Do voting advice applications affect party preferences? Evidence from field experiments in five European countries

Supplementary material

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Contents

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1 VAA design

This section discusses the design of the six voting advice applications (VAAs) we used to field our randomized experiments. All VAAs were developed by the authors in collaboration with country-specific teams. Figure A1 provides a series of example screenshots drawn from the version we created for the 2019 UK general election.

The landing page of every VAA featured a welcome message explaining that voters can use this tool to discover which party is closest to them, as well as information on data protection, data privacy, and the creators of the tool. Users could only proceed if they provided their informed consent and were subsequently directed to a series of pages with demographic questions (see Figure A1a for an example). Depending on the VAA, there were 5 to 9 demographic questions, always including age, gender, and education.

After this, users were asked to indicate their preferences on 25 to 30 policy statements. They were informed that the more policy statements they answer, the better will the tool be able to position them on the political landscape. Figure A1b shows an example policy statement. Users were asked to indicate their preferences on 5-point Likert scales ranging from "completely disagree" to "completely agree", with an additional "no opinion" option. Policy statements were selected by us in collaboration with the country-specific teams so that they reflect salient political issues on which political parties disagree. Policy statements always referred to concrete political issues, such as immigration and taxes. Vague formulations referring to general ideology (e.g., left vs right) were avoided. Policy statements were kept as short as possible and free of technical and legal jargon. We avoided statements that referred to multiple attitude objects (double barreling) as well as leading questions and statements including qualifications. To give readers a picture of the kind of statements that were included in our VAAs, Table A1 shows all policy statements from the VAA that was created for the 2019 UK general election.

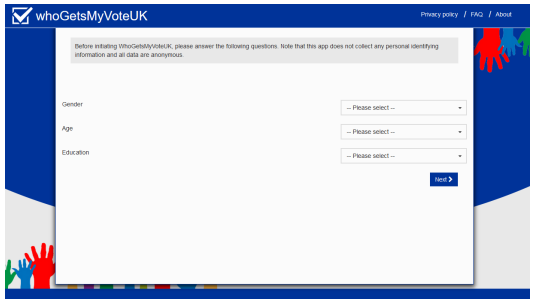
After indicating their preferences on policy issues, users were asked a series of additional questions about their political preferences. Depending on the VAA, users were asked between 8 and 12 questions including questions about their voting behavior in previous elections and their voting intention in the upcoming election. At this point users in the control group were in addition exposed to the PTV page containing 5 to 9 propensity to vote questions. Users could indicate their answers on scales of 0 to 10 using dials that were optimized for use on touch screens (see Figure A1c).

Next, users in both control and treatment groups were shown their estimated issue congruence with various political parties. The results were shown in the form of a bar chart (see Figure A1d). Voter-party issue congruence was estimated by comparing users' answers to the policy statements with the parties' previously coded positions on these same issues. Issue congruence was calculated using an algorithm described in (Mendez 2012) which takes into account preference intensity and 'no opinions'. Party positions were measured via an iterative expert survey based on the Delphi method (Gemenis 2015). Experts were asked to justify their coding decisions by providing references to materials provided by the parties (e.g., election manifestos and position papers) or newspaper articles.

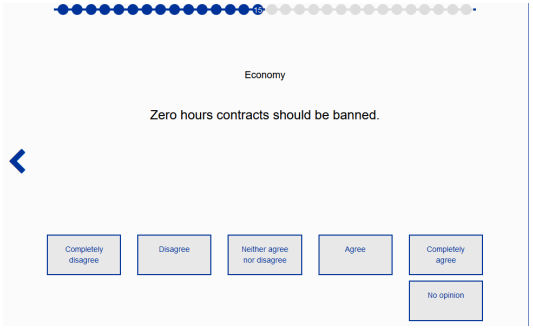
Thirty seconds into the results screen, users were shown a pop-up message asking them to help our research by answering an additional question (see Figure A1e). If they agreed, users in the treatment group were asked to answer the same set of PTV questions (see Figure A1f). Users in the control group were asked to answer an unrelated question about turnout in the upcoming election.

Finally, users also had the option to view two alternative sets of results and to inspect the different parties' positions on each policy statement (see Figures A1g–A1i). The first alternative set of results consisted of a political map which showed the estimated positions of both the user and the various political parties on two political dimensions (e.g., economic left-right or liberal

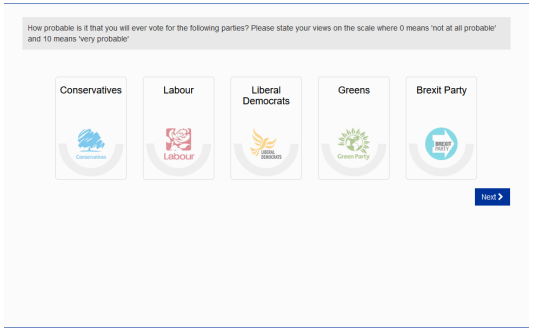
Figure A1: Example Screenshots



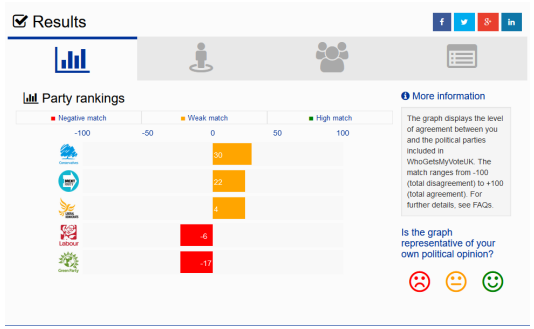
(a) Demographics



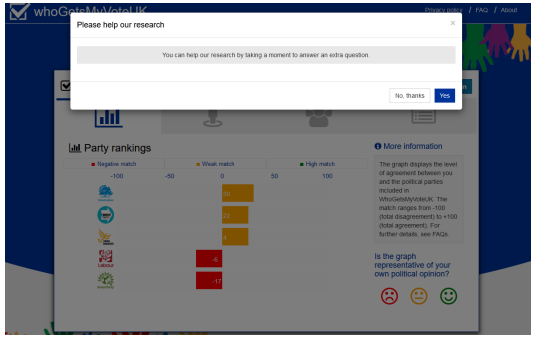
(b) Policy statement



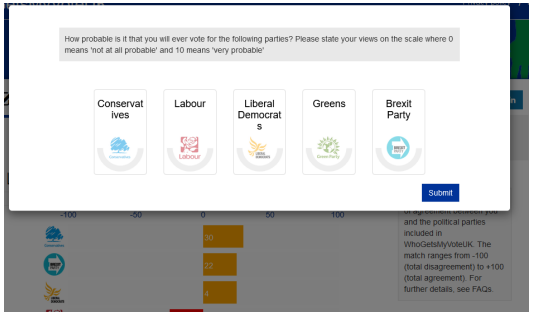
(c) PTVs (control group)



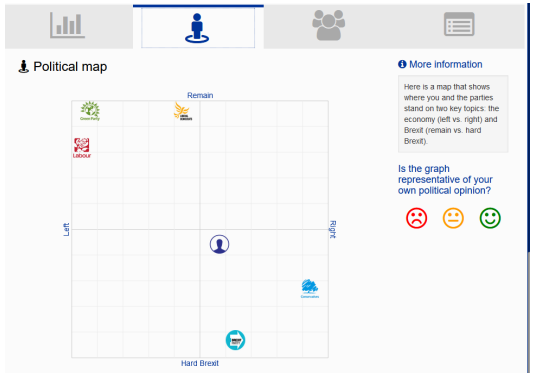
(d) Results screen



(e) Opt-in prompt

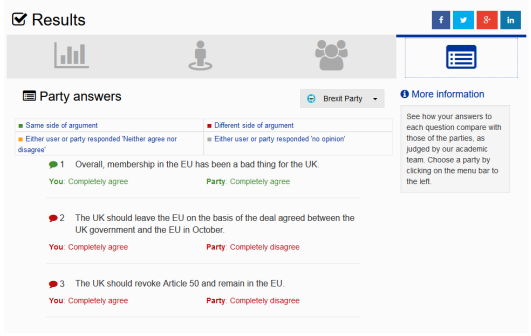


(f) PTVs (treatment group)



(g) Additional results (map)

(h) Additional results (peer)



(i) Party answers

Table A1: Policy statements from VAA deployed in UK prior to 2019 general election

1	Overall, membership in the EU has been a bad thing for the UK.
2	The UK should leave the EU on the basis of the deal agreed between the UK government and the EU in October.
3	The UK should revoke Article 50 and remain in the EU.
4	The UK should leave the EU without a deal.
5	A hard border with the Republic of Ireland should be avoided at all costs.
6	Free movement of people between the UK and the rest of the European Union should end.
7	The UK should maintain the same protections of workers' rights currently guaranteed by the EU, even in the event of Brexit.
8	There should be a new referendum (People's Vote) on the UK's future relationship with the EU, with an option to remain.
9	The UK should be able to conclude its own trade deals with the rest of the world without EU interference.
10	Income tax should be reduced.
11	Inheritance tax should be reduced.
12	Large companies should be forced to give company shares to their workers.
13	The state should actively redistribute from the richest people to the poorest.
14	Rail services should be renationalised and run by the state, not private companies.
15	Zero hours contracts should be banned.
16	The government should introduce a carbon tax to cut greenhouse emissions.
17	Increasing the country's wealth should take priority over tackling climate change.
18	All new homes should be built to zero-carbon standards during the next parliament.
19	The UK should introduce a points-based system to limit the number of immigrants coming into the country.
20	Immigration undermines the cultural values of the UK.
21	The UK should accept more refugees from conflict zones.
22	UK citizens who travelled to Syria to support ISIS should lose their British citizenship.
23	The UK should reduce its foreign aid budget for developing countries.
24	UK arms sales to Saudi Arabia should continue.
25	Upper limits should be placed on rents charged by private landlords on houses and flats.
26	Schools should provide LGBT-inclusive sex and relationship education from primary level.
27	The police should be given more powers to stop and search suspected criminals.
28	Young people should be given the right to vote at the age of 16.
29	The recreational use of marijuana/cannabis should be legalised.
30	Scotland should become an independent country.

vs conservative). The second was a 'social' voting recommendation, which shows how other users who gave similar answers to the policy statements intend to vote. Importantly, the fact that users in the treatment group could have been exposed to different types of results when indicating their party preferences carries a certain risk that we under-estimate the short-term effects of VAA usage on party preferences. However, user tracking suggests that a clear majority of our users (ca. two-thirds) do not access any of the alternative sets of results (Djouvas et al. 2020). Furthermore, the pop-up prompt appeared after only 30 seconds, which makes it unlikely that many users had sufficient time to study multiple sets of results; and the different types of results tend to be highly correlated. Therefore, if there is a downward bias, it is likely to be small.

2 Data cleaning

We exclude two types of invalid entries from all our analyses. First, we drop repeated attempts from the same computer because these likely represent repeated attempts by the same individual. Second, we drop users who accessed our VAAs indirectly via certain third party websites because of violations of our experimental protocol. Table A2 shows the number of valid and invalid responses for all six VAAs.

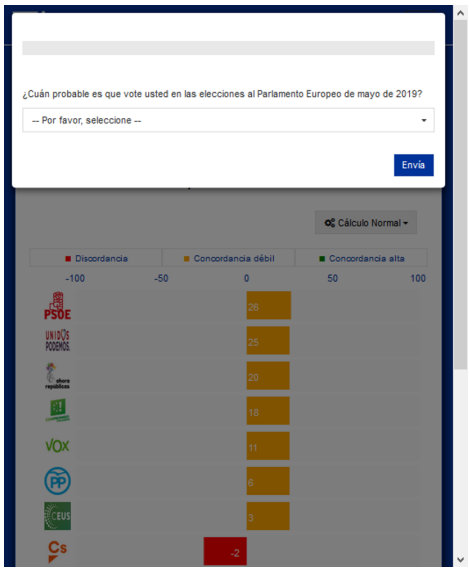
Table A2: Valid and invalid responses

	Total responses	Repeated entries	% repeated	i-frame issue	% i-frame issue	Total invalid	% invalid	Valid responses	% valid
Bulgaria (EP)	4411	238	5.4	358	8.1	581	13.2	3830	86.8
Greece (EP)	16314	805	4.9	0	0.0	805	4.9	15509	95.1
Romania (EP)	16187	612	3.8	1061	6.6	1659	10.2	14528	89.8
Spain (EP)	14817	471	3.2	3692	24.9	4109	27.7	10708	76.3
UK (EP)	59360	1076	1.8	838	1.4	1908	3.2	57452	96.8
UK (GE)	49334	1476	3.0	0	0.0	1476	3.0	47858	97.0

The violations of our experimental protocol came about as follows. For the promotion of our VAAs, we sometimes partnered directly with media organizations (e.g., the *i* newspaper in the UK). In other cases, media organizations decided to feature our VAAs without our knowledge (e.g., *Público* in Spain) . In either case, third parties promoted the VAA using an i-frame, which made it possible for external websites to run the VAA on their own website. The use of i-frames by third parties is a well established approach for public promotion of VAAs, and is in principle entirely unproblematic. However, in a limited number of instances third parties applied incorrect i-frame specifications. Specifically, they did not follow our guidelines of allowing a minimum height of 800 pixels to run the app. For the most part, this remained without consequence, meaning that the VAAs could still be used and users received information on issue congruence. However, an issue emerged with the opt-in page that appeared 30 seconds into the results screen. Specifically, users assigned to the treatment group who agreed to answer a further question could not subsequently confirm their answers because the 'submit' button at the bottom of the page was not visible (see Figure A2a). The same did not apply to the control group because of the single item format (see Figure A2b). As a result, for those i-frame instances the data includes no information on our dependent variable (PTVs) for users assigned to the treatment group. Therefore, we removed all users from third party websites which incorrectly specified the height parameter of their i-frames.

Figure A2: Consequences of missspecified i-frames

(a) Treatment group



(b) Control group

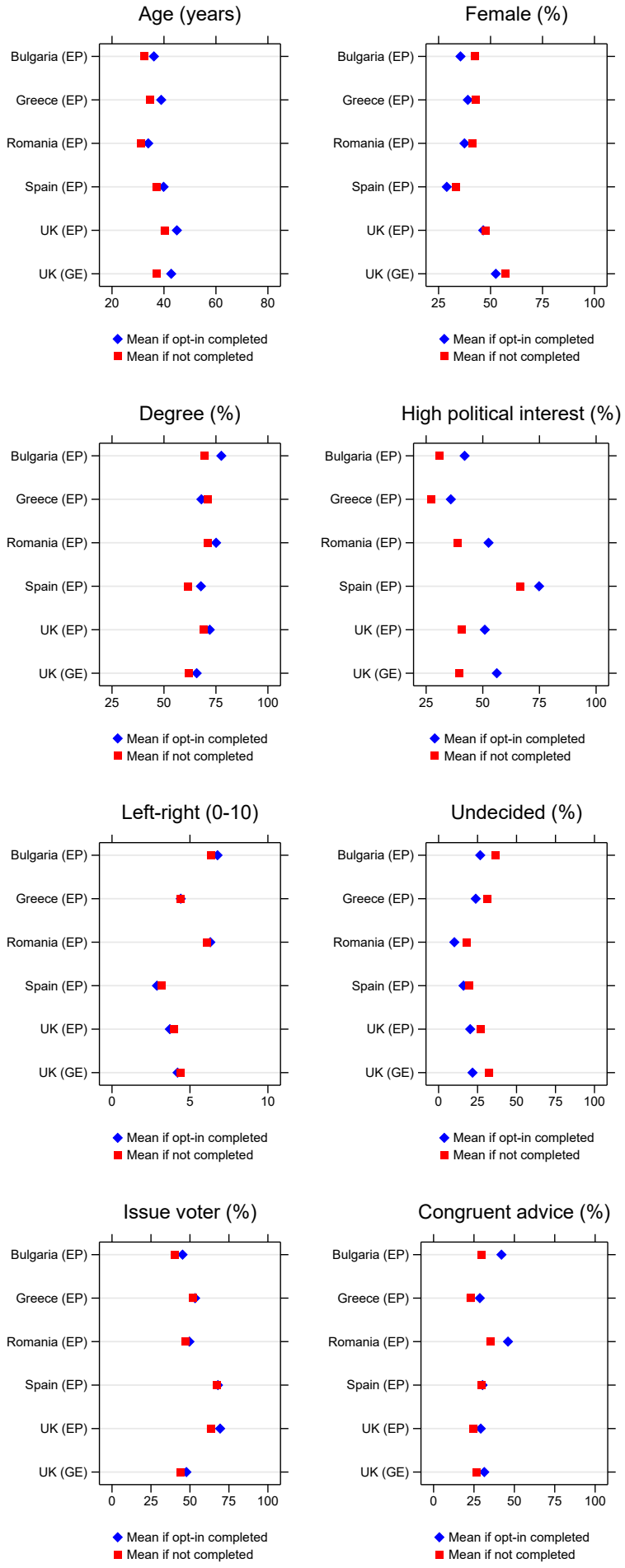
3 Generalizability beyond opt-in samples

As stated in the paper, we analyze only a subset of all valid responses in the paper, namely, those users who agreed to answer an additional opt-in question page after seeing the VAA congruence scores. The reason we do this is to avoid bias due to attrition; however, a potential drawback of this approach is that whether or not users completed the opt-in page is non-random. As a result, this could hamper our ability to generalize from the opt-in samples to all VAA users. In this section, we assess the extent of this risk by comparing the composition of our opt-in and non-opt-in samples.

Figure A3 shows the results. We find that users who completed the opt-in page tended to be a little bit older compared to users who did not complete the opt-in page; have somewhat higher education; and were somewhat more likely to be male and have high political interest. However, the differences are always small. Furthermore, we find no no systematic differences in terms of political leaning and whether or not subjects see themselves as issue voters.

Finally, we consider another potential explanation for why users chose to complete the opt-in page: the nature of the VAA advice they received. Specifically, we consider whether users who were shown a result that is consistent with their prior voting intention and, therefore, might have been happier with the application and experience, were more likely to complete the opt-in page. As the last panel in Figure A3 shows, users who received advice that was congruent with their prior party predisposition were indeed consistently somewhat more likely to complete the opt-in page. However, once more, the differences are small. Overall, this analysis strengthens confidence in our ability to generalize the results from our opt-in samples to all users of our VAAs.

Figure A3: Opt-in takers vs non-takers



4 Additional randomization check

Table 3 in the paper shows that there are no differences between our treatment and control groups in terms of several individual-level attributes including age, gender, education, political interest, political ideology, already being decided whom to vote for, and self-declared issue voter status. Table A3 shows that there are also no differences between users in the treatment and control groups in terms of the issue congruence scores calculated by our applications. This suggests that users in our treatment and control groups on average gave the same answers to the policy statements and therefore on average also received the same voting advice, as we would expect if randomization holds.

A potential concern emerges due to the lack of complete symmetry between our experimental groups in terms of the number of questions asked. As noted in the paper, users who were assigned to the control group were exposed to an extra webpage with 5 to 9 PTV items before they saw the results. We chose not to ask analogous placebo questions in the treatment group to avoid priming effects. A possible drawback of this approach is that users assigned to the control group are likely to have spent a little more time answering questions before arriving at the results screen. However, in light of the many questions included in our VAAs, this is unlikely to make a difference. As Table A4 shows, the differences in overall time spent are small. As shown Table 2 in the paper, users in the treatment and control groups were therefore equally likely to complete the opt-in page.

Table A3: Relationship between treatment group status and VAA congruence scores among opt-in takers

	Party 1		Party 2		Party 3		Party 4		Party 5		Party 6		Party 7		Party 8		Party 9		F-test
	CT	TR	CT	TR	CT	TR	CT	TR	CT	TR	CT	TR	CT	TR	CT	TR	CT	TR	p-value
Bulgaria (EP)	13.8	12.9	35.4	36.2	31.2	31.8	25.8	26.4	7.1	6.9	13.5	13.6							0.15
Greece (EP)	11.4	11.5	15.7	15.7	2.7	2.4	10.5	9.9	21.4	21.2	14.2	14.3	15.8	15.9	21.1	20.7			0.88
Romania (EP)	8.2	8.1	28.2	28.0	34.3	34.1	-10.6	-10.2	36.2	36.2	21.8	22.2	37.6	37.4					0.91
Spain (EP)	39.8	38.9	32.3	31.7	41.8	40.9	14.3	14.3	29.7	29.2	-10.9	-10.4	37.0	36.4	39.8	38.9	-26.9	-26.0	0.99
UK (EP)*	-9.7	-9.5	11.2	11.4	33.4	33.3	42.4	42.1	37.6	37.5	39.4	39.2	41.5	42.5	46.9	46.8	-16.1	-15.9	0.71
UK (GE)*	-8.8	-8.5	-5.9	-5.4	23.8	23.3	25.1	24.7	24.0	23.8	29.4	28.7	30.9	30.7					0.71

Note: Table entries represent means. F-test = test of the overall significance of a regression of treatment assignment on all congruence scores (i.e., the VAA advice scores); CT = control; TR = treated.
* F-test calculated based on national parties only (i.e., without Plaid Cymru and SNP).
Party names from low to high:
Bulgaria (EP): BSP; Democratic Party; GERB; MRF; VMRO; Volya.
Cyprus (EP): AKEL; DHKO; DHSY; EDEK; ELAM; Giasemi; KOP; Symmachia.
Greece (EP): ANEL; EnKen; GD; KKE; KinAl; ND; Potami; SYRIZA.
Romania (EP): ALDE; PMP; PNL; PSD; ProRomania; UDMR; USRplus.
Spain (EP): AR; CEUS; Compromis; Cs; Lliures; PP; PSOE; Podemos; VOX.
UK (EP): Brexit Party; Conservatives; Change UK; Greens; Labour; LibDems; PC; SNP; UKIP.
UK (GE): Brexit Party; Conservatives; Greens; Labour; LibDems; PC; SNP.

Table A4: Time spent until results screen

	CT	TR	Δ	%Δ
Bulgaria (EP)	362	334	28	+8
Greece (EP)	427	385	42	+11
Romania (EP)	384	347	37	+10
Spain (EP)	404	366	38	+9
UK (EP)	344	311	33	+10
UK (GE)	345	319	26	+8

Note: Table entries in the first two columns show the median number of seconds respondents spent on the platform answering questions before they were shown the results screen (i.e., their ideological congruence estimates). Table entries in the third column show the difference between control and treated; and the fourth column shows the additional spent by respondents in the control group in percent (TR = 100%). The opt-in prompt appeared after respondents had spent 30 seconds with the results. CT = control; TR = treated.

5 Regression output

5.1 Average effects conditional on VAA advice

Table A5: Average effects depending on VAA advice (Figure 2)

	(1) BG (EP)	(2) GR (EP)	(3) RO (EP)	(4) ESP (EP)	(5) UK (EP)	(6) UK (GE)
Treated	0.009	0.028	-0.016	0.061	0.044	0.037
	(0.08)	(0.72)	(-0.30)	(1.82)	(2.89)	(1.68)
VAA congruence score	0.087	0.072	0.084	0.053	0.073	0.072
	(33.26)	(62.05)	(66.91)	(79.84)	(260.98)	(151.76)
Treated X VAA congruence score	0.013	0.005	0.007	0.005	0.003	0.004
	(3.32)	(3.07)	(4.11)	(5.31)	(7.12)	(5.65)
Constant	0.324	1.122	0.577	1.463	1.928	3.093
	(4.53)	(40.79)	(15.48)	(59.95)	(176.48)	(196.04)
Voters	1184	5620	2834	3333	20645	12673
Parties	6	8	7	9	9	7
Observations	5809	38696	16824	28429	140485	61726

Note: OLS coefficients with t-values in parentheses. BG = Bulgaria; GR = Greece; RO = Romania; ESP = Spain; UK = United Kingdom; EP = European parliament elections; GE = general election.

5.2 Sub-group analysis

Table A6: Causal heterogeneity analysis, moderator = age

	(1) BG (EP)	(2) GR (EP)	(3) RO (EP)	(4) ESP (EP)	(5) UK (EP)	(6) UK (GE)
Treated	0.706	-0.010	-0.040	0.099	0.080	-0.197
	(1.67)	(-0.07)	(-0.19)	(1.04)	(1.52)	(-2.78)
VAA congruence score	0.070	0.059	0.084	0.050	0.072	0.074
	(6.48)	(14.19)	(17.79)	(26.03)	(76.60)	(48.65)
Treated X VAA congruence score	-0.009	0.005	0.013	0.009	0.005	0.006
	(-0.62)	(0.99)	(2.01)	(3.51)	(3.73)	(2.94)
Age	-0.015	0.001	-0.007	0.001	-0.002	-0.009
	(-1.73)	(0.45)	(-1.55)	(0.35)	(-2.75)	(-7.99)
Treated X age	-0.021	0.001	0.001	-0.001	-0.001	0.006
	(-1.76)	(0.35)	(0.17)	(-0.43)	(-0.69)	(3.47)
VAA congruence score X age	0.001	0.000	0.000	0.000	0.000	-0.000
	(1.71)	(3.01)	(0.12)	(1.82)	(0.79)	(-1.50)
Treated X VAA congruence score X age	0.001	0.000	-0.000	-0.000	-0.000	-0.000
	(1.55)	(0.02)	(-1.04)	(-1.69)	(-1.65)	(-1.12)
Constant	0.836	1.069	0.797	1.441	2.030	3.487
	(2.78)	(9.95)	(5.19)	(20.45)	(53.82)	(68.54)
Voters	1128	5401	2757	3272	20387	12135
Parties	6	8	7	9	9	7
Observations	5532	37288	16416	27943	138749	59133

Note: OLS coefficients with t-values in parentheses. BG = Bulgaria; GR = Greece; RO = Romania; ESP = Spain; UK = United Kingdom; EP = European parliament elections; GE = general election.

Table A7: Causal heterogeneity analysis, moderator = education

	(1) BG (EP)	(2) GR (EP)	(3) RO (EP)	(4) ESP (EP)	(5) UK (EP)	(6) UK (GE)
Treated	0.296	-0.094	-0.004	0.036	0.031	-0.014
	(1.14)	(-1.14)	(-0.03)	(0.63)	(0.92)	(-0.32)
VAA congruence score	0.084	0.068	0.085	0.052	0.072	0.074
	(12.88)	(25.40)	(31.18)	(43.53)	(115.12)	(74.65)
Treated X VAA congruence score	-0.002	0.003	0.009	0.008	0.002	0.004
	(-0.23)	(0.71)	(2.38)	(4.77)	(2.61)	(3.00)
Degree	-0.483	-0.376	-0.222	-0.117	-0.152	-0.140
	(-2.71)	(-5.47)	(-2.38)	(-2.23)	(-5.62)	(-3.90)
Treated X degree	-0.421	0.172	-0.018	0.058	0.017	0.070
	(-1.48)	(1.85)	(-0.13)	(0.81)	(0.45)	(1.39)
VAA congruence score X degree	0.005	0.005	-0.001	0.002	0.001	-0.002
	(0.72)	(1.76)	(-0.42)	(1.33)	(1.60)	(-2.13)
Treated X VAA congruence score X degree	0.021	0.004	-0.002	-0.004	0.001	-0.001
	(2.08)	(0.89)	(-0.49)	(-1.87)	(0.58)	(-0.44)
Constant	0.684	1.379	0.734	1.533	2.038	3.189
	(4.31)	(22.42)	(8.69)	(35.27)	(84.57)	(103.11)
Voters	1140	5367	2768	3194	19873	12039
Parties	6	8	7	9	9	7
Observations	5588	37041	16446	27314	135376	58763

Note: OLS coefficients with t-values in parentheses. BG = Bulgaria; GR = Greece; RO = Romania; ESP = Spain; UK = United Kingdom; EP = European parliament elections; GE = general election.

Table A8: Causal heterogeneity analysis, moderator = political interest

	(1) BG (EP)	(2) GR (EP)	(3) RO (EP)	(4) ESP (EP)	(5) UK (EP)	(6) UK (GE)
Treated	-0.146	-0.007	0.048	-0.037	0.044	0.010
	(-0.94)	(-0.14)	(0.60)	(-0.48)	(1.94)	(0.27)
VAA congruence score	0.082	0.068	0.083	0.054	0.077	0.079
	(21.55)	(41.36)	(43.54)	(30.62)	(177.90)	(87.11)
Treated X VAA congruence score	0.020	0.010	0.006	0.005	0.003	0.007
	(3.57)	(4.40)	(2.06)	(2.10)	(4.89)	(5.32)
High interest	-0.124	-0.190	-0.022	-0.092	-0.028	-0.086
	(-0.87)	(-3.37)	(-0.29)	(-1.47)	(-1.26)	(-2.65)
Treated X high interest	0.349	0.098	-0.116	0.148	-0.004	0.047
	(1.57)	(1.21)	(-1.10)	(1.75)	(-0.12)	(1.02)
VAA congruence score X high interest	0.009	0.008	0.002	-0.000	-0.006	-0.009
	(1.78)	(3.58)	(0.60)	(-0.11)	(-10.53)	(-8.68)
Treated X VAA congruence score X high interest	-0.014	-0.009	0.001	-0.001	-0.000	-0.004
	(-1.80)	(-2.74)	(0.39)	(-0.30)	(-0.34)	(-2.81)
Constant	0.380	1.191	0.584	1.522	1.939	3.122
	(3.67)	(31.97)	(11.19)	(26.98)	(120.77)	(122.50)
Voters	1143	5291	2724	3199	20064	12408
Parties	6	8	7	9	9	7
Observations	5631	36479	16261	27345	136643	60512

Note: OLS coefficients with t-values in parentheses. BG = Bulgaria; GR = Greece; RO = Romania; ESP = Spain; UK = United Kingdom; EP = European parliament elections; GE = general election.

Table A9: Causal heterogeneity analysis, moderator = no vote intention (i.e., undecided)

	(1) BG (EP)	(2) GR (EP)	(3) RO (EP)	(4) ESP (EP)	(5) UK (EP)	(6) UK (GE)
Treated	0.060	0.034	-0.024	0.113	0.035	0.033
	(0.46)	(0.76)	(-0.45)	(3.09)	(2.05)	(1.34)
VAA congruence score	0.095	0.078	0.086	0.054	0.073	0.073
	(33.77)	(58.24)	(67.24)	(72.51)	(229.56)	(142.64)
Treated X VAA congruence score	0.008	0.004	0.006	0.004	0.003	0.003
	(1.87)	(2.17)	(3.22)	(3.90)	(5.95)	(3.84)
Undecided	0.515	0.128	0.363	0.126	-0.082	-0.042
	(2.89)	(1.94)	(2.38)	(1.52)	(-3.12)	(-1.01)
Treated X undecided	-0.157	-0.018	-0.065	-0.226	0.031	0.026
	(-0.58)	(-0.20)	(-0.32)	(-2.17)	(0.84)	(0.44)
VAA congruence score X undecided	-0.035	-0.026	-0.018	-0.006	0.001	0.000
	(-5.30)	(-9.23)	(-3.02)	(-2.75)	(2.08)	(0.16)
Treated X VAA congruence score X undecided	0.017	0.003	0.010	0.007	0.001	0.007
	(1.62)	(0.84)	(1.31)	(2.52)	(0.84)	(3.06)
Constant	0.223	1.094	0.544	1.436	1.946	3.094
	(2.72)	(33.63)	(14.17)	(55.10)	(156.77)	(175.20)
Voters	1073	5189	2727	2950	20033	12015
Parties	6	8	7	9	9	7
Observations	5306	35972	16217	25263	136385	58582

Note: OLS coefficients with t-values in parentheses. BG = Bulgaria; GR = Greece; RO = Romania; ESP = Spain; UK = United Kingdom; EP = European parliament elections; GE = general election.

Table A10: Causal heterogeneity analysis, moderator = self-perceived issue voter

	(1) BG (EP)	(2) GR (EP)	(3) RO (EP)	(4) ESP (EP)	(5) UK (EP)	(6) UK (GE)
Treated	0.032	0.060	0.081	0.072	0.027	0.026
	(0.18)	(0.93)	(1.03)	(1.13)	(0.87)	(0.79)
VAA congruence score	0.081	0.070	0.083	0.053	0.071	0.074
	(18.55)	(36.52)	(46.34)	(36.27)	(117.88)	(101.74)
Treated X VAA congruence score	0.021	0.007	0.005	0.007	0.005	0.003
	(3.03)	(2.34)	(1.99)	(3.31)	(5.59)	(3.37)
Issue voter	-0.341	-0.189	-0.013	-0.073	-0.040	-0.153
	(-2.27)	(-3.19)	(-0.18)	(-1.37)	(-1.52)	(-4.74)
Treated X issue voter	-0.084	0.008	-0.157	0.026	0.024	0.034
	(-0.36)	(0.10)	(-1.49)	(0.34)	(0.66)	(0.74)
VAA congruence score X issue voter	0.017	0.008	0.005	0.001	0.003	-0.004
	(3.03)	(3.07)	(1.82)	(0.55)	(4.56)	(-3.71)
Treated X VAA congruence score X issue voter	-0.013	-0.005	0.001	-0.003	-0.003	-0.000
	(-1.56)	(-1.47)	(0.35)	(-1.26)	(-2.62)	(-0.20)
Constant	0.474	1.197	0.554	1.482	1.954	3.161
	(4.32)	(26.08)	(10.39)	(33.88)	(85.61)	(135.65)
Voters	999	4841	2592	2665	18741	11415
Parties	6	8	7	9	9	7
Observations	4908	33609	15395	22775	127610	55773

Note: OLS coefficients with t-values in parentheses. BG = Bulgaria; GR = Greece; RO = Romania; ESP = Spain; UK = United Kingdom; EP = European parliament elections; GE = general election.

6 Robustness checks

This section reports the results of a series of robustness checks that are referenced in the paper, but not shown.

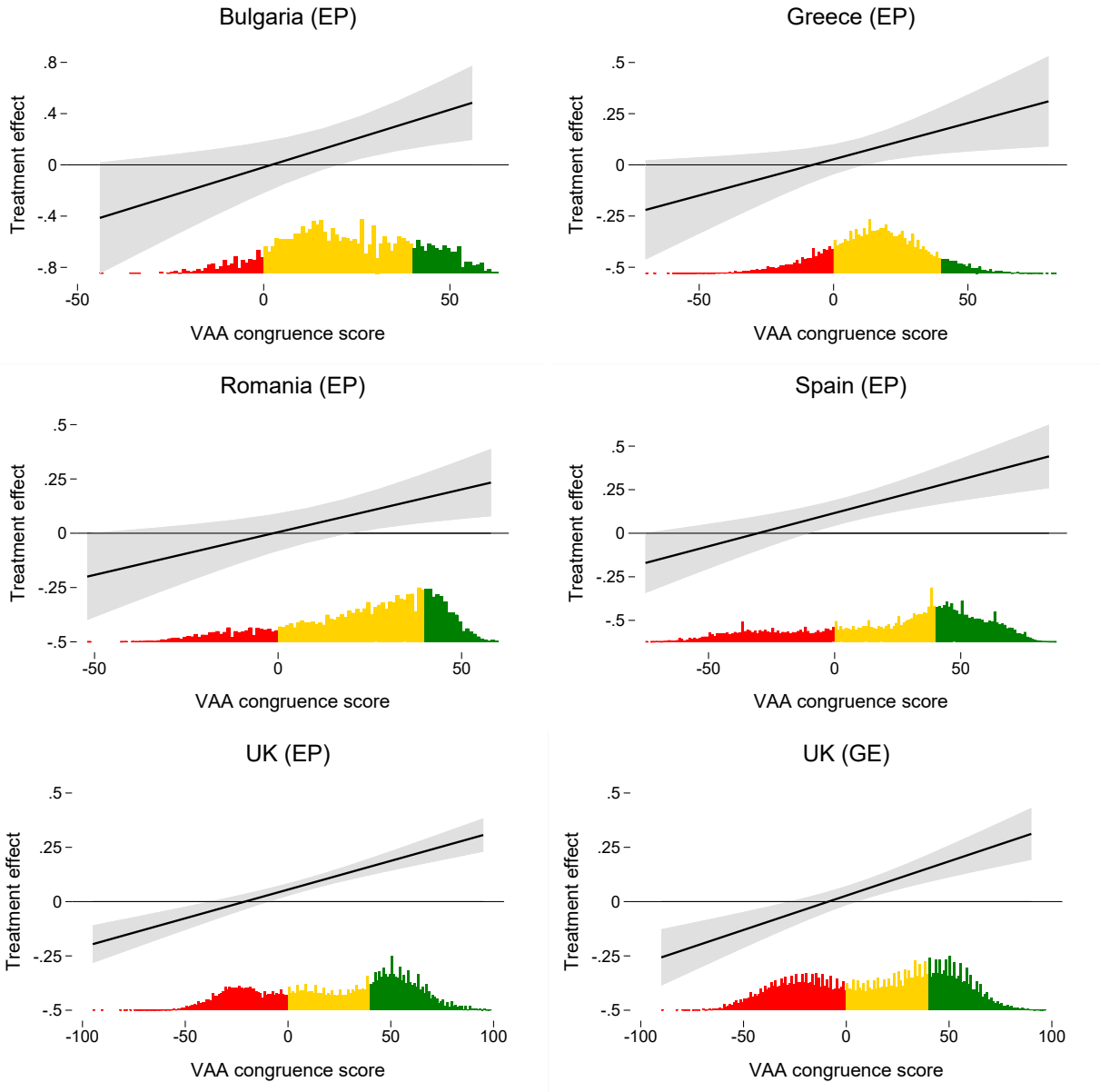
6.1 Average effects conditional on VAA advice

First, we re-estimated all 6 models while adjusting for the following covariates: age (measured in years); gender; education (degree vs no degree); political interest (high vs low); left-right self-placement (0–10), whether or not a user intends to vote for a given party; whether a user already had a vote intention before the VAA advice or was undecided; and whether or not a user perceived of themselves as an issue voter. In addition, we include party dummies (i.e., party fixed effects) in all models. All covariates were measured pre-treatment, that is, before users were exposed to the VAA advice. We find that the interaction between the treatment indicator and the VAA congruence score remains statistically significant in all 6 experiments ($p < 0.01$, except for Greece where $p = 0.019$). The effect sizes remain similar as well, though it is notable that the negative effects of bad (red) matches are now statistically significant in only two cases (the two UK cases). Meanwhile, the positive effects of good (green) matches remain always statistically significant (see Figure A4).

Next, we re-estimated all 6 models while excluding speeders who rushed through our VAAs in 5 minutes or less. 5 minutes is a relatively high bar. Depending on the case between 4% (Greece) and up to 18% (Romania) of users took 5 minutes or less to complete our VAAs. It is well possible that some of these are legitimate users; however, by choosing a high bar we are erring on the side of caution and can therefore be reasonably confident that most if not all random click-throughs are removed from the sample. The results are highly similar to those reported in the paper (see Figure A5).

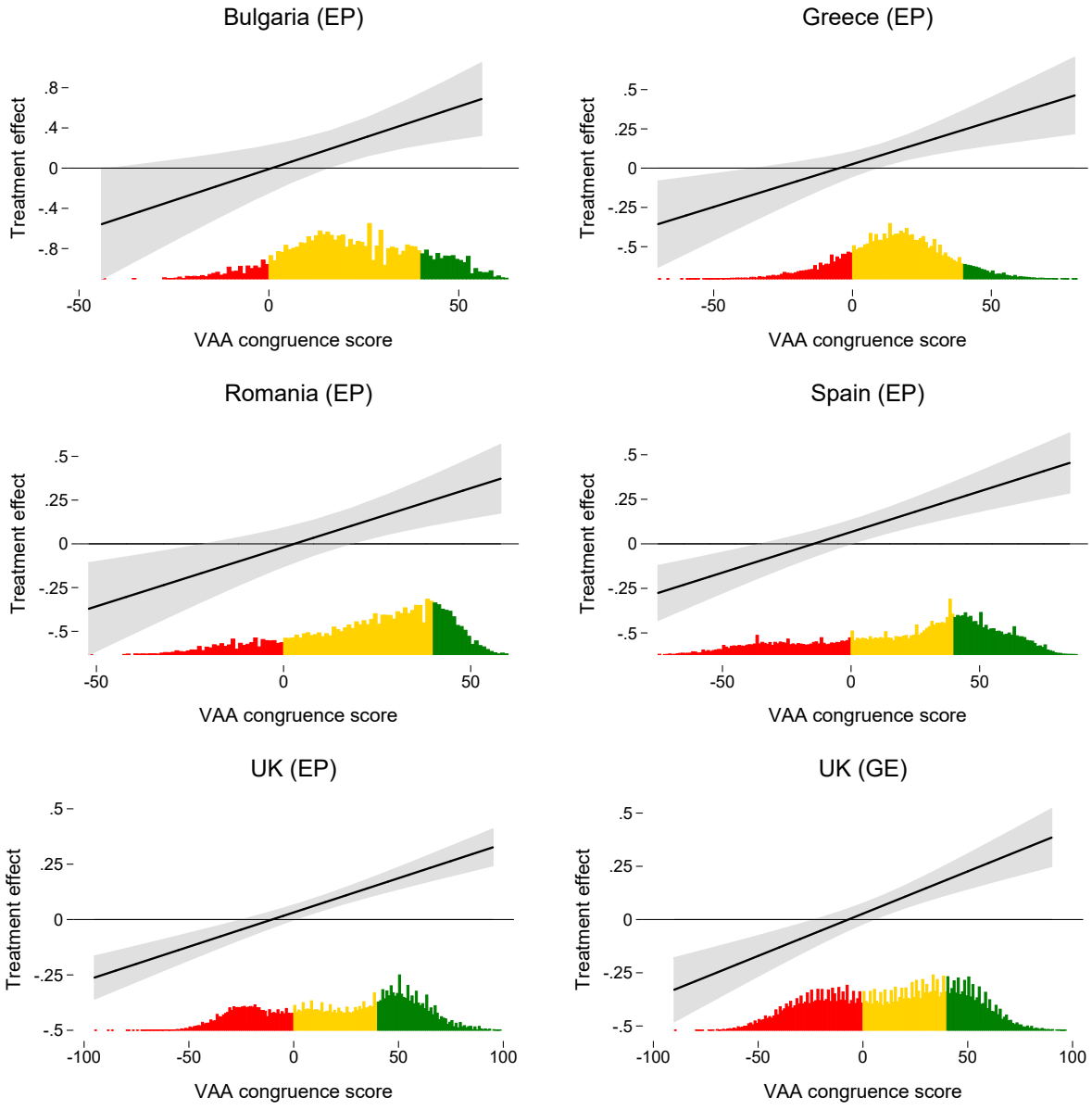
Finally, we re-estimated all 6 models using semi-parametric kernel regression. Kernel regression allows us to flexibly estimate the functional form of VAA effects on party preferences across different levels issue congruence by estimating a series of local effects with a kernel re-weighting scheme. Therefore, kernel regression allows us to relax the assumption of linear interaction effects (Hainmueller et al. 2019). We set the bandwidth to 50 in all models. Standard errors are clustered by the user, as before. The substantive conclusions remain very similar (see Figure A6).

Figure A4: Including covariates



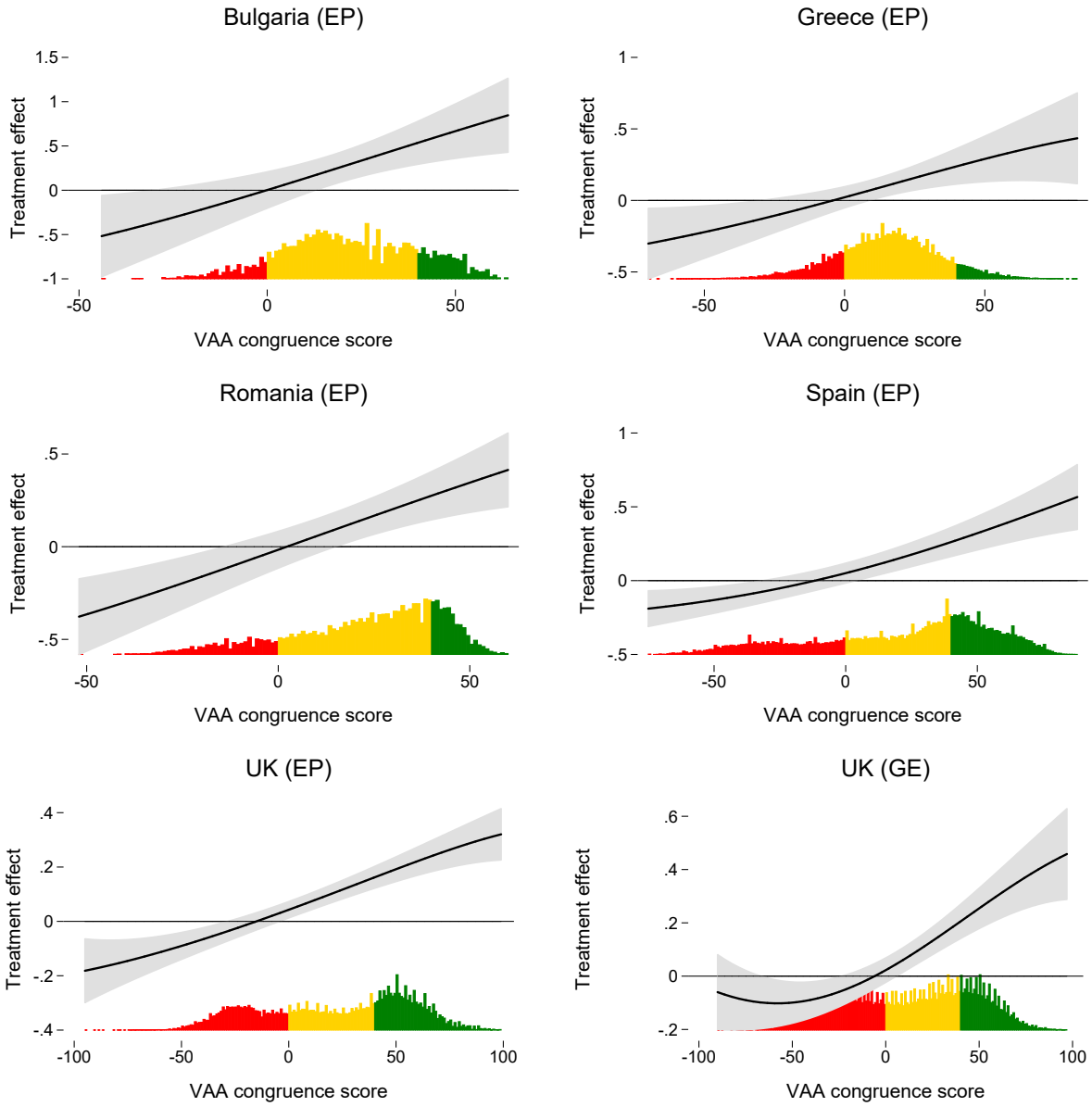
Note: The black lines give point estimates with 95% confidence intervals in gray. The histograms show the number of observations at different levels of agreement with a party. Green = strong match; gold = weak match; red = negative match.

Figure A5: No speeders



Note: The black lines give point estimates with 95% confidence intervals in gray. The histograms show the number of observations at different levels of agreement with a party. Green = strong match; gold = weak match; red = negative match.

Figure A6: Kernel smoothed estimates



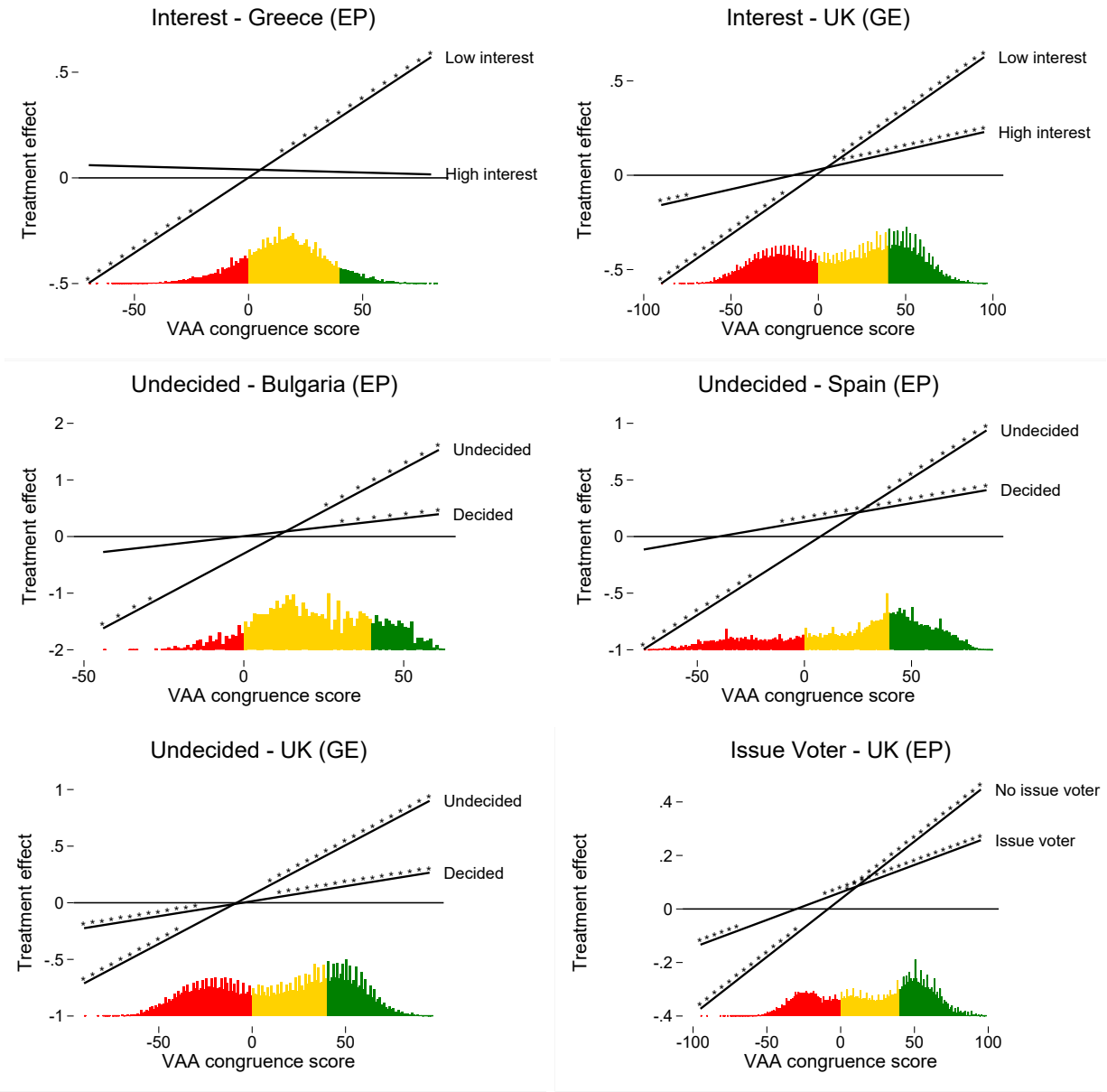
Note: The black lines give point estimates with 95% confidence intervals in gray. The histograms show the number of observations at different levels of agreement with a party. Green = strong match; gold = weak match; red = negative match.

6.2 Sub-group analysis

First, we re-estimated all 30 models while adjusting for the same covariates as above: age (measured in years); gender; education (degree vs no degree); political interest (high vs low); left-right self-placement (0–10), whether or not a user intends to vote for a given party; whether a user already had a vote intention before the VAA advice or was undecided; and whether or not a user perceived of themselves as an issue voter. In addition, we include party dummies (i.e., party fixed effects) in all models. All covariates were measured pre-treatment, that is, before users were exposed to the VAA advice. In the paper, we found evidence that voters with a university degree were more strongly affected by the VAA advice, which contradicted one of hour hypotheses (*H2b)*. Contrary to the paper, we no longer find evidence that education moderates the effect of exposure to VAA advice on party preferences in Bulgaria after accounting for covariates ($p = 0.31$). At the same time, the three-way interaction with the undecided voter dummy is now statistically significant in Bulgaria ($p = 0.047$), providing additional evidence that exposure to VAA advice can affect undecided voters more strongly (*H2d*). All other results are similar compared to those reported in the paper (see A7).

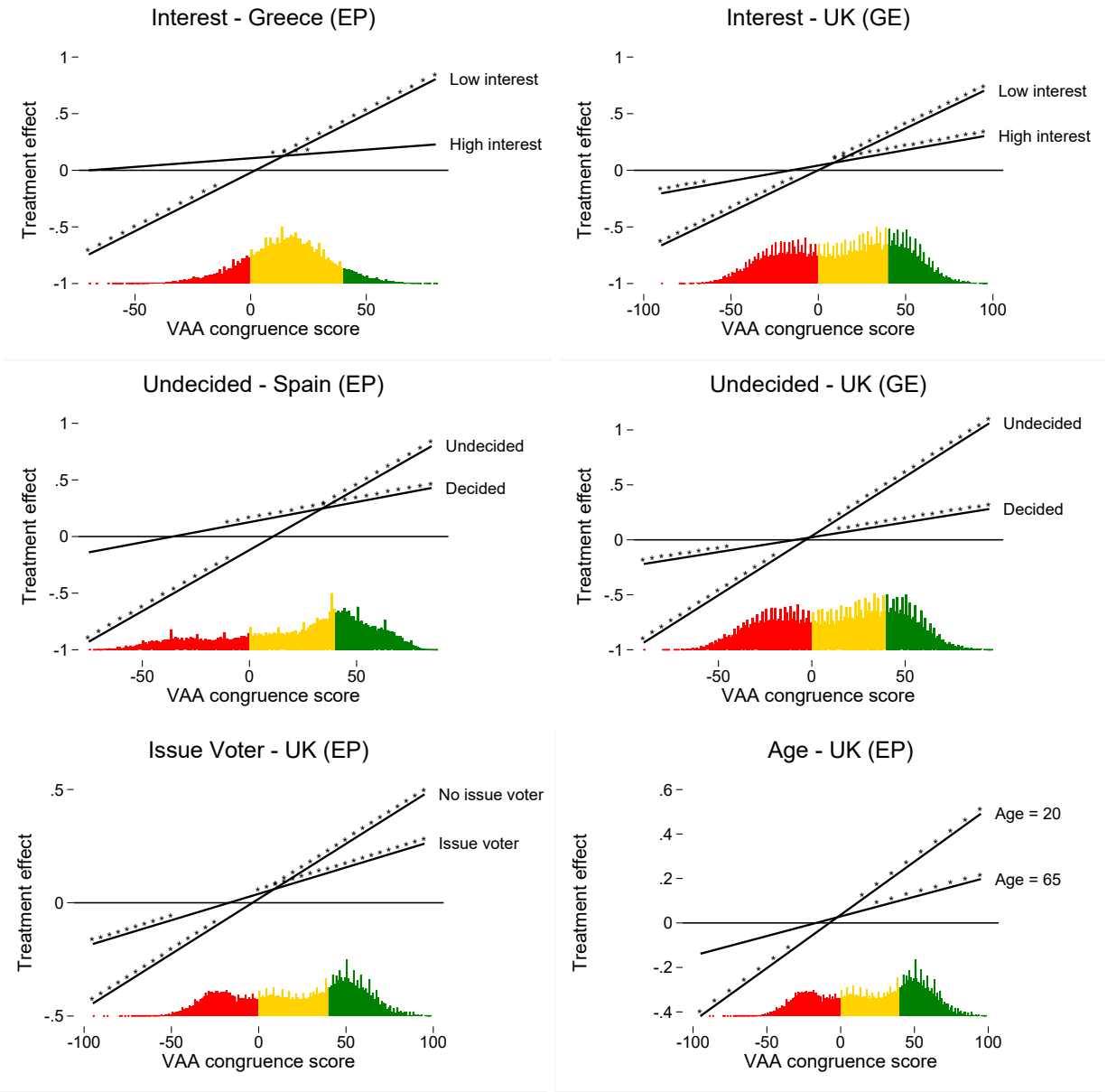
Second, we re-estimated all 30 models while excluding speeders who rushed through the VAAs in 5 minutes or less. The results are again similar to those reported in the paper (see Figure A8). The most notable exception is that the three-way interaction with education in Bulgaria is again not statistically significant ($p = 0.28$). Contrary to what is reported in the paper, we also find a significant three-way interaction with age in one case: the VAA experiment we fielded in the UK before the European Parliament elections. According to this model, younger UK voters were more strongly affected by the VAA advice in this case, lending some support to *H2a*. However, this effect does not replicate in any of the other specifications. Notably, the differences between younger and older voters are also only marginally statistically significant ($p = 0.044$).

Figure A7: Statistically significant ($p < 0.05$) three-way interactions from models including covariates



Note: The solid lines give point estimates (* $p < 0.05$). The histograms show the number of observations at different levels of agreement with a party. Green = strong match; gold = weak match; red = negative match.

Figure A8: Statistically significant ($p < 0.05$) three-way interactions from models excluding speeders



Note: The solid lines give point estimates (* $p < 0.05$). The histograms show the number of observations at different levels of agreement with a party. Green = strong match; gold = weak match; red = negative match.

References

Djouvas, Constantinos, Vasileios Manavopoulos, and Fernando Mendez. 2020. "Mapping voters' engagement with political information sites: The case of voting advice applications." *Paper presented at the 2020 ECPR General Conference.*

Gemenis, Kostas. 2015. "An iterative expert survey approach for estimating parties' policy positions." *Quality & Quantity* 49:2291–2306.

Hainmueller, Jens, Jonathan Mummolo, and Yiqing Xu. 2019. "How much should we trust estimates from multiplicative interaction models? Simple tools to improve empirical practice." *Political Analysis* 27 (2): 163—192.

Mendez, Fernando. 2012. "Matching voters with political parties and candidates: An empirical test of four algorithms." *International Journal of Electronic Governance* 5:264–278.