Supplementary Information for "Does Media Coverage Drive Public Support for UKIP or Does Public Support for UKIP Drive Media Coverage?"

Contents

Diagnostic information for models in Table 1 of the main text

Figure 1 displays diagnostic information for the preferred, simpler VAR model presented in Table 1 (columns 1-2), where the dependent variable is Δ*Support*. The diagram of fit and residuals suggests no visually obvious problems. The autocorrelation function (ACF Residuals) shows no evidence of serial correlation at any lag length, and the partial autocorrelation function (PACF Residuals) shows no evidence of partial autocorrelation at any lag length. Figure 2 displays diagnostic information for the preferred model presented in Table 1, where the dependent variable is Δ*Articles*. The diagram of fit and residuals suggests no visually obvious problems. The autocorrelation function (ACF Residuals) shows no evidence of serial correlation at any lag length, and the partial autocorrelation function (PACF Residuals) shows no evidence of partial autocorrelation (except possibly at lag 9).

To check autocorrelation more formally, we use the Portmanteau test for serially correlated errors, employing the `serial.test` function in the R package *VARS*. Unless otherwise noted, we use the default values for all additional arguments in the tests we report. For the Portmanteau test, we fail to reject the null hypothesis of no serial correlation for both models in Table 1 (p=.1 in both cases). To check heteroskedasticity more formally, we use the multivariate ARCH-LM test for heteroskedasticity, employing the `arch.test` function in the R package *VARS*. For both models in Table 1, the ARCH-LM test fails to reject the null hypothesis of constant error variance (p=.7 in both cases).

Finally, we check temporal stability. If the error structure shows temporal instability, the model specification would be incorrect. We use the `stability` function in the R package *VARS*, which provides confidence intervals within which we would expect the empirical fluctuation process to stay, given a temporally stable model. There are different ways to calculate the empirical fluctuation process. For simplicity, we use the default method based on the cumulative sum of OLS residuals (OLS-CUSUM). Figure 3 displays the results for the main model presented in the article. For both endogenous variables, the empirical fluctuation process is well within the bounds of a temporally stable model.

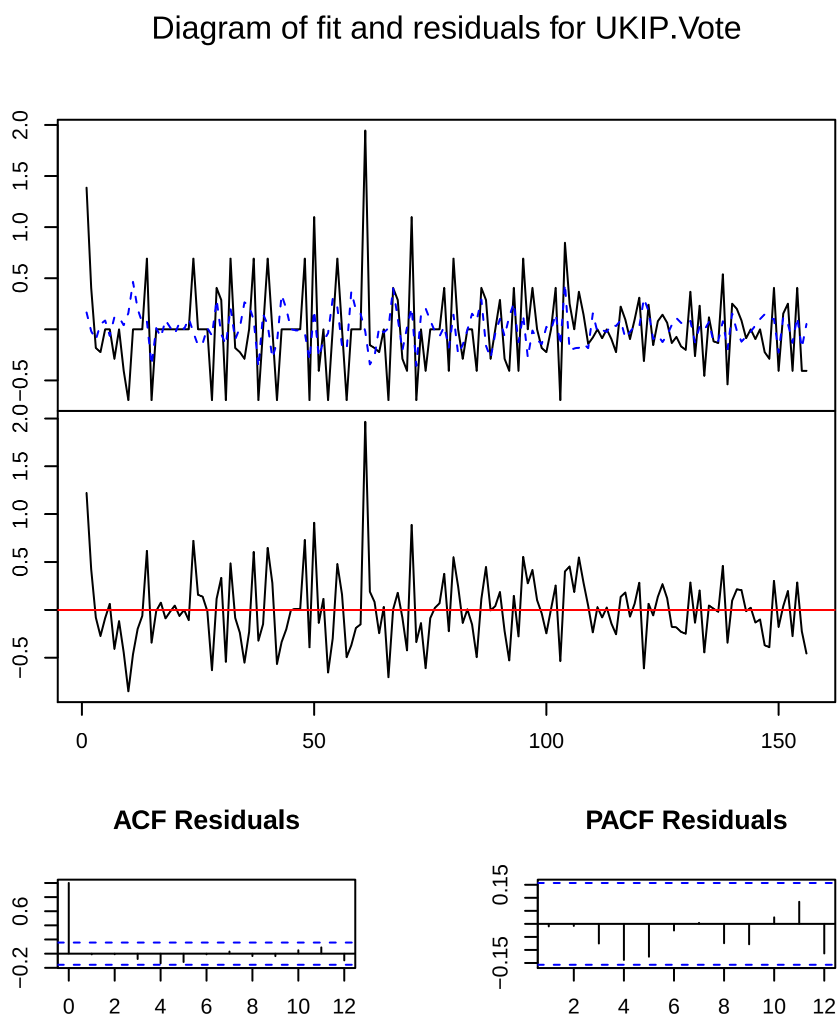


Figure 1: VAR Diagnostics for Model 1 in Table 1 (Support)

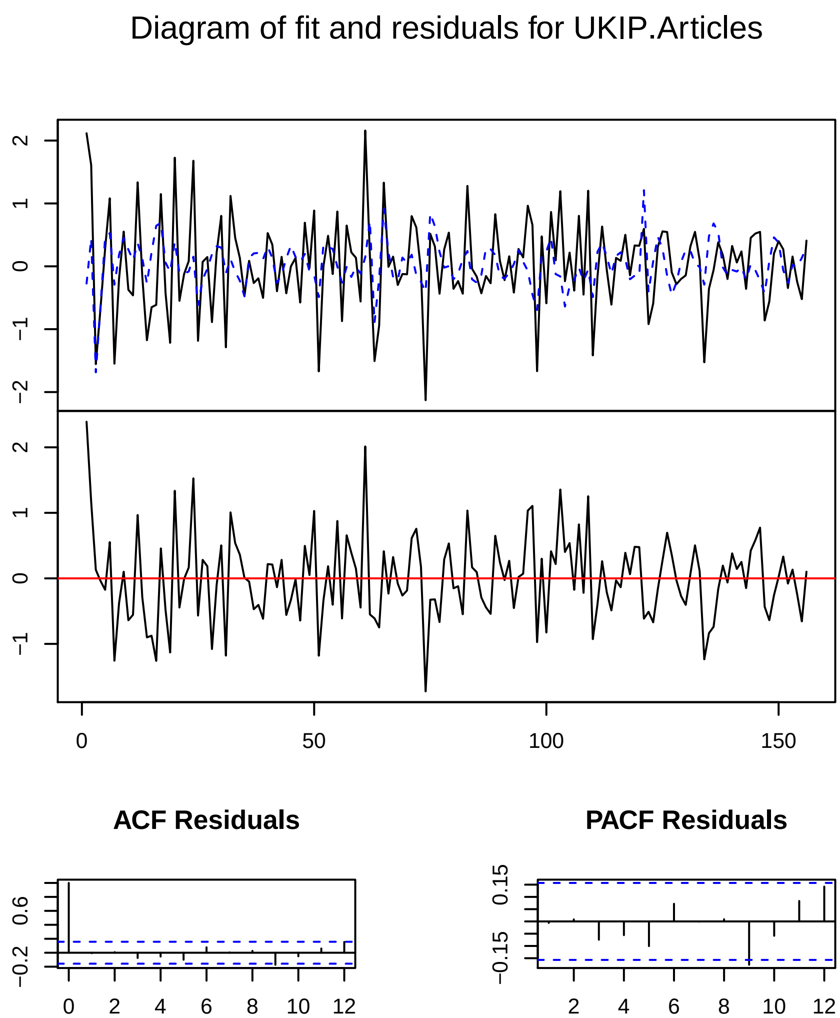
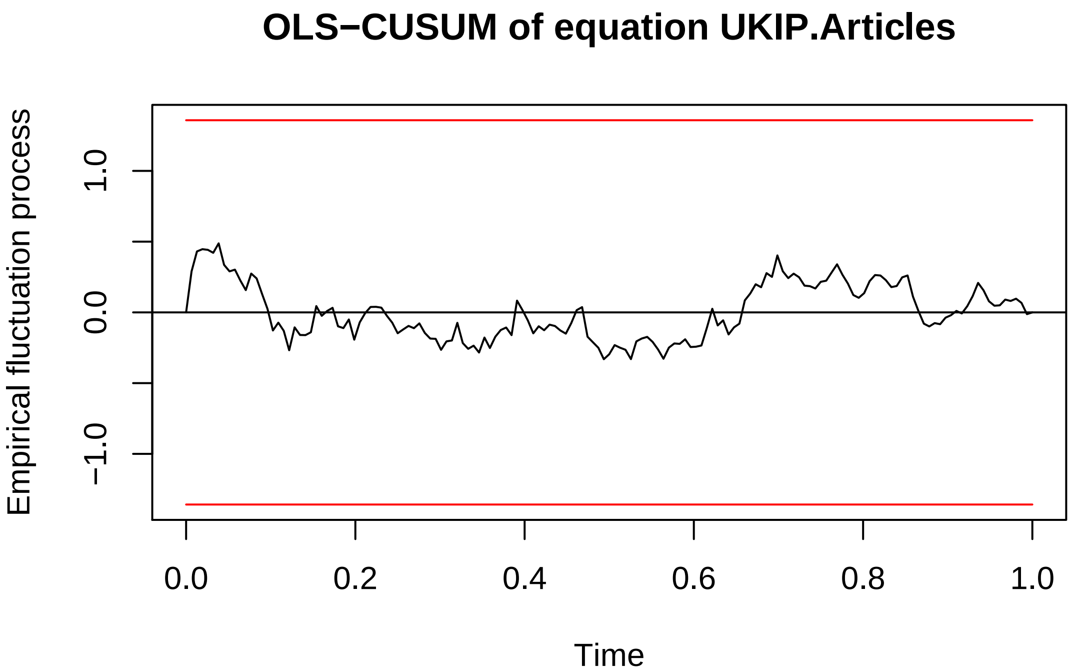


Figure 2: VAR Diagnostics for Model 1 in Table 1 (Articles)



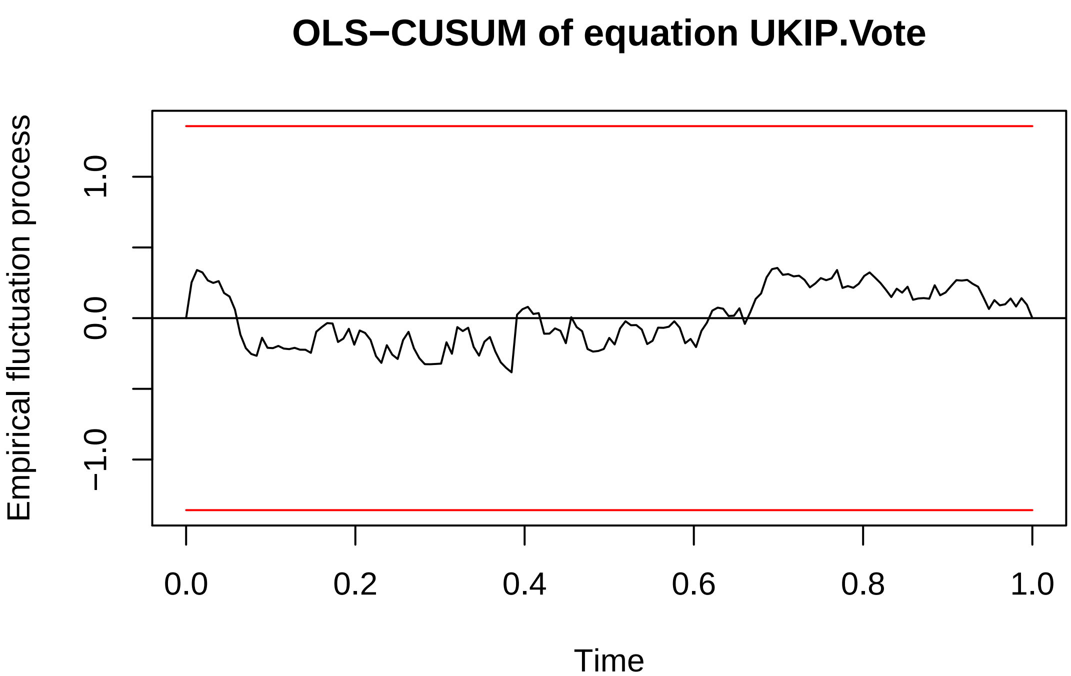


Figure 3: Temporal stability of main VAR model, Articles and Support

Figure 4 at higher resolution, from April 2012 to January 2014

Figure 4 is a "close-up" display of the plot presented in the main text's Figure 4, to ease visualization of a period we analyze qualitatively. As in Figure 4, the vertical lines indicate periods in which media coverage increase without any preceding increase in public support.

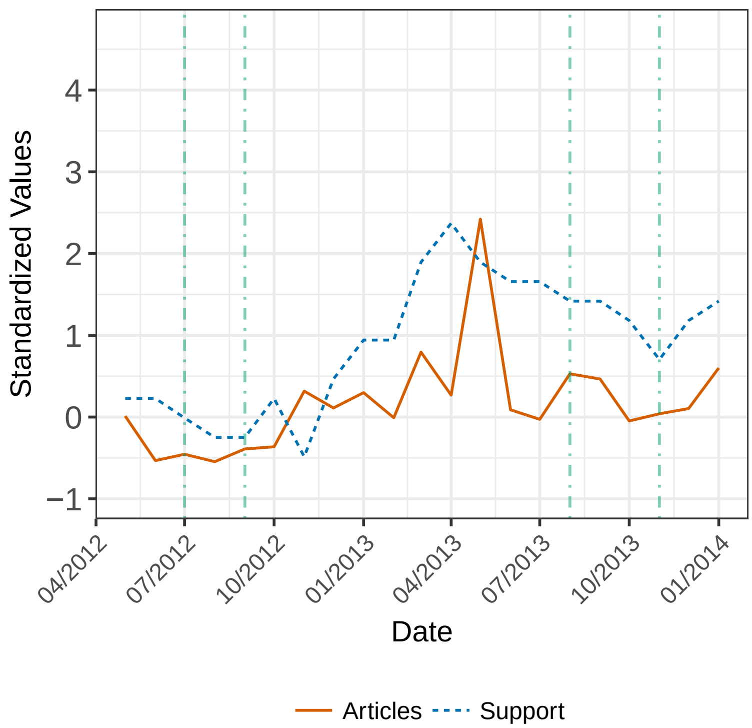


Figure 4: Standardized Time-Series with Green Dot-Dash Lines Indicating Exogenous Media Coverage, April 2012 to January 2014

Weekly data

To assess the causal dynamics of coverage and support at more frequent intervals, we also estimated our models on weekly data. We created weekly estimates of public support for UKIP by aggregating all available vote-intention polls, as maintained by Jennings and others (Ford et al. 2016; Jennings and Wlezien 2016). The polls in this dataset run from April 28, 2010 to April 17, 2017. Accordingly, we recounted the number of articles mentioning UKIP, in the same fashion described in the article, but within 7-day periods beginning April 24, 2010, the last week of April 2010, up to one week after the final poll, April 23, 2017. Because the polls are conducted irregularly, matching polls to weekly coverage counts required some attention. To construct our weekly time-series, we began by dividing the polls into consecutive, numbered weeks for each year (the number of complete seven day periods between January 1st and the given date, plus one). We then calculated the mean percentage reporting an intention to vote for UKIP across all polls in each week. We then divided our weekly coverage counts into year-weeks as we did for our weekly polling averages. We then joined each time-series by year-weeks.

Figure 5 displays the weekly time-series, standardized for comparability, analogous to Figure 1 displaying our monthly series in the main text. The final weekly sample begins May 8, 2010 and ends April 17, 2017.

Both variables become stationary after first differencing, according to the Augmented Dickey-Fuller test (p=.01 for both variables). Thus vector autoregression is estimated with first differences of each variable, as in the models presented in the main text. Optimal lag length is determined by the Akaike Information Criterion to be VAR(7). The model includes a constant and a trend term, as in the monthly model. Diagnostics suggest that using the log of each variable before differencing is again necessary to reduce heteroskedasticity and serial correlation of errors as revealed by ARCH-LM and Portmanteau tests, respectively. The model results are presented in Table 1. The coefficients and standard errors are similar to those found in the monthly models: all but the seventh lag of *Articles* has a positive

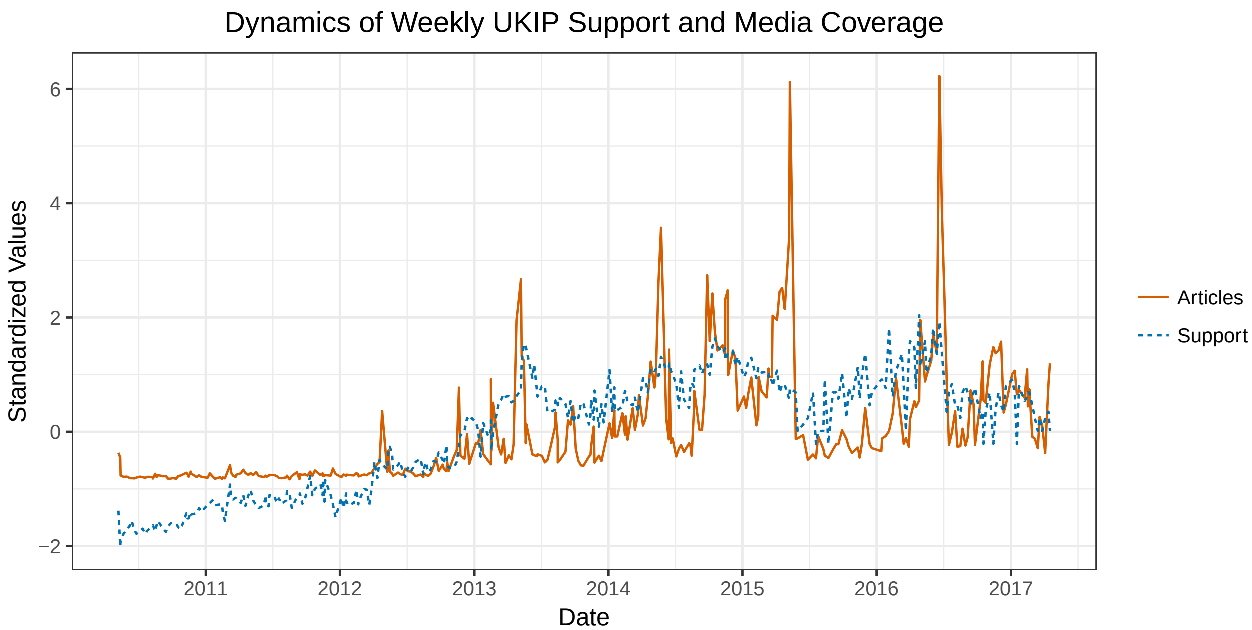


Figure 5: Weekly data for UKIP Support and Media Coverage, May 2010 to April 2017

and significant correlation with *Support*, and no lag of *Support* is correlated with *Articles*. We checked the same diagnostics as we checked for the monthly models, using the same routines. Figures 6 and 7, display fit, residuals, and correlation functions. According to the Portmanteau test, we fail to reject the null hypothesis of serially uncorrelated of errors (p=.06), although the p-value is very near the cutoff for a 95% confidence interval. However, the multivariate ARCH-LM test suggests we must reject the null hypothesis of constant error variance (p=0.0). Thus, the model violates the assumption of homoskedasticity.

To deal with heteroskedasticity, we test for Granger causality using a heteroskedasticity-consistent estimation of the covariance matrix of the coefficient estimates. Specifically, we employ White's estimator using the `vcovHC` function in the R package *sandwich*. The results are displayed in Table 2. As in the monthly models presented in the main text, we reject the null hypothesis that the coefficients for the lags of *Articles* are equal to zero (p=.032), and we fail to reject the null hypothesis that the coefficients for the lags of *Support* are equal to zero (p=.7).

Table 1: Vector Autoregression Using Weekly Measures of Coverage and Support

	Dependent variable:	
	$\Delta Support$	$\Delta Articles$
	(1)	(2)
$\Delta Articles_{t-1}$	0.036*** (0.013)	−0.340*** (0.055)
$\Delta Support_{t-1}$	−0.680*** (0.056)	0.300 (0.250)
$\Delta Articles_{t-2}$	0.044*** (0.013)	−0.260*** (0.059)
$\Delta Support_{t-2}$	−0.480*** (0.067)	0.110 (0.290)
$\Delta Articles_{t-3}$	0.043*** (0.014)	−0.097 (0.060)
$\Delta Support_{t-3}$	−0.360*** (0.068)	0.320 (0.300)
$\Delta Articles_{t-4}$	0.052*** (0.014)	−0.230*** (0.059)
$\Delta Support_{t-4}$	−0.081 (0.068)	0.290 (0.300)
$\Delta Articles_{t-5}$	0.042*** (0.014)	−0.190*** (0.061)
$\Delta Support_{t-5}$	−0.180*** (0.063)	0.071 (0.280)
$\Delta Articles_{t-6}$	0.031** (0.013)	−0.130** (0.059)
$\Delta Support_{t-6}$	−0.140** (0.060)	−0.210 (0.260)
$\Delta Articles_{t-7}$	0.020 (0.013)	−0.044 (0.055)
$\Delta Support_{t-7}$	−0.052 (0.048)	−0.420** (0.210)
Constant	0.041*** (0.014)	0.045 (0.062)
Trend	−0.0002** (0.0001)	−0.0002 (0.0003)
General Elections	−0.071 (0.120)	0.920* (0.520)
EU Elections	0.016 (0.084)	0.680* (0.370)
EU Referendum	0.150 (0.120)	1.300** (0.530)
Observations	335	335
R^2	0.370	0.190
Adjusted R^2	0.330	0.140
Residual Std. Error (df = 316)	0.120	0.520
F Statistic (df = 18; 316)	10.000***	4.100***
Note:		*p<0.1; **p<0.05; ***p<0.01

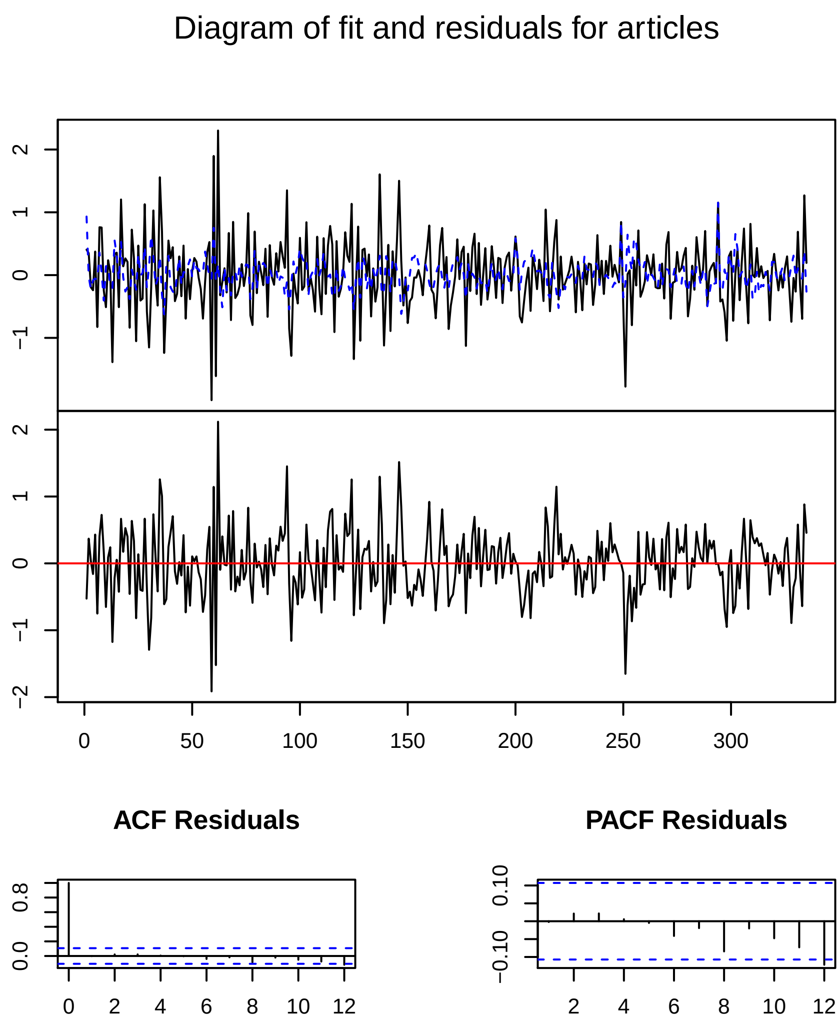


Figure 6: VAR Diagnostics for Weekly Model in Table 3 (Support)

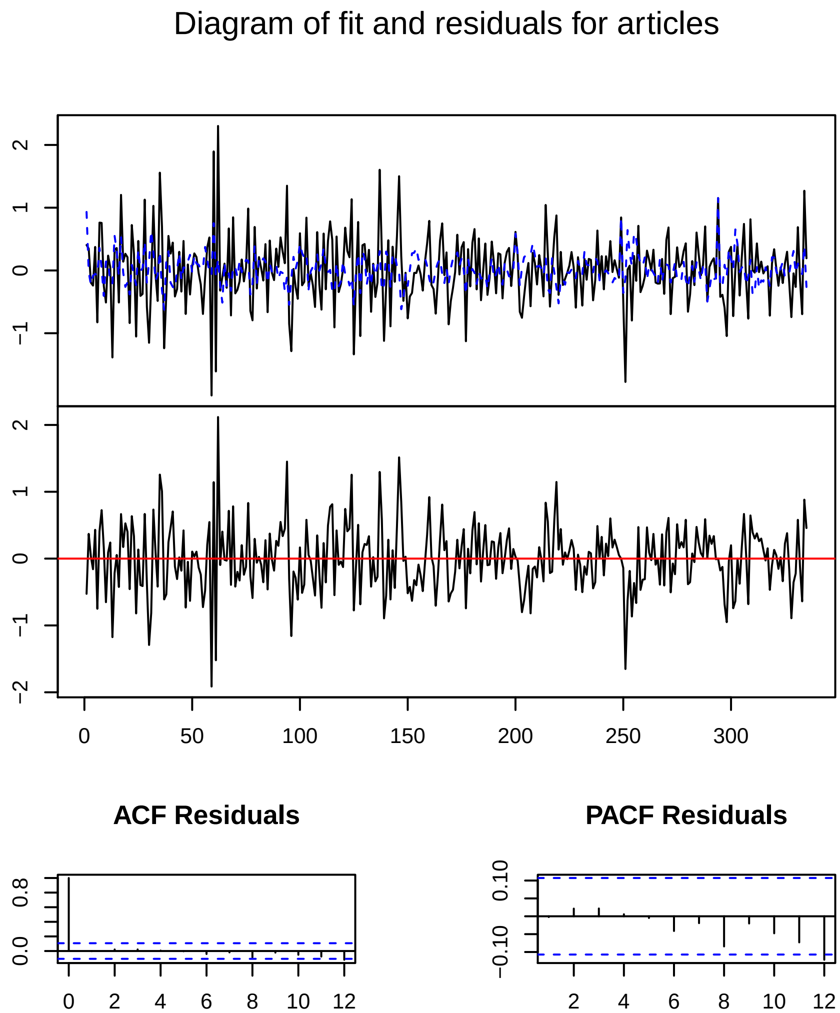


Figure 7: VAR Diagnostics for Weekly Model in Table 3: (Articles)

Table 2: Granger Causality Tests for Weekly Models

	Support (1)	Articles (2)
P-value	0.032	0.710
DF1	3	3
DF2	292	292
F-test	3.000	0.460

Number in parentheses refers to the model number in Table 3 corresponding to each causality test. For each test, the null hypothesis is that the named dependent variable is not Granger-caused by the other endogenous variable of interest (articles or support).

Alternative specifications for monthly models

We check whether the VAR results presented in Table 1 are robust to the inclusion of additional control variables. First, we check whether the results hold controlling for the vote share won by UKIP in each election. To do this, we conceptualize electoral success as a step function, in which the value of *EU Elections* and *National Elections* is equal to the vote share won by UKIP in the most recent election of each type. The value changes on the month of each election, and persists until the next election. It is also possible that various other political events are significant but ommitted variables in the original analyses. The first and most significant example is the EU referendum of June 2016. Based on our qualitative analysis, we also identified two other possible events: the lifting of work restrictions on Bulgarian and Romanian immigrants in January 2014, and David Cameron's reference to UKIP as "fruitcakes," "loonies," and "closet racists" in April 2006. Thus, we also check if our results are robust to the inclusion of these events as dummy variables (*EU Referendum*, *Work Restrictions*, and *Cameron*, respectively).

In Table 3, the first two columns display results from a VAR identical to the VAR presented in Table 1, but with the election variables changed from dummies to step functions of electoral success. Of the four coefficients for both elections and both endogenous variables, only EU vote share is correlated, negatively, with changes in support (β=-0.02, se=.013). A

Table 3: Monthly Vector Autoregressions with Additional Control Variables

	Dependent variable:			
	$\Delta Support$	$\Delta Articles$	$\Delta Support$	$\Delta Articles$
	(1)	(2)	(3)	(4)
$\Delta Articles_{t-1}$	$.110^{**}$	$-.330^{***}$	$.120^{**}$	$-.320^{***}$
	(.050)	(.087)	(.050)	(.086)
$\Delta Support_{t-1}$	$-.440^{***}$	.140	$-.440^{***}$	.150
	(.090)	(.160)	(.090)	(.160)
$\Delta Articles_{t-2}$	$.084^{*}$	$-.340^{***}$	$.087^{*}$	$-.340^{***}$
	(.050)	(.088)	(.050)	(.087)
$\Delta Support_{t-2}$	$-.240^{**}$	$-.058$	$-.240^{**}$	$-.043$
	(.096)	(.170)	(.096)	(.170)
$\Delta Articles_{t-3}$	.075	$-.220^{**}$	$.087^{*}$	$-.200^{**}$
	(.049)	(.086)	(.049)	(.086)
$\Delta Support_{t-3}$	$-.069$	$-.140$	$-.068$	$-.130$
	(.089)	(.160)	(.090)	(.150)
Constant	$.310^{*}$	.410	.020	.051
	(.180)	(.310)	(.065)	(.110)
Trend	.001	.002	$-.0002$	$-.0001$
	(.001)	(.002)	(.001)	(.001)
EU Election Step	$-.022^{*}$	$-.027$		
	(.013)	(.023)		
National Election Step	.005	$-.004$		
	(.015)	(.026)		
EU Referendum			$-.110$	.770
			(.390)	(.680)
Work Restrictions			.170	.360
			(.390)	(.680)
Cameron			$.730^{*}$	1.500^{**}
			(.390)	(.680)
Observations	156	156	156	156
R^2	.160	.180	.160	.210
Adjusted R^2	.110	.140	.100	.150
Note:				*p<0.1; **p<0.05; ***p<0.01

possible interpretation of this result is that UKIP's successful entry into EU parliamentary politics led to an effect of "lost innocence," in which UKIP's outsider, anti-establishment appeal decreased with its increased involvement in the European political system. Also in Table 5, columns 3-4 display results from the VAR when we instead include the dummy variables for notable events. Cameron's comments in April 2006 are positively and significantly associated with changes in UKIP support (β=0.73, se=.39) and media coverage (β=1.51, se=.68).

Most importantly for our hypotheses, the basic pattern of causal ordering identified by our main models remains unchanged. After controlling for each set of potential confounders, all but one of the lags of *Articles* are positively and significantly associated with *Support* (only the third lag of Articles is insignificant when controlling for electoral success). As we find in our original models, changes in support do not predict future changes in coverage after inclusion of these additional control variables. Finally, results from Granger-causality tests (displayed in Table 4), are also consistent with our original findings: it is highly unlikely that the correlation of all lags of *Articles* on *Support* is equal to zero (p=.026 after controlling for electoral success, p=.019 after controlling for notable events), but more likely than not that the correlation of all lags of *Support* on *Articles* is equal to zero (p=.55 after controlling for electoral success, p=.56 after controlling for notable events). Overall, our original inferences appear unlikely to be artefacts of election outcomes or notable events.

Table 4: Granger Causality Tests for Models with Additional Controls

	Support (1)	Articles (2)	Support (3)	Articles (4)
P-value	0.026	0.550	0.019	0.560
DF1	3	3	3	3
DF2	292	292	290	290
F-test	3.100	0.700	3.400	0.690

Number in parentheses refers to the model number in Table 5 corresponding to each causality test. For each test, the null hypothesis is that the named dependent variable is not Granger-caused by the other endogenous variable of interest (articles or support).

Coverage of party leaders

Does the causal ordering between UKIP support and media coverage also hold when we consider media coverage of the party leader instead of the party itself? To consider this possibility, we create an alternative version of the variable *Articles*, which is equal to the number of articles mentioning the surname of the leader of UKIP in any given month. In all other respects, the data is collected in the same fashion outlined in the main text. Table 5 below shows who was party leader throughout the study period.

Table 5: UKIP Leaders by Date

Leader	Date range of party leadership
Roger Knapman	05/10/2002 – 27/09/2006
Nigel Farage	12/09/2006 – 27/11/2009
Lord Pearson	27/11/2009 – 02/09/2010
Jeffrey Titford	06/09/2010 – 05/11/2010
Nigel Farage	05/11/2010 – 16/09/2016
Diane James	16/09/2016 – 4/10/2016
Nigel Farage	5/10/2016 – 28/11/2016
Paul Nuttall	28/11/2016 - present

To construct our time-series, we translate these party leadership periods into a series in which each calendar month is associated with the person who was leader for most of that month. In most cases this is straightforward. In the case of Diane James, she was leader for only a short period in the end of September and beginning of October, 2010. Farage was leader for most of October and September 2016, so in our time-series we consider Farage the leader during those months.

To test whether the results hold for coverage of party leaders, we re-estimate a series of

VARs in the same fashion as previously, including iteratively the same battery of control variables. However, we note that of all UKIP's leaders, Nigel Farage is categorically distinct. Because Farage likely played a fundamentally unique role in the nexus of media coverage and support for UKIP, attracting incomparably intense quantities and qualities of media coverage as well as enthusiasm from UKIP supporters, we would expect there to be a unique "Farage effect" distinct from any potential party leader effect. For this reason, we also control specifically for the months in which Farage is leader. The variable *Farage* is equal to the number of articles mentioning Farage in each month. This allows us to distinguish the effect of changes in Farage's coverage at time t on the dependent variable at time t, from the general effect of coverage of UKIP's leaders. As the results in Table 9 affirm, Nigel Farage's leadership of UKIP has consistently positive and significant effects on both coverage and support, evidencing this argument and justifying the inclusion of Farage's coverage counts as a separate control variable.

The results displayed in Table 6 are broadly consistent with our results regarding party coverage, although the evidence is somewhat weaker. In these models, *Articles* has a consistently significant, positive correlation with future values of *Support*, but only at time *t-2*. Again, in no case do we find evidence that past values of *Support* predict future values of *Articles*. Figures 8 and 9, displaying fit, residuals, and correlation functions, are substantively similar to those produced for the main monthly models, showing no obviously apparent serial correlation or heteroskedasticity. Formal diagnostics for the first baseline model suggest we fail to reject the null of serially uncorrelated errors (p=.1) and reject the null hypothesis of constant error variance (p=.02). Here again, to test our hypotheses given violation of the homoskedasticity assumption requires the heteroskedasticity-consistent Granger-causality tests we explained above, the results of which are displayed in Table 7. The results are again broadly consistent with our results regarding party coverage. In all three sets of models, *Articles* Granger-cause *Support* at a 90% confidence level (p=.022; p=.027; p=.084). Figure 10 displays the temporal stability of the model. Overall, the data are broadly consistent with a model in which public support is partially a function of past media coverage but media coverage is not a function of past public support, even if media coverage is alternatively conceptualized as coverage of party leaders.

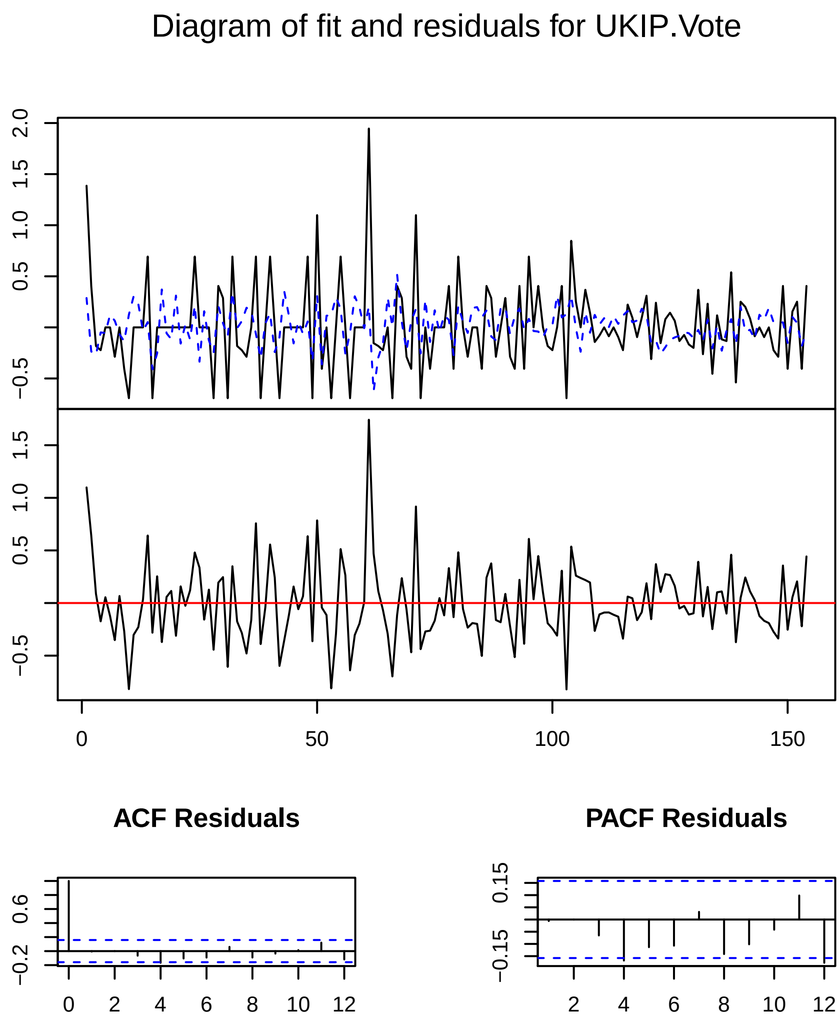


Figure 8: VAR Diagnostics for VAR with Leader Coverage (Support)

Table 6: Vector Autoregressions, Party Leaders

	Dependent variable:					
	$\Delta Support$	$\Delta Articles$	$\Delta Support$	$\Delta Articles$	$\Delta Support$	$\Delta Articles$
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta Articles_{t-1}$	.064*	−.340***	.060*	−.360***	.050	−.380***
	(.035)	(.068)	(.036)	(.068)	(.038)	(.072)
$\Delta Support_{t-1}$	−.390***	.200	−.380***	.190	−.380***	.230
	(.086)	(.160)	(.084)	(.160)	(.084)	(.160)
$\Delta Articles_{t-2}$	.081**	−.310***	.081**	−.320***	.077*	−.350***
	(.035)	(.067)	(.035)	(.067)	(.039)	(.076)
$\Delta Support_{t-2}$	−.160*	−.051	−.170*	−.046	−.180*	−.007
	(.089)	(.170)	(.088)	(.170)	(.090)	(.170)
$\Delta Articles_{t-3}$	.028	−.190***	.029	−.170**	.029	−.220***
	(.035)	(.068)	(.035)	(.067)	(.039)	(.076)
$\Delta Support_{t-3}$	.022	−.073	.022	−.098	−.020	−.065
	(.085)	(.160)	(.085)	(.160)	(.089)	(.170)
$\Delta Articles_{t-4}$					.006	−.056
					(.036)	(.069)
$\Delta Support_{t-4}$					−.110	−.005
					(.083)	(.160)
Constant	.270	.440	.280	.470	.110	.160
	(.180)	(.340)	(.180)	(.340)	(.180)	(.350)
Trend	.001	.002	.001	.002	.001	.002
	(.001)	(.002)	(.001)	(.002)	(.001)	(.002)
EU Election Step	−.020	−.028	−.020	−.029	−.011	−.010
	(.013)	(.024)	(.013)	(.025)	(.013)	(.025)
National Election Step	.010	.001	.008	−.004	.001	−.021
	(.015)	(.028)	(.014)	(.028)	(.015)	(.028)
Unemployment	.047	.054			.130	.190
	(.310)	(.590)			(.310)	(.600)
Immigration	−.003	−.009			−.001	−.008
	(.007)	(.014)			(.007)	(.014)
EU Referendum			−.190	.870	−.200	1.000
			(.390)	(.760)	(.400)	(.760)
Work Restrictions			.022	−.028	.065	.088
			(.390)	(.740)	(.390)	(.750)
Cameron			.490	.073	.530	.200
			(.400)	(.760)	(.390)	(.750)
$\Delta Farage$	.110***	.590***	.100***	.580***	.097***	.550***
	(.035)	(.066)	(.036)	(.068)	(.035)	(.068)
Observations	154	154	156	156	153	153
R^2	.200	.560	.210	.560	.210	.570
Adjusted R^2	.130	.520	.130	.520	.120	.510
Note:						*p<0.1; **p<0.05; ***p<0.01

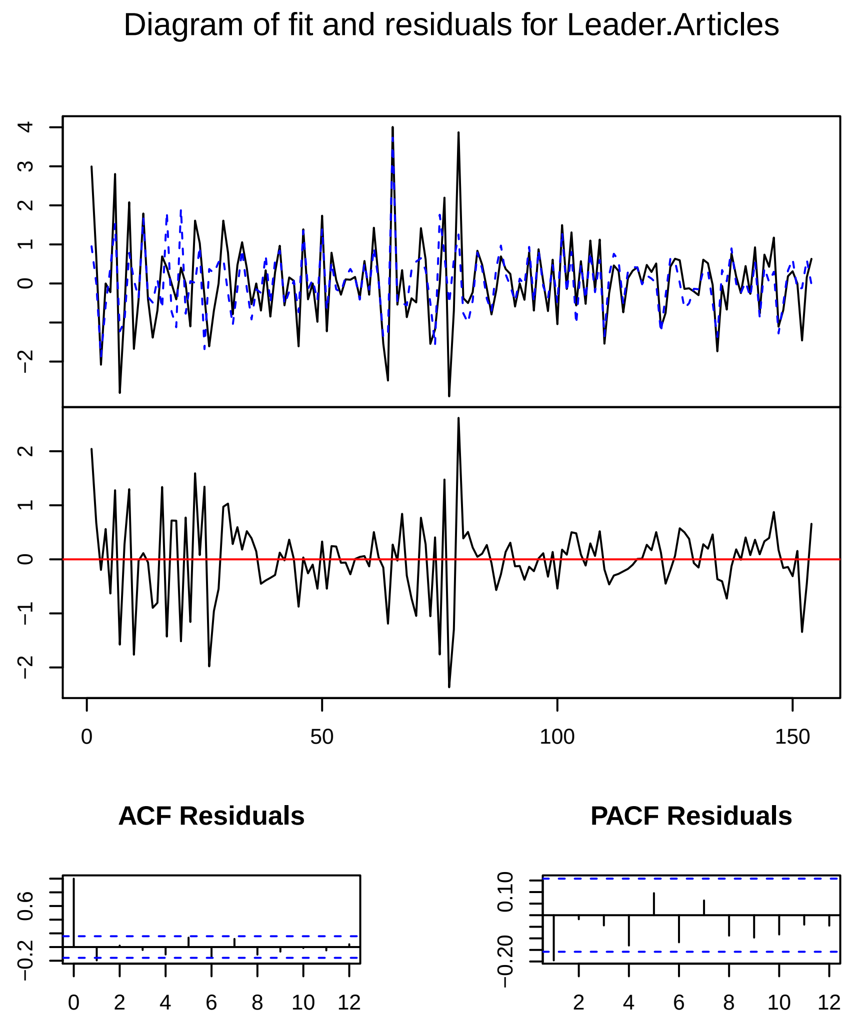


Figure 9: VAR Diagnostics for VAR with Leader Coverage (Articles)

Table 7: Granger Causality Tests, Monthly Party Leader Coverage

	Support (1)	Articles (2)	Support (3)	Articles (4)	Support (5)	Articles (6)
P-value	0.022	0.360	0.027	0.360	0.084	0.480
DF1	3	3	3	3	4	4
DF2	282	282	284	284	270	270
F-test	3.300	1.100	3.100	1.100	2.100	0.870

Number in parentheses refers to the model number in Table 8 corresponding to each causality test. For each test, the null hypothesis is that the named dependent variable is not Granger-caused by the other endogenous variable of interest (articles or support).

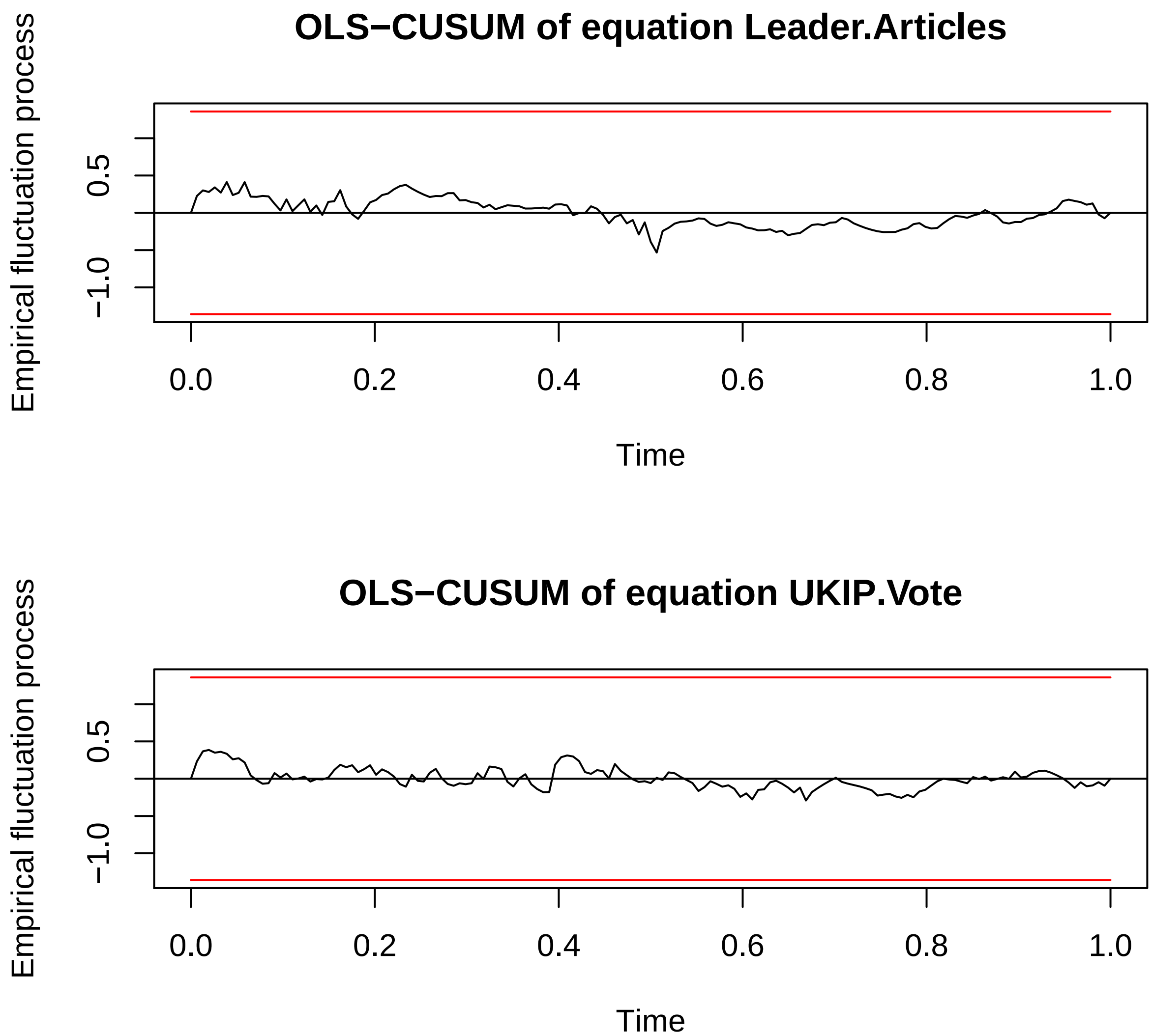


Figure 10: Temporal stability of VAR model, Leader Coverage and Support