

Material insecurity predicts greater commitment to moralistic and less commitment to local deities: A cross-cultural investigation

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1 The existential security hypothesis predicts that in the absence of more successful secular
2 institutions, people will be attracted to religion when they are materially insecure. Most
3 assessments, however, employ data sampled at a state-level with a focus on world religions. Using
4 individual-level data collected in societies of varied community sizes with diverse religious
5 traditions including animism, shamanism, polytheism, and monotheism, we conducted a
6 systematic cross-cultural test ($N = 1820$; 14 societies) of the relationship between material
7 insecurity (indexed by food insecurity) and religious commitment (indexed by both beliefs and
8 practices). Moreover, we examined the relationship between material security and individuals'
9 commitment to two types of deities (moralistic and local), thus providing the first simultaneous
10 test of the existential security hypothesis across co-existing traditions. Our results indicate that
11 while material insecurity is associated with greater commitment to moralistic deities, it predicts
12 less commitment to local deity traditions.

13

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Keywords

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Religious commitment, existential insecurity, moralistic gods, cross-cultural

1. Introduction

As there is an immense diversity in the form, frequency, and intensity of religious commitments, scholars of religion have long been interested in answering the related questions of when, in what ways, and with what intensity people demonstrate commitment to their gods (e.g., Atkinson & Whitehouse, 2011; Cohen et al., 2003; Finke & Stark, 2005; Norenzayan, 2016; Power, 2017b; Purzycki & Sosis, 2011; Rappaport, 1999; Solt et al., 2011; Xygalatas et al., 2013). Moreover, researchers have taken on the challenge of developing accounts of how specific cultural variants in religious commitments come to spread and persist at the expense of others, resulting in the modern landscape of religious commitments that is dominated by the ‘world’ religions (e.g., Baumard & Chevallier, 2015; Norenzayan et al., 2016). And, an emerging cultural evolutionary synthesis posits that the key to accounting for variation in religious commitments is to consider the adaptive benefits that varied forms of religious commitments may provide to adherents in the face of varied socio-ecological challenges (Purzycki & McNamara, 2016).

One such prevalent variant in religious systems is the extent to which they are ‘moralistic’ (i.e., “traditions [that] are characterized as those that emphasize adherence to prosocial norms under the threat of punishment by knowledgeable deities explicitly concerned with how we treat each other”; Purzycki, Ross, et al., 2018, p. 1). Cross-cultural evidence indicates that beliefs in these moralistic deities promote intra-group cooperation (e.g., Lang et al., 2019; Purzycki et al., 2016a) and that they may have evolved in response to the socio-ecological threats to cooperation associated, for example, with living in harsh or resource-scarce regions (e.g., Botero et al., 2014; Snarey, 1996). Bentzen (2019) provides global evidence for how largely unpredictable and potentially devastating ecological threats such as the frequency of earthquakes support the persistence of commitments to moralistic world religions over time (see also Sibley & Bulbulia, 2012 for a test of how natural disasters contribute to religious change following an earthquake in New Zealand). Taken together, the evidence suggests that in times of duress or *insecurity*, individuals are prone to seeking out commitment to certain types of religious traditions.

In a cross-national analysis of 191 societies, Norris & Inglehart (2011) provide evidence that *existential insecurity* (i.e., a perceived vulnerability to societal and personal risks and threats) is a fundamental determinant of the relative strength of religious fervor (in terms of commitment to religious values and practices). In this account – the existential insecurity hypothesis of religious commitments – public demand for and participation in ‘transcendent’ religious traditions (i.e., those that provide a sense of confidence and predictability in a threatening and uncertain world) is greater when existential security is low. When existential security is provided by other means (e.g., effective secular institutions in welfare states), the demand for transcendental religious traditions that have otherwise provided solace from existential problems decreases. Thus, this hypothesis potentially provides a cohesive account of religion’s persistence in developing societies and the relative waning of religious fervor in industrialized societies with wider access to resources. Indeed, even in industrialized societies, religious commitment is positively correlated with income inequality such that those living at lower rungs of the ladder (i.e., in more uncertain circumstances) are more devout than more financially secure others (e.g., Solt et al., 2011). In support of the existential security hypothesis, these results suggest that religious commitments, heightened in times of need, may alleviate some effects of living under uncertain conditions (perhaps by virtue of providing a sense of confidence and predictability in uncertain times or, for example, practices that sustain social support networks in religious communities; see Weigel et al. in this issue).

The crux of Norris & Inglehart’s (2011) hypothesis is that certain religious systems offer their adherents specific absolution from the trials and tribulations of uncertain life circumstances

– something special that is not on offer from affiliation with other cultural groups. This leads to the predictions that (1) insecure individuals should exhibit stronger religious commitments than secure individuals, and (2) religious commitments, specifically, rather than norm compliance to other types of cultural institutions, should adaptively increase under uncertain and insecure conditions. In support of this view, Henrich et al. (2019) observed that variability in prior exposure to war in Sierra Leone, Uganda and Tajikistan positively predicted years-later membership and active participation in Christian and Muslim – but not non-religious – social organizations. In addition to providing further evidence that individuals seek out religious commitments in insecure times, this work points to how moralistic religious traditions may have culturally evolved to “exploit the psychological states created by uncertainty and existential threats as a means to more effectively disseminate themselves” (p. 129; Henrich et al., 2019). In times of need, adherents seek out moralistic deities who offer help and protection. These omnipotent deities, however, are usually also punitive and omniscient, and thus communities of adherents may inadvertently benefit from the cooperative effects of commitments to moralistic deities. In insecure times, as commitments to moralistic deities increase and communities accrue the parochial cooperative benefits of these specific variants in religious beliefs and practices, they may head into more inter-group conflict creating a “feedback loop that will drive the cultural evolution of religions” (Henrich et al. 2019, p. 133).

This view stands in stark contrast to some accounts of how secure/insecure living conditions shape religious commitments. For example, Baumard & Chevallier (2015) propose that moralistic traditions and their focus on less immediate benefits emerge as a result of living in safer, less harsh, and *less* insecure environments. In a test of this hypothesis, Purzycki, Ross, et al. (2018) examined whether materially secure individuals attributed their deities with more moralistic qualities and found no reliable evidence for this hypothesis. That being said, it remains an open question as to whether or not *commitments* to traditions that differ in their ‘moralistic-ness’ vary as a function of secure/insecure living conditions. Indeed, examinations of the contributions of insecurity to religious commitments often employ large-scale survey data made available by research institutions such as Gallup and the World/European Value Survey. Although these datasets are valuable for testing these predictions, they are limited by their lack of sampling from *non-state* societies. Consequently, the sampling from nation states and adherents of world religions (e.g., Christianity, Islam, Buddhism, Hinduism) leaves the existential security hypothesis of religion largely untested amongst most of the world’s religious diversity – especially with regards to local traditions in non-state societies – preventing direct tests of how insecurities moderate commitments to traditions that vary in their moralistic qualities.

To address these concerns, we conducted a systematic cross-cultural examination of the individual-level contributions of perceived food security (an index of existential/material security) to variation in religious commitments directed at two types of deities in a large sample of participants from 14 societies that vary in community size (from hunter-gatherer groups to fully-market integrated urban samples). Moreover, our examination takes into further consideration the variation in the *form* of religious commitments. Across traditions, people express religious commitment in a wide variety of ways. One major dimension of this variation is a differential emphasis on belief and practice (e.g., Cohen, Siegel, & Rozin, 2003; Purzycki & Sosis, 2011), and thus we examined commitment in terms of both belief and practice. In brief, we employed a diverse cross-cultural sample to assess (1) the relationship between two forms of religious commitment (mental--the strength of belief--and behavioral--the frequency of ritual performance/participation), and (2) the relationship between material insecurity and commitment to (3) two classes of deities

(4) holding other demographic variables constant (i.e., age, sex, years of formal education, and number of children).

2. Methods

2.1. Pre-registration and Open Access

The data for this study is part of a larger dataset generated by The Cultural Evolution of Religion and Morality project (Lang et al., 2019; Purzycki et al., 2016a, 2016b). Focal variables were selected from the larger dataset and analytical strategy planned after data collection but prior to the lead author receiving access to the data. All but two of these pre-selected variables, however, were excluded from further analysis for reasons of insufficient variation within sites and/or problematic coding differences between sites and waves of the data collection. Our pre-registration document is publicly available at <https://osf.io/8efwv/>; and data and R scripts for analyses at <https://osf.io/rq75m/>.

2.2. Sample and Deity Selection

Across two waves of data collection, 2,027 individuals from 14 populations participated in the larger study¹ (see Table 1 for demographics). Two target deities were selected following pre-test interviews with an additional sample of locals. If collecting separate samples was not feasible, these participants would return at a future time to participate in the larger study. In these interviews, participants were asked to free-list up to five deities, to rank these deities in order of their importance, to rate the extent of these deities' knowledge, and how punitive/rewarding they are believed to be. From these ratings, at each site, we selected a *moralistic* deity (i.e., one that was high in moral interest and knowledge/punitiveness) and a *local* deity (i.e., one that was salient across participants but was rated relatively lower in moral interest, knowledge, and moral concern). Extensive post-test analyses of the selected deities and their believed attributes suggest that, by and large, participants did indeed distinguish between these deities along the intended dimensions (for more details, see Lang et al., 2019; Purzycki et al., 2016b; 2018).

Note that we recruited participants primarily on the basis of being associated with the moralistic gods of their sites. At the majority of the sites, the most salient moralistic deity was the Christian God. At predominantly Hindu sites (i.e., Lovu, Mauritius, and Mysore), researchers selected Shiva. At the Inland Tanna, and Tyva sites, the moralistic deities were *Kalpapan*, and *Buddha Burgan* (Buddha), respectively. By design, the identities of the local deities were more varied (see Table 1). At the Huatasani and Kananga sites some participants were unfamiliar with and/or did not believe in these local deities identified by the pre-test samples (*Apus* and *Kadima*, respectively), and thus, some participants were asked about different deities (Catholic saints and ancestral spirits). At the Lovu and Samburu sites, researchers did not identify and thus did not ask questions about local deities.

¹Data from one additional site (Hadzaland, Tanzania) were excluded from all our present analyses as responses to the focal items were not measured comparably to the other sites.

1 Table 1. Means (standard deviations) for focal variables by site.

2

Sample/Site	Wave	MG	LG	N	Males	Material Insecurity	Age	Yrs. Formal Ed	No. of children
Cachoeira (Brazil)	II	Christian God	Ogum	274	83	0.86 (0.29)	34.19 (12.87)	8.58 (4.02)	1.81 (1.92)
Coastal Tanna	I + II	Christian God	Tupunus	178	88	0.28 (0.36)	35.14 (14.33)	7.76 (4.22)	2.62 (2.06)
Huatasani (Peru)	II	Christian God	Apus/saints	94	37	0.79 (0.30)	38.51 (15.92)	8.96 (3.80)	2.47 (2.04)
Inland Tanna	I + II	Kalpapan	Tupunus	112	57	0.28 (0.38)	36.25 (15.40)	0.68 (2.04)	3.39 (3.35)
Kananga (DRC)	II	Christian God	Kadima/ancestor spirit	200	79	0.84 (0.34)	38.09 (14.46)	9.51 (3.32)	4.49 (2.98)
Lovu (Fiji)	I	Shiva	---	76	24	0.83 (0.34)	44.56 (16.94)	8.77 (3.78)	2.24 (1.59)
Marajó (Brazil)	I	Christian God	St. Mary	77	37	0.86 (0.24)	34.12 (13.08)	8.00 (3.53)	2.18 (2.56)
Mauritius	I + II	Shiva	Nam	245	144	0.36 (0.38)	36.93 (15.80)	8.84 (3.57)	1.34 (1.72)
Mysore (India)	II	Shiva	Chamundeshwari	165	94	0.10 (0.28)	33.56 (12.34)	13.35 (5.42)	0.91 (1.10)
Samburu (Kenya)	II	Christian God	---	40	12	0.64 (0.42)	51.27 (12.48)	0.70 (1.76)	8.43 (4.13)
Sursurunga (New Ireland)	II	Christian God	Sirmát	163	73	0.57 (0.41)	37.60 (14.13)	7.51 (2.63)	3.01 (2.49)
Turkana (Kenya)	II	Christian God	Ancestor spirit	247	91	0.20 (0.29)	38.03 (16.38)	0.48 (1.23)	3.96 (3.85)
Tyva Republic (Russia)	I	Buddha Burgan	Spirit masters	81	23	0.47 (0.28)	33.53 (12.52)	15.44 (2.29)	1.70 (1.43)
Yasawa (Fiji)	I	Christian God	Ancestor spirits	75	34	0.50 (0.40)	38.04 (15.91)	9.66 (2.42)	2.00 (2.07)
				2027	876	0.51 (0.43)	36.82 (14.87)	7.68 (5.27)	2.66 (2.84)

3 Notes: Wave I data were collected in the summer of 2013, and Wave II data were collected in 2015. See also Soler, Purzycki, & Lang,
4 this issue and Cohen et al., 2017 for an account of why the Brazilian sites exhibit the highest insecurity). MG = Moralistic God; LG =
5 Local God.

6 2.3. Commitment Measures

7 Commitment was assessed with the following questions asked about each deity:

- 8
- 9 (1) How often do you think about [moralistic/local deity]?
- 10 (2) How often do you perform activities or practices to talk to or appease [moralistic/local
- 11 deity]?²
- 12

13 We consider responses to the first item a measure of *mental* commitment and the second

14 *behavioral* commitment. Responses were recorded on a 5-point frequency scale (1 = very

15 rarely/never, 2 = a few times per year, 3 = a few times per month, 4 = a few times per week, 5 =

16 every day or multiple times per day). The distribution of responses at each sampling site are

17 presented in the supplemental Figures S1 and S2.

18

19 2.4. Material Insecurity and Demographics

20 We created an index of material insecurity by averaging responses to four items asking participants

21 about future food security: “Do you worry that in the next [month/six months/year/five years] your

22 household will have a time when it is not able to buy or produce enough food to eat?” (1 = “yes”,

23 0 = “no”; Hruschka et al., 2014). While perceived food security or lack thereof is but one aspect

24 of the existential insecurities potentially facing participants across samples; it is a face-valid

25 indicator of one’s perceived capacity to be able to meet one’s basic needs and is comparable across

26 the range of economic systems represented in this dataset. Responses to these four items were

27 strongly correlated (cross-sample $\alpha = 0.89$, 95% CI = [0.88, 0.90]). To determine the unique effect

28 of material security on commitment when controlling for other factors expected to covary with

29 either religious commitments or material insecurity or both, we adjusted the effects of material

30 insecurity for the effects of age, sex, years of formal education, and number of children (see Vardy

31 et al. in this issue on how sex differently predicts commitment to moralistic and local gods; and

32 also Purzycki, Ross, et al., 2018). By-site summary statistics are presented in Table 1. For

33 ethnographic information about the selected deities, religious commitments, and local context at

34 each field site see Lang et al. (2019) and its associated supplemental materials.

35

36 2.5. Models and Analytical Strategy

37 Reviewers of earlier drafts of this report identified limitations in our pre-registered analytical

38 strategy. The most important of which was our pre-registered plan to dichotomize responses into

39 low/high categories of commitment and then use logistic regressions to model the data. Rather

40 than accepting the information loss associated with creating binary outcome variables, our focal

41 models instead employ ordinal regressions to model the data more appropriately in their

42 original format. This decision, however, came at the cost of dropping one of the commitment

43 outcomes we had identified in our pre-registration³. This item’s response format varied between

44 sites and waves of data collection, which made cross-sample models of this variable untenable (at

² Participants were first asked to indicate whether they performed activities to talk to or appease either deity (yes/no). If participants said yes, they were also asked to indicate how often. If participants said no, they were not asked the follow up frequency question but we coded this a “never” on the frequency scale.

³ At the time of pre-registration, we had identified a third item (“How frequently do you worry about what [moralistic/local deity] thinks about you?”). However, responses to this question were recorded on different scales between sites and waves of data collection. We thus excluded this variable from our analyses.

45 least without recoding, which would, in turn, make an ordinal regression untenable). While the
 46 type of response model we employ (ordered-logit) is a departure from our pre-registered plans
 47 (logistic), the models are otherwise similarly specified. The review process identified additional
 48 and sensible model specifications, which we also include and discuss where relevant.

49 In line with our pre-registered model specifications, our focal Bayesian mixed-effect
 50 ordinal regressions (cumulative logit-link; Bürkner & Vuorre, 2019) estimate the association of
 51 food insecurity to commitment (mental or behavioral; independently modelled) to two types of
 52 deities (local/moralistic). In doing so, these models can provide insight as to whether and in what
 53 ways insecurity is associated with how participants allocate their commitments between the two
 54 deity types. Given that sampling occurred in 14 populations, commitment is modelled with a
 55 varying-intercept for site; and as each commitment item was asked twice (once for each deity), a
 56 varying-intercept for participant is also included. Insecurity was estimated as varying by sampling
 57 site. Models included simple effect covariates for age (years, mean centered), sex (-1 = female, 1
 58 = male), years of formal education (mean centered), and number of children (mean centered). In
 59 the supplemental materials we report results of models with and without covariates. There, we also
 60 report results of models where insecurity is treated as a simple effect. In what follows, we focus
 61 on the model estimated predictions of the interaction of deity type (local/moralistic) and food
 62 insecurity in predicting mental and behavioral religious commitments. Priors were set as weakly-
 63 regularizing: simple effects \sim Normal(0,1); variance components for varying effects \sim
 64 Exponential(1); and the correlation matrix of the variance components \sim LKJCorr(4)
 65 (Lewandowski et al., 2009)⁴. Across all model specifications, four sampling chains converged (\hat{R}
 66 $<$ 1.01 for all parameters; 1500 warmup; 4000 samples), and effective sample sizes were high. All
 67 analyses were conducted in *R* (R Core Team, 2017) and Bayesian models were executed using the
 68 *brms* (Bürkner, 2017) compiler for *RStan* (Stan Development Team, 2017). The summaries of
 69 which are presented in the supplemental materials (Tables S1 and S2). In the main text, we focus
 70 on the predictions generated by these models with regards to the association of material insecurity
 71 to mental and behavioral commitment to local and moralistic deities in these samples.

72

73 3. Results

74

75 3.1. Commitment Descriptives

76

77 3.1.1. Is commitment different across deities?

78 Mental commitment was greater for moralistic deities than the local deities, and especially so at
 79 Christian sites (see Figures S1 and S2). At the non-Christian sites (e.g., Inland Tanna, Mysore,
 80 Tyva Republic), the extent of mental commitment was more diffusely distributed for both deities.
 81 Similarly, behavioral commitment was more frequent toward moralistic deities than toward local
 82 deities, again especially at Christian sites (see Figure S2). However, the extent of this difference
 83 was more variable for behavioral commitment than it was for mental commitment (e.g., at
 84 Yasawa). Recall that participants were typically selected based on their association with the
 85 moralistic gods. In some contexts, everyone was associated with the moralistic deity by default.
 86 Sometimes, the belief in these two deities were in harmony or syncretically interwoven, but in
 87 others, there were religious markets and/or antagonism if the two deities came from different

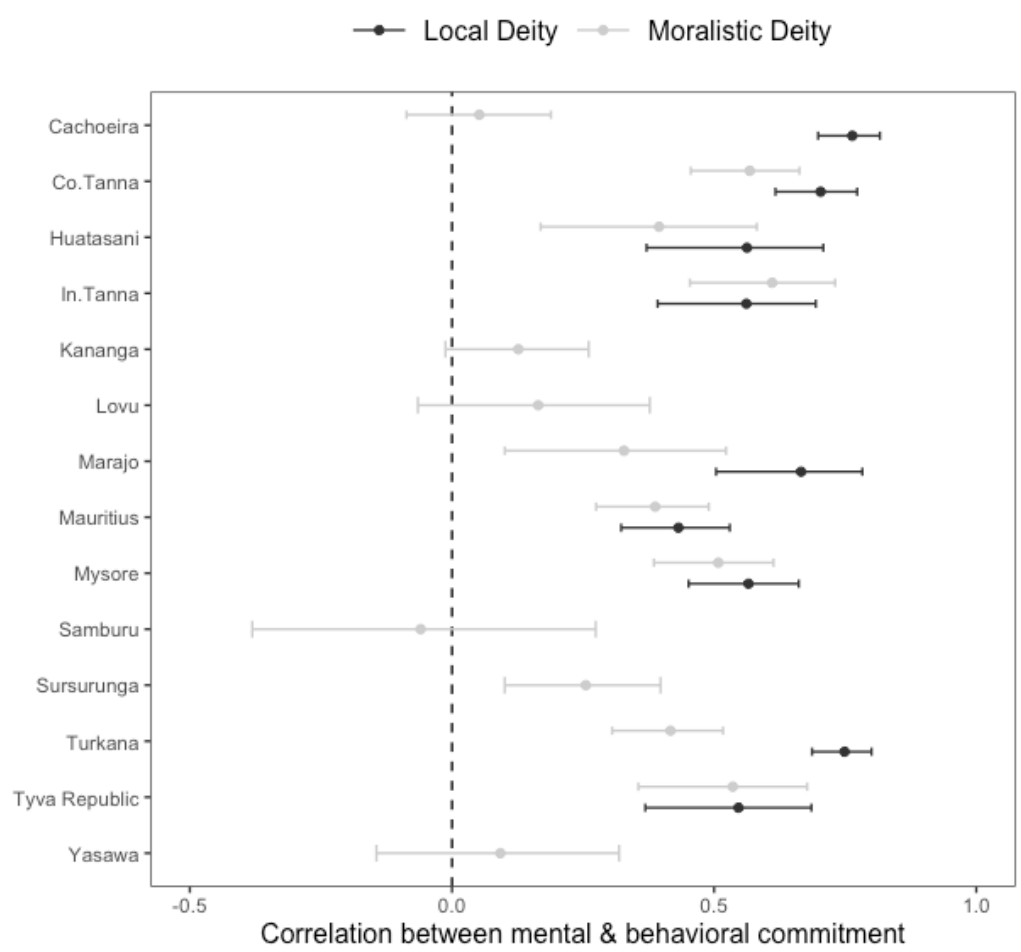
⁴ The use of weakly regularizing priors systemically protects against overfitting of the model to the data during parameter estimation and underfitting (i.e., not learning enough from the data) which often leads to poor predictions (McElreath, 2015, p. 166).

88 religious traditions (see Purzycki, et al. present volume for further discussion). Hence, the observed
89 difference in commitment to moralistic and local deities may stem from pre-existing antagonisms
90 at some sites.

91 *3.1.2. Is there a differential emphasis on behavioral and mental religiosity?*

92 Can we see some traditions more consistently emphasizing either belief or practice? Figure 1
93 presents the by-site and deity distributions of responses as well as the correlations between mental
94 and behavioral commitment. With few exceptions (Cachoeira, Yasawa, and Samburu), the
95 relationships between these two forms of commitment were positively associated across sites and
96 deities. At Cachoeira and Samburu, mental commitment for the moralistic deities was near the
97 ceiling. At Yasawa, behavioral commitment for the moralistic deity was relatively quite low
98 (although this is potentially capturing consistent and relatively unvaried weekly church
99 attendance). Across sites, the relationship between belief and practice was consistently positive for
100 the local deities.

101 Figure 1. By-site and deity correlations between mental and behavioral commitment.
102



103
104
105 Notes: At the Lovu and Samburu sites, no local deity was identified. Local deity data from the
106 Kananga, Sursurunga, and Yasawa sites are not presented due to insufficient variation in
107 commitment (floor effects). Error bars are 95% confidence intervals.
108

109 3.2. Accounting for Religious Commitment

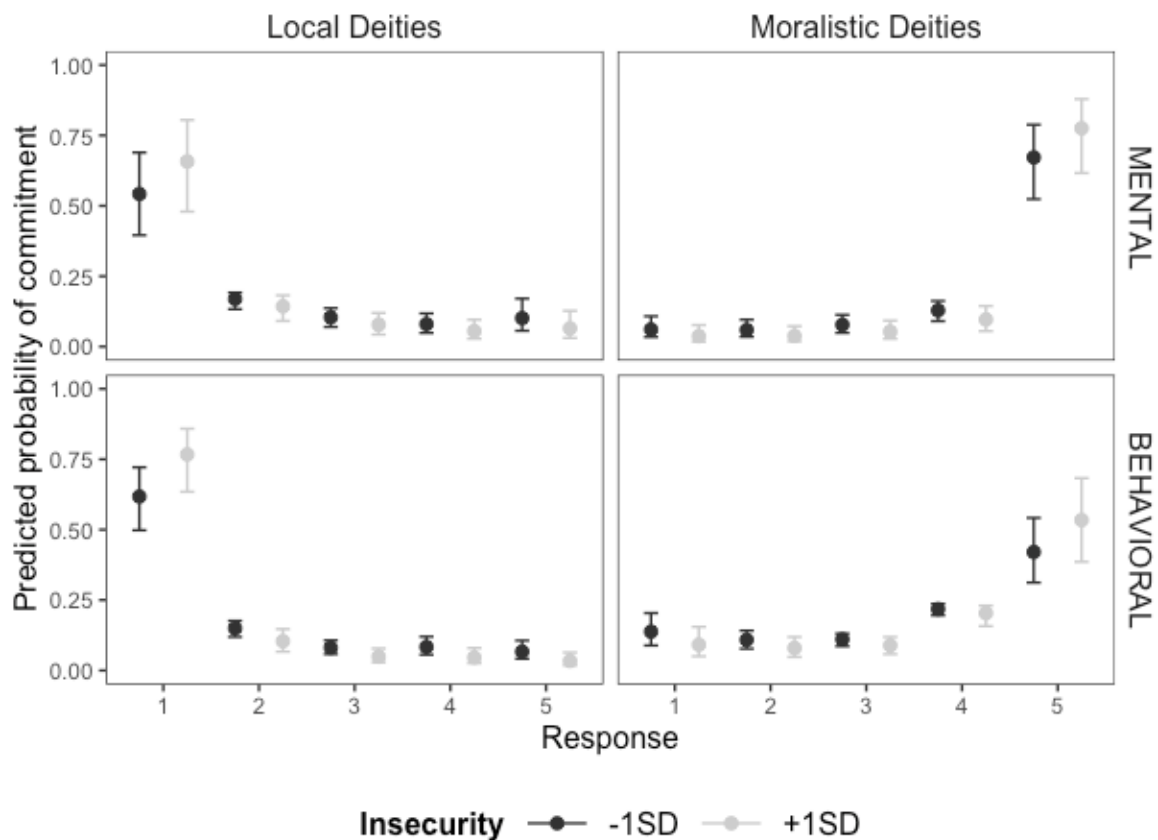
110 Figure 2 presents the predicted probabilities for each type of commitment to both deity types at
 111 low (-1 SD) and high (+1 SD) material insecurity. Predictions were made from models that
 112 included both demographic covariates (age, sex, years of formal education, and number of
 113 children) and in which the parameters for insecurity were estimated as varying by sampling site
 114 (the associated model summaries can be found in the last columns of Tables S1-S2). The figure
 115 illustrates the following focal results:

- 116
- 117 (1) Moderate commitment to either deity type is infrequent, with predicted commitment
- 118 concentrated at the lowest and highest options (representing no/minimal and maximal
- 119 commitment).
- 120 (2) Mental and behavioral commitment to moralistic deities is greater than commitment to
- 121 local deities.
- 122 (3) Material insecurity is associated with greater commitment to moralistic deities.
- 123 (4) Material insecurity is associated with less commitment to local deities.
- 124

125 In detail, the results show that for both deity types, response options indicative of more
 126 moderate levels of commitment were chosen less frequently and show no clear difference between
 127 deities. Across all model specifications and commitment types, the average predicted probability
 128 of reporting maximal commitment (response level = 5) to the moralistic deity was 9 times greater
 129 than for the local deity (moralistic deities = 0.60; local deities = 0.07). Likewise, the average
 130 predicted probability of reporting *minimal* commitment (response level = 1) to the local deity was
 131 7.88 times greater than for the moralistic deity (moralistic deities = 0.08; local deities = 0.65).
 132 These results are consonant with results reported in section 3.1.1 (including the caveats mentioned
 133 there).

134 Figure 2 also illustrates that the difference in commitment to these two types of deities is
 135 greater when existential insecurity is higher than when it is lower. With greater insecurity, the
 136 predicted probability of *maximal* mental commitment to the *moralistic* deity increases by about
 137 1.17 times (-1 SD = 0.66, +1 SD = 0.78) while *minimal* mental commitment to the *local* deity
 138 increases by about 1.21 times (-1 SD = 0.54, +1 SD = 0.66). Similarly, with greater insecurity the
 139 predicted probability of *maximal* behavioral commitment is about 1.26 times greater for the
 140 *moralistic* deities (-1 SD = 0.42, +1 SD = 0.53) while the predicted probability of *minimal*
 141 behavioral commitment to the *local* deities is about 1.24 times greater (-1 SD = 0.62, +1 SD =
 142 0.77). Put simply, while most participants were maximally committed to the moralistic deities and
 143 minimally committed to the local deities – the extent to which this is the case is associated with
 144 reported insecurities in ways consonant with the predictions of existential insecurity hypothesis of
 145 religious commitment. That is, greater commitment to moralistic deities was associated with
 146 greater insecurity. Also, these results indicate that commitment to the local deities is (even) less
 147 likely at higher levels of insecurity. Taken together, these results provide evidence that existential
 148 insecurities are associated with differences in both the strength and type of religious commitments
 149 to which individuals adhere.

150 Figure 2. Predicted probability of commitment to local and moralistic deities



151
 152 Notes: Predicted probabilities of commitment were estimated from ordinal regression models with
 153 a random-intercept for sampling site, individuals, and a by-site varying effect of material insecurity
 154 (covariates = age, sex, formal education, number of children held constant at their means; see last
 155 column of summary tables S1-S2). Bars are 95% credible intervals around each prediction. Black
 156 points illustrate commitment at low insecurity (-1 standard deviation) and grey points high
 157 insecurity (+1 standard deviation).

158 3.2.1 Testing alternative model specifications

159 As mentioned above, the review process identified two additional analytical strategies. The first
 160 replaced the repeated-measures structure of the above-reported models with multivariate analysis
 161 (multiple response ordinal regression models). In so doing, this analysis tests the associations
 162 between insecurity and each type of commitment to each deity independently of the others. In
 163 contrast, the repeated measures models presented above considers commitment to both types of
 164 deities simultaneously. Despite this difference, this alternative modeling strategy remains (in our
 165 view) tenable as the existential insecurity hypothesis may very well predict that each type/form of
 166 insecurity is independently related to insecurity. The results of which indicate that material
 167 insecurity is unrelated to commitment when modelled this way (see Figure S3). Thus, in these
 168 samples, insecurity seems to be related to how individuals distribute their commitments *between*
 169 the examined deities rather than the extent of their commitments to either.

170 Another set of model specifications included deity type as a varying intercept rather than
 171 participant to account for the repeated measures. In these models, insecurity was estimated as
 172 varying by deity type as well as by site. Model summaries are presented in Table S3. The pattern
 173 of predictions estimated from these models largely corroborate our focal results but with some
 174 between-sample variability in the magnitude of commitment change (see Figures S5 to S8). Taken
 175 together, these additional results provide some indication of the stability of this pattern of results
 176 in these diverse populations.

177

178 4. Discussion

179 We employed a diverse data set in an examination of the prevalence, form, and demographic
 180 correlates of religious commitment across cultures in a novel test of the existential security
 181 hypothesis. Our results indicate that, across sites, commitment to (as indexed by time spent
 182 thinking about and time spent performing rituals for) *moralistic* deities is greater than to the less-
 183 moralistic *local* deities. Furthermore, of all the examined deities, the Christian God was
 184 consistently the target of the most commitment (at least with regards to how we indexed
 185 commitment in our analyses). Interestingly, the current data suggest that this might very well be
 186 at the expense of local traditions as commitment to local deities was most distinct from that of the
 187 moralistic deities at Christian sites (see also Purzycki et al., this issue, on the interaction between
 188 belief in moralistic and local deities). This dataset still only brushes the surface of the diversity of
 189 the targets of religious commitment. That being said, these deities were selected based on their
 190 moralistic-qualities and local salience – and thus the differences in the levels of commitment
 191 observed (at least in how we measured commitment in this dataset) are notable.

192 In a cross-cultural test of the existential security hypothesis of religion (Norris & Inglehart,
 193 2011), we find that greater food-related insecurity is associated with greater commitment to
 194 moralistic deities. Greater security, however, was not associated with a weakening of *all* religious
 195 commitments as would be predicted by the existential security hypothesis. Although commitment
 196 to the moralistic deities was lower amongst more secure participants, commitments to *local*
 197 traditions were greater. Thus, these results suggest that the contributions of material security to
 198 religious commitment might be better understood as shaping the *kinds* of religious commitments
 199 individuals uphold under difficult life circumstances rather than only the strength of their overall
 200 devotion. When feeling insecure, commitments to moralistic deities believed to have sufficient
 201 powers to help solve problems might serve an anxiolytic purpose (Norris & Inglehart, 2011), but
 202 when secure, adherents may be freer to explore other features of their local religious traditions.
 203 Moreover, this overall pattern of results held across two types of religious commitment

204 (mental/behavioral) and the inclusion of other demographic controls. Importantly, however, our
205 results do not hold for all examined modelling strategies. In particular, we find no clear association
206 between insecurity and commitments towards these two types of deities when they are modelled
207 independently of each other. That is, this evidence suggests that insecurity in these populations is
208 better understood as being associated with how individuals allocate their commitments between
209 these two deity types rather than associated with the strength of commitment to either of them
210 independently.

211 Our results could be amenable to alternative interpretations. For instance, it is altogether
212 possible that moralistic traditions thrive in and/or play a role in creating materially insecure places.
213 However, in an analysis of a sub-sample of the current data, Purzycki, Ross, et al. (2018) found
214 no evidence that the extent to which deities are attributed with moralistic qualities covaries with
215 material insecurity. Another interpretation may be that all of the mental and behavioral
216 commitment demanded by moralistic traditions makes individuals feel more insecure.
217 Nevertheless, given the growing body of research on how unpredictable, harsh, and insecurity
218 inducing socio-ecological conditions promote greater religious commitment and behavior (e.g.,
219 Bentzen, 2019; Botero et al., 2014; Henrich et al., 2019; Lang et al., 2015), we favor our current
220 interpretation that the psychological experience of insecurity orients individuals towards particular
221 kinds of religious commitments (i.e., primarily commitment to moralistic traditions).

222 The question, however, as to whether people explicitly seek out these moralistic deity
223 traditions because these deities are moralistic, because they are believed to be powerful, or both,
224 remains an open question for future research. Previous work suggests that in times of need,
225 individuals seek out deities that are specifically believed to have capacities for
226 ameliorating/influencing adverse life circumstances (e.g., Kay et al., 2010). And thus, in times of
227 need, individuals may not be seeking out 'moralistic' deities per se, but rather omnipotent ones.
228 Research indicates that insecurity promotes and stabilizes harsher norm enforcement within
229 communities (e.g., Gelfand et al., 2017), and moralistic deities may be particularly potent norm
230 enforcers (e.g., Lang et al., 2019; Purzycki, Henrich, et al., 2018). The moralistic deities targeted
231 in our samples, however, were selected for being both omnipotent and moralistic, and thus we
232 cannot rule out these differences here. But importantly, both of these accounts might account for
233 why we find that insecurity is associated with increased commitments to specifically moralistic
234 deities and not all targets of devotion. Rather than seeking out specific deities, insecure individuals
235 may seek out traditions explicitly offering support and respite from stressful conditions. As one
236 example of how religious institutions in these populations help secure social safety nets, Weigel
237 (this issue) discusses how involvement in the Pentecostal church in the Congo is related to
238 prosocial sharing (at a cost to the self) amongst community members. When food security is low,
239 church community members generate informal insurance amongst themselves by spreading risk
240 through their cooperative networks. More broadly, we cannot ignore that the traditions and
241 associated deities examined here have long local histories, many of which that are antagonistic in
242 ways that likely have implications for how individuals experience, express and/or signal their
243 religious commitments as well as their insecurities (and the source thereof).

244 Indeed, another possibility is that in many societies moralistic traditions are practiced in
245 ways that are antagonistic towards local traditions, forcing more vulnerable individuals to eschew
246 the latter. Those who experience high insecurity are typically more socially vulnerable, and
247 therefore might still believe in local spirits but cannot take the social risk of expressing these
248 commitments because of antagonism between moralistic and local traditions. In Mauritius, for
249 example, the local deity that we asked about is often appeased by black magic ceremonies.

250 Although most people practice those ceremonies at least some of the time, there are strong norms-
251 --and even legislation---against doing so. For individuals with resources, being accused of dealing
252 with those spirits may have reputational costs, but for those with no resources, it might be
253 devastating, as it might cut off the only resources left to them, which is their social support
254 network. For a wider discussion of the relationship between the deities examined here, see
255 Purzycki et al (this issue). This is a particularly interesting avenue for future research as most of
256 the world's adherents to local religious traditions have been challenged with the (and often
257 antagonistic) presence of world religions like Christianity. Moreover, there is sparse empirical
258 evidence for in what ways and with what consequences individuals navigate the demands of
259 adhering to multiple religious systems. In this vein, our results tentatively suggest that individual-
260 level commitments to different traditions may be quite flexible and adaptive in light of differing
261 socio-ecological conditions (Purzycki & McNamara, 2016).

262 Indeed, the results of this study might suggest that commitments are flexible such that they
263 need not fluctuate homogenously. In these samples, greater insecurity was most clearly related to
264 lower *behavioral* commitments to local deities and greater of both forms of commitments to
265 moralistic deities; whereas the differences in mental commitments to local deities at different
266 levels of insecurity were less pronounced. This potentially highlights how mentally committing to
267 varied deities at the same time may come at a low cost – but that it is difficult, and perhaps
268 especially so under insecure conditions, to commit resources (e.g., time) to the practices associated
269 with different traditions. In such cases, individuals seem to adaptively allocate their resources to
270 bolster their commitments to moralistic traditions, perhaps by virtue of the believed (e.g., divine
271 intervention/salvation) and or actual benefits of doing so (e.g., through the anti-anxiolytic effects
272 of ritual participation combined with the cooperative benefits of regular participation in collective
273 ritual practices; e.g., Lang et al., 2020; Power, 2018).

274 Our cross-cultural approach is correlational and cross-sectional. Moreover, the data
275 presented here are not necessarily representative of responses in the broader communities from
276 which our participants were sampled (except the Inland Tanna site where almost the entire
277 community was sampled). Indeed, sampling methods were mixed across field sites, with some
278 sites drawing participants from places of religious worship, others randomly asking participants
279 on the street, others going door to door throughout specific neighborhoods. Importantly, these
280 sampling methods may have differentially restricted the range of observed religious commitment
281 (i.e., sampling at a place of religious worship is likely to draw from a population of relatively
282 committed individuals). Furthermore, participants were primarily recruited on the basis of their
283 adherence to moralistic god traditions; this selection process may have reduced the appearance of
284 adherence to many local god traditions, and this should at least temper confidence in the stark
285 contrast between commitment across both deities. Thus, insecurity could come to relate to religious
286 commitments more clearly (and perhaps, quite differently) in a broader sample of these
287 populations. Furthermore, in the interest of cross-culturally documenting the ebbs and flows of
288 religious commitment, there is an obvious need for more rigorous longitudinal data. That is, an
289 account of the patterns of religious commitment can greatly benefit from in-depth efforts to
290 document and account for the change in prevalence and forms of religious commitment *within*
291 societies (Power, 2017, 2018; Purzycki, 2013b, 2016). Indeed, while the current work provides
292 evidence for some cross-culturally stable relationships – longitudinal data would allow us to more
293 stringently test hypotheses regarding the dynamics of religious commitments and their relationship
294 to insecurity. Moreover, our analyses considered only one form of insecurity – food insecurity.
295 Future research will certainly benefit from considering the relationship between alternative forms

296 of insecurity (resource access vs safety concerns, and/or quality/quantity of local social services,
 297 for example) that can also vary in intensity and duration (acute vs chronic stressors) and
 298 forms/targets of religious commitments.

299 In stark contrast to predictions regarding how commitments to moralistic traditions should
 300 be greater in ‘safer’ environments (Baumard & Chevallier, 2015), we find that it is commitment
 301 to moralistic (not local traditions) that is greatest in more insecure individuals times. Admittedly,
 302 different hypotheses may be devised at the group and individual level regarding these associations,
 303 and future work should clarify the levels at which these correlations might develop. In their classic
 304 study of the existential security hypothesis, Norris & Inglehart (2011) hypothesized that material
 305 insecurity increases religious commitment to ‘transcendent’ religious traditions. Our results
 306 indicate another dimension of between-tradition variability that might account for the types of
 307 religious commitments associated with material insecurity. That is, with greater insecurity,
 308 individuals invest more deeply in *moralistic* religious traditions – and sometimes at the expense
 309 of less-moralistic ones. Looking forward, our results might predict that waning commitments to
 310 world religions that might accompany more certain living conditions may very well be
 311 accompanied by a resurgence in local, or even alternative religious commitments.

312
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322
 323 **Author Contributions:** AB and BGP initiated this study, preregistered the project, planned the
 324 analysis, and wrote the manuscript. AB wrote all R code, conducted all analyses, and made all
 325 graphs. J.H., A.N., and B.G.P. conceived the overarching study. C.L.A., Q.D.A., A.B., E.C.,
 326 E.K.K., C.H., C.L., S.M., R.A.M., C.M., C.P., B.G.P, M.S., T.V., J.L.W., A.K.W., and D.X.
 327 collected data. M.L. and B.G.P. managed the dataset and team communication. All authors
 328 provided feedback on the manuscript.

329
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331
 332 **Data availability:** All

333
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444

Material insecurity predicts greater commitment to moralistic and less commitment to local deities: A cross-cultural investigation

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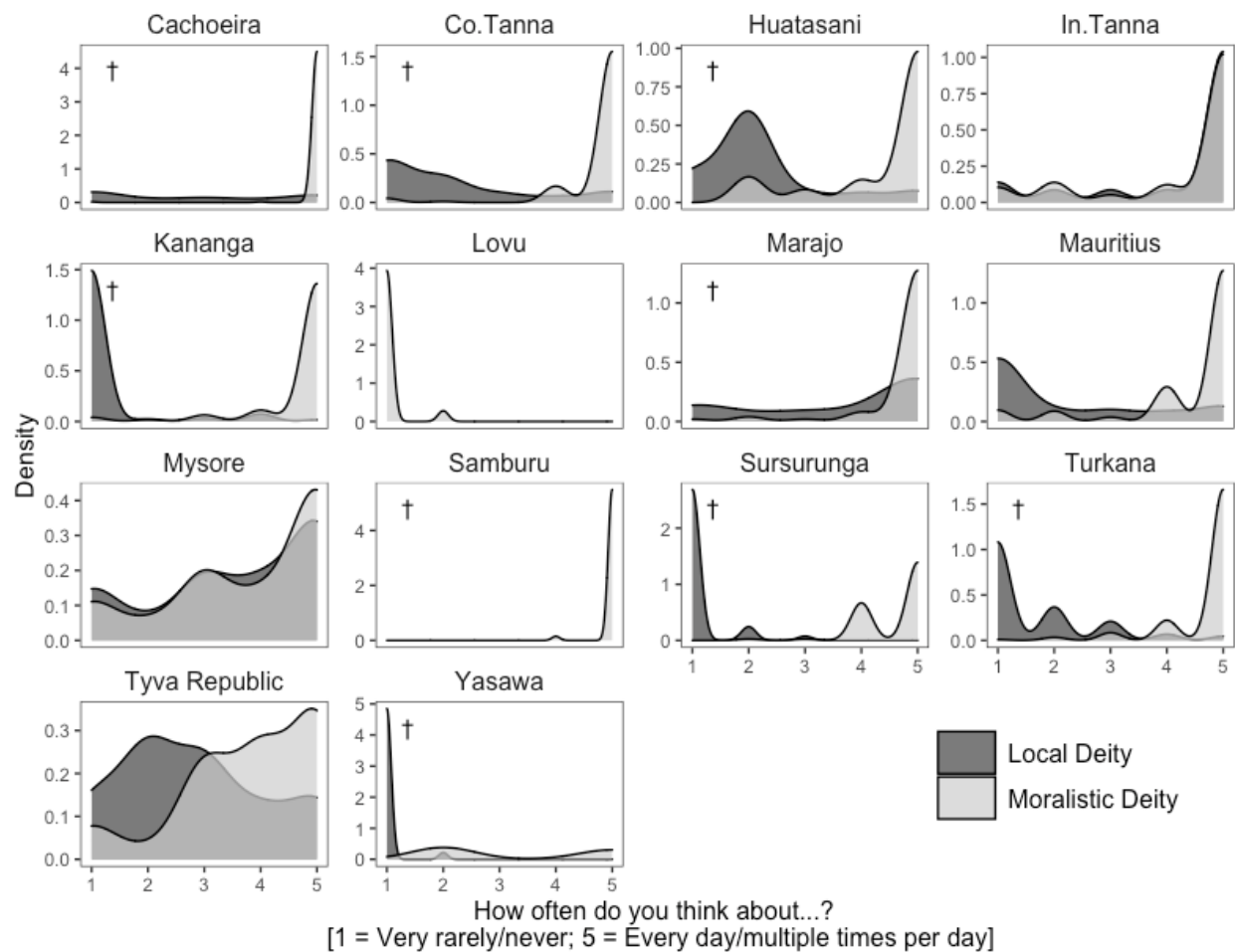
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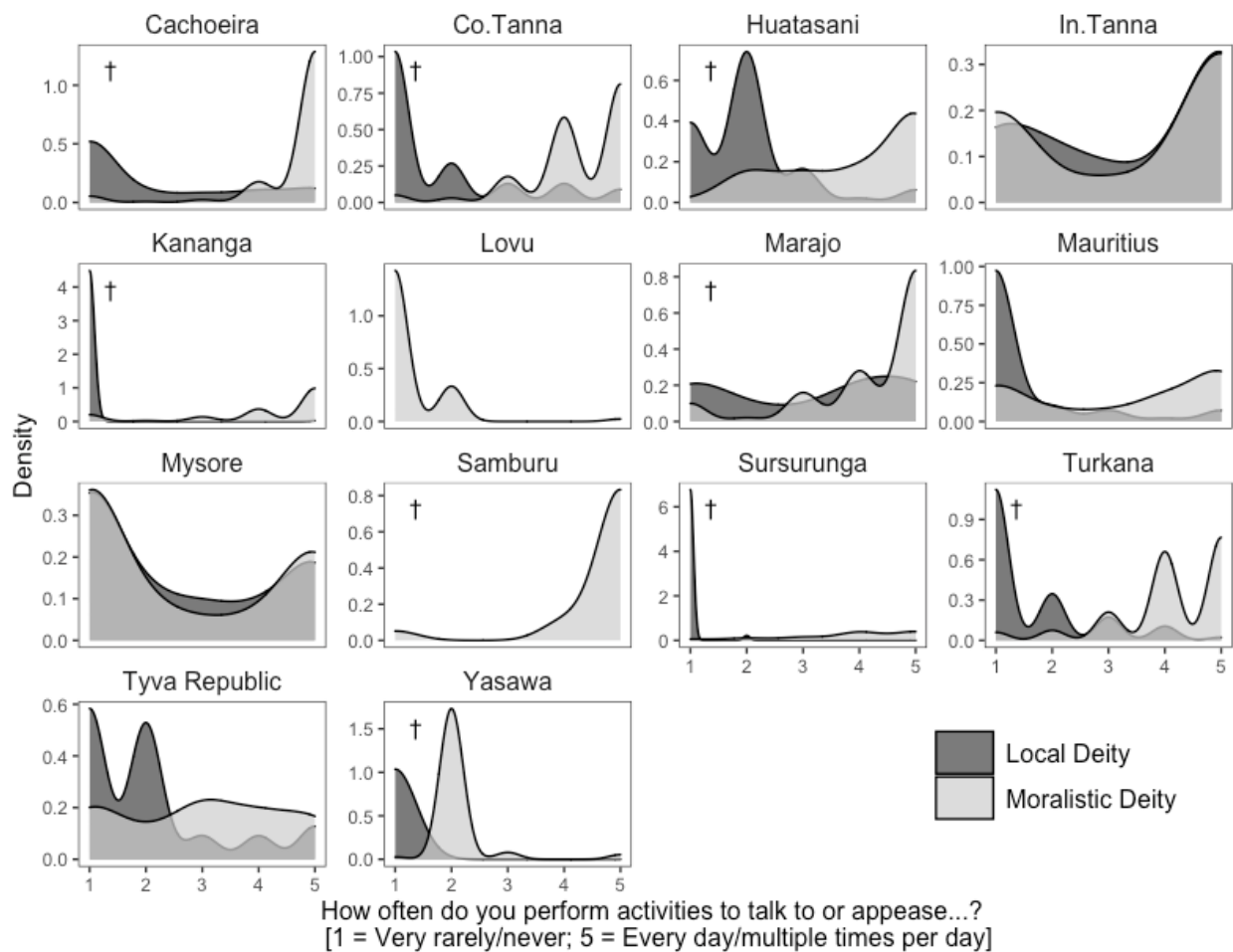
449 Figure S1. By-site distribution of responses to the question: “How often do you think about
 450 [moralistic/local deity]?”



451
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Notes: Sites at which the moralistic tradition was Christian are noted with a cross.

455 Figure S2. By-site distribution of responses to the question: “How often do you perform
 456 activities to talk to or appease [local/moralistic deity]?”



457
 458 Notes: Sites at which the moralistic tradition was Christian are noted with a cross.
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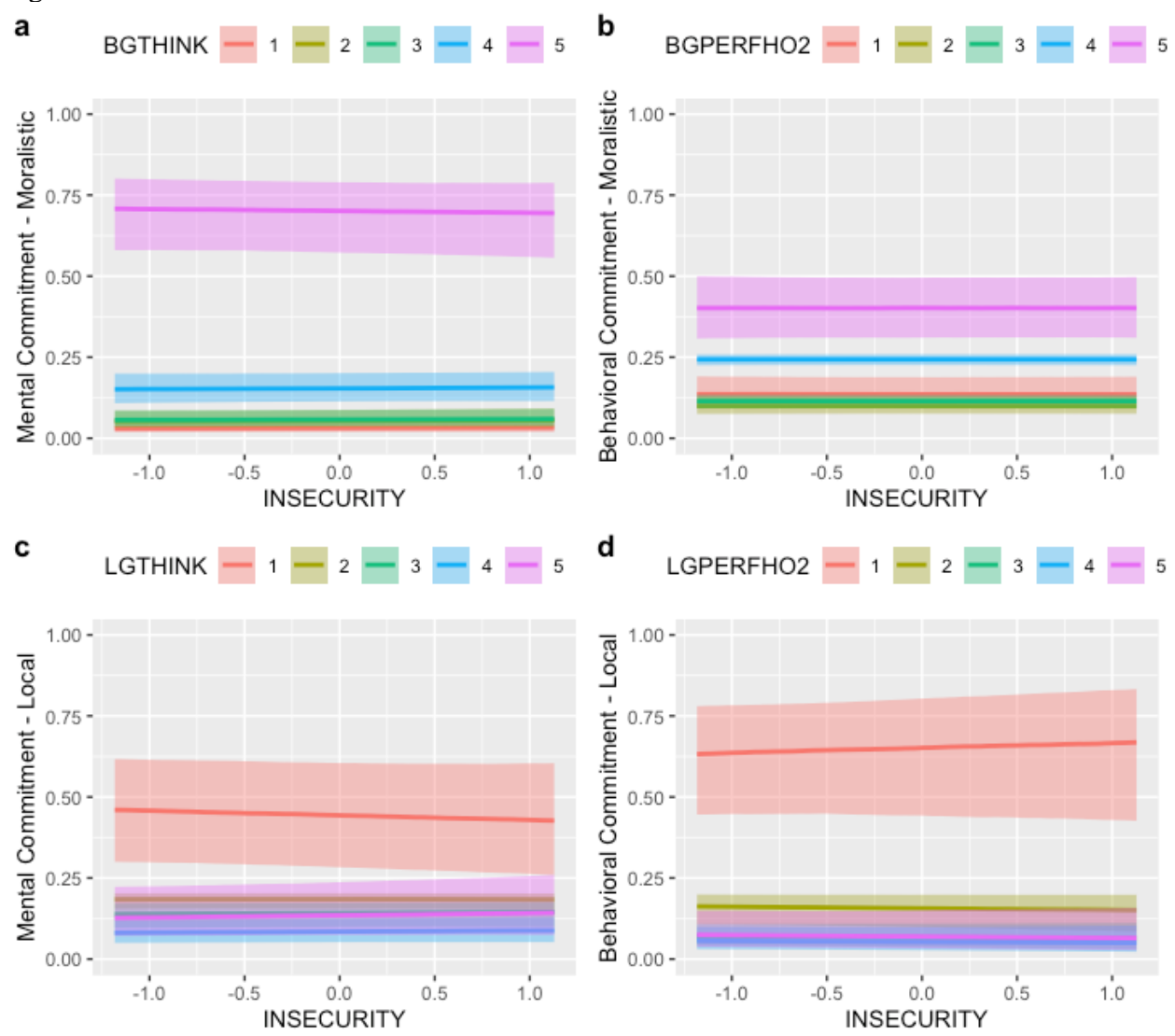
460 Table S1. Model summaries - how often do you think about [moralistic/local deity]?

<i>Predictors</i>	Model 1		Model 2		Model 3		Model 4	
	<i>Log-Odds</i>	<i>CI (95%)</i>	<i>Log-Odds</i>	<i>CI (95%)</i>	<i>Log-Odds</i>	<i>CI (95%)</i>	<i>Log-Odds</i>	<i>CI (95%)</i>
Intercept 1	0.42	-0.46 – 1.35	0.42	-0.38 – 1.26	0.37	-0.47 – 1.25	0.41	-0.41 – 1.25
Interpct 2	1.16	0.29 – 2.09	1.16	0.36 – 2.00	1.11	0.26 – 1.99	1.15	0.34 – 1.99
Intercept 3	1.74	0.88 – 2.68	1.74	0.94 – 2.58	1.70	0.86 – 2.58	1.75	0.93 – 2.58
Intercept 4	2.41	1.54 – 3.35	2.42	1.61 – 3.26	2.38	1.53 – 3.26	2.42	1.60 – 3.27
Material Insecurity (std.)	-0.20	-0.31 – -0.08	-0.23	-0.43 – -0.06	-0.21	-0.32 – -0.09	-0.24	-0.44 – -0.06
Moralistic Deity	3.36	3.19 – 3.54	3.39	3.22 – 3.57	3.38	3.20 – 3.56	3.40	3.22 – 3.59
Insecurity * Moralistic	0.45	0.30 – 0.60	0.51	0.35 – 0.67	0.45	0.29 – 0.60	0.50	0.34 – 0.66
Age (yrs, std.)					0.12	0.02 – 0.21	0.12	0.02 – 0.22
Sex (-1 = Female; 1 = Male)					0.05	-0.02 – 0.12	0.05	-0.02 – 0.13
Formal Education (yrs, std.)					-0.04	-0.15 – 0.08	-0.04	-0.16 – 0.08
Children (no., std.)					0.05	-0.06 – 0.15	0.05	-0.06 – 0.15
Varying effects	Site		Insecurity by Site		Site		Insecurity by Site	
N	14 SITE		14 SITE		14 SITE		14 SITE	
	1889 CID		1889 CID		1820 CID		1820 CID	
Observations	3607		3607		3482		3482	

462 Table S2. Model summaries – “how often do you perform activities to talk to appease [moralistic/local deity]?”

<i>Predictors</i>	Model 1		Model 2		Model 3		Model 4	
	<i>Log-Odds</i>	<i>CI (95%)</i>	<i>Log-Odds</i>	<i>CI (95%)</i>	<i>Log-Odds</i>	<i>CI (95%)</i>	<i>Log-Odds</i>	<i>CI (95%)</i>
Intercept 1	0.80	0.08 – 1.45	0.83	0.15 – 1.52	0.55	0.08 – 1.02	0.83	0.15 – 1.48
Interpct 2	1.53	0.80 – 2.19	1.56	0.89 – 2.26	0.98	0.52 – 1.45	1.55	0.87 – 2.21
Intercept 3	2.05	1.33 – 2.72	2.09	1.40 – 2.78	1.30	0.84 – 1.77	2.08	1.39 – 2.75
Intercept 4	2.96	2.22 – 3.65	2.99	2.30 – 3.70	1.85	1.38 – 2.33	2.99	2.29 – 3.66
Material Insecurity (std.)	-0.34	-0.48 – -0.22	-0.34	-0.53 – -0.14	-0.23	-0.31 – -0.15	-0.36	-0.53 – -0.16
Moralistic Deity	2.89	2.68 – 3.10	2.90	2.70 – 3.11	1.77	1.65 – 1.88	2.90	2.69 – 3.12
Insecurity * Moralistic	0.55	0.40 – 0.70	0.59	0.43 – 0.74	0.35	0.26 – 0.43	0.58	0.44 – 0.73
Age (yrs, std.)					0.12	0.06 – 0.19	0.20	0.10 – 0.30
Sex (-1 = Female; 1 = Male)					0.04	-0.01 – 0.09	0.07	-0.01 – 0.14
Formal Education (yrs, std.)					0.03	-0.05 – 0.10	0.02	-0.10 – 0.14
Children (no., std.)					0.05	-0.02 – 0.11	0.06	-0.04 – 0.17
Varying effects	Site		Insecurity by Site		Site		Insecurity by Site	
N	14 SITE		14 SITE		14 SITE		14 SITE	
	1884 CID		1884 CID		1817 CID		1817 CID	
Observations	3565		3565		3444		3444	

464 Figure S3. Predicted probabilities of commitment resulting from multiple response ordinal
465 regression models



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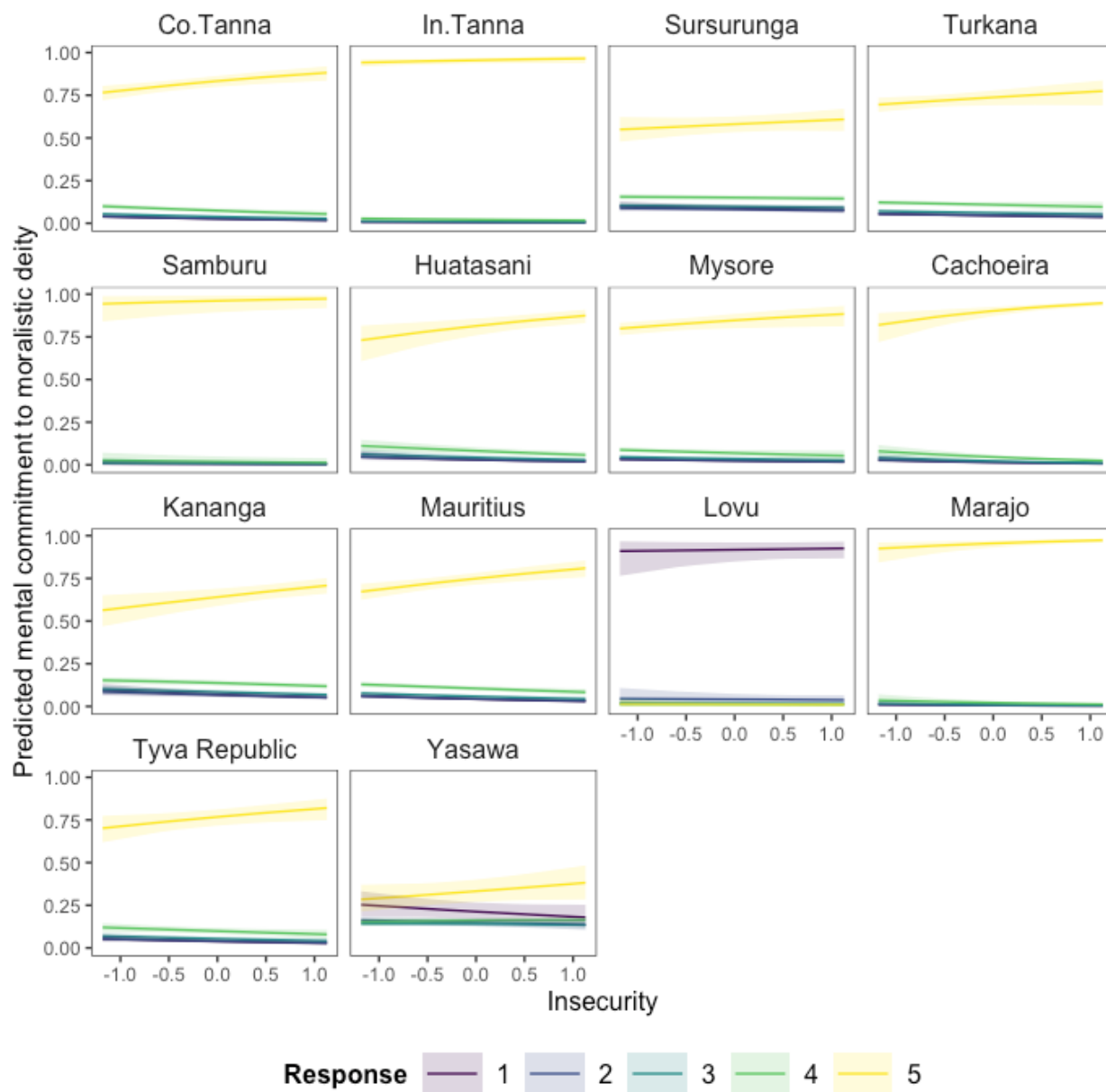
Notes: Confidence bands are 89% credible intervals. BG = Moralistic deity. LG = local deity. THINK = mental commitment. PERFHO2 = behavioral commitment. Colors represent ordinal response levels (1 = low; 5 = high).

471 Table S3. Summaries of additional models (section 3.2.1)
 472

<i>Predictors</i>	Mental Commitment		Behavioral Commitment	
	<i>Log-Odds</i>	<i>CI (95%)</i>	<i>Log-Odds</i>	<i>CI (95%)</i>
Intercept 1	-1.20	-2.92 – 0.59	-0.73	-2.41 – 0.86
Intercept 2	-0.45	-2.17 – 1.34	-0.03	-1.71 – 1.57
Intercept 3	0.13	-1.60 – 1.93	0.46	-1.21 – 2.06
Intercept 4	0.80	-0.92 – 2.61	1.32	-0.36 – 2.92
Insecurity (standardized)	0.02	-0.87 – 0.92	-0.04	-1.00 – 0.89
N	2 _{DEITY} 14 _{SITE}		2 _{DEITY} 14 _{SITE}	
Varying effects	Insecurity by Deity; Insecurity by Site		Insecurity by Deity; Insecurity by Site	
Observations	3607		3565	

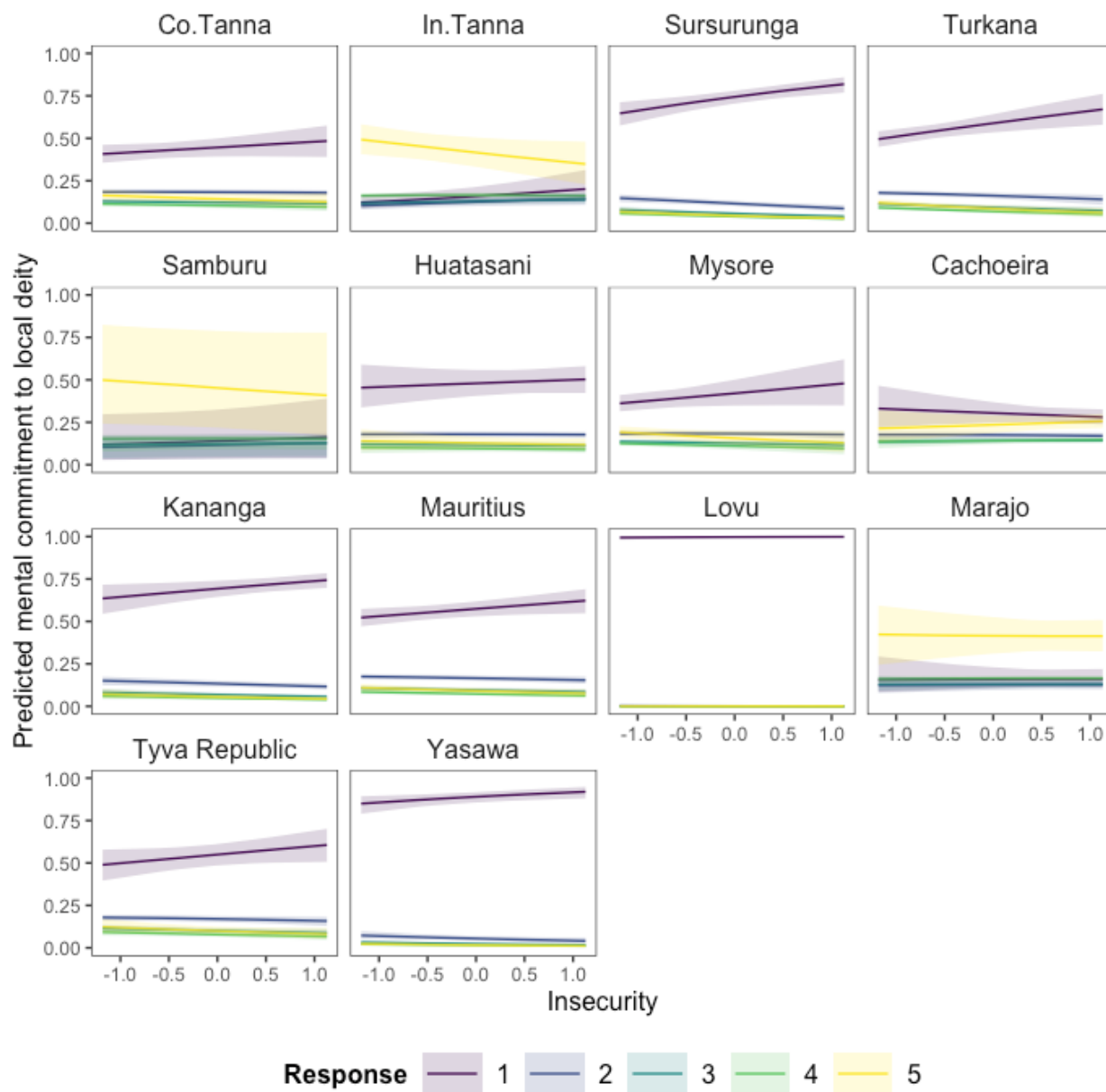
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474 Figure S5. Predicted probabilities of mental commitment to the *moralistic* deities by site and
 475 insecurity



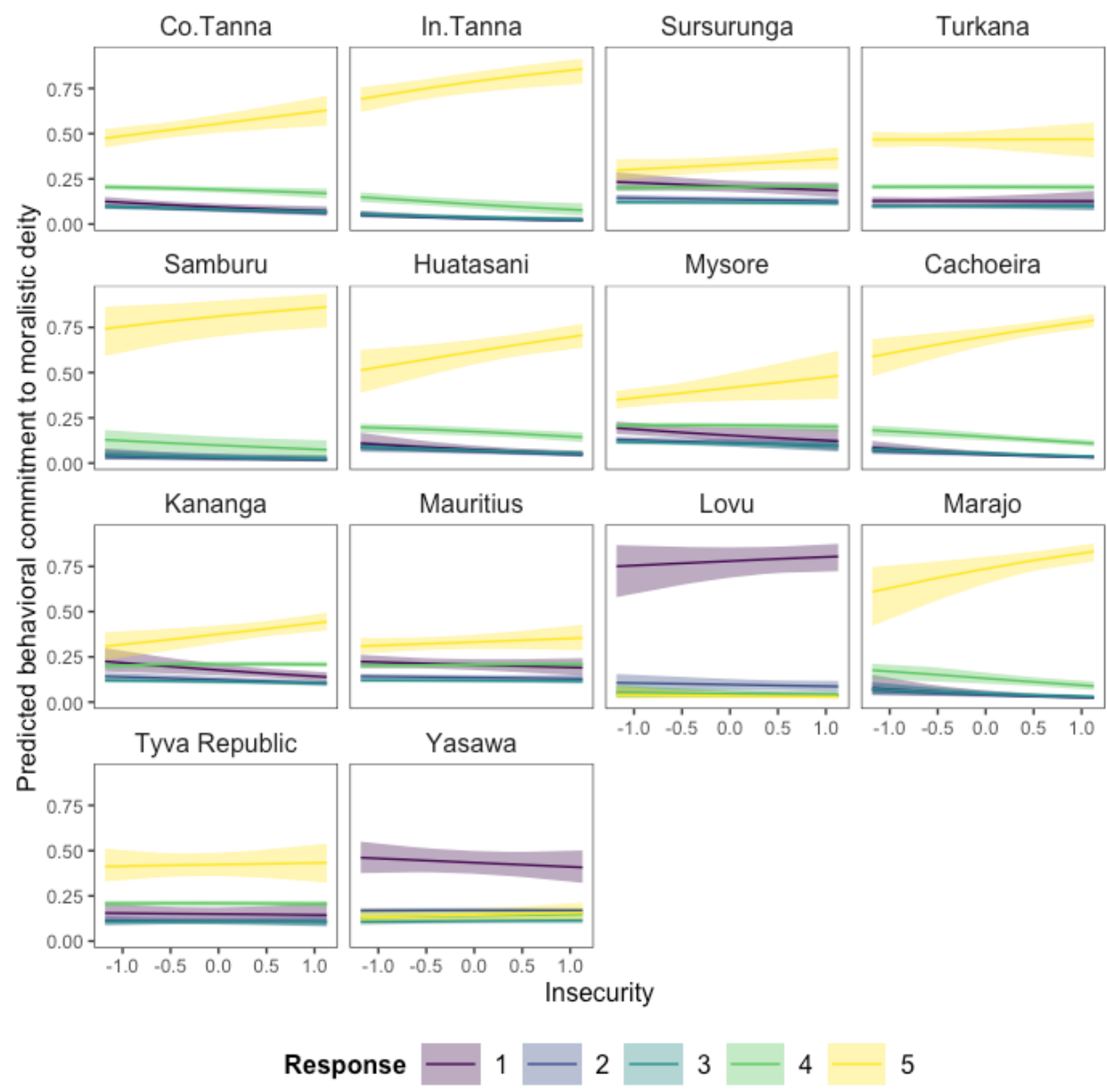
476 Notes: Shaded regions are 95% credible intervals. Predictions generated from model summarised
 477 in Table S3 [Mental Commitment].
 478
 479

480 Figure S6. Predicted probabilities of mental commitment to the *local* deities by site and
 481 insecurity



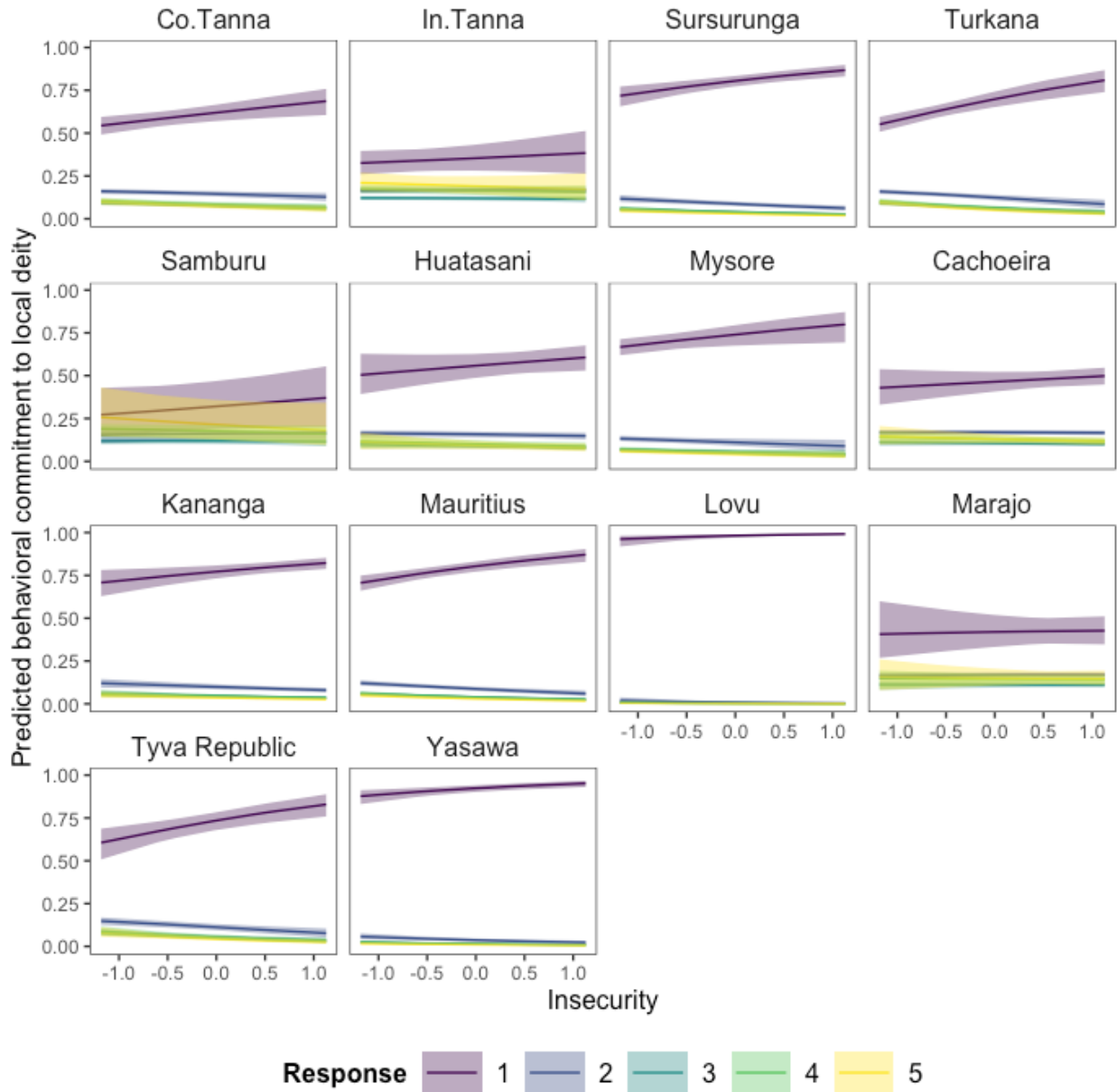
482 Notes: Shaded regions are 95% credible intervals. Predictions generated from model summarised
 483 in Table S3 [Mental Commitment].
 484
 485

486 Figure S7. Predicted probabilities of behavioral commitment to the *moralistic* deities by site and
487 insecurity



488 Notes: Shaded regions are 95% credible intervals. Predictions generated from model summarised
489 in Table S3 [Behavioral Commitment].
490

Figure S8. Predicted probabilities of behavioral commitment to the *local* deities by site and insecurity (estimated at the individual level)



Notes: Shaded regions are 95% credible intervals. Predictions generated from model summarised in Table S3 [Behavioral Commitment].