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20/01: PARADISE POSTPONED: FUTURE  
TENSE AND RELIGIOSITY

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# Paradise Postponed: Future Tense and Religiosity\*

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**ABSTRACT.** This paper identifies a new source of differences in religiosity: the presence of future tense marking in language. We argue that the rewards and punishments that incentivise religious behaviour are less effective for speakers of languages that contain future tense marking. Consistent with this prediction, we show that speakers of future-tensed languages are less 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 lower 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. In other languages, speakers talk about the future in the same way they talk about the present. This difference extends to religious discourse, e.g. scriptures, prayers, etc.<sup>1</sup> Does this grammatical difference have an effect on speakers' religious convictions and behaviour? In this paper, we argue that the answer is: yes, whether a speaker's language is future- or present-tensed has an influence on his/her religiosity.

At first, the idea that a mere grammatical difference may have cognitive and behavioural effects 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 simply 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 may then contribute to spreading, amplifying, or preserving these traits (Mavisakalyan and Weber, 2017).

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<sup>1</sup> For instance, the following famous passage from the Second Epistle to Timothy is in the future tense in the French bible (1.), but in the present tense in the Finnish bible (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**<sub>future</sub> of all works evil, and he me **save**<sub>future</sub> to me make enter into his kingdom heavenly.

2. *Ja Herra on vapautava minut kaikesta ilkivallasta ja pelastava minut taivaalliseen valtakuntaansa*

And the Lord is **freeing**<sub>present</sub> me from all wickedness, and **saves**<sub>present</sub> me in his heavenly kingdom.

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 future tense is associated with higher long-term orientation, reflected in lower time discount rates, i.e. speakers of a present-tensed language tend to discount future costs and rewards less than speakers of a language that contains future tense (Galor et al., 2016). Second, by talking about the future as if it were present, speakers of a present-tensed language 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: *a positive or even paradisiacal afterlife*. Speakers of languages with future tense, we propose, value this future good less highly and locate it further away from their own temporal position than do speakers of present-tensed languages. As a result, they are less likely to be religious.

Based on data from a collection of nationally-representative surveys from 83 countries, we show that the effect of speaking a future-tensed language on the probability of being religious is indeed negative and large. Relative to an individual whose language does not grammatically distinguish between present and future, speaking a future-tensed language reduces an individual's probability of being religious by 6.5 percentage points 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 future-tensed languages derive lower comfort from being religious and have lower 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 a review see Mavisakalyan and Weber, 2017). 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). Third, and directly relevant to our study, the literature has shown that *future tense* affects

speakers' inter-temporal preferences (Sutter et al., 2018) and induces less future-oriented behaviours including lower saving and lower investment in health (Chen, 2013; Guin, 2015) and less environmental concern and action (Mavisakalyan et al., 2018) at the level of individuals and countries. At the corporate level, future tense is associated with lower precautionary cash holdings (Chen et al., 2017), lower investment in research and development (Chi et al., 2020) and lower loan spreads and lower 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 able to deal 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 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. We call such languages *future-tensed*. Other languages speak about the future in the same way they speak about the present. We call these *present-tensed*. Languages of the first group possess *inflectional future tense marking*. Languages of the second group do not possess inflectional future tense, and either do not mark the future at all, or do so by other means, e.g. with the help of a present-tensed auxiliary verb. For instance, when talking about tomorrow's weather, speakers of a present-tensed language 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, a future-tensed language, use a dedicated future verb form when expressing the same information:

- (1) Il **fait** froid aujourd'hui.  
It **do<sub>present</sub>** cold today.  
'It is cold today.'
- (2) Il **fera** froid demain.  
It **do<sub>future</sub>** cold today.  
'It will be cold tomorrow.'

As pointed out above, linguistic features can affect economic outcomes through 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 elaborate on both points.

First, we follow [Chen \(2013, §2\)](#) and maintain that the absence of future-tense marking leads speakers of present-tensed languages "to perceive future events as less distant" ([Chen, 2013, p. 695](#)). Talking about future outcomes in the present tense locates them subjectively



closer to the agent's present temporal position. Present tense decreases, 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 count 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, present-tensed languages are 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).<sup>2</sup>

Both channels of influence, the cognitive and the cultural one, work in the same direction—both predict that speakers of future-tensed languages engage less in future directed actions and are less 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).

**2.2. Future tense and religiosity.** How do these points bear on the case of religiosity? Our central conjecture is that differences in religiosity between speakers of present-tensed languages and speakers of future-tensed languages can be partially explained by the fact that being religious has lower expected utility for speakers of future-tensed languages. As just mentioned, the two groups of speakers differ in their assessment of future-directed actions. Both the cognitive and the cultural channel lead speakers of future-tensed languages to assign lower expected utility to actions that promise future rewards. Importantly, this applies to an agent's decision of being religious: in this case, the relevant future reward promised to the faithful is *a positive or paradisiacal afterlife*. We can summarize this point as follows:

HYPOTHESIS: Being religious has a lower expected utility for speakers of future-tensed languages compared to similar speakers of present-tensed languages.

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. What are the expected costs and benefits that determine an agent's choice? It

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<sup>2</sup> Typically, time discounting is represented by a discounting function involving a discounting factor  $\delta$  determined by an agent's discount rate  $r$ . Smaller discount rates result in a discounting factor closer to 1.



is helpful to distinguish between *short-term costs and benefits* and *long-term costs and benefits* associated with the choice of being religious.

Being religious involves more than merely accepting a certain set of doctrines on a cognitive level. Being religious 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. For instance, most religious codes prohibit abortion, homosexuality, prostitution, etc. These norms regularly 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, and it may 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 between present-tensed and future-tensed speakers. As pointed out above, present-tensed speakers 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. But there is also a potential long-term cost: most religions also contain the threat of a harmful, 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. One can minimise the risk of incurring the long-term costs by not sinning. And indeed, most people expect to personally 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 present-tensed and future-tensed languages. First, speakers of future-tensed

languages value the good of a positive afterlife less and perceive it as more distant. Second, they also value the harm of a negative afterlife less and again perceive it as further away. As a result, they are less likely to bear the associated short-term costs of being religious, e.g. engaging in religious practices. They also have less reason to comply with the relevant religious norms and can therefore be expected to judge transgressions less 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 grammatical future tense  $FutureTense_{ict}$  in the language spoken by the individual, together with (i) 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 (ii) 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  $\varepsilon_{ict}$  further contribute to the propensity for being religious, leading to an equation of the form:

$$Religious_{ict}^* = \beta FutureTense_{ict} + \mathbf{X}_{ict}'\delta + \mathbf{K}_c'\gamma + \mathbf{W}_t'\psi + \varepsilon_{ict} \quad (1)$$

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  $\varepsilon_{ict}$  becomes:

$$\begin{aligned} Pr(Religious_{ict} = 1 | FutureTense_{ict}, \mathbf{X}_{ict}, \mathbf{K}_c, \mathbf{W}_t) &= \\ &= \Phi(\beta FutureTense_{ict} + \mathbf{X}_{ict}'\delta + \mathbf{K}_c'\gamma + \mathbf{W}_t'\psi) \end{aligned} \quad (2)$$

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

$$\begin{aligned} \frac{\partial Pr(Religious_{ict} = 1 | FutureTense_{ict}, \mathbf{X}_{ict}, \mathbf{K}_c, \mathbf{W}_t)}{\partial FutureTense_{ict}} &= \\ &= \beta \phi(\beta FutureTense_{ict} + \mathbf{X}_{ict}'\delta + \mathbf{K}_c'\gamma + \mathbf{W}_t'\psi) \end{aligned} \quad (3)$$

While this estimation approach allows us to isolate the effects of language from those of institutions, geography and socio-economic conditions, 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 there being 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 common proto-language.

Second, although the proposed approach accounts for many significant factors that may affect individual’s behaviour—geography, 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. We should note, however, that our empirical approach explicitly allows for the language effect to work through two channels without disentangling them: first, by serving as an indicator of more basic cultural factors; and second, by directly influencing religious attitudes and behaviours.

In addition to studying the link between future tense and religiosity, we (i) assess the validity of the assumptions underlying this relationship; and (ii) implications for taking up costs associated with religiosity. To tackle (i), we explore whether the effectiveness of the incentives and disincentives associated with religion varies depending on the presence of future tense in an individual’s language. Exploring (ii) leads us to look at the implications of 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 explore these issues as we present this extended analysis in §4.2.

**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 future tense in their language.

We thus utilise the four most recent 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 146,464 individuals in 83 countries. This is due to two key factors. First, data on grammatical structure of 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 Language Structures (WALS) Online (Dahl and Velupillai, 2013). 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 inflectional future tense is available for 222 languages), it is still less than 10% of the world’s languages (Comrie et al., 2013) and the samples are at times relatively small compared to survey data that contain information on the languages spoken by individuals 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. Additionally, a small number of observations with missing values on key variables are dropped.

Our baseline outcome variable, RELIGIOUS, is a dummy 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 (Table 1). We analyse how religiosity, as measured by this variable, is affected by FT LANGUAGE—a dummy for inflectional future tense. Nearly half of the individuals in the sample speak a language that has inflectional future tense. We study 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.<sup>3</sup> 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

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<sup>3</sup> We regard denomination as exogenous in our context. Furthermore, we ascertain that it is statistically unrelated to language future tense. The results are available on request.

denomination at all.<sup>4</sup> Our analysis additionally controls for a range of background characteristics of individuals. These include gender, age, family status, educational attainment, employment and income. These variables are described in Table 1.

[Table 1 about here.]

## 4. RESULTS

**4.1. Baseline results.** We start with undertaking a probit estimation of religiosity on language future tense. Table 2 presents the marginal effects from this estimation described in equation 3. We start with a parsimonious specification looking at the relationship between FT LANGUAGE and RELIGIOUS in a given country and religion context (column 1). Consistent with our central hypothesis, there is a significant and negative relationship between presence of future tense and the probability of being religious. Additionally, as can be expected, individuals in one of the major religious denomination contexts are more likely to be religious relative to the rest. In column (2) we introduce controls for language families to account for the relatedness of languages as discussed in §3.1. The estimated significant negative relationship between FT LANGUAGE and RELIGIOUS is robust to this change in specification as it is 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 religiosity. As seen in columns (4) and (5), the estimated relationship between FT LANGUAGE 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 future-tensed language reduces an individual's probability of being religious by 3.9 percentage points, in line with our central hypothesis in §2.2.

[Table 2 about here.]

To identify the relationship between FT LANGUAGE 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

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<sup>4</sup> Splitting this group into two - those with other and those with no denomination - has no implication for the results.

belonging to country-language pairs with at least 100 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 negative marginal effect of FT LANGUAGE on RELIGIOUS. Moreover, this sample restriction significantly increases the estimated size of the effect with the marginal effect at 6.6 percentage points.

A significant source of linguistic diversity in our sample is the presence of immigrants. To avoid conflating the differences in individuals' languages with differences between natives and immigrants, we drop the immigrants from the sample at the cost of reducing the sample size to around 28,000 observations. This sample reduction only modestly decreases the estimated significant negative effect of FT LANGUAGE on RELIGIOUS relative to the effect established on the baseline sample.

The proposed intuition behind the link between future tense and religiosity is particularly applicable to monotheist religious contexts 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 (4) 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 FT LANGUAGE is negative and significant. The results in column (5), on the other hand, are based on individuals in non-monotheist religion contexts—around 38,000 observations in total. The marginal effect of FT LANGUAGE is negative but statistically insignificant.

While our identification strategy, described §3.1, accounts for many significant factors that may affect an individual's propensity to endorse a religion—geography, institution, cultural context—it is possible that the effect of FT LANGUAGE 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 future-tensed language reduces an individual's probability of being religious by 6.5 percentage points in this specification with more extensive list of controls.

[Table 3 about here.]

**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 less effective for speakers of future-tensed languages, since they value them less and perceive them as less 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 or hellish future afterlife. 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, 5 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, paradisiacal 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 derived 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 less effective for speakers of future-tensed languages, 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:

$$ReligIncentives_{ict}^* = \zeta FutureTense_{ict} + \mathbf{X}_{ict}'\eta + \mathbf{K}_c'\theta + \mathbf{W}_t'v + \omega_{ict} \quad (4)$$

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 4 reports the results. First, we undertake probit estimation of BELIEF IN HELL on FT LANGUAGE. As column (1) shows, we estimate a negative marginal effect on FT LANGUAGE, however it is statistically insignificant.

What about the rewards from religion? Are they less effective for speakers of future-tensed languages? The results of our probit estimation of BELIEF IN HEAVEN on FT LANGUAGE are reported in column (2) of Table 4. The estimated marginal effect confirms a significant and negative relationship between speaking a future-tensed language and the probability of believing in heaven. Relative to an individual whose language does not grammatically distinguish between present and future, speaking a future-tensed language reduces an individual's probability of believing in heaven by 7.3 percentage points.

Not only may speaking a future-tensed language affect individuals' perception of the long-term rewards associated with religion, speakers of future-tensed languages may also derive a lower 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 4). The results are consistent with our conjecture. The marginal effect of moving from a present-tensed to a future-tensed language on the probability of getting comfort and strength from religion is negative at 4.5 percentage points. The explanation for this may be, as we hypothesised in §2.2, that present-tensed speakers, 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.

[Table 4 about here.]

So, it appears that the incentives, particularly the future rewards, offered by religion are less effective for speakers of future-tensed languages. Are they then also less 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 presence of 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 3.9 (between attending once a year and attending on holidays only). The sample mean of prayer frequency, on the other hand, is 5.4 (between once a week and more than once a week).

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

$$ReligFrequency_{ict}^* = \mu FutureTense_{ict} + \mathbf{X}_{ict}'\zeta + \mathbf{K}_c'\lambda + \mathbf{W}_t'\sigma + v_{ict} \quad (5)$$

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:

$$ReligFrequency_{ict} = \begin{cases} 1 & \text{if } ReligFrequency_{ict}^* \leq \tau_1 \\ 2 & \text{if } \tau_1 < ReligFrequency_{ict}^* \leq \tau_2 \\ 3 & \text{if } \tau_2 < ReligFrequency_{ict}^* \leq \tau_3 \\ 4 & \text{if } \tau_3 < ReligFrequency_{ict}^* \leq \tau_4 \\ 5 & \text{if } \tau_4 < ReligFrequency_{ict}^* \leq \tau_5 \\ 6 & \text{if } \tau_5 < ReligFrequency_{ict}^* \leq \tau_6 \\ 7 & \text{if } ReligFrequency_{ict}^* > \tau_6, \end{cases} \quad (6)$$

where *ReligFrequency* is a categorically ordered frequency of religious practices that takes values on a scale from 1 (lowest frequency) to 7 (highest frequency).  $\tau_j$  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 5.

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 speaking a future-tensed language 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 present-tensed to a future-tensed language increases an individual's propensity of never attending a religious service by 2.3 percentage points, and also decreases 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 present-tensed to a future-tensed language increases an individual's probability of never praying outside of religious services by 0.5 percentage points and decreases the probability of daily prayers by 5.3 percentage points. These results are in accordance with our predictions in §2.2 regarding the reduced willingness of speakers of future-tensed languages to bear the short-term costs of being religious.

[Table 5 about here.]

In a second step, we assess the relevance of future tense in language 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 religions. Specifically, we analyse the responses to questions on whether individuals consider the following behaviours as justifiable, ranging from 1 (never justifiable) to 10 (always justifiable): (i) homosexuality; (ii) prostitution; (iii) abortion; and (iv) suicide. Given that in monotheist religious contexts all count as sins, we limit the sample to individuals in these religious contexts for the purposes of this analysis.<sup>5</sup> Moreover, to ensure that the observed effects are religion-mediated, we estimate equation 1 jointly with the following equation determining individual tolerance for 'sinful' behaviour:

$$\text{SinTolerance}_{ict} = \kappa \text{Religious}_{ict} + \mathbf{X}_{ict}' \rho + \mathbf{K}_c' \chi + \mathbf{W}_t' \pi + \iota_{ict} \quad (7)$$

<sup>5</sup>The sample means of these variables are: (i) homosexuality: 2.94; (ii) prostitution: 2.64; (iii) abortion: 3.36; and (iv) suicide: 2.17.

The results of estimating equations 1 and 7 simultaneously using Seemingly Unrelated Regressions (SUR) are reported in Table 6. The coefficients of interest are  $\beta$  in equation 1 and  $\kappa$  in equation 7: is future tense associated with less 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 a ‘yes’. Accordingly, future tense appears to decrease compliance with religious norms. Again, this is in agreement with our general prediction from §2.2, according to which the incentives religion provides to comply with the respective norms are less effective for speakers of future-tensed languages, as they discount them more and perceive them as less imminent.

[Table 6 about here.]

## 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. The carrot is the promise of a future afterlife in heaven (or one that is better than the status quo); the stick is the threat of a future afterlife in hell (or one that is worse than the status quo). We argue that both are less effective for speakers of future-tensed languages, as they perceive them as smaller and temporally more distant.

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 speakers of present-tensed languages, speakers of future-tensed languages are less 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 less appeal for speakers of future-tensed languages.

Our results imply that the reasons why religious preaching is less successful in some contexts may be because of the grammar of the language used. 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 the language effect works through speakers' cognition. Experimental work on this issue may be fruitful. 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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Table 1: Descriptive statistics

Variable	Definition of Variable	Mean
RELIGIOUS	0-1 binary variable; equals 1 if respondent is 'a religious person'	0.696 (0.460)
FT LANGUAGE	0-1 binary variable; equals 1 if respondent's language has inflectional future tense	0.497 (0.500)
DENOMINATIONS:		
CHRISTIAN	0-1 binary variable; equals 1 if respondent has Christian denomination	0.486 (0.500)
MUSLIM	0-1 binary variable; equals 1 if respondent has Muslim denomination	0.248 (0.432)
JEWISH	0-1 binary variable; equals 1 if respondent has Jewish denomination	0.005 (0.071)
HINDU	0-1 binary variable; equals 1 if respondent has Hindu denomination	0.023 (0.151)
EAST ASIAN	0-1 binary variable; equals 1 if respondent has Buddhist or other East Asian religious denomination	0.044 (0.206)
OTHER	0-1 binary variable; equals 1 if respondent has other or no denomination	0.193 (0.395)
BASELINE CONTROLS:		
MALE	0-1 binary variable; equals 1 if respondent is male	0.485 (0.500)
AGE	Respondent's age	41.040 (16.150)
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	0.289 (0.453)
PRIMARY	0-1 binary variable; equals 1 if respondent has primary-level education	0.212 (0.409)
SECONDARY	0-1 binary variable; equals 1 if respondent has secondary-level education	0.267 (0.442)
TERTIARY	0-1 binary variable; equals 1 if respondent has tertiary-level education	0.521 (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	0.202 (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	0.299 (0.458)
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	0.061 (0.238)

Note.—Standard deviations in parentheses.  $N = 146,464$ .

Table 2: Baseline regressions — probit marginal effects

	(1)	(2)	(3)	(4)	(5)
FT LANGUAGE	-0.033*	-0.040***	-0.037**	-0.039**	-0.039**
	(0.019)	(0.015)	(0.017)	(0.017)	(0.017)
CHRISTIAN	0.435***	0.435***	0.418***	0.417***	0.417***
	(0.027)	(0.011)	(0.028)	(0.030)	(0.026)
MUSLIM	0.449***	0.452***	0.446***	0.443***	0.443***
	(0.031)	(0.011)	(0.032)	(0.035)	(0.029)
JEWISH	0.245***	0.245***	0.229**	0.228**	0.227**
	(0.091)	(0.091)	(0.093)	(0.092)	(0.091)
HINDU	0.426***	0.423***	0.415***	0.413***	0.413***
	(0.041)	(0.033)	(0.041)	(0.043)	(0.040)
EAST ASIAN	0.303***	0.307***	0.294***	0.293***	0.293***
	(0.048)	(0.049)	(0.051)	(0.051)	(0.051)
MALE			-0.094***	-0.092***	-0.092***
			(0.006)	(0.010)	(0.004)
AGE			0.001	0.002*	0.002*
			(0.001)	(0.001)	(0.001)
AGE <sup>2</sup>			0.001	0.001	0.001
			(0.001)	(0.001)	(0.001)
MARRIED			0.014**	0.014**	0.014***
			(0.005)	(0.005)	(0.005)
NO CHILDREN			-0.019**	-0.017**	-0.017**
			(0.008)	(0.008)	(0.008)
PRIMARY				0.032***	0.032***
				(0.011)	(0.010)
SECONDARY				0.012**	0.013**
				(0.006)	(0.005)
EMPLOYED				-0.005	-0.005
				(0.005)	(0.005)
INCOME GROUP 1					0.004
					(0.013)
INCOME GROUP 2					-0.009
					(0.011)
INCOME GROUP 3					-0.001
					(0.008)
INCOME GROUP 4					0.005
					(0.008)
Language families	No	Yes	Yes	Yes	Yes
Countries	Yes	Yes	Yes	Yes	Yes
Waves	Yes	Yes	Yes	Yes	Yes
Pseudo R <sup>2</sup>	0.218	0.218	0.232	0.233	0.233
N	146,464	146,464	146,464	146,464	146,464

Note. Dependent variable is RELIGIOUS. 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)
FT LANGUAGE	-0.049** (0.020)	-0.066*** (0.019)	-0.048*** (0.015)	-0.028** (0.013)	-0.021 (0.039)	-0.065*** (0.016)
Ethnicities	No	No	No	No	No	Yes
Denominations	Yes	Yes	Yes	Yes	Yes	Yes
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 $R^2$	0.233	0.289	0.214	0.111	0.188	0.250
N	112,111	70,950	28,326	108,257	38,183	146,143

Note. Dependent variable is RELIGIOUS. The sample is restricted to: individuals belonging to country-language pairs with at least 100 observations (column 1); individuals who are not speakers of one of the four global languages: Arabic, English, Russian and Spanish (column 2); non-immigrants (column 3); individuals within monotheist (Christian, Muslim, Jewish) denomination groups (column 4); individuals outside monotheist denomination groups (column 5). Column (6) is based on the baseline sample definition. Robust standard errors clustered by country and language are in parentheses. \*Denotes significance at 10 percent; \*\*at 5 percent; \*\*\*at 1 percent levels.

Table 4: Regressions with alternative dependent variables: incentives to endorse religion — probit marginal effects

	(1)	(2)	(3)
FT LANGUAGE	-0.052 (0.069)	-0.073** (0.033)	-0.045*** (0.014)
Denominations	Yes	Yes	Yes
Baseline controls	Yes	Yes	Yes
Language families	Yes	Yes	Yes
Countries	Yes	Yes	Yes
Waves	Yes	Yes	Yes
Pseudo $R^2$	0.250	0.307	0.311
N	93,297	51,070	53,969

Note. Dependent variable is: BELIEF IN HELL (column 1), BELIEF IN HEAVEN (column 2) and COMFORT FROM RELIGION (column 3). Robust standard errors clustered by country and language are in parentheses. \*Denotes significance at 10 percent; \*\*at 5 percent; \*\*\*at 1 percent levels.

Table 5: 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						
	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)
FT LANGUAGE	0.023** (0.010)	0.013** (0.006)	0.007** (0.003)	0.010** (0.005)	-0.005** (0.002)	-0.026** (0.012)	-0.023** (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 <sup>2</sup>				0.065			
N				109,995			
	Panel B: Determinants of prayers outside of religious services						
	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)
FT LANGUAGE	0.005*** (0.002)	0.007*** (0.002)	0.006*** (0.002)	0.008*** (0.003)	0.011*** (0.004)	0.015*** (0.005)	-0.053*** (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 <sup>2</sup>				0.084			
N				14,843			

Note Dependent variable is ATTENDANCE (Panel A) and PRAYERS (Panel B). Robust standard errors clustered by country and language are in parentheses. \*Denotes significance at 10 percent; \*\*at 5 percent; \*\*\*at 1 percent levels.

Table 6: Regressions with alternative dependent variables: conformity with religious norms - SUR coefficients

	(1)		(2)		(3)		(4)	
	RELIGIOUS	HOMOSEXUALITY	RELIGIOUS	PROSTITUTION	RELIGIOUS	ABORTION	RELIGIOUS	SUICIDE
FT LANGUAGE	-0.020** (0.009)		-0.032*** (0.008)		-0.027*** (0.008)		-0.025*** (0.008)	
RELIGIOUS		-0.315*** (0.020)		-0.298*** (0.016)		-0.574*** (0.017)		-0.298*** (0.014)
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 <sup>2</sup>	0.116	0.372	0.292	0.203	0.275	0.266	0.283	0.142
N		94,663		120,736		135,567		134,782

Note.— Robust standard errors are in parentheses. \*Denotes significance at 10 percent; \*\*at 5 percent; \*\*\*at 1 percent levels.



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