attending religious services and praying outside of religious services, both categorised into 7 groups. While information on attendance of services is available for all four waves of WVS used in this study, we observe information on prayers outside of religious services in wave 3 only, which leaves us with a significantly smaller sample size. For an average individual in the estimation sample, the frequency of attendance is at 4.3 (between attending on holidays only and once a month). The sample mean of prayer frequency, on the other hand, is 5.9 (between once a week and more than once a week).

We characterise the relationship between lack of inflectional future tense and the frequency of engagement in religious practices as follows:

$$ReligFrequency^{*}_{ict} = \mu NoInflectFT_{ict} + \mathbf{X_{ict}}'\xi + \mathbf{K_c}'\lambda + \mathbf{W_t}'\sigma + \nu_{ict} \quad (5)$$

where for an individual i in a country c at time t, $ReligFrequency^*_{ict}$ is the unobserved religious practice frequency. Instead of $ReligFrequency^*_{ict}$, however, we can only observe categories of responses as follows:

$$ReligFrequency_{ict} = \begin{cases} 1 & if \quad ReligFrequency^*_{ict} \leqslant \tau_1 \\ 2 & if \quad \tau_1 < ReligFrequency^*_{ict} \leqslant \tau_2 \\ 3 & if \quad \tau_2 < ReligFrequency_{ic}t^* \leqslant \tau_3 \\ 4 & if \quad \tau_3 < ReligFrequency^*_{ict} \leqslant \tau_4 \\ 5 & if \quad \tau_4 < ReligFrequency^*_{ict} \leqslant \tau_5 \\ 6 & if \quad \tau_5 < ReligFrequency^*_{ict} \leqslant \tau_6 \\ 7 & if \quad ReligFrequency^*_{ict} > \tau 6, \end{cases} \tag{6}$$

where *ReligFrequency* is a categorically ordered frequency of religious practices that takes values on a scale from 1 (lowest frequency) to 7 (highest frequency). τ_j represents the threshold of switching from category j to category j+1, for $j=\overline{1,6}$. Hence, we apply an ordered probit model using observations in (6) to fit the parameter vector in equation (5) and calculate marginal effects to interpret the results. These are reported in Table 7.

By construction, the marginal effect on the lowest outcome (never attends/prays) always has the opposite sign to that of the highest outcome (attends more than once a week/daily prayers outside religious services). There is a statistically significant effect of absence of inflectional future tense on the frequency of individuals' attendance to religious services (Panel A) and on the frequency of prayers (Panel B). The estimates reported in panel A, for example, suggest that moving from a language with inflectional future tense to a language without an inflectional future tense decreases an individual's propensity of never attending a religious service by 2 percentage points, and also increases the probability of attending religious services more than once a week by the same magnitude. Similarly, as we observe from panel B, moving from a a language with inflectional future tense to a language without inflectional future tense is associated with a 0.5 percentage points decrease in the probability of never praying outside of religious services and a 5.3 percentage points increase in the probability of daily prayers. These results are in accordance with our predictions in §2.2 regarding the higher willingness of speakers of languages without inflectional future tense to bear the short-terms costs of being religious.

In a second step, we assess the relevance of future tense systems for an individual's willingness to take up the short-term costs associated with religiosity by looking at compliance with norms prescribed by religions. We generate variables based on the information about individuals' tolerance for behaviours (we do not observe actual behaviours themselves) that are construed as 'sins' in most monotheist religions. Specifically, we analyse the responses

Table 7: Regressions with alternative dependent variables: frequency of religious practices - ordered probit marginal effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Panel A: Determinants of attendance to religious services; dependent variable: ATTENDANCE						
	Pr(Never=1)	Pr(Less often=1)	Pr(Once a year=1)	Pr(Only holidays=1)	Pr(Once a month=1)	Pr(Once a week=1)	Pr(More than once a week=1)
NO INFLECTIONAL FT	-0.020**	-0.012*	-0.006*	-0.009*	0.004*	0.023**	0.020**
	(0.010)	(0.006)	(0.003)	(0.005)	(0.002)	(0.012)	(0.010)
Denominations	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Language families	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Countries	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Waves	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.065						
N	111,635						
	Panel B: Determinants of prayers outside of religious services; dependent variable: PRAYERS						
	Pr(Never=1)	Pr(Less often=1)	Pr(Several times a year=1)	Pr(At least once a month=1)	Pr(Once a week=1)	Pr(More than once a week=1)	Pr(Every day=1)
NO INFLECTIONAL FT	-0.005***	-0.007***	-0.006***	-0.008***	-0.011***	-0.015***	0.053***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.004)	(0.005)	(0.017)
Denominations	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Language families	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Countries	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Waves	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.084						
N	14,843						

Note.— The sample is restricted to individuals within monotheist (Christian, Muslim, Jewish) denomination groups. Robust standard errors clustered by country and language are in parentheses. *Denotes significance at 10 percent; **at 5 percent; ***at 1 percent levels.

Table 8: Regressions with alternative dependent variables: conformity with religious norms - SUR coefficients

	(1)		(2)		(3)		(4)	
	Dependent variables:							
	RELIGIOUS	HOMOSEXUALITY	RELIGIOUS	PROSTITUTION	RELIGIOUS	ABORTION	RELIGIOUS	SUICIDE
NO INFLECTIONAL FT	0.018**		0.026***		0.020**		0.017**	
	(0.009)		(0.009)		(0.009)		(0.008)	
RELIGIOUS		-0.331***		-0.351***		-0.578***		-0.250***
		(0.020)		(0.019)		(0.020)		(0.016)
Denominations	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Language families	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Countries	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Waves	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.115	0.369	0.121	0.190	0.112	0.246	0.115	0.132
Mean of dependent variable	0.805	2.940	0.808	3.140	0.803	3.100	0.810	1.960
N	96,124		88,576		100,587		99,845	

Note.— The sample is restricted to individuals within monotheist (Christian, Muslim, Jewish) denomination groups. Robust standard errors are in parentheses. *Denotes significance at 10 percent; **at 5 percent; ***at 1 percent levels.

to questions on whether individuals consider the following behaviours as justifiable, ranging from 1 (never justifiable) to 10 (always justifiable): (1) homosexuality; (2) prostitution; (3) abortion; and (4) suicide. To ensure that the observed effects are religion-mediated, we estimate equation 1 jointly with the following equation determining individual tolerance for 'sinful' behaviour:

$$SinTolerance_{ict} = \kappa \text{Religious}_{ict} + \mathbf{X_{ict}}'\rho + \mathbf{K_c}'\chi + \mathbf{W_t}'\pi + \iota_{ict} \tag{7}$$

The results of estimating equations 1 and 7 simultaneously using Seemingly Unrelated Regressions (SUR) are reported in Table 8.[11] The coefficients of interest are β in equation 1 and κ in equation 7. Is absence of inflectional future tense associated with higher religiosity? And does religiosity lower the tolerance for behaviours that are construed as sins in monotheist religions? The response to both questions across the four models we estimate is 'yes'. Accordingly, lack of inflectional future tense is associated with an increased compliance with religious norms. Again, this is in agreement with our general prediction from §2.2, according to which the incentives religion provides are less effective for speakers of languages without inflectional future tense, as they discount them less and perceive them as more imminent.

5. Conclusion

Religiosity matters for a range of behaviours we care about. Yet we know little about the origins of differences in religiosity. This paper posits that future tense marking is a source of difference in religious attitudes and behaviours. Religion wields a big carrot and a big stick—an afterlife in heaven or an afterlife in hell. We argue that both carrot and stick are more effective for speakers of languages without inflectional future tense, as they perceive them as bigger and temporally closer.

We explore this prediction in a large sample of countries comparing individuals who are identical in their observable characteristics, but differ in the grammatical structure of their language. We confirm that relative to users of inflectional future tense, speakers who do not use inflectional future tense are more likely to be religious and to act consistent with religious prescriptions: attend ceremonies, pray, comply with religious norms. In an attempt to shed light on the causes of such behaviour, we show that the rewards offered by religions, i.e. future promise of heaven and immediate psychological comfort, hold more appeal for speakers of languages lacking inflectional future tense.

[11] SUR system is system of equations with no endogenous right-hand-side variables that allows for contemporaneous cross-equation error correlation. It is different from three-stage least squares which represents a system of equations with endogenous regressors and requires instrumental variables for identification.

If future tense should turn out to have a direct causal influence, then our results suggest that religious preaching may be less successful in some contexts because of the grammar of the respective language. The results contribute to several vibrant strands of literature in economics of religion, culture, language and behaviour. Still, our analysis could be extended in several directions in the future. While we highlight that differences in future tense explain differences in religiosity, we do not empirically distinguish between the possible pathways along which this may happen. The possibility that language acts as a marker of deeper cultural traits is consistent with our results, as is the possibility that language affects speakers' cognition and behavior. Further experimental work on this issue would be fruitful. Another promising area for future research is to investigate in more detail potential differences in the fine-grained pay-off structures of different theologies, and to examine whether there are corresponding variations in effect size. Differences in religiosity are large and have profound consequences for behaviour and outcomes. Our work suggests that the cultural origins of such differences are significant, thereby calling for more empirical work at the intersection of economics of culture and religion.

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APPENDIX

Table A1: Regressions with alternative dependent variables: religious denomination - probit marginal effects

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variables:					
	CHRISTIAN	MUSLIM	JEWISH	HINDU	EAST ASIAN	OTHER
NO INFLECTIONAL FT	-0.078	0.061	0.000	-0.018	0.000	0.053
	(0.063)	(0.417)	(0.001)	(0.000)	(0.003)	(0.066)
Baseline controls	No	No	No	No	No	No
Language families	Yes	Yes	Yes	Yes	Yes	Yes
Countries	Yes	Yes	Yes	Yes	Yes	Yes
Waves	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.439	0.795	0.299	0.638	0.627	0.215
Mean of dependent variable	0.495	0.267	0.007	0.047	0.072	0.218
N	151,056	136,051	111,530	78,839	97,653	142,539

Note.— Robust standard errors clustered by country and language are in parentheses. *Denotes significance at 10 percent; **at 5 percent; ***at 1 percent levels.