

# 1 DiD Design

**README:** The following document presents results for two DiD models (1) TWFE as in Brodeur et al. (2021)<sup>1</sup> and (2) Borusyak, Jaravel, and Spiess (2023)<sup>2</sup>. It also reports pre-trends tests as suggested in Borusyak, Jaravel, and Spiess (2023).

3 different treatment definitions are used:

- **Lockdown Announcement:** Day in which a statewide lockdown is announced. (1 in tables, Blue in graphs)
- **Lockdown Start:** Day in which a city lockdown starts within a state. (2 in tables, Red in graphs)
- **Lockdown End:** 7 seven prior to the lockdown announcement. (3 in tables, Green in graphs)

**TWFE:** The empirical strategy leverages the panel structure of the Google Trends data and the staggered implementation of COVID-19 lockdowns within a difference-in-differences framework. The daily frequency of the series enables us to incorporate 2019 observations to construct the counterfactual trajectory, in addition to never-treated and not-yet-treated units, as is standard DiD designs. As in ([well-being paper](#)), we estimate the following.

$$y_{it} = \gamma \mathcal{D}_{it} \times \mathbb{1}_{2020} + \delta \mathcal{D}_{it} + \rho L(x_{it}) + \mu_i + \lambda_t + \varepsilon_{it}$$

where  $y_{it}$  are Google searches for a specific topic of interest in state (country)  $i$  at time  $t$ ,  $\mathbb{1}_{2020}$  an indicator variable for year 2020,  $\mathcal{D}$  is a dummy equal to one since the day lockdown is announced in 2020 and its paired day from 2019.  $L(x_{it})$  controls for one day lagged Covid-19 average deaths and average cases,  $\mu_i$  are state (country) fixed effects, while  $\lambda_t$  is composed of fixed effects for year, week (of year) and day of week (dow). The parameter of interest is  $\gamma$ , standard errors are clustered at the day of year level, and regressions are weighed by state's (country's) population.

**Borusyak, Jaravel, and Spiess (2023):** Within the set of observations  $it \in \Omega$ , we define the set of treated observations as  $\Omega_1 = \{it \in \Omega : D_{it} = 1\}$  and  $\Omega_0 = \{it \in \Omega : D_{it} = 0\}$  as the set of untreated observations (which include never-treated units). We estimate the effect of Covid-19 lockdowns in three steps<sup>3</sup>.

1. For untreated observations  $it \in \Omega_0$  and weighting by population, regress  $y_{it} = \delta \mathcal{D}_{it} + \mu_i + \lambda_t + \varepsilon_{it}$  to estimate fixed effects
2. For treated observations  $it \in \Omega_1$ , compute  $\hat{\tau}_{it} = y_{it} - \hat{y}_{it}(0)$ , where the last term comes from extrapolating the previous model to the treated subsample.
3. Aggregate for treated observations averaging  $\hat{\tau}_w = \sum_{it \in \Omega_1} w_i \hat{\tau}_{it}$ , where  $w_i$  weights by population.

**Pre-trends test:** As suggested in Borusyak, Jaravel, and Spiess (2023), for  $it \in \Omega_0$  estimate  $y_{it} = \sum_{k<0} \tau_k \mathcal{E}_{it}^k \times \mathbb{1}_{2020} + \sum_{k<0} \delta_k \mathcal{E}_{it}^k + \delta \mathcal{D}_{it} + \mu_i + \lambda_t + \varepsilon_{it}$ . We should expect  $\tau_k$  to be non-significant.

The following three sections present results for three different specifications of time fixed effects.

- FE1: year, week-of-year, dow, state FEs
- FE2: year, day of year (1-100), dow, state FEs
- FE3: year, state interacted with day of year (1-100), dow FEs

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<sup>1</sup> Abel Brodeur, Andrew E. Clark, Sarah Fleche, Nattavudh Powdthavee, COVID-19, lockdowns and well-being: Evidence from Google Trends, Jurnal of Public Economics, Volume 193, 2021

<sup>2</sup>Kirill Borusyak, Xavier Jaravel, and Jann Spiess. Revisiting Event Study Designs. Working Paper, 2023.

<sup>3</sup>Covid controls are not included in step one due to lack of variation and, most importantly, absence of high values. The latter makes the ‘out-of-sample’ predictions unreliable when extrapolating for treated observations.

## 2 Results: FE 1

Table 1: Topics

	TWFE			BJS		
	(1)	(2)	(3)	(1)	(2)	(3)
Faith	12.699*** (1.258) [0.000]	12.850*** (1.069) [0.000]	11.748*** (1.166) [0.000]	15.847*** (0.999) [0.000]	15.740*** (0.845) [0.000]	14.667*** (0.883) [0.000]
God	9.110*** (0.672) [0.000]	9.687*** (0.707) [0.000]	8.318*** (0.875) [0.000]	10.707*** (0.560) [0.000]	10.934*** (0.471) [0.000]	9.605*** (0.457) [0.000]
Prayer	16.940*** (1.216) [0.000]	17.250*** (1.084) [0.000]	17.099*** (1.177) [0.000]	19.955*** (0.745) [0.000]	19.504*** (0.646) [0.000]	19.057*** (0.588) [0.000]
Meditation	8.003*** (1.549) [0.000]	6.609*** (1.416) [0.000]	5.449*** (1.348) [0.000]	9.969*** (0.626) [0.000]	8.092*** (0.595) [0.000]	6.831*** (0.572) [0.000]
Religion	-1.187 (1.675) [0.480]	-3.697** (1.572) [0.021]	-6.445*** (1.654) [0.000]	1.112 (1.097) [0.311]	-1.901** (0.965) [0.049]	-4.207*** (0.883) [0.000]
Spirituality	-3.474*** (1.308) [0.009]	-4.759*** (1.234) [0.000]	-6.468*** (1.268) [0.000]	-2.662*** (0.816) [0.001]	-4.147*** (0.786) [0.000]	-5.602*** (0.793) [0.000]

**Notes:** This table reports t-tests for mean differences between attendees and non-attendees treatment and control groups. \*significant at 10%, \*\*significant at 5%, \*\*\*significant at 1%

Table 2: Subcategories

	TWFE			BJS		
	(1)	(2)	(3)	(1)	(2)	(3)
Astrology	-3.665*** (1.158) [0.002]	-3.802*** (1.071) [0.001]	-5.004*** (1.110) [0.000]	-5.329*** (0.903) [0.000]	-5.573*** (0.901) [0.000]	-6.425*** (0.941) [0.000]
Buddhism	-5.404*** (1.251) [0.000]	-7.161*** (1.295) [0.000]	-7.052*** (1.041) [0.000]	-6.963*** (0.760) [0.000]	-8.984*** (0.733) [0.000]	-8.932*** (0.671) [0.000]
Christianity	12.635*** (1.991) [0.000]	11.759*** (1.759) [0.000]	11.351*** (1.575) [0.000]	13.450*** (0.733) [0.000]	12.268*** (0.711) [0.000]	11.844*** (0.704) [0.000]
Hinduism	-6.983*** (1.219) [0.000]	-8.309*** (1.249) [0.000]	-10.518*** (1.731) [0.000]	-7.974*** (1.071) [0.000]	-9.367*** (1.031) [0.000]	-11.138*** (1.193) [0.000]
Islam	2.765* (1.422) [0.055]	1.100 (1.312) [0.404]	-1.246 (1.248) [0.320]	4.346*** (0.862) [0.000]	2.330*** (0.805) [0.004]	0.248 (0.691) [0.720]
Judaism	15.449*** (2.876) [0.000]	12.911*** (2.684) [0.000]	10.095*** (2.640) [0.000]	17.073*** (0.593) [0.000]	14.338*** (0.550) [0.000]	12.025*** (0.630) [0.000]
Occult	9.950*** (1.031) [0.000]	10.220*** (0.916) [0.000]	9.777*** (0.887) [0.000]	11.652*** (0.739) [0.000]	11.404*** (0.720) [0.000]	11.108*** (0.719) [0.000]
Paganism	8.736*** (1.254) [0.000]	8.831*** (1.135) [0.000]	7.571*** (1.228) [0.000]	8.901*** (1.036) [0.000]	8.538*** (0.963) [0.000]	7.289*** (0.984) [0.000]
Worship	2.968 (2.648) [0.265]	2.747 (2.791) [0.327]	3.205 (2.547) [0.211]	2.674*** (1.020) [0.009]	2.161** (1.023) [0.035]	2.793*** (1.061) [0.008]
Scientology	6.624*** (1.519) [0.000]	6.488*** (1.505) [0.000]	5.904*** (1.473) [0.000]	10.507*** (1.414) [0.000]	9.716*** (1.380) [0.000]	9.152*** (1.316) [0.000]
Selfhelp	3.962*** (1.217) [0.002]	1.865 (1.211) [0.127]	-0.296 (1.335) [0.825]	3.110*** (0.697) [0.000]	0.953 (0.634) [0.133]	-0.757 (0.668) [0.257]
Skeptics	2.843* (1.663) [0.090]	0.974 (2.288) [0.671]	0.323 (2.104) [0.878]	3.140*** (1.080) [0.004]	1.151 (1.457) [0.430]	0.522 (1.275) [0.682]
Spirituality	1.220 (0.865) [0.162]	1.625* (0.920) [0.080]	0.935 (1.115) [0.404]	-0.047 (0.745) [0.950]	0.694 (0.712) [0.330]	-0.052 (0.685) [0.939]
Theology	-5.007*** (1.431) [0.001]	-6.447*** (1.368) [0.000]	-6.929*** (1.290) [0.000]	-6.156*** (1.176) [0.000]	-7.737*** (1.028) [0.000]	-8.305*** (1.047) [0.000]

**Notes:** This table reports t-tests for mean differences between attendees and non-attendees treatment and control groups. \*signifcantant 10%, \*\*signicantat 5%, \*\*\*significant 1%

Figure 1: Pretrends - Topics

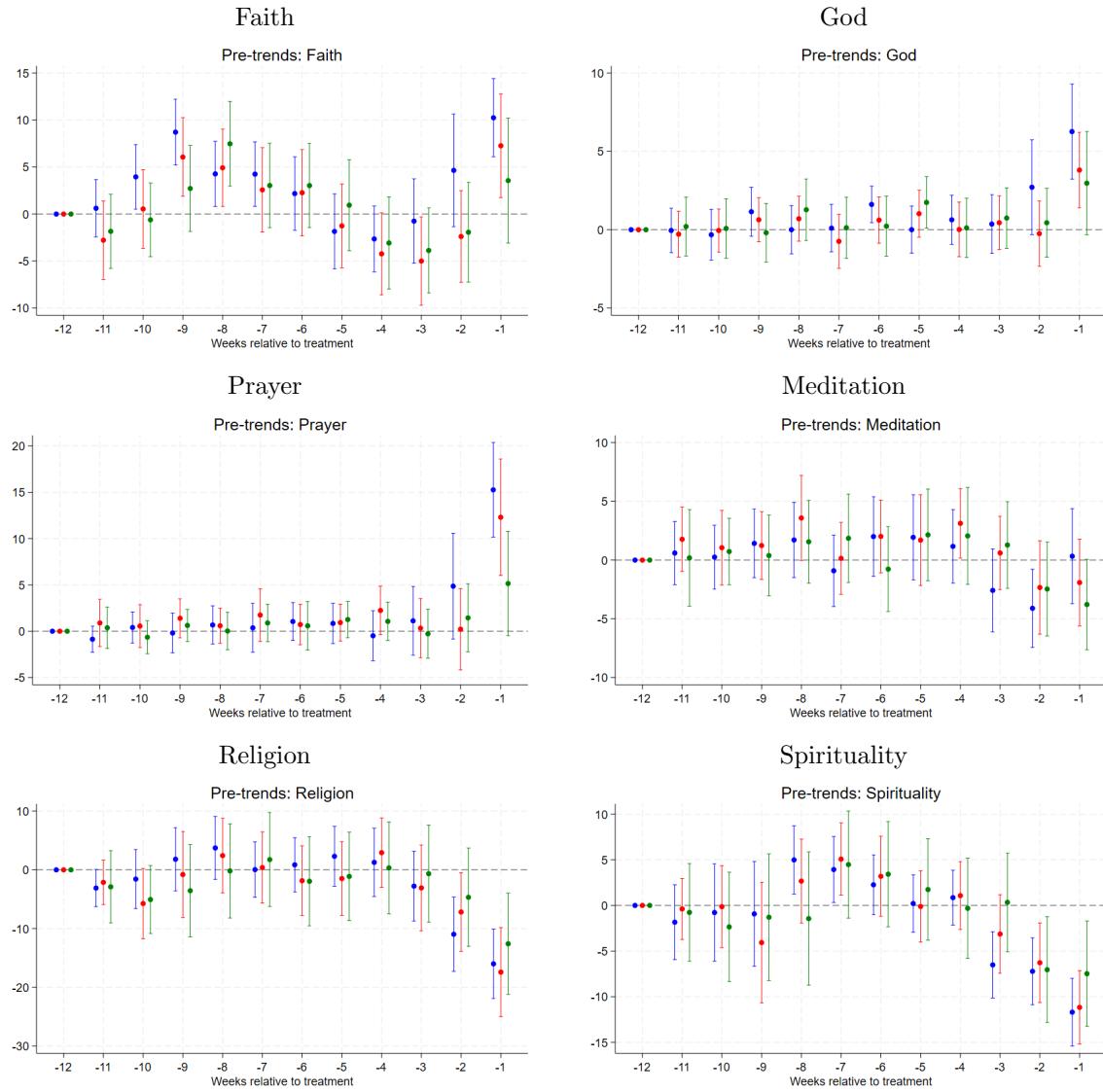


Figure 2: Pretrends - Subcategories

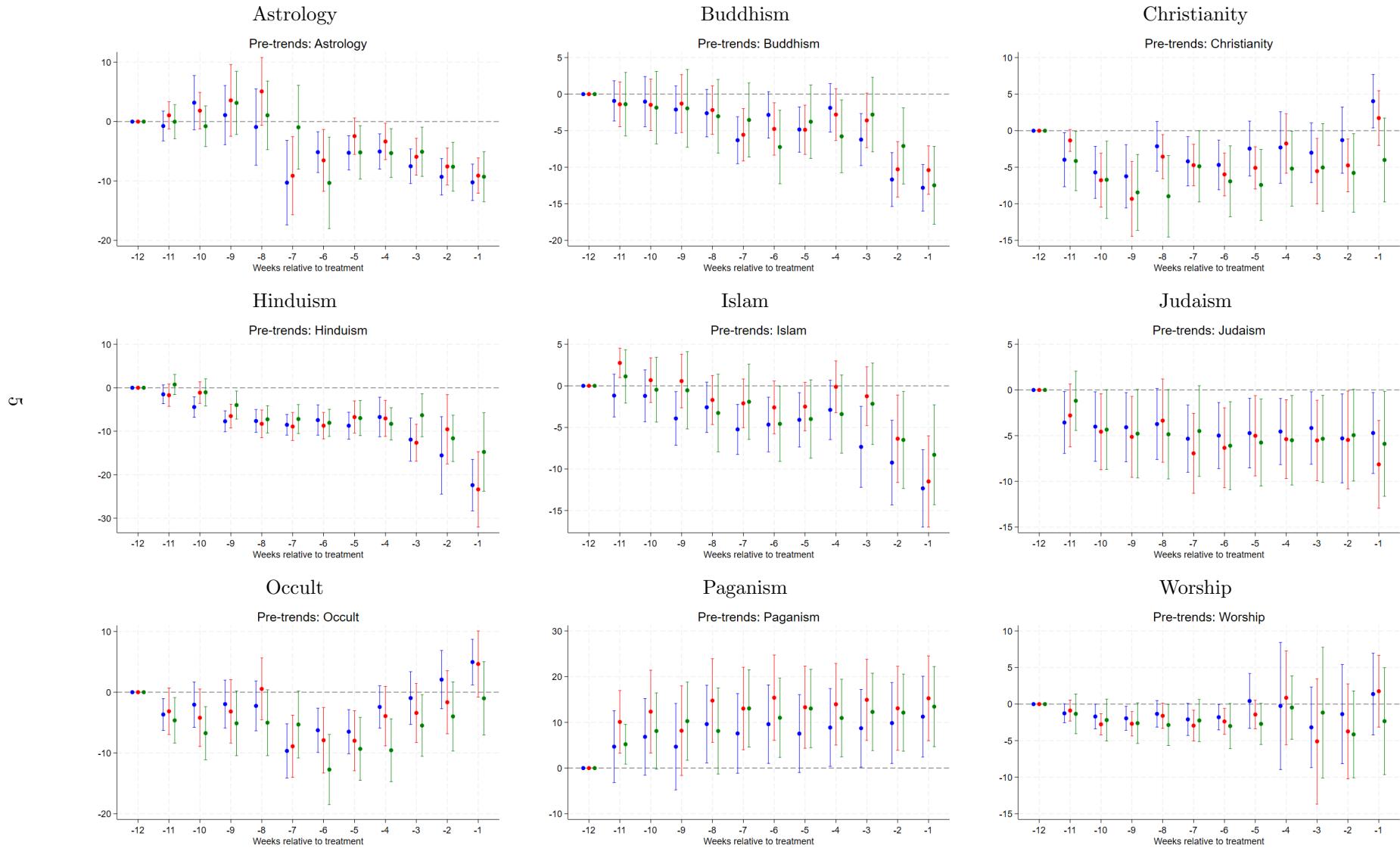
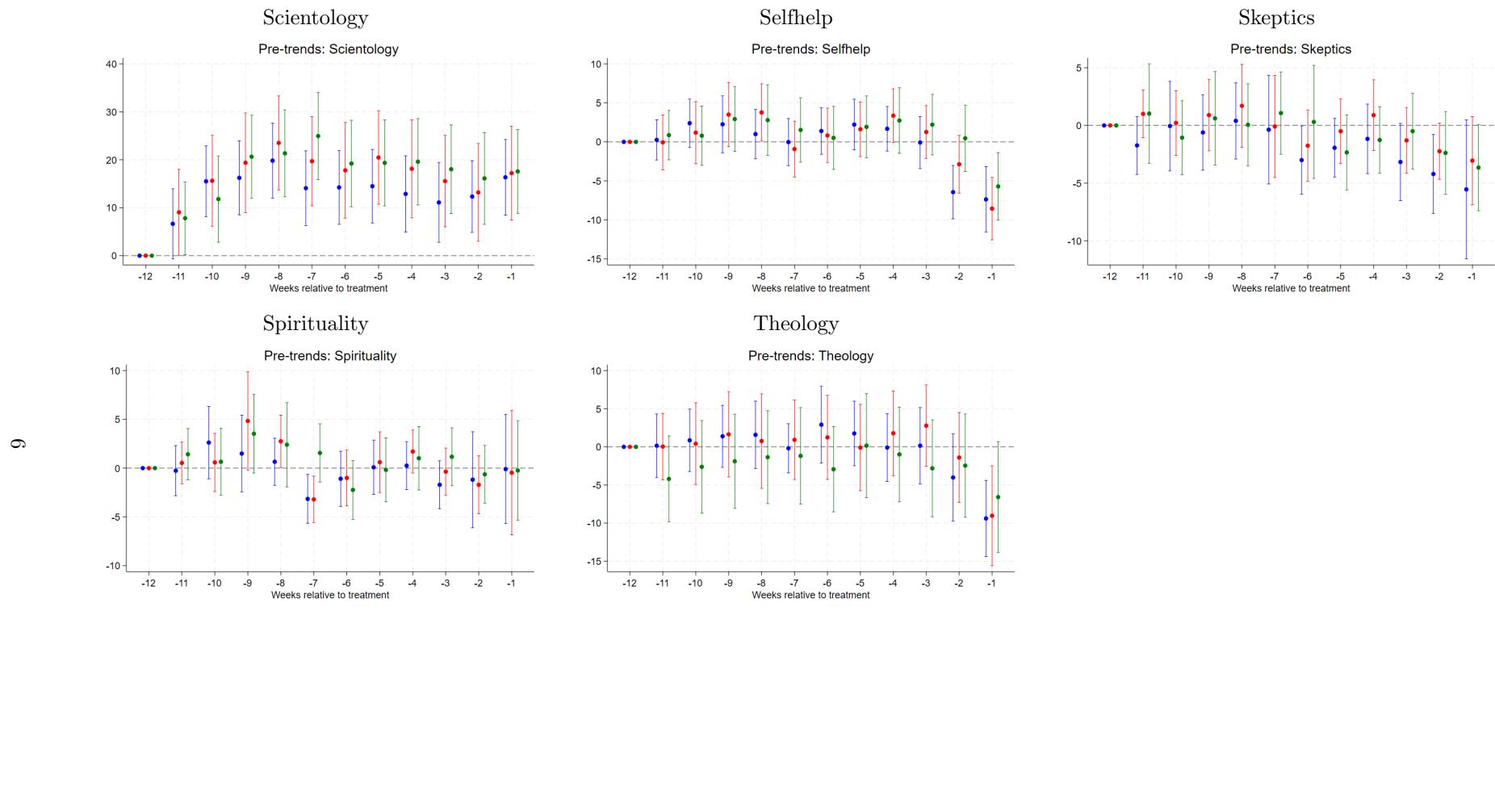


Figure 3: Pretrends - Subcategories



### 3 Results: FE 2

Table 3: Topics

	TWFE			BJS		
	(1)	(2)	(3)	(1)	(2)	(3)
Faith	12.668*** (1.204) [0.000]	12.861*** (1.021) [0.000]	11.940*** (1.125) [0.000]	15.887*** (0.770) [0.000]	15.720*** (0.657) [0.000]	14.745*** (0.722) [0.000]
God	9.228*** (0.572) [0.000]	9.912*** (0.551) [0.000]	8.688*** (0.745) [0.000]	10.787*** (0.401) [0.000]	11.145*** (0.286) [0.000]	9.847*** (0.287) [0.000]
Prayer	16.987*** (1.316) [0.000]	17.380*** (1.153) [0.000]	17.426*** (1.116) [0.000]	19.631*** (0.669) [0.000]	19.314*** (0.570) [0.000]	19.018*** (0.463) [0.000]
Meditation	8.547*** (1.582) [0.000]	7.264*** (1.454) [0.000]	6.187*** (1.378) [0.000]	10.193*** (0.550) [0.000]	8.450*** (0.524) [0.000]	7.256*** (0.490) [0.000]
Religion	0.385 (1.656) [0.817]	-2.267 (1.572) [0.152]	-5.396*** (1.703) [0.002]	2.278** (0.975) [0.019]	-1.015 (0.846) [0.230]	-3.603*** (0.764) [0.000]
Spirituality	-2.886** (1.272) [0.025]	-4.282*** (1.202) [0.001]	-6.008*** (1.245) [0.000]	-2.581*** (0.778) [0.001]	-4.042*** (0.750) [0.000]	-5.506*** (0.715) [0.000]

**Notes:** This table reports t-tests for mean differences between attendees and non-attendees treatment and control groups. \*significant at 10%, \*\*significant at 5%, \*\*\*significant at 1%

Table 4: Subcategories

	TWFE			BJS		
	(1)	(2)	(3)	(1)	(2)	(3)
Astrology	-3.331*** (1.151) [0.005]	-3.475*** (1.066) [0.002]	-4.671*** (1.089) [0.000]	-5.347*** (0.779) [0.000]	-5.381*** (0.782) [0.000]	-6.295*** (0.820) [0.000]
Buddhism	-4.723*** (1.164) [0.000]	-6.468*** (1.203) [0.000]	-6.528*** (0.964) [0.000]	-6.688*** (0.567) [0.000]	-8.562*** (0.501) [0.000]	-8.633*** (0.463) [0.000]
Christianity	13.663*** (2.240) [0.000]	12.783*** (1.984) [0.000]	12.247*** (1.764) [0.000]	13.671*** (0.665) [0.000]	12.647*** (0.664) [0.000]	12.159*** (0.646) [0.000]
Hinduism	-7.358*** (1.410) [0.000]	-8.771*** (1.502) [0.000]	-10.839*** (1.806) [0.000]	-8.656*** (0.995) [0.000]	-9.993*** (0.960) [0.000]	-11.371*** (0.860) [0.000]
Islam	2.916** (1.428) [0.044]	1.224 (1.306) [0.351]	-1.334 (1.371) [0.333]	4.105*** (0.686) [0.000]	1.966*** (0.618) [0.001]	-0.276 (0.475) [0.560]
Judaism	16.993*** (3.063) [0.000]	14.278*** (2.894) [0.000]	11.412*** (2.828) [0.000]	17.256*** (0.479) [0.000]	14.533*** (0.466) [0.000]	12.252*** (0.442) [0.000]
Occult	10.478*** (1.033) [0.000]	10.769*** (0.951) [0.000]	10.360*** (0.914) [0.000]	11.984*** (0.631) [0.000]	11.920*** (0.584) [0.000]	11.457*** (0.569) [0.000]
Paganism	9.657*** (1.214) [0.000]	9.568*** (1.125) [0.000]	8.374*** (1.200) [0.000]	9.289*** (0.768) [0.000]	9.001*** (0.761) [0.000]	7.870*** (0.796) [0.000]
Worship	3.719 (2.770) [0.182]	3.349 (2.738) [0.224]	3.645 (2.455) [0.141]	2.678*** (0.945) [0.005]	2.199** (0.879) [0.012]	2.668*** (0.907) [0.003]
Scientology	7.011*** (1.485) [0.000]	7.000*** (1.278) [0.000]	6.176*** (1.352) [0.000]	10.893*** (1.112) [0.000]	10.156*** (0.966) [0.000]	9.379*** (1.012) [0.000]
Selfhelp	4.619*** (1.105) [0.000]	2.636** (1.132) [0.022]	0.263 (1.337) [0.845]	3.394*** (0.605) [0.000]	1.295** (0.554) [0.019]	-0.614 (0.614) [0.317]
Skeptics	2.803* (1.661) [0.095]	1.066 (2.206) [0.630]	0.300 (2.065) [0.885]	2.709*** (0.596) [0.000]	0.790 (0.554) [0.154]	0.029 (0.566) [0.959]
Spirituality	1.409 (0.910) [0.125]	1.746* (0.890) [0.053]	1.158 (1.039) [0.268]	0.054 (0.649) [0.934]	0.703 (0.586) [0.230]	0.073 (0.595) [0.902]
Theology	-4.551*** (1.301) [0.001]	-6.026*** (1.182) [0.000]	-6.774*** (1.174) [0.000]	-5.752*** (0.740) [0.000]	-7.487*** (0.651) [0.000]	-8.233*** (0.664) [0.000]

**Notes:** This table reports t-tests for mean differences between attendees and non-attendees treatment and control groups. \*signifcantant 10%, \*\*signicantat 5%, \*\*\*significant 1%

Figure 4: Pretrends - Topics

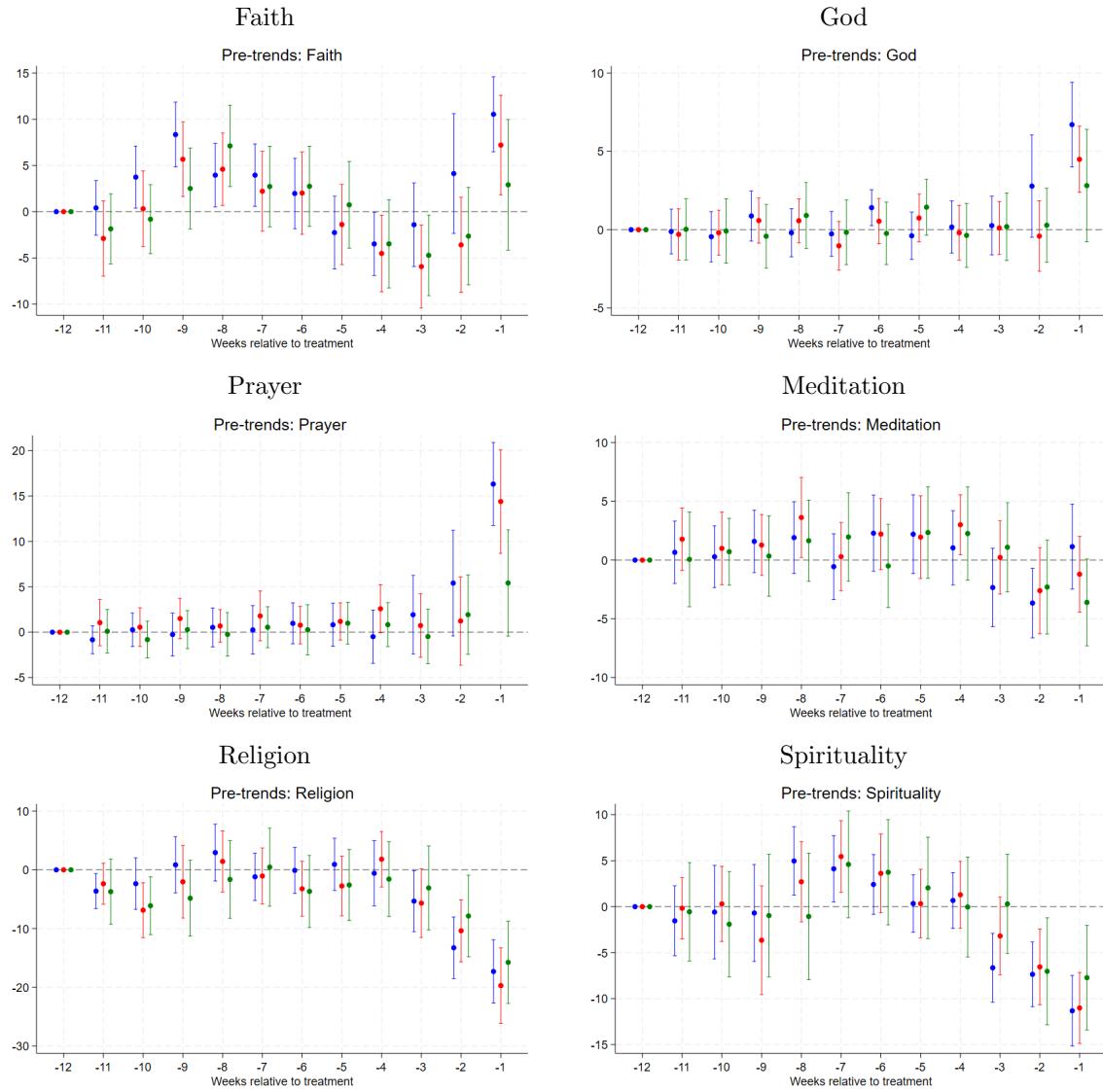


Figure 5: Pretrends - Subcategories

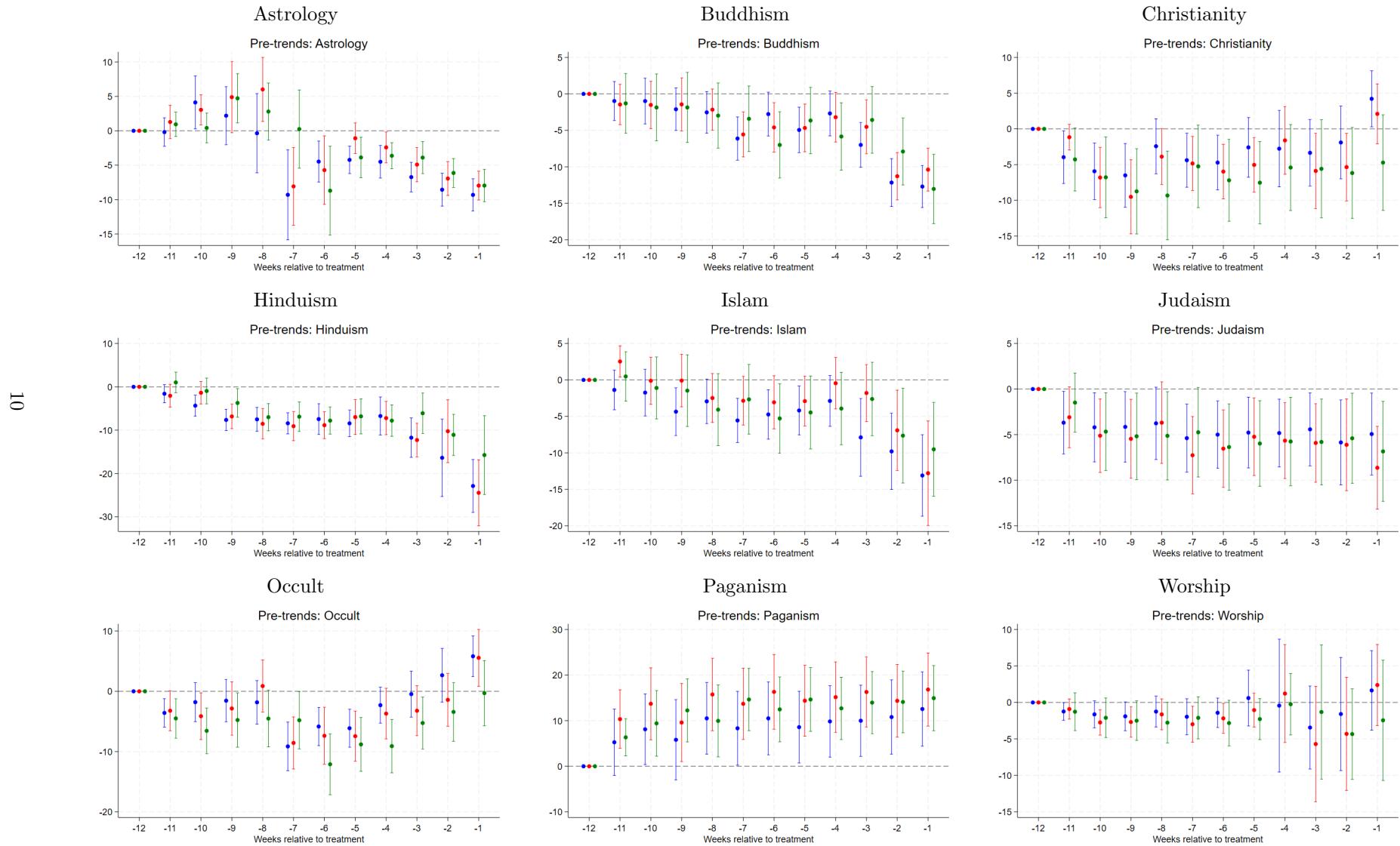
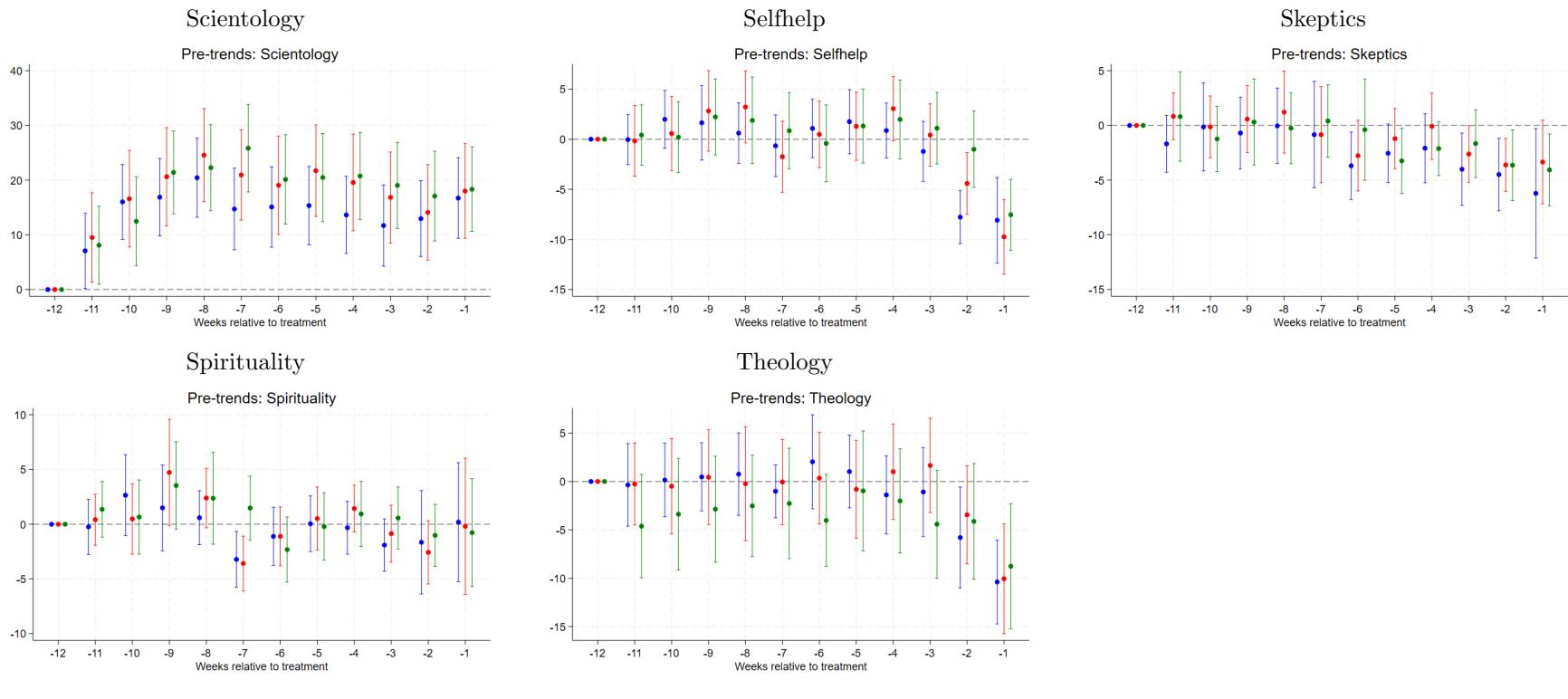


Figure 6: Pretrends - Subcategories



## 4 Results: FE 3

Table 5: Topics

	TWFE			BJS		
	(1)	(2)	(3)	(1)	(2)	(3)
Faith	13.177*** (1.172) [0.000]	13.253*** (0.997) [0.000]	12.307*** (1.106) [0.000]	15.655*** (0.615) [0.000]	15.282*** (0.595) [0.000]	14.327*** (0.604) [0.000]
God	8.997*** (0.563) [0.000]	9.741*** (0.545) [0.000]	8.498*** (0.741) [0.000]	10.508*** (0.299) [0.000]	10.805*** (0.244) [0.000]	9.429*** (0.247) [0.000]
Prayer	17.031*** (1.325) [0.000]	17.420*** (1.160) [0.000]	17.451*** (1.124) [0.000]	19.805*** (0.700) [0.000]	19.532*** (0.604) [0.000]	19.143*** (0.489) [0.000]
Meditation	8.845*** (1.592) [0.000]	7.529*** (1.454) [0.000]	6.292*** (1.387) [0.000]	10.087*** (0.429) [0.000]	8.215*** (0.429) [0.000]	6.944*** (0.419) [0.000]
Religion	0.588 (1.658) [0.723]	-2.186 (1.584) [0.171]	-5.393*** (1.727) [0.002]	1.675* (0.938) [0.074]	-1.852** (0.929) [0.046]	-4.230*** (0.777) [0.000]
Spirituality	-3.464*** (1.231) [0.006]	-4.716*** (1.166) [0.000]	-6.389*** (1.200) [0.000]	-2.194*** (0.763) [0.004]	-3.724*** (0.759) [0.000]	-5.088*** (0.702) [0.000]

**Notes:** This table reports t-tests for mean differences between attendees and non-attendees treatment and control groups. \*significant at 10%, \*\*significant at 5%, \*\*\*significant at 1%

Table 6: Subcategories

	TWFE			BJS		
	(1)	(2)	(3)	(1)	(2)	(3)
Astrology	-3.440*** (1.133) [0.003]	-3.565*** (1.050) [0.001]	-4.776*** (1.075) [0.000]	-5.439*** (0.784) [0.000]	-5.547*** (0.786) [0.000]	-6.447*** (0.825) [0.000]
Buddhism	-4.530*** (1.144) [0.000]	-6.490*** (1.200) [0.000]	-6.523*** (0.952) [0.000]	-6.735*** (0.511) [0.000]	-9.006*** (0.476) [0.000]	-9.044*** (0.459) [0.000]
Christianity	13.535*** (2.176) [0.000]	12.636*** (1.923) [0.000]	12.102*** (1.706) [0.000]	13.326*** (0.613) [0.000]	12.259*** (0.627) [0.000]	11.792*** (0.610) [0.000]
Hinduism	-7.522*** (1.466) [0.000]	-8.943*** (1.551) [0.000]	-11.033*** (1.859) [0.000]	-9.191*** (1.070) [0.000]	-10.568*** (1.023) [0.000]	-11.602*** (0.859) [0.000]
Islam	2.812** (1.411) [0.049]	1.083 (1.286) [0.401]	-1.526 (1.364) [0.266]	3.982*** (0.641) [0.000]	1.517** (0.681) [0.026]	-0.488 (0.529) [0.357]
Judaism	16.886*** (3.118) [0.000]	14.088*** (2.923) [0.000]	11.164*** (2.844) [0.000]	16.552*** (0.405) [0.000]	13.786*** (0.406) [0.000]	11.745*** (0.392) [0.000]
Occult	10.216*** (0.987) [0.000]	10.556*** (0.911) [0.000]	10.155*** (0.879) [0.000]	11.903*** (0.590) [0.000]	11.779*** (0.568) [0.000]	11.340*** (0.527) [0.000]
Paganism	9.893*** (1.243) [0.000]	9.739*** (1.153) [0.000]	8.483*** (1.227) [0.000]	9.001*** (0.755) [0.000]	8.639*** (0.751) [0.000]	7.501*** (0.773) [0.000]
Worship	3.526 (2.747) [0.202]	3.176 (2.728) [0.247]	3.505 (2.439) [0.154]	2.520*** (0.917) [0.006]	1.857** (0.824) [0.024]	2.438*** (0.911) [0.007]
Scientology	6.570*** (1.523) [0.000]	6.788*** (1.316) [0.000]	6.001*** (1.380) [0.000]	11.302*** (0.967) [0.000]	10.641*** (0.949) [0.000]	9.823*** (0.997) [0.000]
Selfhelp	4.670*** (1.116) [0.000]	2.605** (1.141) [0.025]	0.176 (1.353) [0.897]	3.125*** (0.587) [0.000]	0.620 (0.595) [0.297]	-1.672*** (0.519) [0.001]
Skeptics	2.654 (1.734) [0.129]	0.860 (2.266) [0.705]	0.082 (2.113) [0.969]	3.353*** (0.558) [0.000]	1.263** (0.526) [0.016]	0.637 (0.502) [0.204]
Spirituality	1.450 (0.880) [0.102]	1.798** (0.887) [0.045]	1.191 (1.054) [0.261]	-0.359 (0.597) [0.547]	0.234 (0.601) [0.697]	-0.546 (0.527) [0.300]
Theology	-3.946*** (1.236) [0.002]	-5.756*** (1.122) [0.000]	-6.634*** (1.157) [0.000]	-6.006*** (0.650) [0.000]	-8.044*** (0.617) [0.000]	-8.770*** (0.557) [0.000]

**Notes:** This table reports t-tests for mean differences between attendees and non-attendees treatment and control groups. \*significant at 10%, \*\*significant at 5%, \*\*\*significant at 1%

Figure 7: Pretrends - Topics

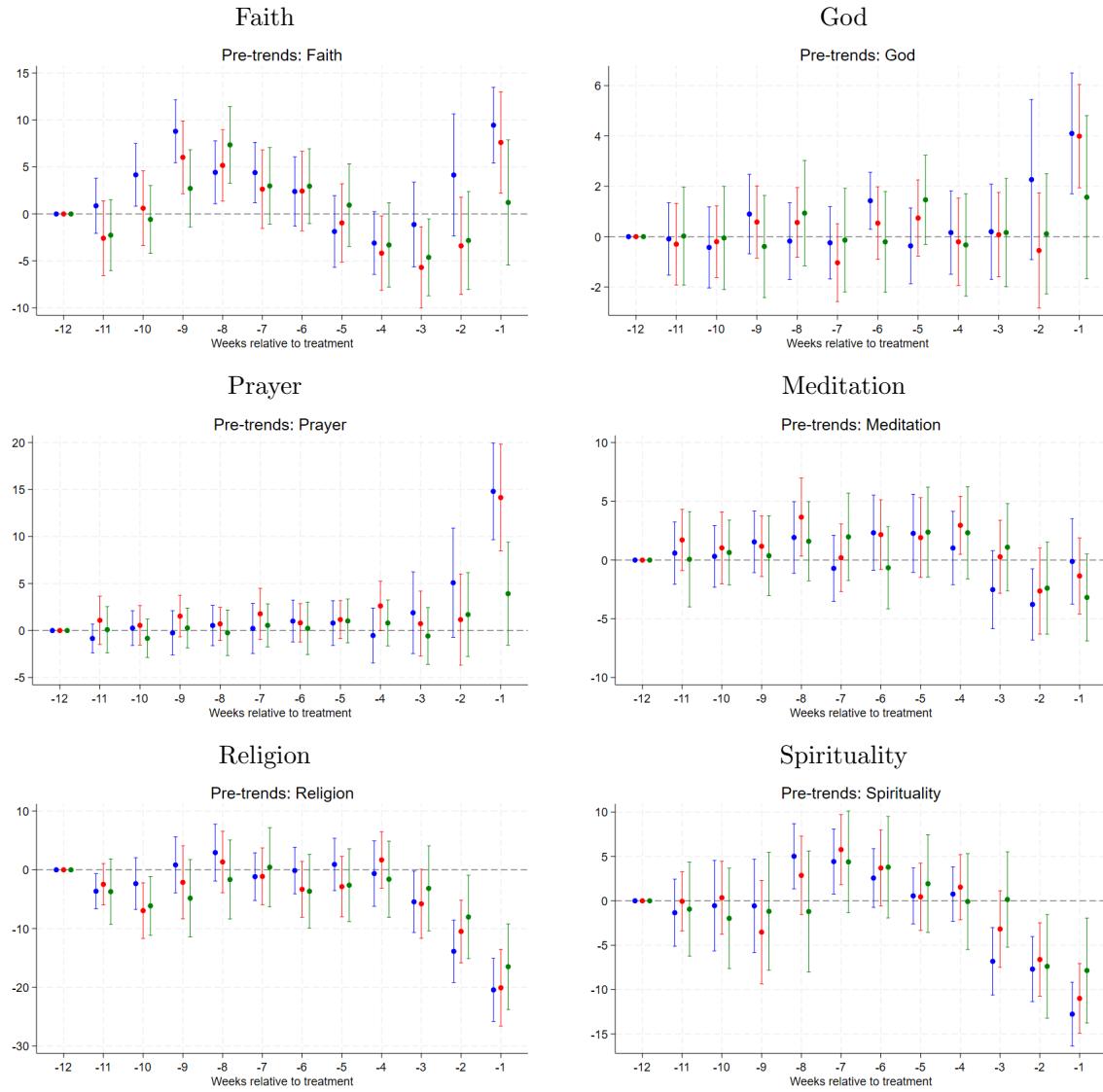


Figure 8: Pretrends - Subcategories

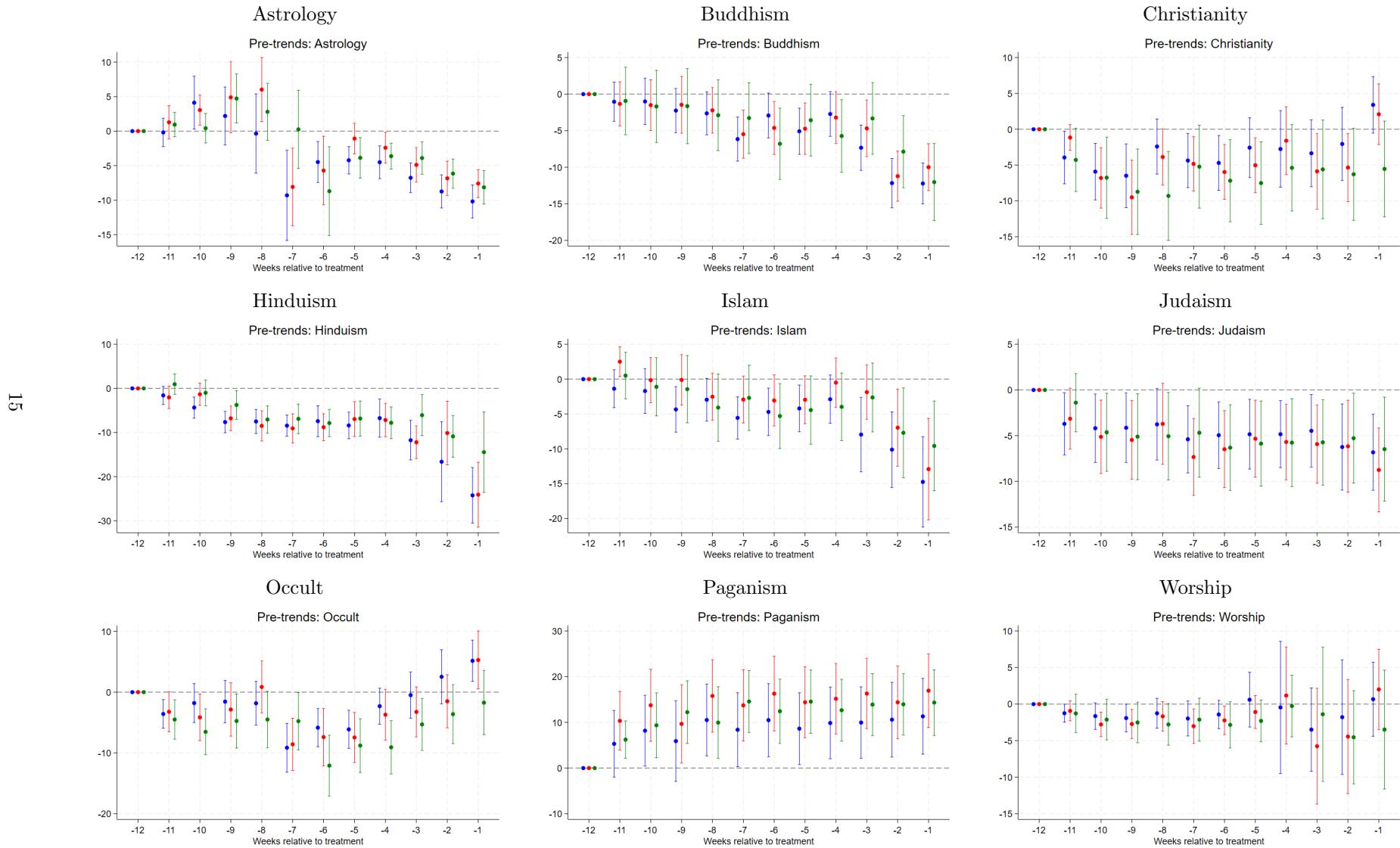


Figure 9: Pretrends - Subcategories

