Stuart N. Soroka, Dominik A. Stecula, and Christopher Wlezien. "It's (Change in) the (Future) Economy, Stupid: Media, Public Opinion, and Economic Indicators," *American Journal of Political Science.*

Supplementary Information

Appendix A: Measuring Media Tone

Our work above focuses on a relatively simple measure of media tone: the number of positive words minus the number of negative words, divided by the total number of words in the article. The measure is calculated at the article level, then; and when multiplied by 100, the measure captures the percentage-point difference between positive and negative words in an article. The monthly figures are the average tone across all articles for that month.

The calculation itself is very simple, but distinguishing positive and negative words is of course no mean task. We rely here on the Lexicoder Sentiment Dictionary (LSD), consisting of general (not subject-specific) lists of roughly 3000 positive and 3000 negative words. The dictionary has been subjected to testing elsewhere (Young and Soroka 2012; Soroka 2012); we will not test it further here, but rather note that the dictionary has been shown to produce reliable measures of tone for both economic and non-economic newspaper content.

It is worth noting that zero is not the neutral point for our measure of net tone. An equal number of positive and negative words (or the total absence of any positive or negative words) need not seem to human readers to be neutral — it might be that we require a few positive words in order for an article to seem neutral, for instance; indeed, testing elsewhere (see above) suggests that this is the case. We are not interested in the neutral point here, however — we care only about movement over time. So we do not attempt to center our series on a human-defined neutral point (as in Soroka 2012); we simply use tone exactly as the LSD produces it.

It is also worth noting that our measure of tone is just one of several possibilities. One alternative is the Coefficient of Imbalance (*CI*), drawn from work by Janis and Fadner (1943), and calculated as follows:

$$Cf = (f^2 - fu) \ / \ rt, \text{ where } f \ > u \ ;$$
$$Cu = (uf - f^2) \ / \ rt, \text{ where } f < u \ ; \text{ and}$$
$$CI = Cf - Cu \ ,$$

where f is the number of favorable items (e.g., words, phrases, articles), u is the number of unfavorable items, r is the number of relevant items and t is the total number of items (so r includes just the items categorized as positive or negative, while t includes all items, including those categorized as neutral). *Cf* is the coefficient of favorable imbalance, and *Cu* is the coefficient of unfavorable imbalance. *CI* is equal to either *Cf* or *Cu*, depending on whether f or u is greater. The advantages of

this measure are discussed in some detail in Janis and Fadner (1943); the measure has been used with some success in political communication as well (Goidel et al 2010; Belanger and Soroka 2012). That said, the *CI* is very highly correlated with the basic net tone measure (in this dataset, at .99 in levels). We thus see no particular advantage here to the *CI* approach, as opposed to our more straightforward *Net Tone* measure.

Another possibility is to rely on a set of words specific to the economic domain that quite clearly reflect either positive or negative trends. There are some tone dictionaries designed for financial news in particular, for instance one developed by Loughran and McDonald (2011). This is also the approach used in the *Economist*'s R-word index, for instance — an index of the number times the word recession appears in articles in the *New York Times* and the *Washington Post*. (For details see http://www.economist.com/node/566293?Story_ID=566293.) Indeed, it is relatively easy to generate an R-word index from our data — though our database includes not all articles, but just those on major economic issues.

There may be advantages to considering an R-word-style index alongside our measures of media tone. In part, doing so would help confirm that our *Net Tone* measure is capturing what we believe it is capturing. We would also like to try to improve upon the R-word index, however. So we generate a count of the word "recession," but we also generate a second, slightly expanded index that includes the following four words: "decline," "recession," "depression," and "crisis." For the time being, we will refer to it as the Angst Index (since it includes words that capture not just poor economic conditions, but worry). Note that the Angst Index could not work if we were searching all news content — the use of the word decline, or crisis, would vary across subjects, and indeed would not reliably indicate discussion of the economy at all. (It is for this reason that none of these words is already included in the LSD, of course.) But within economic articles, each of these four words quite clearly suggests negative economic trends.[1]

Figure A1 illustrates each of four options where measuring media tone is concerned. Table A1 includes pairwise correlations between the measures. It is very clear that the differences between our Net Tone measure and the CI measure are marginal. Our expanded index is also only marginally different from the R-word index; indeed, it appears as though most of the variation is generated by the word "recession" anyway. We do not wish to under-state the relationship between the tone and word-count measures. Figure A2 re-plots the Net Tone measure alongside a reversed expanded index, and illustrates the relatively strong relationship between

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[1] Note that it is also possible to generate tone for specific topics in economic news; indeed, our data include measures for volume and tone for a wide range of subtopics, including productivity, employment, inflation, home sales, inequality, interest rates, commodity prices, money supply, etc. We do not explore these here; though forthcoming work may look in particular at the employment and inflation subtopics

the two approaches. The word counts essentially capture the negative side of our
tone measure (though with some differences).

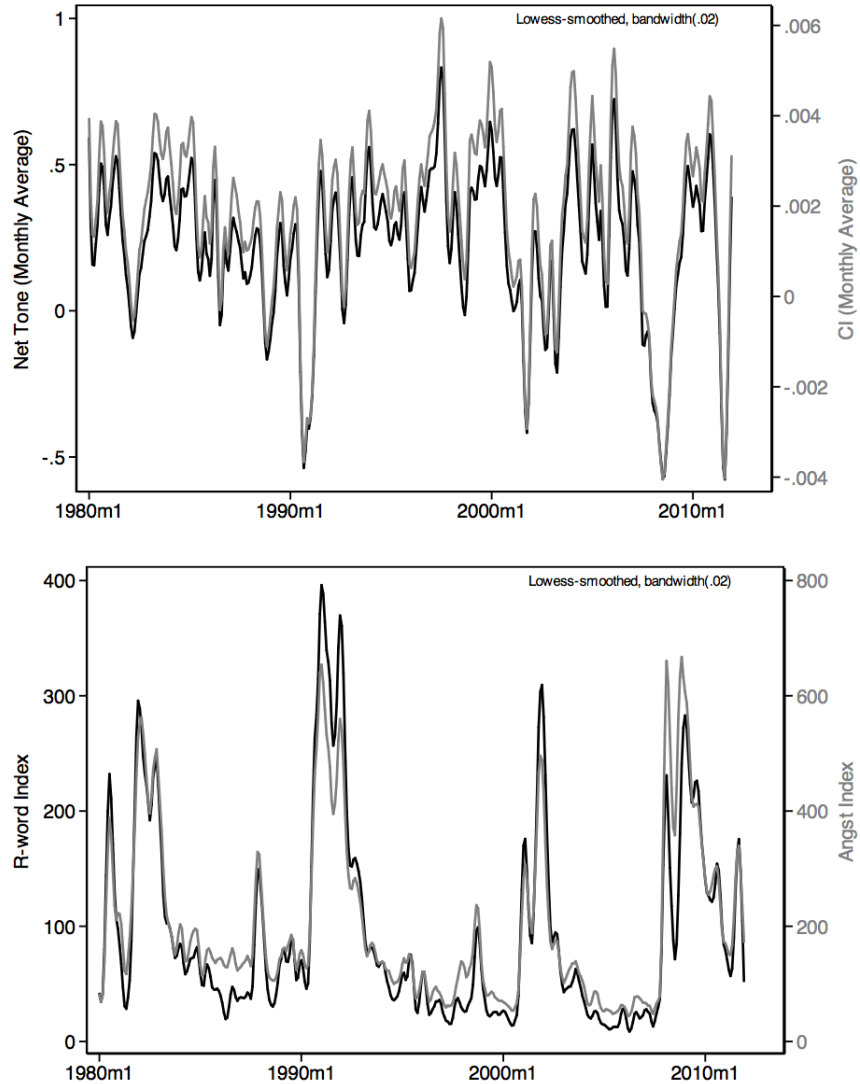Figure A1. Alternative Measures of Tone in Economic News

Table A1. Pairwise Correlations between Media Measures

	Net Tone	CI	R-word
CI	0.995***		
R-word Index	-0.323**	-0.335**	
Angst Index	-0.405***	-0.415***	0.937***

* p < .05; ** p < .01; *** p < .001.

Figure A2. Net Tone and the Angst Index
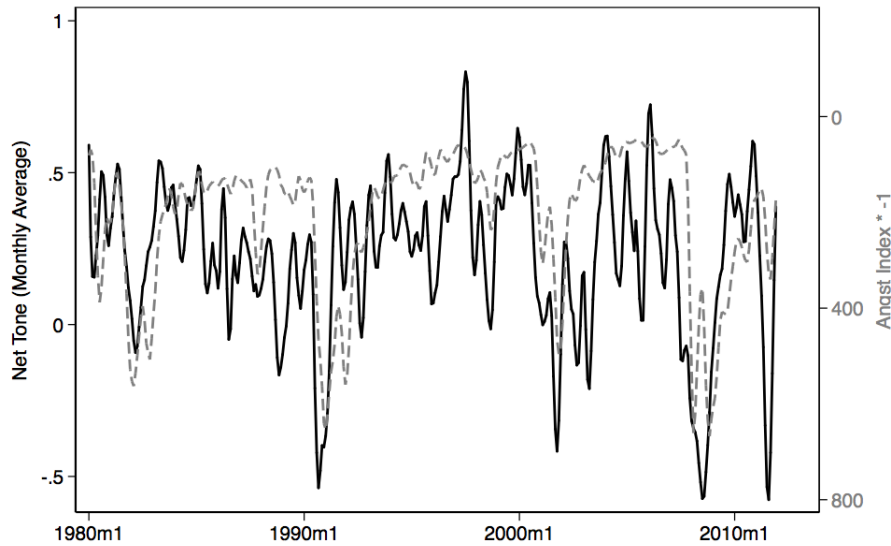

Table A2. Pairwise Correlations between Media Measures,
the economy, and public evaluations

	Leading Indicators	Economic Sentiment
Net Tone	0.148*	0.377***
CI	0.169**	0.377***
R-word	-0.610***	-0.019
Angst Index	-0.596***	-0.070

a p < .10; * p < .05; ** p < .01; *** p < .001.

Table A2 presents pairwise correlations between each of the four media measures and each of three indicators: (1) the leading economic indicators series, and (2) the MCSI sociotropic prospective economic sentiment index. (All series are described in the text above.) The correlations between the word counts and the economic indicators are striking — clearly, there is a strong (negative) relationship between the appearance of the word "recession" and trends in the economy. But the link between media and public opinion is not in evidence at all where the word counts are concerned. Use of the word "recession" may well signal downturns in the economy; but public perceptions of the economy appear to be driven by other words as well. Economic sentiment is strongly positively correlated with tone.

It is for these reasons that we rely on our relatively simple measure of Net Tone above: it is barely different from the more sophisticated *CI* measure, and diagnostics suggest that while word-count measures are powerful signals of economic trends, opinion is more strongly correlated with (and perhaps responsive to) broader measures of media content.

Appendix B: Tests of Stationarity

Appendix Table B1 shows tests of stationarity, both Dickey-Fuller and augmented Dickey-Fuller, for all the time series used in the analyses above.

Table B1. Tests of Stationarity

	Dickey-Fuller		Augmented Dickey-Fuller	
	Lagged DV coefficient [a]	Test Statistic [b]	Lagged DV coefficient [a]	Test Statistic [b]
Economy				
Leading Indicators	-.010 (.008)	-1.279, p=.639	-.016 (.006)	-2.478, p=.121
Coincident Indicators	-.012 (.009)	-1.451, p=.558	-.017 (.008)	-2.166, p=.219
Lagging Indicators	-.022 (.011)	-2.056, p=.263	-.029 (.010)	-2.869, p=.049
Media				
Count	-.192 (.030)	-6.397, p=.000	-.142 (.030)	-4.679, p=.000
Tone	-.485(.044)	-11.073, p=.000	-.389 (.049)	-7.879, p=.000
Economic Evaluations				
Retrospective	-.032 (.013)	-2.460, p=.125	-.039 (.013)	-3.013, p=.034
Prospective	-.148 (.027)	-5.553, p=.000	-.138 (.028)	-4.944, p=.000

[a] Cells contain OLS coefficients with standard errors in parentheses.
[b] Cells contain Dickey-Fuller or augmented Dickey-Fuller (with one lag) test statistics with p-values.

Dickey-Fuller tests reject the null hypothesis of a unit root for the media and public opinion series, which tells us that effects on these series decay, and particularly for media coverage, especially tone. The economic indicators series, by contrast, are non-stationary, which implies that economic changes do not decay but instead persist. These differences have consequences for our analysis and interpretation of the effects of the variables, as discussed above.

Appendix C: Measures of the Past, Present and Future Economy

Items included in the Conference Board indices have changed over time. The most recent revision was in 2001. Since that time, indices have been as follows:

Lagging: Average duration of unemployment; Inventories to sales ratio, manufacturing and trade; Change in labor cost per unit of output, manufacturing (%); Average prime rate charged by banks (%); Commercial and industrial loans outstanding; Consumer installment credit outstanding to personal income ratio; Change in consumer price index for services (%)

Current: Employees on nonagricultural payrolls; Personal income less transfer payments; Index of industrial production; Manufacturing and trade sales

Leading: Average weekly hours, manufacturing; Average weekly initial claims for unemployment insurance; Manufacturers' new orders, consumer goods and

materials; Vendor performance, slower deliveries diffusion index; Manufacturers' new orders, nondefense capital goods; Building permits, new private housing units; Stock prices, 500 common stocks; Money supply, M2; Interest rate spread, 10-year Treasury bonds less Federal funds (%); Index of consumer expectations (excluded in our version; see discussion in text).

We note that although all components are measured concurrently, they have been shown to reflect either the past, current, or future economy. (See the discussion in the text.) We can nevertheless provide a basic illustration here. Appendix Table C1 shows bivariate correlations between changes in each of the three indices and changes in the unemployment rate (seasonally adjusted, from the FRED), from unemployment four months ago (*t-4*) to unemployment four months into the future (*t+4*). Results are as we should expect if the Conference Board indicators do indeed capture the past, present and future economy: the highest correlations between the lagging indicators series and unemployment occur with past unemployment (*t-1* through *t-4*); the highest correlations between the concurrent indicators series and unemployment occur with current unemployment (*t-1* through *t+1*); and the highest correlations between the leadings indicators series and unemployment occur with future unemployment (*t+1* through *t+4*).

Table C1. Bivariate Correlations: Conference Board Indicators and Unemployment

In Changes

Unemployment at...	EI, lag	EI, co	EI, lead
t-4	-0.285*	-0.192*	0.006
t-3	-0.235*	-0.320*	-0.098
t-2	-0.308*	-0.277*	-0.135*
t-1	-0.201*	-0.346*	-0.163*
t	-0.121	-0.466*	-0.314*
t+1	-0.033	-0.403*	-0.318*
t+2	0.052	-0.339*	-0.357*
t+3	0.030	-0.306*	-0.382*
t+4	0.081	-0.263*	-0.293*

N varies from 379 to 384, depending on data availability. * $p < .01$.

The Conference Board has of course conducted much more careful diagnostics; past work also shows that the leading indicators series predicts future changes in real per capita disposable income as well (Wlezien and Erikson 1996). Table C1 nevertheless is a useful demonstration of the extent to which the indicators used here do indeed capture changes in the unemployment rate at different times.

Another test of the degree to which the indices capture the past, present and future economy is to substitute other economic measures, at various lags and leads,

in our models of media content. Table C2 offers one example: a model of changes in media volume, and then tone, regressed on lagged levels of the dependent variable alongside changes in unemployment, ranging from *t-2* to *t+2*.

Table C2. Responsiveness of Media to Lagging, Coincident, and Leading Changes in Unemployment

EI Type:	DV: Δ in...	
	Count	Tone
DV $_{t-1}$	-.255***	-.558***
	(.032)	(.047)
Δ Unemp $_{t-2}$	3.824	-.048
	(6.143)	(.090)
Δ Unemp $_{t-1}$	22.774***	-.063
	(6.015)	(.090)
Δ Unemp $_t$	2.645	-.065
	(5.880)	(.089)
Δ Unemp $_{t+1}$	14.365*	-.187*
	(5.991)	(.092)
Δ Unemp $_{t+2}$	9.002	-.310***
	(6.103)	(.093)
Constant	19.498***	.125***
	(2.623)	(.018)
N	379	379
Rsq	.182	.287

* $p < .05$; ** $p < .01$; *** $p < .001$. Cells contain OLS coefficients with standard errors in parentheses. *Count* is the total number of articles; *Tone* is net tone based on the LSD.

Results suggest that tone reflects future rather than past or current changes in unemployment; the volume of coverage is partly affected by past changes in unemployment, but the future economy matters as well. In both cases, then, results are as we see using Conference Board indicators. The table thus makes clear that findings in Tables 2 and 3 are not dependent on the Conference Board indicators; they also serve as further evidence, albeit indirectly, that Conference Board indicators do indeed reflect the past, present and future economy (or in this specific case, past, present and future changes in the unemployment rate).

Appendix D: Past Studies of Media Coverage of the Economy

The text makes several references to past studies of media coverage of the economy, which are listed in Appendix Table D1. Note that studies are mixed in their use of levels or changes. Some rely at least in part on Leading Economic Indicators series; though many use lagging and coincident indicators, either in the form of an index or

individually. To be clear: we see all this work as making a valuable contribution to what we know about media coverage of the economy. Our point here is just that this work has largely tended to assume the importance of one economic measure or another. Our findings illustrate the necessity, in terms of better understanding the nature of media content, of testing the various possibilities.

	Operationalization of...	
Study (chronologically)	..the economy	... news media content
Harrington 1989	Inflation (Changes and Levels); Unemployment (Changes and Levels); Real Changes in GNP (Changes and Levels)	Two measures of three major network news programs (CBS, ABC, and NBC): number of seconds of coverage given to the economic statistics; dummy of whether or not the report on the economic statistic leads the evening news program (Levels)
Stevenson et al 1994	Leading Economic Indicators (Levels)	NYT articles referencing "recession" (Levels)
Blood and Phillips 1995	Leading Economic Indicators (Levels)	NYT "recession" headlines (Levels)
Goidel and Langley 1995	Inflation (Levels and 12 mo. Changes); Unemployment (Levels and 12 mo. Changes); GDP (Levels and 12 mo. Changes)	Volume and tone of economic stories per month on the front page of the NYT (Levels)
Blood and Phillips 1997	Leading Economic Indicators (Levels)	NYT economic headlines (Levels)
Wu et al 2002	Leading Economic Indicators (Levels)	NYT "recession" headlines (Levels)
Hester and Gibson 2003	Inflation (Changes); Unemployment (Changes); Dow Jones Industrial Average (Changes)	Volume and tone of economic stories on the front page of the NYT and in the ABC World News Tonight broadcasts (Levels)
De Boef and Kellstedt 2004	Lagging and Coincident Economic Indicators and Inflation (Quarterly growth rates); unemployment (Levels)	NYT Section A economic stories content analyzed for source and tone (Levels)

| | Operationalization of. . . | |
Study (chronologically)	..the economy	. . . news media content
Doms and Morin 2004	Several including S&P 500 (% change month to month); gasoline prices (Changes); payroll employment (Changes)	3 indices constructed of top 30 US newspapers, weighted by circulation and pertaining to three developments: recession, layoff and economic recovery (Levels)
Fogarty 2005	Index of Coincident Economic Indicators (Changes); Unemployment (Changes); Inflation (Changes)	Volume and tone of economic stories per month on the front page of the NYT (Levels)
Soroka 2006 (2012, 2014)	Unemployment (Changes); inflation (Changes); Leading Economic Indicators (lagged Changes)	Volume and tone of media content (Levels)
Ju 2008	Composite Index of the current economy, equivalent of Index of Coincident Economic Indicators (Levels and Changes)	Volume and tone of economic news stories on the front pages of Chosun-Ilbo and Donga-Ilbo, leading South Korean dailies (Levels)
Lamla and Lein 2008	Harmonized index of consumer prices (Levels)	German Newspaper and TV stories on inflation content analyzed for whether they deal with past, present or future inflation dynamics (Levels)
Goidel et al 2010	Leading Economic Indicators (Levels)	2 local newspapers, 2 local TV broadcasts and 2 national sources (NYT and CBS Evening News) content analyzed for tone of economic news (Levels)
Hollanders and Vliegenthart 2011	Stock market indicator - Amsterdam Exchange Index (logged Changes)	Major Dutch daily newspapers NRC Handelsblad content analyzed for references to negative aspects of the economy such as downturn and recession (Changes)

| | Operationalization of… | |
Study (chronologically)	..the economy	… news media content
Casey and Owen 2013	Gas prices (Changes); Dow Jones industrial average (Changes); Unemployment (Changes); Inflation (Changes); Predictions for the growth rate of real GDP from the Philadelphia Fed's Survey of Professional Forecasters (Changes)	2 indices constructed of NYT and Washington Post economic news coverage pertaining to two developments: recession and unemployment (Changes)