

Bank of England

Annex: Yield curve sensitivity to investor positioning around economic shocks

Annex to Staff Working Paper No. 1,029

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Yield curve sensitivity to investor positioning around economic shocks

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1 Positioning

1.1 By investor type

Table 1: Net positioning - Descriptive statistics

Maturity	Summary statistics							JB test	
	Million contracts							Null-hypothesis: normal	
	Mean	Min	Max	Std. Dev.	Median	Skewness	Kurtosis	statistic	p.value
Asset manager									
Mar '19	7.14	-4.00	26.42	8.38	5.17	0.96	2.80	18.88	0.00
Jun '19	-2.79	-20.61	15.80	8.90	-2.11	-0.07	1.97	8.36	0.02
Sep '19	12.75	-18.79	37.66	13.32	12.53	-0.25	2.13	10.57	0.01
Dec '19	-16.34	-65.01	22.67	23.73	-14.17	-0.62	2.25	27.20	0.00
Mar '20	-20.44	-75.41	21.83	26.46	-6.86	-0.57	1.85	38.69	0.00
Jun '20	-18.20	-75.01	26.60	28.87	-6.47	-0.51	1.86	34.79	0.00
Sep '20	-23.00	-71.56	20.60	20.71	-18.97	-0.69	2.57	31.11	0.00
Dec '20	4.51	-50.79	32.21	19.44	10.26	-1.24	3.74	99.68	0.00
Mar '21	9.61	-5.69	27.48	7.70	8.81	0.35	2.39	12.96	0.00
Jun '21	7.14	-0.78	25.04	6.40	5.14	1.04	3.22	65.32	0.00
Sep '21	3.97	-1.96	12.23	3.92	2.76	0.48	1.90	31.04	0.00
Dec '21	5.42	-0.17	27.50	6.45	1.95	1.55	5.05	203.28	0.00
Mar '22	1.79	-0.56	8.61	2.44	0.89	1.30	3.69	107.28	0.00
Jun '22	1.35	-0.15	8.93	2.05	0.30	2.00	6.98	465.64	0.00
Sep '22	0.26	-1.81	2.76	0.73	-0.01	0.94	4.40	79.92	0.00
Dec '22	-0.08	-4.03	2.59	0.78	-0.01	-3.50	17.95	3881.87	0.00
Mar '23	-0.02	-0.14	0.00	0.02	-0.02	-3.09	12.52	1732.90	0.00
Jun '23	-0.01	-0.01	0.00	0.00	0.00	-0.48	1.43	32.94	0.00
Sep '23	-0.04	-0.41	0.00	0.07	-0.01	-3.12	15.03	948.82	0.00
Dec '23	NaN	NaN	NaN	NA	NA	NaN	NaN	NaN	NaN
Mar '24	NaN	NaN	NaN	NA	NA	NaN	NaN	NaN	NaN
Jun '24	NaN	NaN	NaN	NA	NA	NaN	NaN	NaN	NaN
Sep '24	NaN	NaN	NaN	NA	NA	NaN	NaN	NaN	NaN
Dec '24	NaN	NaN	NaN	NA	NA	NaN	NaN	NaN	NaN
Mar '25	NaN	NaN	NaN	NA	NA	NaN	NaN	NaN	NaN
Broker									
Mar '19	-17.04	-22.97	0.43	4.36	-18.09	2.20	9.10	287.18	0.00
Jun '19	-4.10	-10.71	1.56	3.74	-6.12	0.13	1.18	27.04	0.00
Sep '19	1.87	-10.90	14.42	2.51	2.41	0.01	7.20	185.95	0.00
Dec '19	0.26	-8.13	9.52	2.74	0.08	0.13	4.43	27.20	0.00
Mar '20	0.38	-6.17	4.25	1.73	0.08	-0.38	4.24	31.02	0.00
Jun '20	1.05	-6.56	13.51	3.78	0.67	0.56	3.41	20.93	0.00
Sep '20	-1.81	-15.57	5.02	4.63	-0.47	-0.77	2.74	35.67	0.00
Dec '20	0.87	-6.35	11.68	3.48	0.42	0.73	3.30	32.52	0.00
Mar '21	-0.02	-3.15	2.87	1.02	-0.01	0.16	3.55	5.60	0.06
Jun '21	0.16	-2.06	2.43	0.48	0.16	-0.97	8.53	464.49	0.00
Sep '21	0.21	-1.86	2.50	0.56	0.15	-0.23	6.27	148.48	0.00
Dec '21	0.16	-0.68	1.20	0.28	0.19	0.03	5.24	63.61	0.00
Mar '22	0.13	-1.25	2.82	0.52	-0.05	1.88	8.63	606.59	0.00
Jun '22	-0.12	-1.31	1.36	0.39	-0.17	1.17	5.99	180.77	0.00
Sep '22	0.29	-1.56	2.22	0.49	0.22	0.59	4.47	44.35	0.00
Dec '22	-0.11	-1.18	1.19	0.32	-0.15	0.54	6.05	125.31	0.00
Mar '23	-0.06	-1.60	0.33	0.32	-0.01	-3.38	15.54	2494.95	0.00
Jun '23	-0.13	-1.14	0.32	0.31	-0.04	-2.29	7.05	457.68	0.00
Sep '23	-0.03	-0.61	0.24	0.11	-0.02	-2.84	14.47	1952.60	0.00
Dec '23	-0.06	-0.38	0.89	0.12	-0.01	1.08	14.96	1766.70	0.00
Mar '24	0.03	-1.07	0.24	0.09	0.00	-5.74	76.11	65495.73	0.00
Jun '24	0.01	-0.14	0.14	0.02	0.01	0.74	25.33	5970.61	0.00
Sep '24	-0.01	-0.06	0.26	0.02	0.00	7.24	95.57	104617.32	0.00
Dec '24	0.01	-0.07	0.10	0.02	0.00	-0.75	7.86	251.82	0.00
Mar '25	-0.01	-0.04	0.04	0.01	0.00	-0.54	3.42	9.84	0.01
CCP									
Mar '19	-294.33	-456.75	1.80	104.93	-299.06	0.33	2.45	3.74	0.15
Jun '19	-42.95	-157.52	77.81	47.35	-46.69	0.10	2.77	0.73	0.69
Sep '19	-133.07	-219.70	33.80	54.04	-143.09	0.53	2.48	14.81	0.00
Dec '19	-57.59	-411.31	127.61	143.63	-11.38	-0.70	2.37	30.99	0.00
Mar '20	-74.62	-275.13	73.54	70.96	-59.92	-0.62	2.75	23.94	0.00
Jun '20	-52.19	-187.08	41.31	53.38	-46.06	-0.73	2.82	32.46	0.00
Sep '20	-23.05	-247.64	128.88	67.14	-16.56	-0.57	2.84	19.63	0.00
Dec '20	69.81	-111.49	197.89	46.94	60.02	0.44	3.47	14.71	0.00
Mar '21	-33.40	-114.90	11.32	28.97	-34.53	-0.49	2.50	18.08	0.00
Jun '21	-21.58	-86.69	22.56	20.96	-22.98	-0.76	4.05	50.57	0.00
Sep '21	-16.35	-73.00	26.69	18.47	-15.74	-0.61	3.75	30.27	0.00
Dec '21	11.82	-34.28	74.51	22.42	9.98	0.49	2.55	17.03	0.00
Mar '22	-2.31	-33.21	33.78	10.53	-2.26	0.18	4.07	18.76	0.00

Jun '22	12.64	-6.90	39.95	10.68	10.17	0.51	2.75	16.58	0.00
Sep '22	0.66	-17.23	22.16	6.65	0.47	0.49	4.99	73.30	0.00
Dec '22	-1.37	-13.54	33.63	7.39	-2.37	1.37	5.36	193.73	0.00
Mar '23	-1.06	-10.47	12.42	3.98	-1.40	0.99	4.72	102.35	0.00
Jun '23	4.00	-4.93	29.80	6.03	1.30	1.88	6.23	366.37	0.00
Sep '23	-0.54	-7.14	10.92	2.49	-0.56	0.77	6.60	228.07	0.00
Dec '23	-1.35	-11.90	3.70	2.71	-0.40	-1.18	4.31	107.11	0.00
Mar '24	1.08	-0.69	5.81	1.46	0.53	1.30	3.63	106.70	0.00
Jun '24	0.36	-0.99	1.97	0.57	0.16	0.81	3.23	39.83	0.00
Sep '24	-0.11	-0.99	0.88	0.40	-0.06	-0.68	3.12	24.16	0.00
Dec '24	-0.20	-0.99	0.58	0.40	-0.05	-0.54	2.36	17.00	0.00
Mar '25	0.20	-0.86	0.85	0.45	0.00	-0.15	2.32	4.02	0.13

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Mar '19	234.20	5.08	388.40	111.53	277.88	-0.75	2.21	14.76	0.00
Jun '19	-28.84	-122.64	26.46	28.04	-26.42	-0.58	3.16	11.00	0.00
Sep '19	92.15	-61.10	195.20	47.49	99.69	-0.92	3.87	43.65	0.00
Dec '19	-40.86	-178.97	201.30	85.72	-54.53	0.64	2.90	22.02	0.00
Mar '20	61.45	-99.59	185.32	43.75	60.93	-0.32	3.83	16.33	0.00
Jun '20	74.73	-17.45	232.55	60.44	61.96	0.69	2.75	29.57	0.00
Sep '20	5.72	-141.78	142.67	50.12	-3.92	0.33	3.00	6.57	0.04
Dec '20	-75.54	-242.21	76.30	62.39	-48.30	-0.67	2.31	33.94	0.00
Mar '21	9.47	-57.16	54.48	20.01	9.29	-0.21	3.26	3.66	0.16
Jun '21	18.59	-37.77	55.31	20.35	24.26	-0.31	2.26	13.98	0.00
Sep '21	19.67	-27.28	52.06	12.63	22.85	-1.01	3.96	74.17	0.00
Dec '21	-18.92	-68.68	14.86	23.04	-25.00	0.07	1.74	24.08	0.00
Mar '22	-1.83	-30.81	26.05	8.52	0.42	-1.01	4.61	98.74	0.00
Jun '22	-16.74	-51.37	2.90	11.45	-14.20	-0.37	2.18	18.19	0.00
Sep '22	-4.36	-31.86	10.44	7.83	-0.96	-1.15	3.18	78.66	0.00
Dec '22	-0.56	-19.38	16.54	4.92	-0.36	0.01	5.63	102.52	0.00
Mar '23	1.91	-14.86	13.67	3.81	0.89	0.26	4.85	55.20	0.00
Jun '23	-0.99	-14.17	12.34	2.49	-0.38	-1.36	10.78	1010.78	0.00
Sep '23	-0.71	-8.44	6.73	1.80	-0.25	-1.10	8.13	464.62	0.00
Dec '23	0.86	-8.23	12.92	3.11	-0.01	1.18	6.07	185.79	0.00
Mar '24	-0.05	-5.06	3.84	1.17	0.01	-0.65	9.76	704.20	0.00
Jun '24	-0.05	-0.66	0.32	0.12	-0.01	-1.69	9.19	740.22	0.00
Sep '24	-0.10	-0.41	0.15	0.10	-0.10	-0.19	3.30	1.04	0.60
Dec '24	0.11	-0.21	0.30	0.12	0.17	-1.43	3.74	31.45	0.00
Mar '25	NaN	NaN	NaN	NA	NA	NaN	NaN	NaN	NaN

Hedge Fund

Mar '19	-39.65	-114.41	44.69	52.07	-48.90	-0.17	1.55	11.30	0.00
Jun '19	8.79	-13.09	51.46	17.62	2.50	1.32	3.67	58.29	0.00
Sep '19	-32.26	-264.62	87.16	75.51	11.05	-1.02	2.90	43.10	0.00
Dec '19	21.38	-21.65	142.92	39.14	6.25	1.68	4.95	194.64	0.00
Mar '20	-0.53	-46.79	32.63	18.50	3.55	-0.75	2.66	34.70	0.00
Jun '20	-6.55	-61.47	23.53	22.55	2.56	-0.99	2.44	61.62	0.00
Sep '20	39.57	-33.14	327.87	73.81	8.90	1.69	5.10	231.56	0.00
Dec '20	-6.96	-67.60	36.50	24.05	0.88	-1.22	3.42	89.37	0.00
Mar '21	15.46	-7.60	59.99	13.84	9.53	1.06	3.32	67.00	0.00
Jun '21	3.18	-10.96	14.98	4.10	3.34	-0.47	4.69	54.81	0.00
Sep '21	-0.29	-19.35	16.21	5.76	-0.62	0.20	3.94	15.24	0.00
Dec '21	-3.94	-18.78	11.87	5.27	-2.85	0.18	3.92	14.22	0.00
Mar '22	-4.21	-13.17	10.38	4.66	-5.00	0.69	2.86	28.13	0.00
Jun '22	1.65	-10.88	20.27	4.98	0.12	1.32	6.49	247.07	0.00
Sep '22	4.02	-1.28	16.35	3.18	3.30	1.39	5.13	157.85	0.00
Dec '22	3.97	-12.42	13.22	4.93	4.66	-0.94	4.22	64.48	0.00
Mar '23	-2.52	-13.52	6.56	4.04	-0.50	-0.92	2.89	43.44	0.00
Jun '23	-0.12	-9.67	9.59	3.32	0.36	0.40	4.70	39.12	0.00
Sep '23	-1.98	-8.57	6.03	3.28	-2.32	0.64	3.47	9.54	0.01
Dec '23	3.57	-4.41	13.03	3.49	5.12	-0.44	2.92	3.97	0.14
Mar '24	-2.90	-3.85	-1.00	0.87	-3.50	0.98	2.47	17.65	0.00
Jun '24	-1.09	-1.10	-1.00	0.02	-1.10	3.88	16.06	173.08	0.00
Sep '24	NaN	NaN	NaN	NA	NA	NaN	NaN	NaN	NaN
Dec '24	NaN	NaN	NaN	NA	NA	NaN	NaN	NaN	NaN
Mar '25	NaN	NaN	NaN	NA	NA	NaN	NaN	NaN	NaN

Insurance/Pension

Mar '19	16.28	3.52	32.56	10.62	16.06	0.14	1.42	13.13	0.00
Jun '19	9.90	-7.98	31.50	12.41	3.01	0.64	1.71	25.83	0.00
Sep '19	7.05	-8.54	35.20	12.54	1.31	1.08	2.75	49.22	0.00
Dec '19	9.44	1.08	54.51	11.52	4.36	2.77	9.82	982.88	0.00
Mar '20	9.63	0.00	40.78	10.92	2.40	0.75	2.36	39.18	0.00
Jun '20	1.92	-13.61	13.57	3.59	0.70	0.58	6.40	187.84	0.00
Sep '20	1.42	-1.76	11.69	2.83	0.66	1.97	6.06	364.06	0.00
Dec '20	3.47	-1.11	16.59	4.80	1.36	1.45	3.73	121.69	0.00
Mar '21	2.59	0.00	8.50	2.86	1.53	0.67	1.83	35.34	0.00
Jun '21	1.67	-3.00	13.21	3.57	0.06	2.25	6.70	284.10	0.00
Sep '21	1.50	-1.29	5.81	1.36	1.39	0.73	3.74	15.92	0.00
Dec '21	-0.71	-7.52	6.21	2.65	-1.38	0.64	4.80	35.45	0.00
Mar '22	0.01	0.00	0.04	0.01	0.01	1.64	3.82	43.56	0.00
Jun '22	-0.19	-0.28	0.08	0.18	-0.28	1.15	2.33	0.96	0.62

Sep '22	-0.01	-0.49	0.00	0.07	0.00	-6.56	44.02	3555.25	0.00
Dec '22	NaN	NaN	NaN	NA	NA	NaN	NaN	NaN	NaN
Mar '23	NaN	NaN	NaN	NA	NA	NaN	NaN	NaN	NaN
Jun '23	NaN	NaN	NaN	NA	NA	NaN	NaN	NaN	NaN
Sep '23	NaN	NaN	NaN	NA	NA	NaN	NaN	NaN	NaN
Dec '23	NaN	NaN	NaN	NA	NA	NaN	NaN	NaN	NaN
Mar '24	NaN	NaN	NaN	NA	NA	NaN	NaN	NaN	NaN
Jun '24	NaN	NaN	NaN	NA	NA	NaN	NaN	NaN	NaN
Sep '24	NaN	NaN	NaN	NA	NA	NaN	NaN	NaN	NaN
Dec '24	NaN	NaN	NaN	NA	NA	NaN	NaN	NaN	NaN
Mar '25	NaN	NaN	NaN	NA	NA	NaN	NaN	NaN	NaN
Other									
Mar '19	6.01	-1.34	24.73	6.68	1.92	0.98	2.94	19.50	0.00
Jun '19	5.55	-7.36	17.16	5.03	5.68	-0.07	2.79	0.52	0.77
Sep '19	6.03	-6.95	17.09	5.28	6.09	-0.12	2.30	5.63	0.06
Dec '19	-2.55	-18.20	14.22	6.37	-2.93	0.54	3.11	15.37	0.00
Mar '20	5.07	-24.08	83.29	22.62	-0.45	2.41	7.49	645.71	0.00
Jun '20	3.73	-20.17	73.08	18.88	0.24	1.86	6.59	397.35	0.00
Sep '20	5.17	-18.12	24.07	8.70	4.35	0.00	2.59	2.56	0.28
Dec '20	-1.22	-16.85	18.89	7.89	-0.09	-0.03	2.54	3.13	0.21
Mar '21	4.40	-4.54	19.41	5.04	3.49	0.41	2.34	16.63	0.00
Jun '21	0.53	-5.48	9.13	2.68	0.13	0.62	3.20	23.33	0.00
Sep '21	0.25	-6.37	20.32	4.15	0.15	2.80	13.97	2249.58	0.00
Dec '21	-1.26	-7.89	10.44	3.15	-1.57	1.25	5.80	208.53	0.00
Mar '22	3.36	-8.05	13.99	3.28	3.65	0.12	3.44	3.74	0.15
Jun '22	0.50	-4.80	3.98	1.44	0.42	-0.13	3.90	12.92	0.00
Sep '22	-2.22	-8.18	2.76	2.81	-2.75	-0.09	1.64	27.60	0.00
Dec '22	-0.98	-8.35	1.36	2.00	-0.40	-1.73	5.58	274.17	0.00
Mar '23	1.37	-4.27	5.46	1.38	1.33	-0.42	5.68	113.46	0.00
Jun '23	-1.94	-7.34	0.66	2.59	-0.73	-1.10	2.52	73.71	0.00
Sep '23	2.37	-0.13	8.96	2.70	1.32	1.07	2.58	67.22	0.00
Dec '23	-0.65	-4.50	0.56	1.12	0.00	-1.06	2.82	63.66	0.00
Mar '24	-0.16	-1.15	0.71	0.45	-0.15	-0.26	2.56	6.02	0.05
Jun '24	-0.13	-1.14	1.05	0.49	0.00	-0.53	2.90	14.05	0.00
Sep '24	0.12	-0.68	0.97	0.40	0.01	0.67	2.93	21.33	0.00
Dec '24	0.14	-0.67	0.91	0.40	0.00	0.17	2.11	8.12	0.02
Mar '25	-0.19	-0.84	0.82	0.44	0.00	0.09	2.24	4.39	0.11
Other bank									
Mar '19	-24.23	-65.59	11.89	24.15	-18.55	-0.01	1.52	11.18	0.00
Jun '19	-15.76	-34.83	-2.62	8.89	-11.94	-0.71	2.05	22.92	0.00
Sep '19	-5.68	-27.55	6.20	7.79	-2.87	-0.88	2.49	35.03	0.00
Dec '19	-1.05	-17.80	33.76	8.88	-0.72	0.52	3.85	23.40	0.00
Mar '20	-7.09	-35.35	16.47	10.35	-8.69	0.29	2.72	6.01	0.05
Jun '20	-9.02	-34.45	19.28	9.79	-7.65	-0.54	2.81	18.09	0.00
Sep '20	-2.02	-25.84	8.44	6.49	-0.22	-1.77	5.94	315.14	0.00
Dec '20	-9.43	-26.24	14.45	5.69	-10.97	0.74	4.11	50.58	0.00
Mar '21	-4.63	-13.13	4.74	3.00	-5.38	0.66	3.57	30.70	0.00
Jun '21	-1.56	-6.72	20.36	4.04	-2.60	2.35	9.51	959.38	0.00
Sep '21	-1.35	-9.03	4.07	2.16	-0.95	-1.00	5.22	132.43	0.00
Dec '21	1.19	-12.20	6.72	2.95	1.29	-0.44	3.40	13.68	0.00
Mar '22	3.89	-3.61	7.04	2.31	4.05	-0.65	3.03	25.03	0.00
Jun '22	1.31	-3.64	9.45	1.76	0.75	0.95	7.14	303.05	0.00
Sep '22	2.63	-1.34	7.44	1.88	2.07	0.67	2.94	25.83	0.00
Dec '22	-0.01	-7.17	2.62	1.84	0.60	-2.48	7.94	590.57	0.00
Mar '23	0.60	-0.65	4.16	0.98	0.04	1.78	6.13	196.31	0.00
Jun '23	-1.32	-15.23	4.86	4.34	-0.04	-1.47	4.54	95.96	0.00
Sep '23	-0.23	-1.08	-0.03	0.26	-0.03	-0.70	1.88	21.48	0.00
Dec '23	0.00	-0.01	0.01	0.00	0.00	-0.26	4.56	16.14	0.00
Mar '24	0.00	-0.01	0.01	0.00	0.00	0.00	4.27	9.79	0.01
Jun '24	NaN	NaN	NaN	NA	NA	NaN	NaN	NaN	NaN
Sep '24	NaN	NaN	NaN	NA	NA	NaN	NaN	NaN	NaN
Dec '24	NaN	NaN	NaN	NA	NA	NaN	NaN	NaN	NaN
Mar '25	NaN	NaN	NaN	NA	NA	NaN	NaN	NaN	NaN
PTF									
Mar '19	106.11	0.76	155.97	29.17	108.62	-1.18	6.16	78.55	0.00
Jun '19	65.61	2.80	120.19	30.95	56.73	0.11	1.75	12.43	0.00
Sep '19	45.71	0.15	117.68	35.49	33.80	0.43	1.68	25.80	0.00
Dec '19	81.03	-12.04	211.69	74.06	86.87	0.39	1.70	29.78	0.00
Mar '20	23.92	-22.42	154.70	44.91	1.55	1.05	3.07	64.80	0.00
Jun '20	0.97	-17.23	37.86	11.66	-1.56	1.12	3.68	81.13	0.00
Sep '20	-3.16	-53.49	37.94	17.76	-1.54	-0.48	3.25	14.58	0.00
Dec '20	10.87	-32.61	64.49	23.50	3.98	0.42	2.32	17.22	0.00
Mar '21	-3.69	-17.03	11.29	6.63	-3.23	-0.12	2.16	11.23	0.00
Jun '21	-10.34	-40.47	18.44	14.31	-4.83	-0.43	2.18	21.03	0.00
Sep '21	-9.86	-33.91	1.99	10.18	-4.70	-0.87	2.19	54.71	0.00
Dec '21	3.25	-10.45	30.93	8.33	0.77	1.92	6.02	351.70	0.00
Mar '22	-1.84	-8.04	3.95	2.12	-1.38	-0.43	2.88	11.10	0.00
Jun '22	-1.67	-16.17	2.67	3.54	-0.55	-2.34	8.29	736.24	0.00
Sep '22	-0.79	-6.46	1.41	1.29	-0.50	-1.71	6.80	385.68	0.00

Dec '22	-0.36	-7.81	3.04	1.28	-0.09	-2.75	14.55	2412.36	0.00
Mar '23	-0.29	-2.96	1.32	0.80	-0.13	-1.28	4.56	133.17	0.00
Jun '23	-0.14	-1.65	1.19	0.33	-0.14	-0.40	6.49	189.30	0.00
Sep '23	0.03	-1.31	1.19	0.20	0.02	0.32	12.81	1424.88	0.00
Dec '23	0.19	-1.06	1.42	0.24	0.20	0.80	11.35	1052.24	0.00
Mar '24	-0.08	-0.32	0.29	0.09	-0.10	1.14	5.34	152.74	0.00
Jun '24	-0.17	-0.35	0.10	0.09	-0.19	0.80	2.78	37.09	0.00
Sep '24	0.04	-0.12	0.22	0.04	0.04	0.80	4.85	77.47	0.00
Dec '24	0.04	-0.15	0.09	0.04	0.05	-1.94	8.01	412.21	0.00
Mar '25	0.00	-0.07	0.04	0.02	0.01	0.18	2.38	3.74	0.15
Systematic									
Mar '19	-0.10	-1.81	2.02	0.86	-0.09	0.22	2.58	1.85	0.40
Jun '19	0.95	-2.18	4.96	1.15	1.03	-0.63	5.16	48.44	0.00
Sep '19	2.02	-2.40	6.80	1.80	2.26	-0.16	2.44	4.37	0.11
Dec '19	2.98	-7.33	11.01	3.86	3.11	-0.42	2.92	8.98	0.01
Mar '20	1.67	-4.30	10.05	2.62	1.09	0.65	3.30	25.85	0.00
Jun '20	2.61	-3.78	9.08	3.13	2.09	0.18	1.76	24.40	0.00
Sep '20	1.21	-3.38	5.85	1.44	1.08	0.25	3.29	4.79	0.09
Dec '20	2.06	-2.07	8.88	2.35	1.39	1.15	3.70	84.58	0.00
Mar '21	0.42	-11.41	7.44	3.51	0.90	-1.67	7.21	423.14	0.00
Jun '21	2.65	-1.93	12.38	3.31	1.49	1.57	4.73	184.88	0.00
Sep '21	2.86	-0.38	13.35	4.66	0.23	1.37	3.05	105.16	0.00
Dec '21	2.72	-0.14	13.96	5.00	0.00	1.50	3.34	109.52	0.00
Mar '22	1.77	-0.33	12.71	3.43	0.00	1.94	5.65	201.36	0.00
Jun '22	2.31	0.00	11.37	4.06	0.00	1.48	3.41	54.70	0.00
Sep '22	0.00	0.00	0.00	0.00	0.00	0.51	2.08	7.67	0.02
Dec '22	0.00	0.00	0.00	0.00	0.00	-0.98	1.96	10.25	0.01
Mar '23	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Jun '23	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Sep '23	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Dec '23	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Mar '24	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Jun '24	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Sep '24	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Dec '24	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Mar '25	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
SSA									
Mar '19	2.74	0.74	5.31	2.26	0.74	0.24	1.07	20.16	0.00
Jun '19	2.52	0.07	9.49	3.02	1.11	1.71	4.13	35.86	0.00
Sep '19	0.61	-3.52	4.01	0.89	0.78	-0.54	7.41	216.08	0.00
Dec '19	2.30	-0.71	8.31	1.95	2.42	0.29	2.33	8.56	0.01
Mar '20	0.66	-1.20	1.89	0.73	0.76	-0.32	2.02	9.13	0.01
Jun '20	-0.47	-2.31	2.58	1.09	-0.32	0.38	3.44	2.63	0.27
Sep '20	-0.22	-2.03	2.60	0.78	-0.04	-0.99	4.70	71.59	0.00
Dec '20	1.47	0.00	3.48	0.63	1.23	0.39	3.72	7.54	0.02
Mar '21	1.68	0.00	6.00	2.44	0.00	0.91	2.02	16.28	0.00
Jun '21	-1.74	-3.58	0.00	1.58	-1.79	-0.05	1.28	17.52	0.00
Sep '21	-0.70	-2.00	0.00	0.96	0.00	-0.61	1.37	14.15	0.00
Dec '21	0.45	-0.50	1.79	0.99	0.00	0.33	1.38	22.80	0.00
Mar '22	0.09	-0.01	1.40	0.31	0.00	3.56	14.53	550.82	0.00
Jun '22	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Sep '22	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Dec '22	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Mar '23	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Jun '23	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Sep '23	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Dec '23	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Mar '24	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Jun '24	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Sep '24	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Dec '24	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Mar '25	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Unclassified									
Mar '19	4.54	-1.27	11.41	3.08	4.03	0.39	2.33	5.30	0.07
Jun '19	4.35	0.71	20.02	3.82	2.88	1.76	6.95	218.35	0.00
Sep '19	2.89	-3.38	11.21	3.45	1.58	1.04	3.13	44.69	0.00
Dec '19	3.71	-2.93	17.95	4.16	2.55	1.11	4.05	77.99	0.00
Mar '20	0.65	-7.39	13.97	3.68	0.43	1.29	6.38	255.92	0.00
Jun '20	1.09	-7.29	8.96	2.83	0.64	-0.24	5.05	63.95	0.00
Sep '20	0.80	-7.89	23.58	5.48	0.94	1.39	6.89	328.39	0.00
Dec '20	1.25	-7.81	6.17	2.62	0.86	-0.50	3.79	23.59	0.00
Mar '21	0.26	-5.16	6.97	2.16	1.31	-0.50	3.03	14.12	0.00
Jun '21	1.15	-0.11	4.44	0.98	1.20	0.96	3.94	64.05	0.00
Sep '21	0.64	-5.95	5.96	2.14	1.20	-0.50	3.35	16.08	0.00
Dec '21	0.25	-6.08	4.50	1.86	0.14	-0.18	3.32	3.30	0.19
Mar '22	-0.12	-4.21	4.14	1.83	0.12	-0.68	3.35	22.91	0.00
Jun '22	0.48	-0.96	2.36	0.84	0.41	0.23	2.27	8.13	0.02
Sep '22	0.39	-0.07	1.50	0.44	0.20	0.83	2.43	24.03	0.00
Dec '22	0.10	-0.19	0.84	0.19	0.10	0.51	3.80	6.63	0.04

Mar '23	-0.11	-0.28	0.00	0.09	-0.09	-0.53	2.02	2.28	0.32
Jun '23	NaN	NaN	NaN	NA	NA	NaN	NaN	NaN	NaN
Sep '23	-1.82	-3.18	-0.50	1.11	-1.25	-0.24	1.30	4.84	0.09
Dec '23	-1.23	-1.60	-0.60	0.45	-1.47	0.61	1.52	4.30	0.12
Mar '24	NaN	NaN	NaN	NA	NA	NaN	NaN	NaN	NaN
Jun '24	-0.01	-0.01	-0.01	0.00	-0.01	NaN	NaN	NaN	NaN
Sep '24	NaN	NaN	NaN	NA	NA	NaN	NaN	NaN	NaN
Dec '24	NaN	NaN	NaN	NA	NA	NaN	NaN	NaN	NaN
Mar '25	NaN	NaN	NaN	NA	NA	NaN	NaN	NaN	NaN

Note:

Descriptive statistics of net positions by investor type.

1.2 Speculative investors

1.2.1 Descriptive statistics

Table 2: Descriptive statistics of net positions for speculative investors.

Summary statistics						
Million contracts						
Maturity	Mean	Min	Max	Std. Dev.	Median	
Mar '19	64.74	-111.76	155.81	65.32	89.23	
Jun '19	73.71	-4.06	124.11	27.23	79.82	
Sep '19	13.53	-227.08	98.49	56.62	33.70	
Dec '19	100.53	-23.39	328.49	100.59	77.29	
Mar '20	23.21	-50.96	151.37	46.86	9.76	
Jun '20	-5.48	-70.91	42.76	20.74	-0.48	
Sep '20	35.77	-27.86	294.98	60.03	9.03	
Dec '20	3.93	-61.52	72.93	25.26	1.85	
Mar '21	11.55	-11.85	62.40	16.44	8.96	
Jun '21	-7.12	-37.15	19.81	14.21	-5.42	
Sep '21	-10.06	-51.37	12.67	14.24	-5.22	
Dec '21	-0.65	-14.16	28.70	8.59	-3.07	
Mar '22	-5.96	-17.54	7.06	4.34	-6.66	
Jun '22	-0.22	-15.33	20.25	5.36	-0.03	
Sep '22	2.68	-2.84	16.25	2.91	2.09	
Dec '22	3.05	-14.25	13.54	4.94	2.41	
Mar '23	-2.45	-13.04	7.50	4.13	-0.25	
Jun '23	-0.23	-9.67	9.20	2.80	0.02	
Sep '23	-0.67	-8.57	6.64	2.19	-0.04	
Dec '23	1.41	-4.29	13.38	2.68	0.29	
Mar '24	-0.94	-3.85	0.16	1.39	-0.13	
Jun '24	-0.23	-1.31	0.10	0.24	-0.20	
Sep '24	0.04	-0.12	0.22	0.04	0.04	
Dec '24	0.04	-0.15	0.09	0.04	0.05	
Mar '25	0.00	-0.07	0.04	0.02	0.01	

1.2.2 Autocorrelation

Table 3: Autocorrelation of net positioning by contract

Autocorrelation					
Maturity	AC1	AC2	AC3	AC4	AC5
Mar '19	-0.969	0.937*	-0.925	0.914*	-0.909
Jun '19	-0.995	0.972*	-0.968	0.952*	-0.955
Sep '19	-0.902	0.797*	-0.776	0.751*	-0.744
Dec '19	-0.972	0.938*	-0.948	0.959*	-0.944
Mar '20	-0.978	0.956*	-0.942	0.928*	-0.92
Jun '20	-0.704	0.407*	-0.488	0.568*	-0.488
Sep '20	-0.937	0.874*	-0.873	0.873*	-0.864
Dec '20	-0.847	0.693*	-0.727	0.761*	-0.719
Mar '21	-0.949	0.897*	-0.89	0.882*	-0.889
Jun '21	-0.95	0.9*	-0.893	0.886*	-0.878
Sep '21	-0.986	0.972*	-0.968	0.965*	-0.958
Dec '21	-0.948	0.896*	-0.871	0.846*	-0.824
Mar '22	-0.947	0.894*	-0.891	0.888*	-0.879
Jun '22	-0.892	0.784*	-0.768	0.752*	-0.733
Sep '22	-0.902	0.804*	-0.8	0.797*	-0.814

Dec '22	-0.974	0.947*	-0.94	0.932*	-0.921
Mar '23	-0.906	0.812*	-0.807	0.803*	-0.799
Jun '23	-0.899	0.796*	-0.791	0.786*	-0.783
Sep '23	-0.882	0.762*	-0.753	0.743*	-0.743
Dec '23	-0.727	0.449*	-0.526	0.603*	-0.562
Mar '24	-0.774	0.531*	-0.588	0.642*	-0.603
Jun '24	-0.966	0.913*	-0.896	0.875*	-0.859
Sep '24	-0.883	0.744*	-0.72	0.696*	-0.691
Dec '24	-0.947	0.855*	-0.842	0.823*	-0.817
Mar '25	-0.996	0.983*	-0.952	0.925*	-0.904

2 Yields

2.1 Descriptive statistics

Table 4: Descriptive statistics of yield changes (dependent variable)

Maturity	Summary statistics							JB test	
	Basis points						Kurtosis	Null-hypothesis: normal	
	Mean	Min	Max	Std. Dev.	Median	Skewness		statistic	p.value
Short sterling									
Mar '19	-0.05	-1.37	1.49	0.62	0.00	0.12	2.77	0.24	0.89
Jun '19	-0.07	-3.09	2.92	0.97	0.02	-0.09	4.37	8.94	0.01
Sep '19	-0.07	-6.64	3.94	1.45	0.01	-0.63	5.72	66.49	0.00
Dec '19	-0.08	-9.21	5.71	1.86	-0.11	-0.44	6.16	105.93	0.00
Mar '20	-0.08	-9.97	9.84	2.50	0.01	0.08	5.49	69.27	0.00
Jun '20	-0.12	-9.96	11.67	2.93	0.05	0.06	4.42	22.83	0.00
Sep '20	-0.13	-10.32	12.10	3.26	0.04	0.07	3.87	8.63	0.01
Dec '20	-0.14	-10.51	12.14	3.51	-0.03	0.10	3.61	4.67	0.10
Mar '21	-0.14	-10.42	12.12	3.66	0.03	0.14	3.48	3.47	0.18
Jun '21	-0.15	-10.27	12.06	3.75	0.00	0.16	3.36	2.61	0.27
Sep '21	-0.15	-10.25	11.98	3.82	-0.11	0.17	3.22	1.83	0.40
Dec '21	-0.16	-10.17	11.88	3.86	-0.12	0.17	3.10	1.45	0.48
Mar '22	-0.17	-10.06	11.93	3.90	-0.32	0.19	3.02	1.59	0.45
Jun '22	-0.17	-9.96	12.02	3.92	-0.47	0.22	2.98	2.08	0.35
Sep '22	-0.18	-9.87	12.13	3.96	-0.58	0.25	2.99	2.81	0.25
Dec '22	-0.18	-9.79	12.27	4.00	-0.41	0.28	3.03	3.63	0.16
Mar '23	-0.19	-9.72	12.42	4.04	-0.36	0.32	3.09	4.64	0.10
Jun '23	-0.17	-9.64	12.75	4.08	-0.41	0.36	3.18	6.21	0.04
Sep '23	-0.21	-9.76	13.07	4.14	-0.56	0.42	3.25	8.39	0.02
Dec '23	-0.21	-9.87	13.33	4.18	-0.61	0.46	3.31	10.51	0.01
Mar '24	-0.22	-9.90	13.55	4.25	-0.61	0.50	3.34	12.49	0.00
Jun '24	-0.20	-9.94	13.73	4.30	-0.62	0.53	3.40	14.15	0.00
Sep '24	-0.13	-9.27	13.87	4.35	-0.53	0.60	3.44	15.94	0.00
Dec '24	-0.19	-9.22	13.98	4.33	-0.46	0.58	3.48	14.47	0.00
Mar '25	-0.06	-10.45	14.05	4.70	-0.42	0.57	3.37	9.49	0.01
OIS									
Mar '19	-0.10	-5.00	3.00	1.15	0.00	-0.16	5.66	36.78	0.00
Jun '19	-0.15	-7.00	4.00	1.36	0.00	-0.56	6.71	117.79	0.00
Sep '19	-0.14	-9.00	6.00	1.68	0.00	-0.39	6.70	149.65	0.00
Dec '19	-0.13	-10.00	6.00	2.03	0.00	-0.39	5.62	97.68	0.00
Mar '20	-0.16	-12.00	10.50	2.57	0.00	0.00	5.53	91.53	0.00
Jun '20	-0.19	-13.00	12.50	2.94	0.00	0.06	4.96	54.81	0.00
Sep '20	-0.22	-14.00	13.50	3.21	0.00	0.06	4.61	37.06	0.00
Dec '20	-0.23	-15.00	14.00	3.39	0.00	0.06	4.55	34.40	0.00
Mar '21	-0.24	-15.00	15.00	3.57	0.00	0.19	4.42	30.90	0.00
Jun '21	-0.25	-16.00	15.50	3.71	0.00	0.15	4.44	30.74	0.00
Sep '21	-0.26	-16.00	16.00	3.77	0.00	0.18	4.43	31.23	0.00
Dec '21	-0.27	-16.00	16.00	3.80	0.00	0.19	4.34	27.72	0.00
Mar '22	-0.28	-15.00	17.00	3.84	0.00	0.26	4.30	27.79	0.00
Jun '22	-0.28	-14.00	17.00	3.86	0.00	0.29	4.19	25.05	0.00
Sep '22	-0.29	-14.00	17.50	3.89	0.00	0.32	4.23	27.33	0.00
Dec '22	-0.30	-15.00	17.50	3.93	0.00	0.29	4.35	30.82	0.00
Mar '23	-0.30	-15.00	18.00	3.98	0.00	0.29	4.33	30.01	0.00
Jun '23	-0.29	-15.00	18.00	4.01	0.00	0.29	4.35	30.89	0.00
Sep '23	-0.32	-15.00	17.50	4.05	0.00	0.26	4.18	23.39	0.00
Dec '23	-0.31	-15.00	18.00	4.09	0.00	0.29	4.29	27.80	0.00
Mar '24	-0.33	-15.00	18.00	4.14	0.00	0.33	4.30	29.34	0.00
Jun '24	-0.32	-15.00	18.00	4.16	0.00	0.35	4.27	28.88	0.00
Sep '24	-0.35	-14.00	18.50	4.16	0.00	0.42	4.38	32.48	0.00
Dec '24	-0.38	-9.00	13.50	4.04	0.00	0.38	3.24	6.08	0.05

2.2 Autocorrelation

Table 5: Autocorrelation of yield changes by contract.

Maturity	Autocorrelation				
	AC1	AC2	AC3	AC4	AC5
Mar '19	0.107*	0.015	0.031	-0.032	-0.008
Jun '19	0.297*	0.042	0.001	-0.041	-0.011
Sep '19	0.343*	-0.032	0.014	-0.007	0.003
Dec '19	0.421*	0.011	0.058	0.016	0.032
Mar '20	0.446*	0.018	0.084*	0.045	0.043
Jun '20	0.436*	0.014	0.076*	0.012	0.042
Sep '20	0.435*	-0.006	0.059	0.005	0.041
Dec '20	0.444*	-0.009	0.044	-0.001	0.034
Mar '21	0.447*	-0.01	0.044	-0.002	0.034
Jun '21	0.449*	-0.014	0.043	-0.002	0.025
Sep '21	0.449*	-0.018	0.043	0.009	0.024
Dec '21	0.451*	-0.018	0.039	0.008	0.021
Mar '22	0.45*	-0.027	0.039	0.017	0.02
Jun '22	0.448*	-0.033	0.037	0.021	0.016
Sep '22	0.444*	-0.045	0.036	0.031	0.019
Dec '22	0.439*	-0.053	0.038	0.036	0.019
Mar '23	0.435*	-0.064	0.034	0.038	0.016
Jun '23	0.437*	-0.064	0.036	0.043	0.011
Sep '23	0.44*	-0.066	0.038	0.053	0.008
Dec '23	0.442*	-0.068	0.037	0.051	0.002
Mar '24	0.45*	-0.061	0.036	0.049	-0.002
Jun '24	0.452*	-0.053	0.039	0.044	-0.007
Sep '24	0.497*	-0.003	0.079*	0.046	-0.03
Dec '24	0.526*	0.014	0.047	0.033	-0.026
Mar '25	0.538*	0.008	0.068	0.09*	-0.018

3 Shocks

3.1 Descriptive statistics

Table 6: Descriptive statistics of shock variables.

Shock type	Summary statistics							JB test	
	Basis points							Null-hypothesis: normal	
	Mean	Min	Max	Std. Dev.	Median	Skewness	Kurtosis	statistic	p.value
ESI	0	-6.00	4.16	1	0.06	-1.37	14.41	1963.71	0
Brexit	0	-6.34	6.50	1	-0.07	0.33	15.86	2364.37	0
Monetary Policy	0	-7.95	5.22	1	0.10	-3.22	25.73	7950.91	0
Risk sentiment	0	-3.58	6.89	1	-0.02	1.20	11.69	1157.76	0

3.2 Autocorrelation

Table 7: Autocorrelation of shocks variables.

Shock type	Autocorrelation				
	AC1	AC2	AC3	AC4	AC5
ESI	0.002	0.125*	0.015	0.034	-0.004
Brexit	-0.074	-0.129	0.092	0.017	-0.041
Monetary Policy	0.042	0.146*	-0.01	-0.035	0.139*
Risk sentiment	-0.008	0.031	0.028	0.064	0.007

4 ESI robustness

We report supporting evidence for the robustness of the ESI measure. Specifically:

- While there are theoretical grounds for the ESI being endogenous with risk sentiment, some simple checks find little empirical evidence that the two are correlated.
- There might be concerns around using ESI weights based on historical data sensitivity, but we show this will not create endogeneity in the final regression given low persistence in the first difference of yields and data surprises.
- Our ESI is comparable to other external measures.

Economic surprises and risk sentiment

The historically-weighted ESI is calculated using weights from the regression:

$$\Delta y^{intra} = \tilde{e}si\beta' + \varepsilon \quad (1)$$

where Δy^{intra} is $(J \times 1)$ vector of 10-minute intraday changes in 3-year spot interest rates around data releases, and $\tilde{e}si$ is a $(J \times (K + 1))$ matrix of intraday data surprises and a constant. The subsequent aggregate ESI is calculated as:

$$ESI_t = (esi_{1,t}, \dots, esi_{K,t})(\hat{w}_1, \dots, \hat{w}_K)' \quad (2)$$

where $\hat{w}_k = \frac{\hat{\beta}_k}{\sum_i |\hat{\beta}_i|}$

The first challenge against the ESI construction might be that the underlying economic surprises could be endogenous with other drivers of rates. This would bias coefficients in both (1) and when using the aggregate ESI as an independent variable.

We mitigate the degree of bias in (1) by running the regression at intraday frequency. By using a brief 10-minute window for the change in yields, it ensures that other market moving events, such as monetary policy announcements, are not systematically confounded with the data releases. There could theoretically be other unobservable omitted variables. One primary candidate is risk sentiment which affects yields and could also affect the economic surprises by influencing investor expectations. For instance, when sentiment is positive, investors may have overly optimistic macroeconomic expectations, and vice versa when sentiment is negative.

Figure 1 plots the daily changes in different proxy measures of UK risk sentiment against daily changes in the UK ESI. The proxy risk sentiment measures range from option implied volatility to model-based estimates of risk premia. Specifically, they include:

- UK 10y nominal term premia
- UK-focused equity risk premia
- FTSE AS equity risk premia
- FTSE AS 12-month implied volatility

- Short sterling 12-month implied volatility
- VIX index

As Figure 1 shows, across the different measures there is no discernible relationship with economic surprises. At most, there is a significant negative relationship with short sterling implied volatility. But it is possible that the channel of association here is through the ESI affecting the short sterling yield, which mechanically affects the implied volatility. Overall, we find little evidence of a significant relationship between risk sentiment and economic surprises.

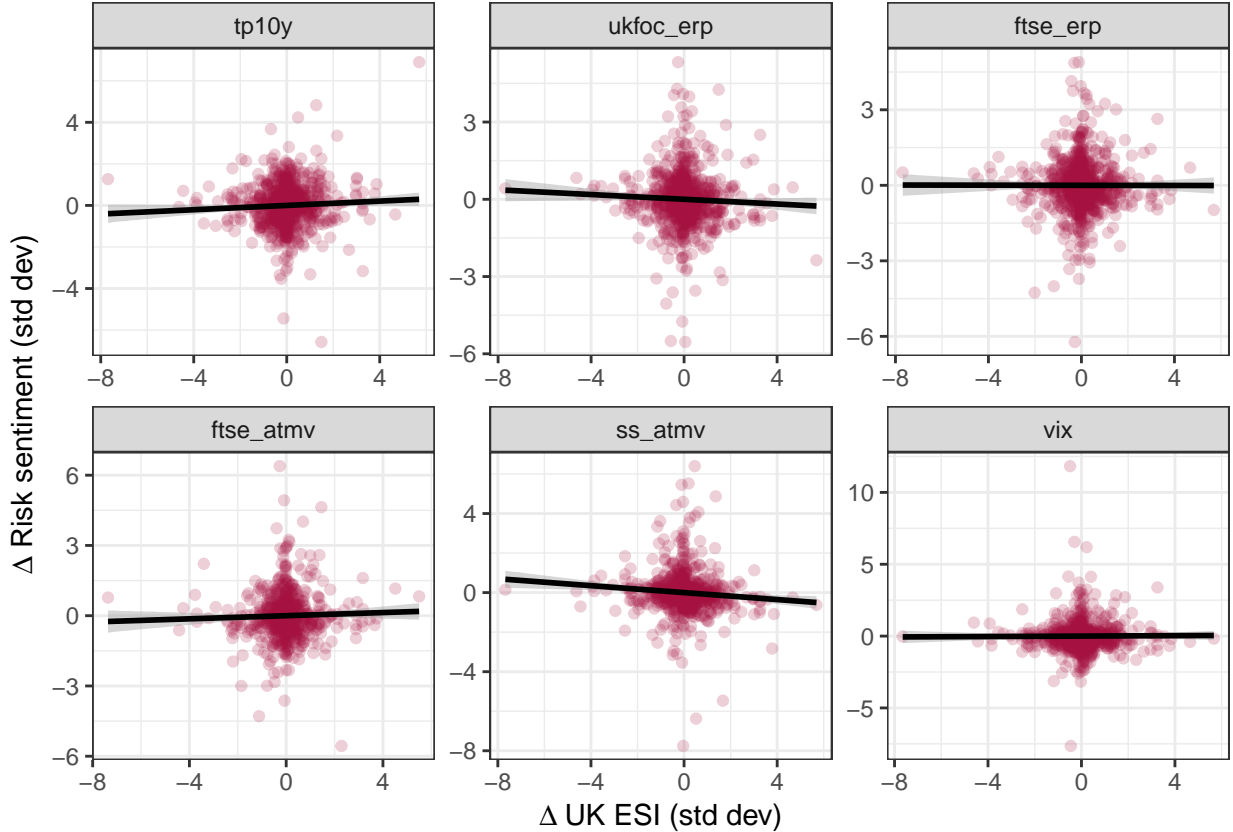


Figure 1: UK ESI and proxy measures of risk sentiment. The sample period is 11-Feb-2009 to 24-Jan-2020. All variables have been normalised to have mean zero and standard deviation one.

4.1 Using the historically-weighted ESI in a regression of yields

A second challenge that could be levelled against the aggregate ESI being used as an independent variable in a regression of changes in yields, is that the ESI weights are based on historical data sensitivity. We judge that this would not induce any bias. The aggregate ESI is a function of the intraday changes in yields and economic surprises, sampled from a period pre-dating the final regression. Assuming for simplicity that the underlying economic surprises are all exogenous variables, any potential endogeneity will depend on the degree of persistence in Δy_t^{intra} and $esi_{k,t}$, i.e. the extent to which past values are correlated with current values.

Figures 2 and 3 demonstrate that any persistence in the series dies out very quickly. Given that we pre-date the weights sample sufficiently far back (10 months prior), all persistence would have died out.

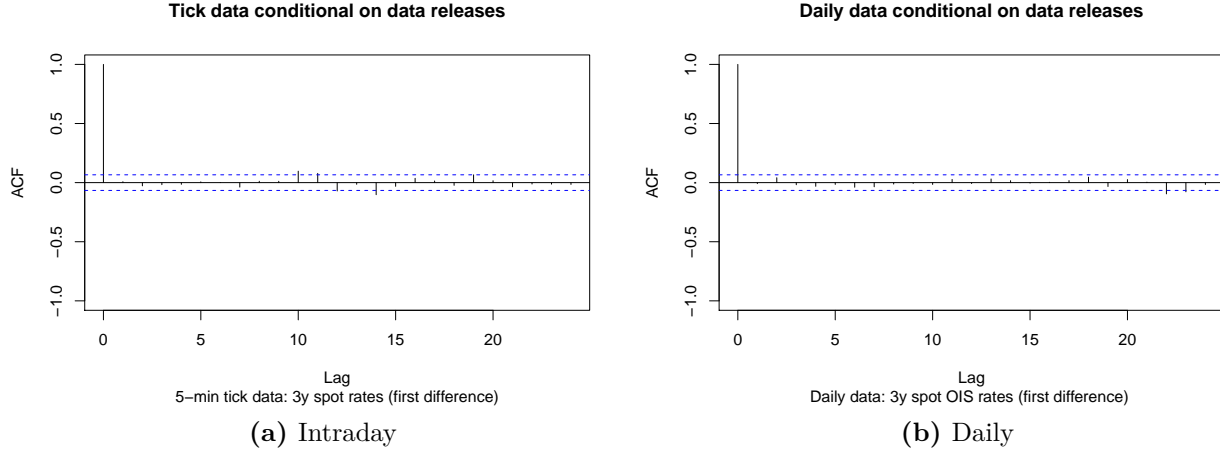


Figure 2: Autocorrelation functions of yields around data releases.

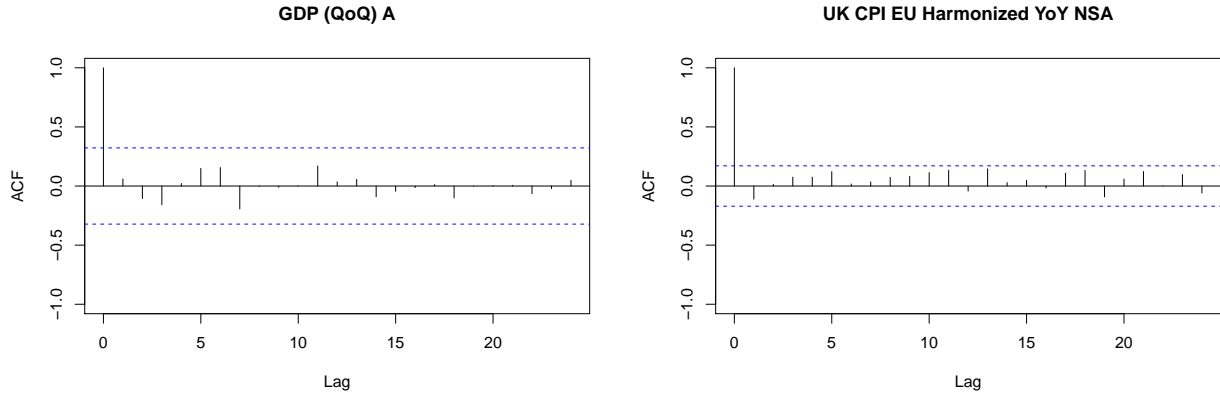


Figure 3: Autocorrelation functions of data surprises.

4.1.1 Identifying assumption

A more formal proof is presented below, setting out how the autocorrelation of individual series links to the identifying assumption in the ESI regression.

The basic regression framework incorporating the ESIs is:

$$\Delta p_t^{daily} = a + bESI_t + e_t \tag{3}$$

where Δp_t^{daily} are daily asset price changes and ESI_t is some function of individual data surprises on day t , i.e. $ESI_t = f(esi_{1,t}, \dots, esi_{K,t})$ for a set of K data surprises. By OLS:

$$\begin{aligned}\hat{b} &= \frac{\sum_t^T (\Delta p_t^{daily} - \bar{\Delta p}^{daily})(ESI_t - \bar{ESI})}{\sum_t^T (ESI_t - \bar{ESI})^2} \\ &= b + \frac{\sum_t^T e_t(ESI_t - \bar{ESI})}{SST_{ESI}}\end{aligned}\quad (4)$$

Let the denominator $\sum_t^T (ESI_t - \bar{ESI})^2 = SST_{ESI}$. SST here denotes *sum of squared totals*.

We do not observe the true ESI_t , and we estimate it as: $E\hat{S}I_t = (esi_{1,t}, \dots, esi_{K,t})(\hat{\omega}_1, \dots, \hat{\omega}_K)'$. In our actual treatment, $\hat{\omega}_k = \frac{\hat{\beta}_k}{\sum_i^K |\beta_i|}$. But for simplicity, let us treat $\hat{\omega}_k = \hat{\beta}_k$.

So $E\hat{S}I_t = esi_t \hat{\beta}'$ where esi_t is a $(1 \times K)$ vector of data surprises, and $\hat{\beta}'$ is $(K \times 1)$ vector of coefficients. $\hat{\beta}$ is estimated from a regression:

$$\Delta p^{intra} = \tilde{esi} \beta' + \varepsilon \quad (5)$$

where Δp^{intra} is $(J \times 1)$ vector of intraday price changes, and \tilde{esi} is $(J \times K)$ matrix of intraday data surprises (for simplicity we drop the constant). Note that the sample period for the the historical weights regression (5) pre-dates the sample period for main regression (3)

In general terms, $\hat{\beta}$ is some function $g(\Delta p^{intra}, \tilde{esi})$. If $\hat{\beta}$ is estimated by OLS then, $\hat{\beta}_{OLS} = (\tilde{esi}' \tilde{esi})^{-1} \tilde{esi} \Delta p^{intra}$.

Therefore, $ESI_t = esi_t \times g(\Delta p^{intra}, \tilde{esi})$. For brevity, let us write this as $esi_t g_J$. Substituting it into (4):

$$\hat{b} = b + \frac{\sum_t^T e_t (esi_t g_J - \bar{esi} g_J)}{SST_{esi_t g_J}}$$

Then:

$$\begin{aligned}E(\hat{b} | esi_{1,t}, \dots, esi_{K,t}) &= E\left(b + \frac{\sum_t^T e_t (esi_t - \bar{esi}) g_J}{SST_{esi_t g_J}} \mid esi_{1,t}, \dots, esi_{K,t}\right) \\ &= b + E\left(\frac{\sum_t^T e_t (esi_t - \bar{esi}) g_J}{SST_{esi_t g_J}} \mid esi_{1,t}, \dots, esi_{K,t}\right)\end{aligned}$$

So the key identifying assumption will be:

$$E\left(\frac{\sum_t^T e_t (esi_t - \bar{esi}) g_J}{SST_{esi_t g_J}} \mid esi_{1,t}, \dots, esi_{K,t}\right) = 0$$

In order for the above condition to be met, it boils down to the numerator being zero. In particular:

$$E(e_t(esi_t - \bar{esi})g_J|esi_{1,t}, \dots, esi_{K,t}) = 0$$

Assuming that the underlying $esi_{k,t}$ is exogenous to e_t , assuming e_t is normally distributed with mean 0, this can also be written as:

$$\begin{aligned} Cov(e_t, g_J|esi_{1,t}, \dots, esi_{K,t})(esi_t - \bar{esi}) &= 0 \\ Cov(e_t, g_J|esi_{1,t}, \dots, esi_{K,t}) &= 0 \end{aligned} \tag{6}$$

g_J consists of a historical sample pre-dating the final sample. Recall that $g_J = g(\Delta p^{intra}, \tilde{esi})$. The covariance term in (6) will be non-zero only to the extent that past price changes and economic surprises can affect future values. This depends on the persistence of the two series.

4.1.2 Comparison with other ESIs

We compare our ESI weights to those generated using OLS regression. Using intraday data, the results are similar. We also check how the results vary when using the daily change in yields as the dependent variable in (1). Under LASSO, both intraday and daily regressions identify the same data releases as being the most important. But in the intraday regression, LASSO is able to better discriminate between the relative weights on the different releases, while in the daily regression, it sets a majority of them to zero. OLS yields counterintuitive results for the daily regression.

We also compare the historically-weighted aggregate ESI to:

- Even-weighted ESI: this takes the simple average of data surprises on a given day. Data releases which do not have a release on the day are excluded from the day-average.
- Citi ESI: Citi calibrate their ESIs to the FX market reaction to data surprises. They include a ninety-day discount factor, which means that data surprises drop out of Citi's index after ninety days. That can cause their ESI to change even if there is no new data.
- Goldman Sachs MAP Index

Figure 4 plots the different ESIs. To make them comparable on one scale, we standardise them. Since the Citi and GS ESIs are already somewhat cumulated, we plot it in its raw form. Internally estimated ESIs have been cumulated. The dynamics across the four measures is broadly similar.

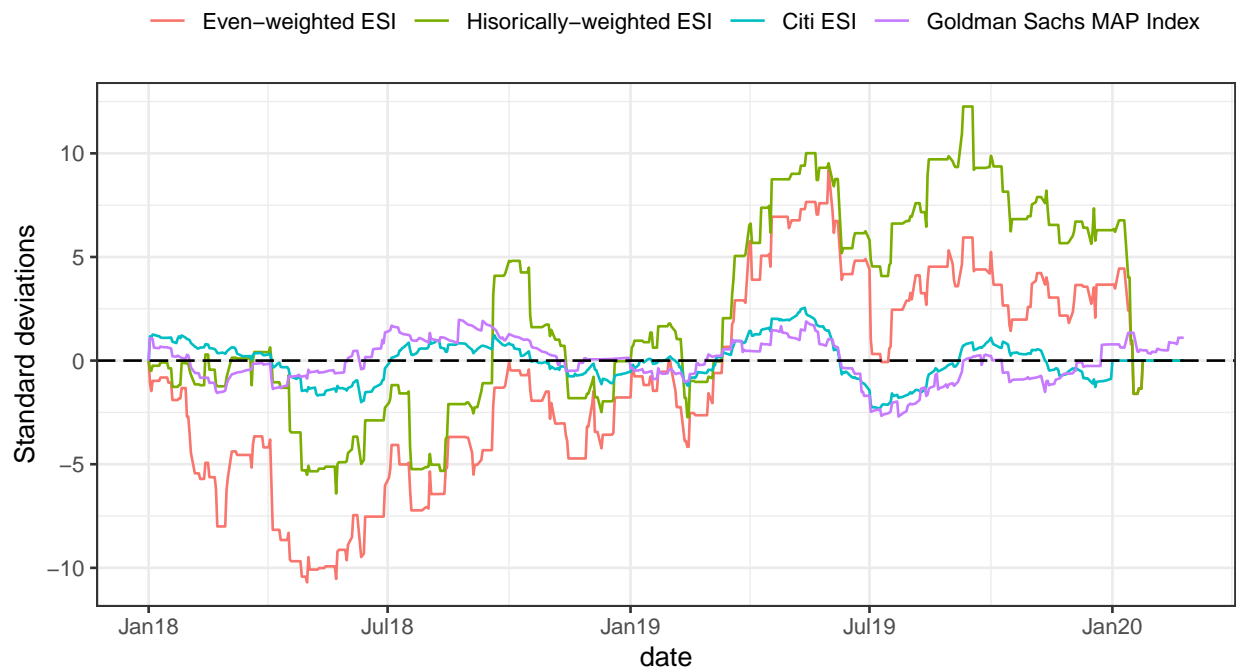


Figure 4: Cumulative ESIs