Appendix

Sample statistics

IO tweets

We use two releases of IO tweets from the unhashed datasets provided by Twitter Transparency Center in December, 2019 and April, 2020. The first of these datasets , detailed in Table A.1, contained only tweets identified as originating from Saudi state-backed IO activity. Because all of these tweets were attributed to Saudi Arabia, we do not filter these tweets by `"user_reported_location"`. Unfortunately, Twitter does not provide details on how these tweets were ultimately attributed to Saudi state-backed IO activity. In the main analyses, we decide to retain all tweets from this release, irrespective of user-reported location, given that they were attributed to Saudi state-backed activity by Twitter. In Table A.2 we provide descriptive statistics for the sample used in the main analyses: tweets in 2019. Here, we see that ∼6.5m tweets had some location information (61%). The N of tweets from this release included in the final IO analysis sample is bolded in red.

IO dataset	# tweets	# tweets with location	% with location
saudi_arabia_112019	32054257	18840595	58.78

Table A.1: IO tweets Release 1: full date-range provided in data release.

IO dataset	# tweets	# tweets with location	% with location
saudi_arabia_112019 (2019)	**6456312**	3947510	61.14

Table A.2: IO tweets Release 1: tweets in 2019.

The second IO release was in April, 2020. These tweets came bundled with tweets attributed to state-backed Information Operations in Egypt and the UAE. We therefore filtered these tweets by user-reported location to obtain a sample of tweets for Saudi Arabia. We present aggregate statistics for this sample in Table A.3 below. Of the ∼36.5m tweets, ∼19.3m

included user-reported locations (53%), and of the reported locations, ∼9.9m were in Saudi Arabia (27%). In Table A.4 we provide descriptive statistics for the sample used in the main analyses: tweets in 2019. Here, we see that ∼7.6m tweets had some location information (48%), and of the reported locations ∼3.4m were in Saudi Arabia. The N of tweets from this release included in the final IO analysis sample is bolded in red.

IO dataset	# tweets	# tweets with location	tweets in Saudi	% with location	% with location in Saudi Arabia
sa_eg_ae_022020	36523980	19344502	9924380	52.96	51.3

Table A.3: IO tweets Release 2: full date-range provided in data release.

IO dataset	# tweets	# tweets with location	tweets in Saudi	% with location	% with location in Saudi Arabia
sa_eg_ae_022020 (2019)	15769043	7616583	**3370759**	48.3	21.38

Table A.4: IO tweets Release 2: tweets in 2019.

Finally, in Table A.5 we the total N of tweets after combining the two sets of tweets for 2019 from both releases. Note: the total N of tweets after combining the two datasets is slightly less than the sum of the two sets of tweets for 2019 in Saudi Arabia displayed in Tables A.2 and A.4 (i.e., 6456312 + 3370759) because there was some tweet IDs that appeared in both datasets. These duplicates were therefore removed for the final analysis.

IO dataset	# tweets	# accounts
Combined sa_eg_ae_022020 (2019) & saudi_arabia_112019 (2019)	9826132	4536

Table A.5: IO tweets analysis sample: all tweets in 2019 combined.

Sampled account details

Tweet dataset	% Arabic tweets
IO tweets	92.3
GEO tweets	73.0
NEWS tweets	99.5
SA tweets	89.0
TOP tweets	86.0

Table A.6: Percentage Arabic language tweets by tweet dataset.

Table A.7: 100 Most Followed Users in SA Sample

rank	screen_name	followers_count	type
1	Talhabeeb	6668550.00	influencer
2	_m4nb_	547382.00	influencer
3	Fahad_Alotaibi_	508620.00	football
4	AhmedJallalah	452684.00	business
5	Saif_Hamoh	409020.00	media
6	dr_alimalki	387835.00	cleric
7	1binkasem	276961.00	influencer
8	moh_Altwaijri	241763.00	sports
9	imede_	162196.00	influencer
10	tourismpictures	123285.00	entertainment
11	1Wether	121325.00	weather
12	Abdulahalsalemm	104618.00	journalist
13	Turki_binFaisal	104508.00	government
14	m_albryk	103209.00	entertainment
15	azoz6670	98474.00	football
16	Riyadh_mmm	91489.00	business
17	mrj112	86007.00	influencer
18	AL_HJARI	83228.00	influencer
19	B_swed	82968.00	influencer
20	Y_senan	80997.00	entertainment
21	azizooghali	75920.00	sports
22	bahaforest	75627.00	influencer
23	swsynbd	74909.00	football
24	ahmed_alabdallh	74294.00	government
25	meteb_alnofay	73834.00	influencer
26	OmarExplains	72473.00	entertainment
27	snap_tabuk	71631.00	media
28	abdoh4magic	70772.00	entertainment
29	IIabraj	64637.00	entertainment
30	BahaUniversity	63168.00	university
31	hamadGR	62302.00	influencer
32	bader2992	61698.00	influencer
33	Hamad_L77	60261.00	influencer
34	Moh1Rz2H3	59734.00	influencer
35	su_subit	58460.00	cleric
36	alqassimwater	58365.00	business
37	iiSultt	55103.00	influencer
38	AsirTourism	53991.00	business
39	i_____300	53938.00	influencer
40	hash_salman___	53045.00	government
41	Arafatbinhassan	52507.00	cleric
42	majidr99	49896.00	football
43	AliAlmeshaal	48794.00	influencer
44	Mkhnews	47970.00	media
45	DrKhalidAloudah	46990.00	business
46	OmarAlwhibi	46495.00	influencer
47	Manafa_co	44117.00	business
48	aiydhalqhtani	42557.00	sports
49	Brand_Gifts1	41512.00	business
50	MOE_ONZ	40413.00	government
51	AlObayyd	39989.00	influencer
52	WaleedMuath	38540.00	influencer
53	OMAR_____911	38235.00	influencer
54	ahmadanaji	37328.00	influencer
55	gunfdhnet	34461.00	media
56	ayalyami	34450.00	media
57	AliAlmohsen1	33795.00	influencer
58	majed_otayf	33182.00	media
59	s3dzxx	33143.00	influencer

60	zalfadah1408	32643.00	influencer
61	hamood_9h	32526.00	influencer
62	_5LiD_	32438.00	influencer
63	A_Alrasheed5	32200.00	influencer
64	aa5sdfg802	32085.00	influencer
65	jubailnow	31597.00	media
66	WaIeedGH	31052.00	sports
67	TasiPro	30887.00	business
68	FaisalALa7mari	30511.00	entertainment
69	aalsanie	30509.00	business
70	yanbu___news	30249.00	media
71	ALHarbi_seif	30060.00	influencer
72	alkhamisziad	29717.00	academic
73	alshnaif	29293.00	media
74	khobar_history	28659.00	media
75	RBahais	28509.00	business
76	na7da7n	28021.00	influencer
77	mycruiseksa	27908.00	business
78	DrAlashgar	27814.00	business
79	azmrsh	26808.00	entertainment
80	MajidSociety	26527.00	business
81	MajedAlFahad	26069.00	influencer
82	3z_w1	26009.00	influencer
83	Azizooo1	25982.00	cleric
84	Enfahadd	25872.00	influencer
85	Artisana_Decor	25791.00	business
86	saleh_br	25586.00	influencer
87	k1k21	25021.00	influencer
88	AloniniYb	24824.00	influencer
89	alknfri8	24799.00	entertainment
90	jameel_hazzazi	24745.00	suspended
91	rahla22	24653.00	influencer
92	fu___82	24214.00	sports
93	asg1391h	23955.00	influencer
94	fawwazalhrbi	23818.00	influencer
95	yutm_511	23569.00	influencer
96	alashiri747	23340.00	influencer
97	___hm78	23182.00	business
98	malaysiatravel1	23031.00	business
99	alshehri_dr	22760.00	business
100	burydahprojects	22628.00	business

Table A.8: 100 Most Followed Users in GEO Sample

rank	screen_name	followers_count	type
1	FrencHMonTanA	2956783.00	entertainment
2	melly_goeslaw	2326600.00	entertainment
3	PeterPsquare	1847002.00	entertainment
4	AnisaRahma_Adi	1272228.00	entertainment
5	Almoj_alazra8	966210.00	football
6	faizalfbi76	671525.00	entertainment
7	emma_maembong	630200.00	entertainment
8	HamadAlMuneef	536749.00	government
9	bourashed	534029.00	media
10	salimafillah	528097.00	entertainment
11	NAmrabat53	517448.00	football
12	khalid88990	513100.00	football
13	mjeedalfawzan	471353.00	entertainment
14	mq8y	446310.00	influencer
15	datoacmizal	417949.00	entertainment
16	nahlah_aljammal	388198.00	journalist
17	ka3am_al3ayel	376709.00	entertainment
18	HaqueMarissa	375918.00	entertainment
19	jeddahnews_	369562.00	media
20	rohara_group	332886.00	business
21	_tu00	320112.00	suspended
22	MoaSalem	318990.00	entertainment
23	mainohustlehard	317475.00	entertainment
24	5o___51	305668.00	influencer
25	DA2_Ridho	297461.00	entertainment
26	DA2_Rizki	293574.00	entertainment
27	yasser_madkhli	291085.00	entertainment
28	Hafez_AlMedlej	280293.00	football
29	O___vip	277818.00	influencer
30	Mhzh_	261793.00	football
31	moh_Altwaijri	258195.00	sports
32	Ai9i9i	251851.00	influencer
33	fi9_z	246577.00	media
34	qap_1	245207.00	influencer
35	99t	243429.00	influencer
36	ab_raddadi	229705.00	entertainment
37	Ruleyork	229155.00	entertainment
38	beautyouamal	229004.00	influencer
39	Ahmadbinnaqi	229002.00	suspended
40	farooi	213172.00	business
41	mltqa_al3nzh	209435.00	suspended
42	Sami_Alhomood	207970.00	cleric
43	alzhirri	203013.00	entertainment
44	TMFaisalx	196044.00	influencer
45	md_almousa	188310.00	entertainment
46	MoustafaELFarra	186430.00	influencer
47	alromansiahKSA	182856.00	business
48	hemsh8	179713.00	entertainment
49	laylaiskandar	175717.00	entertainment
50	3zizez	171817.00	influencer
51	ArwaHomaidan	169893.00	entertainment
52	tdrebnews	160606.00	media
53	Sharqiya_event	160379.00	entertainment
54	Ss_m_f	159563.00	suspended
55	KSA_A52	152717.00	suspended
56	WonhoChung	150202.00	entertainment
57	HatoonKadi	149854.00	entertainment
58	AliKuemkh	148277.00	football
59	_x19_	147959.00	influencer

60	H_____60	143811.00	suspended
61	_467___	139397.00	suspended
62	joshua00966	137874.00	suspended
63	Abualfawarss123	137866.00	media
64	souza5	137373.00	football
65	kupinang	136010.00	entertainment
66	ShougAA6	133265.00	influencer
67	Nada_Fadel	132922.00	business
68	FHAD_M_305	127811.00	entertainment
69	MFMiraFilzah	124719.00	entertainment
70	BassemCHRISTO	122404.00	entertainment
71	JeddahChamber	121225.00	government
72	MajeedAlrhedi	120798.00	entertainment
73	Jfurlanich	120400.00	journalist
74	s7sn_	117439.00	influencer
75	aljubailtoday1	116337.00	media
76	sz_v27	112689.00	influencer
77	triggar6	111393.00	influencer
78	mkki1982	107393.00	suspended
79	snake_toe	106736.00	influencer
80	rahneputri	106082.00	influencer
81	nabilhdad	104708.00	suspended
82	SultanQhtani	102822.00	media
83	abb_hf	102616.00	influencer
84	NIZARAALGHANNAM	100776.00	suspended
85	3_1i	100278.00	influencer
86	TurkiAlmohsen	100080.00	influencer
87	F_abarh	99910.00	suspended
88	ZulAbrarHakim	98867.00	influencer
89	abualmshx	98087.00	suspended
90	abdullahacbadem	97533.00	government
91	sredusa	97523.00	university
92	ABUALMSH	97067.00	suspended
93	Cydiagold	96437.00	suspended
94	Msdossary7	95900.00	football
95	Ahoud40009	95564.00	business
96	abualmsh	94776.00	suspended
97	DrFahad55	92732.00	business
98	alaqsaclinics	92227.00	business
99	ALM3TA9M	91390.00	influencer
100	Mabkhot_b13	91306.00	suspended

Table A.9: Top 50 Most Followed Saudi Accounts

rank	screen_name	type
1	MohamadAlarefe	religious
2	Dr_alqarnee	religious
3	shugairi	religious
4	SaudiNews50	news
5	sabqorg	news
6	salman_alodah	religious
7	Alwaleed_Talal	royal family
8	HashKSA	aggregator
9	Alhilal_FC	football
10	KingSalman	royal family
11	abdulrahman	football
12	SamiAlJaber	football
13	fayez_malki	celebrity
14	waleedalfarraj	news
15	SalehAlmoghamsy	religious
16	Talhabeeb	celebrity
17	Y20	football
18	battalalgoos	football
19	alhabibali	religious
20	naseralomar	religious
21	AzzamAlDakhil	government
22	spagov	government
23	k_alshenaif	football
24	PTT_Riyadh	religious
25	akaworldwide	aggregator
26	Nawal_Al3eed_	celebrity
27	AlRiyadh	news
28	SaudiMOH	government
29	MOISaudiArabia	government
30	KSA24	news
31	stc_ksa	company
32	TurkiAldakhil	government
33	Turki_alalshikh	government
34	ittihad	football
35	tfrabiah	government
36	Mobily	company
37	BidzSaleh	celebrity
38	TatweirT	aggregator
39	faisalbinturki1	royal family
40	afaaa73	royal family
41	DaleSteyn62	football
42	KSASociety	aggregator
43	moe_gov_sa	government
44	AdelAljubeir	government
45	altemyat	football
46	aleqtisadiah	news
47	AlNassrFC	football
48	KSAMOFA	government
49	ActionYaDawry	football
50	Dr_almosleh	religious

Table A.10: Top 15 Saudi News Accounts

rank	screen_name
1	AlwatanSA
2	AlRiyadh
3	OKAZ_online
4	al_jazirah
5	aawsat_News
6	Almadinanews
7	News_Brk24
8	aleqtisadiah
9	alweeamnews
10	SPAregions
11	SaudiNews50
12	sabqorg
13	Akhbaar24
14	alShrqNews
15	twasulnews

Table A.11: Politically-relevant hashtags and codings from NEWS accounts

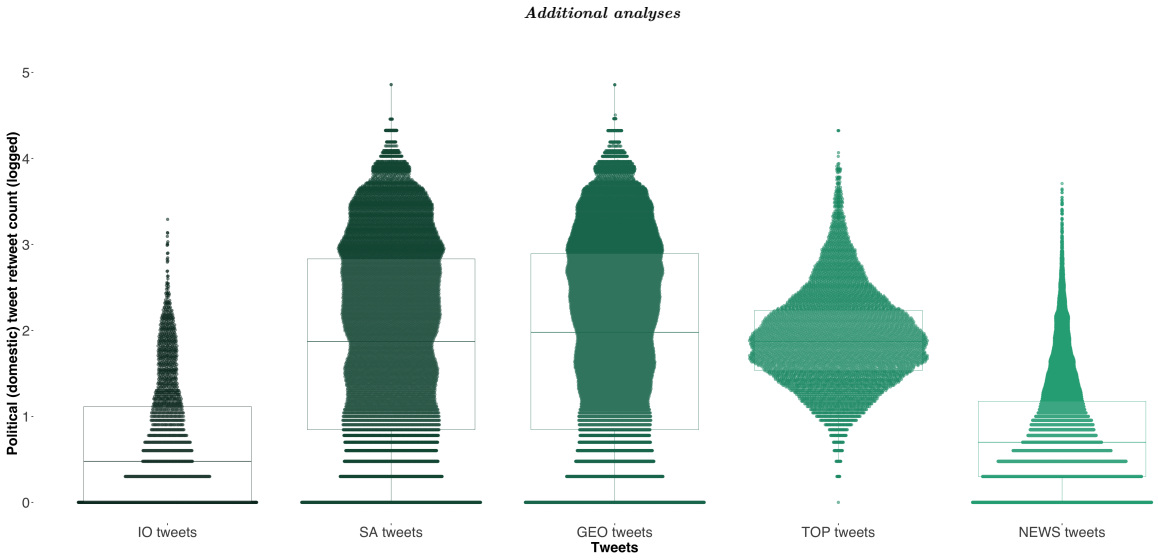
rank	frequency	translated hashtag	domestic political	foreign political	iran	yemen	royal
1	6813	#iran	0	1	1	0	0
2	6424	#yemen	0	1	0	1	0
3	4769	#crown_prince	1	0	0	0	1
4	3462	#cabinet	1	0	0	0	0
5	3297	#sudan	0	1	0	0	0
6	2846	#Custodian_of_the_Two_Holy_Mosques	1	0	0	0	1
7	2696	#Custodian_of_the_Two_Mosques	1	0	0	0	1
8	2581	#iraq	0	1	0	0	0
9	2514	#turkey	0	1	0	0	0
10	2496	#the_alliance	0	1	0	1	0
11	2405	#syria	0	1	0	0	0
12	2287	#education	1	0	0	0	0
13	2264	#aramco	1	0	0	0	0
14	2231	#lebanon	0	1	0	0	0
15	2197	#economy	1	0	0	0	0
16	2030	#egypt	0	1	0	0	0
17	2018	#Trump	0	1	0	0	0
18	1820	#Washington	0	1	0	0	0
19	1818	#UAE	0	1	0	0	0
20	1705	#america	0	1	0	0	0
21	1412	#britain	0	1	0	0	0
22	1396	#kuwait	0	1	0	0	0
23	1340	#houthi	0	1	0	1	0
24	1243	#libya	0	1	0	0	0
25	1242	#qatar	0	1	0	0	0
26	1213	#algeria	0	1	0	0	0
27	1160	#tunisia	0	1	0	0	0
28	1150	#bahrain	0	1	0	0	0
29	1140	#russia	0	1	0	0	0
30	1138	#commerce	1	0	0	0	0
31	1105	#pakistan	0	1	0	0	0
32	1084	#oil	1	0	0	0	0
32	1084	#jobs	1	0	0	0	0
33	1070	#king_salman	1	0	0	0	1
34	945	#economic_reports	1	0	0	0	0
35	935	#india	0	1	0	0	0
36	889	#civil_defence	1	0	0	0	0
37	867	#public_prosecution	1	0	0	0	0
38	844	#france	0	1	0	0	0
39	826	#mohammed_bin_salman	1	0	0	0	1
39	826	#houthis	0	1	0	1	0
40	813	#palestine	0	1	0	0	0
41	759	#Tehran	0	1	1	0	0
42	752	#economy	1	0	0	0	0
43	735	#citizens_account	1	0	0	0	0
44	728	#shura_council	1	0	0	0	0
45	714	#arab summit	0	1	0	0	0
46	687	#employment	1	0	0	0	0
47	643	#UN	0	1	0	0	0
48	630	#civil_service	1	0	0	0	0
49	628	#new zealand	0	1	0	0	0
50	627	#ministry_of_education	1	0	0	0	0
51	625	#justice	1	0	0	0	0
52	585	#sanaa	0	1	0	0	0
53	581	#ameerca	0	1	0	0	0
54	568	#jordan	0	1	0	0	0
55	557	#Tramp	0	1	0	0	0
56	549	#crownprinceinindia	0	1	0	0	1
57	548	#ISIS	0	1	0	0	0

58	546	#khalid_bin_faisal	1	0	0	0	0
59	544	#interior_ministry	1	0	0	0	0
60	543	#police	1	0	0	0	0
61	538	#riyadh_agreement	0	1	0	0	0
62	505	#justice_ministry	1	0	0	0	0

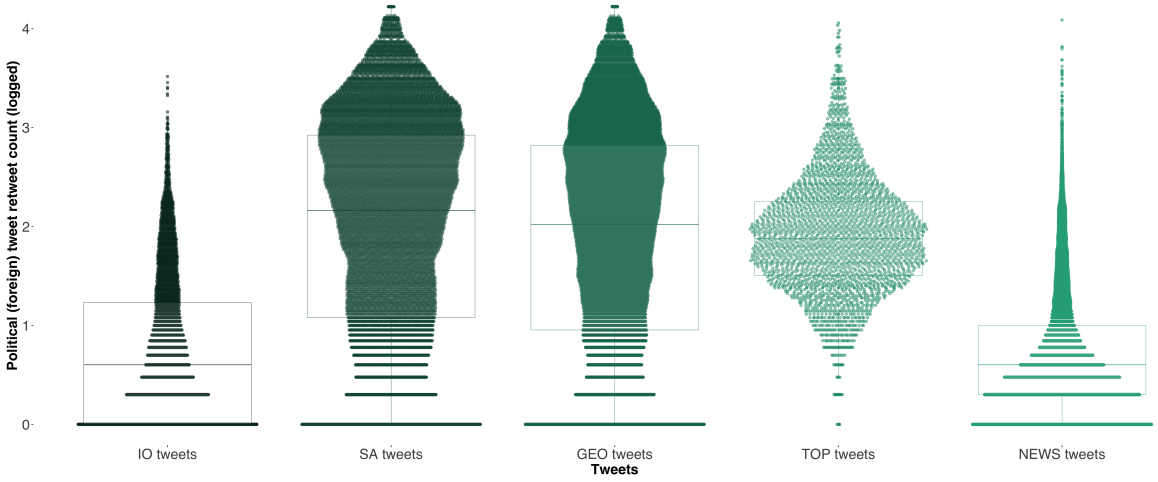
Table A.12: Most mentioned IO accounts in SA, GEO, TOP, and NEWS samples combined

rank	screen_name	# times mentioned
1	zV1mp	641
2	506MBS	627
3	Plelive	577
4	ETDose	402
5	ThbtY	316
6	giile7	291
7	ajmidm	286
8	iiSnB	284
9	phzw50	221
10	ij202	154
11	TurkibinTalal	108
12	iAb3al	93
12	RMCFarab	93
13	MubarakAldosari	89
14	AlderbyN	83
15	as7as14	81
16	a7mrL	74
17	i2i2b	71
18	iihaqbani	56
19	xxt44	54
20	suuny2010	43
20	vbqq	43
21	tweeqksa	40
22	sillicon77	39
23	360motions	34
23	afaqn2030	34
24	beINAlahli	32
24	brtriangle	32
25	albarakati0	30
25	OnsidearV	30
26	KingsAFC	28
27	naifbinsalamah1	26
28	rowef88	25
29	MRakah	23
29	Raeialsalfah	23
30	AAlOmaim	22
30	M7sniii	22
31	S7MiO	21
32	ii2iz	20
32	kljjkllpopo	20
33	DexSAIF	19
34	abdullahalorfj	18
34	M3LmKsa	18
35	alhejazclub	16
35	anjalbishah	16
36	Heev97	15
36	YahyaSAltaleedi	15
37	2moresa	14
37	AbeerAlsamt	14
37	Kuco33inho	14
38	12345mmggoo	13
38	EngAbuJulia	13
38	farraj966	13
38	panki2015	13
39	ahmyam1	12
39	almdaryah	12
39	iitzkon	12
39	llwdne	12

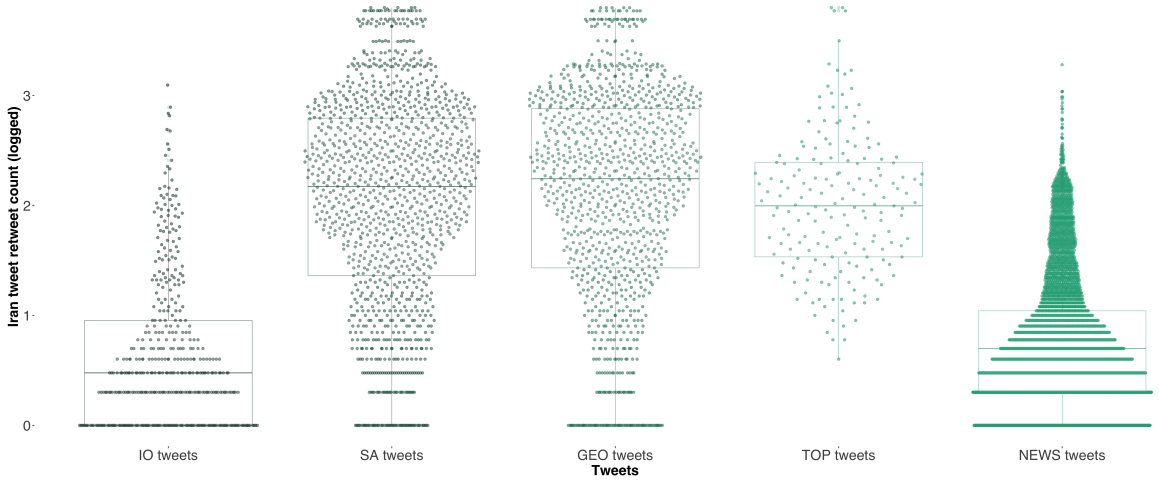
40	darthwolv	11
40	lanaslittlegurl	11
40	vandettals	11
41	0ii	10
41	Abusaud188Am	10
41	Bander232	10
41	hobaasha	10
41	JazanOffice1	10



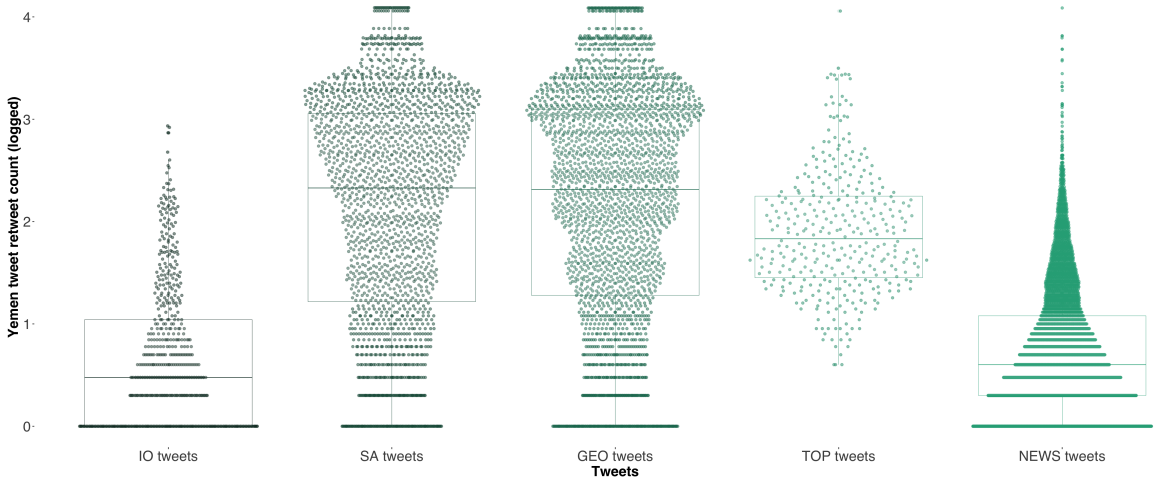
(a) Kernel density scatter plots of retweets for tweets mentioning domestic political hashtags in IO accounts and four benchmark samples.



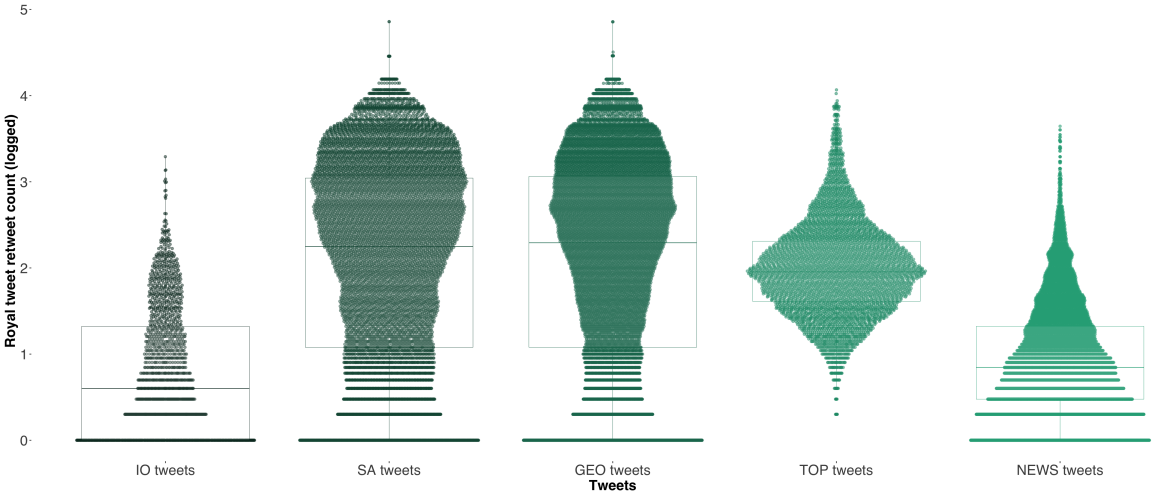
(b) Kernel density scatter plots of retweets for tweets mentioning foreign political hashtags in IO accounts and four benchmark samples.



(c) Kernel density scatter plots of retweets for tweets mentioning Iran-related hashtags in IO accounts and four benchmark samples.



(d) Kernel density scatter plots of retweets for tweets mentioning Yemen-related hashtags in IO accounts and four benchmark samples.



(e) Kernel density scatter plots of retweets for tweets mentioning Saudi royal family-related hashtags in IO accounts and four benchmark samples.

Figure A.1. Kernel density scatter plots of retweets for tweets mentioning different political hashtags in IO accounts and four benchmark samples. Overlaid boxplots show median, first, and third quartiles of distribution.

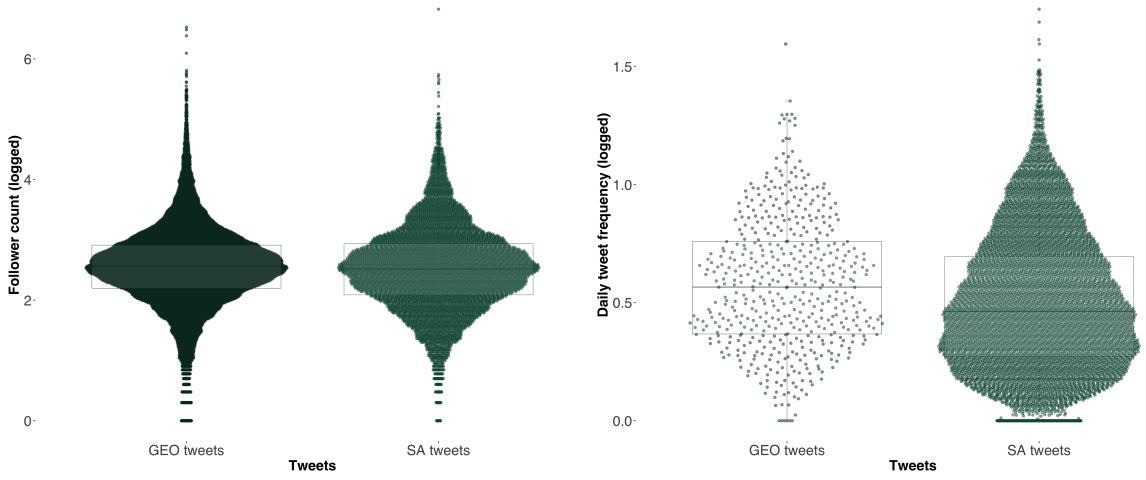


Figure A.2. Comparison of GEO and SA sample characteristics.

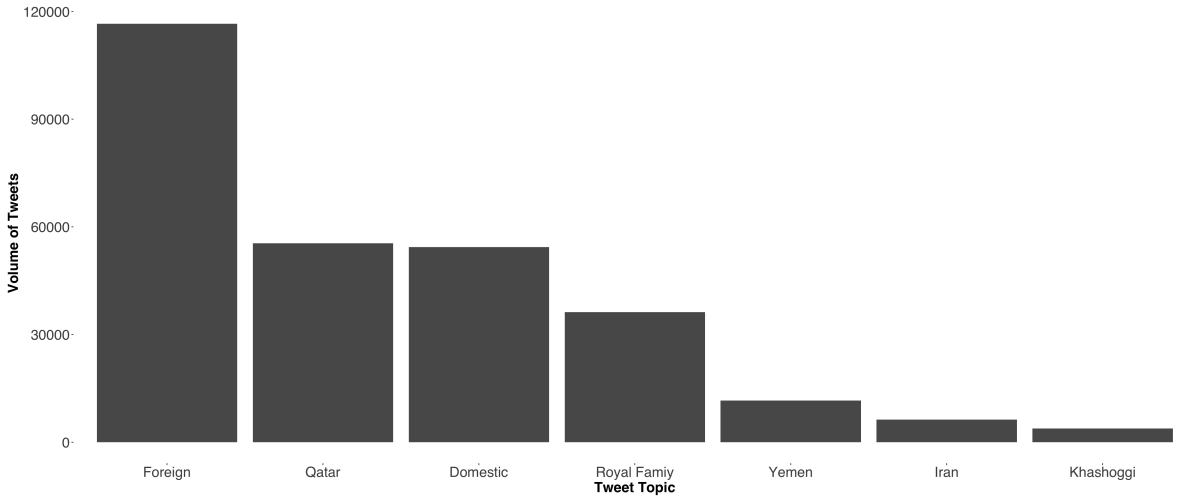


Figure A.3. Distribution of news topics in Saudi IO Tweets.