Assessing the Effects of Media Coverage of the Economy on Aggregate Economic Public Opinion*

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Abstract

Do economic performance and economic media coverage influence public perceptions of the economy? Efforts to assess the causal effects are hampered by the interrelationships among the variables as well as the difficulty of measuring the tone of media coverage. In this paper we offer a fresh analysis of these questions by employing a new measure of media tone and bringing to bear a more careful accounting of available economic variables at multiple lag lengths than previous studies have used. We find that both media tone and economic attitudes are strongly shaped by economic performance. Yet beyond the role of the economy itself, media tone has a noticeable direct effect on economic attitudes. This finding has important normative and political significance, given that economic attitudes influence a wide variety of political behaviors.

Economic performance influences important political phenomena like presidential approval and election outcomes (e.g., Hibbs 2000; Kramer 1971; Lewis-Beck 1988; MacKuen, Erikson, and Stimson 1992; Tufte 1975). Incumbent presidents and their parties are rewarded in good economic times and punished in bad ones. But how, exactly, do citizens assess the economy in the first place? Perhaps the simplest explanation is that citizens' economic wellbeing causes their economic assessments, which in turn influence their political opinions and behaviors. A second explanation is that news coverage of the economy, rather than the economy itself, drives citizens' economic perceptions. And a third possibility is that both economic news coverage and real economic performance shape public perceptions of the economy.

Determining whether the media plays a causal role in the process is important because there is no reason to expect that media coverage will perfectly mirror actual economic performance. In fact, a substantial body of empirical evidence argues that news coverage of the economy does not always track economic performance (e.g., Blood and Phillips 1995; Doms and Morin 2004; Goidel and Langley 1995). Sometimes news coverage will be more positive than economic performance warrants, and often it will be more negative (Soroka 2006). If citizens' economic assessments respond to news coverage (either instead of or in addition to responding to actual economic performance), the political rewards and punishments they confer on politicians and parties may be biased. This, of course, was George H.W. Bush's concern in his bid for reelection in 1992, when he claimed the economy was performing at a notably higher level than the media was giving him credit for (Hetherington 1996).

Despite the importance of assessing the causal effects of actual economic performance and news coverage of the economy, doing so is difficult. Published research has demonstrated that news coverage of the economy predicts economic attitudes (Casey and Owen 2013; De Boef

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and Kellstedt 2004; Doms and Morin 2004; Fan and Cook 2003; Goidel and Langley 1995; Goidel et al. 2010; Hollanders and Vliegenthart 2011; Nadeau et al. 1999; Soroka 2006; Soroka, Stecula, and Wlezien 2015). But as others have articulated and as we lay out below, there are a number of reasons to question whether the evidence is indicative of a causal relationship. As observed by Soroka et al. (2015), the "fact that media variables are statistically significant predictors of public perceptions need not mean that news coverage actually causes those perceptions. It may be that media measures just do a very good job of capturing the economy itself, better even than particular economic indicators" (Soroka, Stecula, and Wlezien 2015, 471).

This paper attempts to estimate the effects of economic news coverage on economic attitudes to determine whether news coverage has a distinct effect on economic attitudes above and beyond the role played by economic performance. To do this, we employ a new measure of media tone developed by applying supervised machine learning methods to thousands of newspaper articles in four national newspapers and validated by human coding. We advance previous work on the questions of how both economic performance and media tone affect collective economic attitudes (as measured through the Index of Consumer Sentiment) by estimating models of media tone and economic attitudes that are "saturated" with economic indicators and then analyzing the relationship between the residuals from these two models. This approach allows us to determine whether the portion of economic news coverage that cannot be explained by economic performance has a significant influence on the portion of citizens' economic attitudes that also cannot be explained by economic performance. The evidence we present suggests that it is not merely the case that media tone and mass economic attitudes two move together. We find that there is a direct causal effect of media tone on public opinion.

The Case for and Against the Influence of Economic News on Economic Perceptions

At the outset, it is useful to clarify what we mean—and what is generally meant—by the term "economic performance." Specifically we are interested in the overall, aggregate performance of the U.S. economy as measured by the large number of economic indicators, many of which are produced and published by the government. For example, the economy is stronger when unemployment is lower and growth is higher. Economic performance is also stronger when unemployment is dropping and growth is increasing. Collectively, the range of available economic indicators provides a good proxy for the reality of "economic performance."

A second initial issue to consider relates to the effect that economic news coverage may have on economic attitudes, specifically consumer confidence (which we will measure with the Index of Consumer Sentiment—ICS). News coverage of the economy surely reflects some (but probably not all) of what is happening with the economy "on the ground." This first portion of news coverage includes reports and discussion of jobs reports, stock market trends, economic growth, etc. At the same time, there may be other aspects of economic news coverage that is out of sync with economic performance—what we will call "extra-economic" media coverage. Some of this extra-economic media coverage might not reflect economic "realities." For instance, it might be due to journalists letting their personal perspectives color their reporting. Yet some extra-economic media coverage surely contains valid economic cues that our measures of economic fundamentals simply fail to capture. The economy is, after all, more than the sum of government statistics. Whether accurate or not, it is important to determine whether these extra-economic media cues shape citizens' perceptions. Thus, our question to consider: Does "extra-economic" news coverage of the economy influence public opinion about economic performance? Several conceptual and empirical issues make answering this question difficult.

Conceptual Issues

Let us consider the reasons we might expect—and might not expect—economic news coverage to influence consumer sentiment. We begin with the observation that public perceptions of economic performance are clearly related (through some causal chain) to economic performance. There is a positive correlation between economic performance and economic assessments; when times are good, people are more positive in their assessments than when times are not so good. Evidence of this relationship is abundant. Succinctly summarizing the empirical research, De Boef and Kellstedt (2004, 647) write "we have long known that economic conditions influence consumer sentiment."

It may well be the case that the positive correlation between economic performance and economic assessments reflects a direct causal link, with no media influence. Unlike many social and political phenomena that most citizens exclusively experience through the media (e.g., drug addiction, capital punishment, foreign conflicts), ordinary members of the public routinely have their own economic experiences and these may shape their perceptions of the economy. People get and lose jobs. Their earnings increase and decrease. The prices they pay for goods and services change from month to month. Relatedly, through social interaction, people may learn about the experiences of friends, family, colleagues, neighbors, and others. Collectively, all of these experiences could produce aggregate public opinion about the economy that reflects overall national economic performance. When times are good, more people get and keep jobs, earn more money, buy more goods and services, perhaps save more and reduce debt, etc. These experiences in turn produce more positive assessments of the economy. When times are bad, the reverse takes place. In short, collective economic experiences may directly lead to collective

economic opinion. No direct, intervening, or any other effect of the media is necessary.[1] Indeed,

it is possible that "economic issues are precisely the type least likely to be influenced by mass

media, presumably because of the immediacy and accessibility of personal experiences" (Mutz

1992, 484).

Yet news coverage of the economy (and, in particular, media tone) may also influence

collective economic opinion. Some existing evidence is consistent with this hypothesis (e.g.,

Kiewiet 1983; Nadeau et al. 1999; Soroka 2006; Soroka, Stecula, and Wlezien 2015). Content

analyses of news coverage (television and newspapers) routinely reveal that the economy

receives a substantial amount of coverage, both in absolute terms and relative to other issues

(Boydstun 2013; Harrington 1989). News coverage of the economy may provide citizens with

context for understanding their own economic experiences and thus judging economic

performance. And people are likely exposed to at least some of the news coverage of the

economy. The exposure might be direct or indirect, and it might be intentional or unintentional.

In any case, the sizable amount of news coverage of the economy in combination with many

citizens' regular exposure to it suggest the plausibility of the proposition that mass economic

attitudes are influenced by news coverage of the economy.

Economic news coverage may influence collective perceptions of economic performance

via a second route. There are a number of reasons to believe the information contained in

economic news coverage may be biased in the sense that it is overly optimistic or pessimistic

than performance warrant at a particular time. First, journalistic incentives might create a

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[1] This is not to say the media has no effect. Rather, a strong connection between reality (national

economic performance) and opinion (collective economic assessments) *could* be produced

without the media playing a causal role.

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negativity bias in economic reporting (Soroka 2006). Second, journalists may unintentionally

bring their subjective (and inaccurate) perceptions of the economy to bear on their reporting.

Third, the information available to news outlets at the time of reporting might not be accurate.

For example, during the presidential campaign period between January and October of 1992, the

government's initial reports of economic performance indicated an average monthly increase of

25,000 jobs, a 1.5 percent increase in personal income, a 2.3 percent growth in consumer

expenditures, and a GDP growth rate of 2.0 percent. Over time, those estimates have been

revised upward considerably and suggest that economic performance was indeed much better.

The jobs, income, consumer expenditure, and GDP data now indicate increases of 82,000 jobs,

2.7 percent, 4.8 percent, and 4.4 percent, respectively. In other words, revised estimates show

that the economy in 1992 was performing two to four times better than initially reported. If the

media faithfully and accurately reported the available economic information at the time, the tone

would have been more negative than justified by economic reality, which only became apparent

in official government reports afterward. Indeed, from this perspective, Bush's complaints were

legitimate (Hetherington 1996). Finally, the resource and agenda limitations of the media, along

with the complexity of the economy, make it possible that even the most able and well-

intentioned members of the media might present a picture of the economy that does not perfectly

reflect economic reality.

A related consideration is that, just as economic assessments may be caused by economic

performance, so, too, might news coverage of the economy. Amid their myriad goals, members

of the media are motivated by accuracy in reporting (Cook 1998; Graber and Dunaway 2014).

Existing empirical evidence substantiates the proposition that economic performance and the

tone of news coverage move together (e.g., Casey and Owen 2013; Fogarty 2005; Goidel and

Langley 1995; Hollanders and Vliegenthart 2011; Nadeau et al. 1999; Soroka 2006, 2012; Soroka, Stecula, and Wlezien 2015; Wu et al. 2002). Simply put, one would expect a positive correlation (perhaps a very strong one) between the tone of news coverage of the economy and mass economic assessments, even if there is no causal relationship between the two because both are caused, at least in part, by economic reality.

Taking these considerations into account, we expect that economic performance directly influences media tone and economic attitudes. But, we also expect that the portion of economic news coverage *not* driven by economic performance has a significant influence on how citizens view the economy. In other words, we expect that media tone has a direct effect on economic attitudes, too, just as economic performance does.

If public perceptions of the economy are shaped by economic news coverage, either in lieu of or in addition to the influence of economic performance, the implications are significant. In a world in which economic news coverage perfectly reflects economic fundamentals, it does not matter politically (or normatively) whether economic attitudes respond to news coverage. In this case news coverage provides the same information as the economy itself. Importantly, this would not exclude a causal influence on citizen perceptions; it could be that citizen responses to changing economic performance occur only because citizens hear about them through media coverage. But such a situation would not be normatively concerning. Our normative concerns should begin at the point at which there are deviations between economic performance and economic news coverage. Again, we can think of this portion of coverage as being "extra-economic" in the sense that it reaches beyond economic realities as captured by fundamental economic statistics. It is important to assess whether this extra-economic aspect of economic

news coverage influences citizens' economic assessments because we want to know whether news outlets have sway over citizens' perceptions of the world.

These conceptual issues also pose an analytical problem. Since we have good reasons to think that the economy influences both citizens' economic perceptions and economic news coverage, and since we have good reasons to think that economic news coverage might also shape economic perceptions, how are we to disentangle empirically the causal effects?

Empirical Challenges in Modeling Consumer Sentiment

The conceptual issues highlighted above present two central problems for assessing the causal relationships among economic performance, economic attitudes, and media tone. First, whether media tone causes economic attitudes, we expect the two variables to be positively correlated. One solution to this problem is to include economic performance measures along with a measure of media tone in models of economic attitudes. The logic behind this approach is that if the public responds to both (or only directly to media), then an effect of media tone will be evident even with economic performance in the model. For this approach to work, however, we must do a complete job of capturing "economic performance" by including *all* relevant economic indicators that are correlated with economic media tone, or else estimates of the effect of media tone will be biased.

Although previous research makes important contributions, most studies include a relatively modest set of economic indicators and, just as importantly, a limited lag structure. The result may be that media coverage measures may very well serve as proxies for economic performance and pick up its effects in addition to any media effects. In their influential work, for example, Soroka et al. (2015) control for current changes and one lag of the leading economic

indicator index in their effort to determine the influence of media sentiment on consumer sentiment.[2] MacKuen, Erikson and Stimson (1992) model sentiment as a function of current values of change in unemployment, inflation, and quarterly annualized growth in the leading economic indicator index, along with survey measures of attention to economic news. Goidel and Langley (1995) include the current unemployment rate, percent change in the CPI over the last month, percent change in the unemployment rate over the last 12 months, and percent change in GDP over the last quarter—all at time t—along with counts of positive and negative news stories. De Boef and Kellstedt (2004) model sentiment as a function of a more extensive set of economic variables, including the lagging economic indicator index, the coincident economic indicator index, inflation, unemployment, and the federal funds rate—all at time t— along with a variety of political variables. The inclusion of this broad set of indicators obviates any direct influence of economic news coverage in their analysis. Doms and Morin (2004) include the most comprehensive set of economic indicators in their effort to isolate the effect of

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[2] The leading economic indicator index as provided by the Conference Board is a weighted average of average weekly hours, manufacturing; average weekly initial claims for unemployment insurance; manufacturers' new orders; consumer goods and materials; the ISM® Index of New Orders; manufacturers' new orders, nondefense capital goods excluding aircraft orders; building permits; new private housing units; stock prices, 500 common stocks; interest rate spread; leading credit index; 10-year treasury bonds less federal funds; and average consumer expectations for business conditions. Soroka et al. (2015) have a version of the index excluding consumer expectations that are included in the index of consumer sentiment from the University of Michigan consumer surveys.

stories mentioning recession. They include percent change in year over year change in the S&P, lags of monthly changes in the CPI, lags of the monthly unemployment rate, change in payroll employment, and current change in gas prices in their models of consumer sentiment. Their study is perhaps the strongest test of the influence of media coverage to date. They find that counts of the words "recession" and "economic slowdown" have an additional effect on consumer sentiment, beyond economic performance, and yet their focus on mentions of recession is distinct from the general question about the overall influence of economic news coverage. As we will show below, even these more extensive sets of economic indicators are not enough to capture the full effect of economic performance. As such, much of the previous research reporting an effect of media on economic attitudes is prone to omitted variable bias and is therefore potentially misleading. If stock market performance, for example, is important to consumers' evaluations of the economy, omitting market prices and their changes from models of consumer sentiment means those effects—because they are covered in the media—will be attributed to the media, rather than economic performance, where they properly belong.

We advance efforts to isolate the effects of economic performance and economic media tone on economic attitudes by fitting models of both media tone and economic attitudes as a function of a large array of economic indicators (including many lags and different period growth rates of each) in an effort to purge both measures of the portion of their variance that is explained by economic performance. Then we examine the relationship between the residuals in these models for evidence that media tone directly influences perceptions of the economy. Throughout our analyses, we focus on the period from January of 1980 through December of 2014, using the month as our temporal unit of analysis.

A Strategy for Isolating the Effects of Economic Performance and Media Tone on Attitudes

For our analysis, we adopt a strategy used by De Boef and Kellstedt (2004) to utilize many economic indicators and measures to tap economic performance. Specifically, in order to isolate the portion of consumer sentiment due to economic performance from that due to other factors, we estimate a saturated model of consumer sentiment that includes a large number of lags of a number of highly collinear economic time series and excludes media measures and lagged consumer sentiment, thereby maximizing the potential for the economy to explain variation in sentiment. The result, as De Boef and Kellstedt note, provides "an excellent ex ante forecast of economic sentiment based solely on economic conditions" (2004, 6). The residuals from this model—what they refer to as irrational exuberance and pessimism, and what we call "extra-economic" attitudes—are thus purged, to the best of our ability, of the influence of economic performance.

In addition to estimating a saturated model of consumer sentiment, we also estimate a saturated model of the tone of economic news coverage. Our purpose in estimating this model is identical: we want to isolate the portion of the tone of economic news coverage due to economic performance from that "extra-economic" portion that is due to other factors, thereby purging media tone from its roots in economic performance. If we have effectively purged the consumer sentiment and media tone measures of their economic causes, then we have eliminated the possibility that economic performance confound the relationship between media tone and economic sentiment. We can then examine the relationship between the residuals from the two models and ask how the "extra-economic" portion of the tone of news coverage about the economy affects the "extra-economic" portion of citizen evaluations of the economy.

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Briefly, we find that the residuals from these models exhibit systematic variation and that media tone has a significant effect on economic attitudes when both are purged of economic performance measures, providing the best evidence that the tone of economic news coverage has an independent, direct causal effect on economic perceptions.

Measures of Economic Performance

Our chief goal is to purge both consumer sentiment and media tone of their respective economic causes. This means we need to be comprehensive in our selection of economic indicators. We include seven sets of measures of economic performance designed to capture the many dimensions of economic performance. The first four are identical to those used in De Boef and Kellstedt (2004): monthly and quarterly growth rates in the consumer price index (CPIAUCSL, all urban consumers, all items) as calculated by the BLS and downloaded from FRED; monthly and quarterly growth rates in the Conference Board's Index of Lagging Economic Indicators[3]; monthly and quarterly growth rates in the Conference Board's Index of Coincident Indicators[4];

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[3] The index of lagging economic indicators includes: 1) the average duration of unemployment (measured in weeks, sign inverted); 2) inventory to sales ratio (manufacturing and trade); 3) labor costs per unit of output (manufacturing); 4) average prime rate charged by banks; 5) volume of business loans held by banks and commercial paper issued by nonfinancial companies; 6) consumer installment credit to personal income ratio; and 7) the consumer price index for services.

[4] The index of coincident economic indicators includes: 1) payroll employment—changes represent the net hiring and firing of nonagricultural businesses; 2) personal income (less transfer payments, inflation adjusted); 3) industrial production index (covers physical output of all stages

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and the monthly (civilian) unemployment rate as calculated by the BLS (UNRATE) and

downloaded from FRED.[5] They capture both statistics of central concern to families—prices and

the job market—and additionally, via the Conference Board indices, they capture "cyclical

turning points" in the aggregate economy as measured by statistics that capture manufacturing

activity, the labor market, financial conditions, and incomes.[6] And they capture short (monthly

and quarterly) rates of change in aggregate economic performance. Additionally, we include

annualized changes in these same measures and unemployment 12 months prior in order to

capture longer-term trends in economic performance. We also include three other sets of

measures that tap economic performance: monthly, quarterly and annualized growth rates in the

number of jobs added (BLS); the monthly quarterly, and annualized growth rate in real

disposable per capita income (A229RX0, chained 2009 dollars, seasonally adjusted annual rate),

downloaded from FRED; and monthly, quarterly, and annualized growth rates in the average

daily closing stock prices in the S&P composite index, in 2016 dollars as reported by Shiller

(2015) and downloaded from his website.[7] These measure trends in job growth, average

incomes, and financial market performance. In total we include 57 right-hand-side economic

variables, after accounting for the full set of lags and complement of growth rates. We believe

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of production in manufacturing, mining, gas and electric utility industries); and 4) real

manufacturing and trade sales.

[5] We omit the Conference Board Index of Lagging Economic Indicators because the index

includes one of the components of the Index of Consumer Sentiment.

[6] https://www.conference-board.org/data/bci/index.cfm?id=2160 (accessed January 27, 2017).

[7] http://www.econ.yale.edu/~shiller/data.htm (accessed January 27, 2017).

this comprehensive set of measures taps into the full range of economic activity as it may be perceived by consumers making judgments about economic performance.

Measuring the Tone of Economic News Coverage

Scholars have assessed media coverage of the economy using a variety of strategies. The usual approach is to identify stories about the economy, typically using the *New York Times*, and apply some coding rules or a dictionary to the text to create a measure of the tone of news coverage. Some have counted the frequency of use of the term recession as an indicator of negative tone (Blood and Phillips 1995, Doms and Morin 2004), or broader set of terms (Hopkins and King 2010). Others have applied sentiment dictionaries developed to capture the positive vs. negative tone of discussion across any policy issue (and thus not specific to the economy) (Soroka, Stecula, and Wlezien 2015). Still others have generated and applied dictionaries in the specific context of the research question (De Boef and Kellstedt 2004). These different measures have significantly expanded our understanding of the causes and effects of media coverage of the economy.

Here, we build on recent innovations in treating "text as data." We use a measure of the tone of economic news (i.e., positive, negative, or neutral) that relies on supervised machine learning (SML) techniques (Gareth et al. 2013; Grimmer and Stewart 2013; Klebanov, Diermeier, and Beigman 2008; Lowe 2008; Monroe, Colaresi, and Quinn 2008; Monroe and Schrodt 2008; Van Atteveldt, Kleinnijenhuis, and Ruigrok 2008). Briefly, SML involves three steps. In step one, human coders label the tone of a sample set of texts. In step two, the features of the labeled text (words and phrases) are used to predict the tone assigned by the humans in the sample. "In this way the classifier learns the relevant features of the dataset and the weight

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assigned to each" (Barberá et al. 2016, 10). The results are evaluated using cross-validation, in which the accuracy of predicted tone is compared to (out of sample) subsets of the human-coded data. The results from multiple classification methods are compared before the best classifier is applied to the full set of available texts in the final step. Monthly measures of media tone can then be created by computing the average predicted probability that the tone of an article is positive across all articles in a given month.

Barberá et al. (2016) recommend using supervised machine learning techniques to measure the tone of economic news coverage for three main reasons: 1) SML estimates the features of the text and the weights attached to each directly from the data rather than (as in dictionaries) by fiat, 2) word context can be readily assessed by including short phrases as features, and 3) the measure is readily evaluated relative to human perceptions of tone.[8] Barberá et al. (2016) develop and validate (relative to human coding) a measure of tone of the U.S. economy as presented in the *New York Times* from 1948-2014.[9] In what follows we rely on an

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[8] Points 2 and 3 can be addressed using dictionary methods as well, but assessing word context and evaluating the results of classification are more difficult. Typically no effort is made to evaluate the measure relative to human coding, but see Soroka and Young (2006) for an exception. Instead, dictionary-based measures are usually assessed with tests of convergent validity that rely on the correlation of a measure (here tone of economic news coverage) with others thought to be related to it (here economic indicators).

[9] Barberá et al. (2016) compare the predictive accuracy (relative to human coding) of measures of tone of the U.S. economy as presented in the *New York Times* 1980-2011 generated by SML and by a number of sentiment dictionaries, including Lexicoder Sentiment Dictionary (Young and Soroka 2012), which is used by Soroka et al. (2015), Sentistrength (Thelwall et al. 2010),

measure of tone generated by Barberá et al. (2016) using an expanded universe of media comprised of the four national newspapers with the highest circulation in the United States: *New York Times, Washington Post*, *Wall Street Journal*, and *USA Today*. While newspapers, and these papers in particular, do not capture the full extent of the media environment, newspapers continue to originate the majority of policy-based content that is then circulated and filtered through the rest of the media system (Althaus, Edy, and Phalen 2001; Golan 2006; Haider-Markel and Cagle 2004; McCombs and Funk 2011).

Briefly, the measure was developed as follows: A sample of stories from each of the four newspapers over the period they are available electronically was selected using an extended keyword search.[10] A subset of 4,000 articles from each newspaper was then randomly selected

and Hopkins and King's 9-word index (2010), which consists of counting the number of articles per month mentioning nine economic words (inflat, recess, unempl, slump, layoff, jobless, invest, grow, growth). They find the accuracy of SML classifications to be significantly greater (between 71 and 74%) than Lexicoder ($\approx$57%), Sentistrength ($\approx$57%) and Hopkins and King's index (39%).

[10] Using Proquest, Barberá et al (2016) downloaded all articles in the four papers that contained any of the following terms in parentheses (employment, unemployment, inflation, consumer price index, GDP, gross domestic product, interest rates, household income, per capita income, stock market, federal reserve, consumer sentiment, recession, economic crisis, economic recovery, globalization, outsourcing, trade deficit, consumer spending, full employment, average wage, federal deficit, budget deficit, gas price, price of gas, deflation, existing home sales, new home sales, productivity, retail trade figures, wholesale prices) AND the term "United States." This search produced 108,186 stories from the *New York Times* (Jan 1947-December 2014),

and human-coded using CrowdFlower. In the next step, the human-coded data were then used to train a classifier on each individual newspaper.[11] The result is a predicted tone for each article in

62,213 from the *Washington Post* (January 1951-December 2014), 69,018 from the *Wall Street Journal* (January 1984-December 2014), and 21,961 from *USA Today* (April 1957-December 2014). After downloading the stories we removed any article that mentions any country name, country capital, nationality or continent name (Schrodt 2011) in the headline or first 1000 characters of the articles and does NOT mention U.S., U.S.A. or United States in that same text fragment.

[11] The first 5 sentences of all articles were coded first for relevance (yes, no, not sure). Anywhere from 20% (*Washington Post*) to 70% (*New York Times*) of the articles were coded as relevant and only those articles coded as relevant were used to train the classifier. Irrelevant articles tended to cover economic conditions in other countries or make only vague reference to the economy in the first five sentences. All relevant articles were coded for tone on a 9point scale (1 most negative and 9 most positive). The scale was collapsed such that 1-4=0, 6-9=1. The midpoint (5) was omitted for binary classification. The machine learning algorithm used to train the classifier uses logistic regression with an L2 penalty where the features are the 75,000 most frequent stemmed unigrams, bigrams, and trigrams appearing in at least 3 documents and no more than 80% of all documents (stopwords are included). We compared the performance of a number of classifiers with regard to accuracy and precision in both out-of-sample and cross-validated samples before selecting logistic regression with an L2 penalty. We also compared the performance of classifiers trained separately on each newspaper, but the out-of-sample predictive accuracy within and across newspapers was highest for the classifier trained on the full set of articles (64%) and so we use it here.

each newspaper to predict the tone of each article. A monthly measure of tone was calculated for each paper by averaging across the predicted tone of the full set of articles in a given month. In the final step, the results for each newspaper were averaged to create a measure of the weighted average sentiment across the newspapers. The weights were based on the number of relevant articles in each paper in each month. For the analysis presented here, we focus on the time period from January of 1980 through December of 2014.

The measure of media tone is presented in Figure 1. The series has a mean of 27.5% positive and a standard deviation just under 4.4 percentage points over this time period. It ranges from approximately 13% positive to 37% positive, confirming the tendency for the media to focus on the negative. The series moves as we would expect given our knowledge of economic history. It is relatively low in the early1980s and early 1990s, grows more positive over much of the Clinton years, and declines again in the early 2000s before rebounding and bottoming out in the 2008 recession after which it climbs slowly upward (but still consistently well below the long run mean) to the end of the series. Notably, the series is fairly choppy. Given that the media is primed to cover new information, this is not surprising, but undoubtedly some of the bumps and wiggles we see are due to measurement error.

< Figure 1 >

Results

The first step in our effort to purge the effects of economic performance from both the tone of economic news coverage and perceptions of economic performance is to model each as a function of the set of economic indicators described above. To do so, we make two specification decisions. First, we omit lagged dependent variables from the models, which allows economic

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variables to account for as much of the variation in these two variables as possible. Second we adopt a lag structure that includes contemporaneous, lag 1, and lag 2 values of each variable in the set of economic indicators described above. We employ this lag structure for two reasons. First, we are agnostic with respect to the correct lag structure but suspect that any effects play out over time. This approach requires the inclusion of some number of lags. Second, most of our indicators are included in the model as growth rates measured with reference to the previous month, quarter, and year, such that we need not include larger numbers of lags. These two specification decisions—the inclusion of a large number of lags of highly collinear time series and the omission of lags of the dependent variable—mean that individual estimates from the model are inefficient and coefficients may be incorrectly signed or statistically insignificant. They will, however, remain unbiased and asymptotically consistent. Given that our interest is not in ascertaining the precise nature of the influence of economic performance on consumer sentiment, but in allowing economic indicators to have their maximal influence on media tone and consumer sentiment, the potential inefficiency of the estimates is not of concern.

Table 1 reports the results. Block F-tests on each set of economic variables test for the joint significance of each set of variables. We present the p-values associated with the F-tests in Table 1 in the equation for ICS (column 1) and media tone (column 2). (See Appendix Table A1 for descriptive statistics.)

< Table 1 >

We find that variation in both the ICS and media tone is significantly predicted by a broad array of economic indicators measured over a number of lags, confirming our expectations that both are influenced by economic performance. In particular, both equations account for a large proportion of the variance, nearly 85 percent of consumer sentiment and 68 percent of

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economic news coverage, notably higher proportions than reported in previous studies based on less complete sets of economic indicators and lags. (And, recall that the models do not include lagged values of the dependent variables.) Both consumer sentiment and media sentiment follow economic fundamentals quite closely. (See Appendix Figures A1 and A2, where we map the observed values of media tone and then ICS against the values of each predicted by the economic performance measures.) Further, with the exception of the lagging economic indicator index, each set of economic indicators accounts for significant variation in the ICS. Media tone, on the other hand, responds to all but real disposable income growth per capita (p=0.379) and perhaps the number of jobs added (p=0.088). That so many of the block F-tests show a significant influence on consumer sentiment suggests that previous studies containing fewer economic controls and with a less robust lag structure likely suffer from omitted variable bias.

The residuals from these two models represent that portion of media tone and economic sentiment that cannot be explained by economic fundamentals. We present the residuals from both these models in Figure 2 in order to better understand the extra-economic variation in each variable. Two findings are readily apparent in the figure. First, even after controlling for a number of economic indicators, there is systematic variation in both consumer sentiment and the tone of economic news coverage. For example, we see periods (early 1980s and 2000s) when consumer sentiment is overly optimistic (given economic performance as reported by the government) for extended periods of time and others when it is more negative than economic performance measures warrant (early 1990s and from 2005 to the end of our analysis in December of 2014). Media tone appears to exhibit less systematic variation after accounting for economic performance, but it too is overly positive in the early 1980s, Clinton's second term,

and, perhaps surprisingly, 2010-2012. It is overly negative during much of the 1980s and early

1990s (as then-President Bush suggested), and since Obama's reelection to the White House.

Second, the two series often move together. For example, both trend upward following

the 2008 recession up until 2012 and then both trend downward from 2012 to the end of the

series. These results suggest the extra-economic portion of media tone may cause, in turn,

exuberance and pessimism on the part of the public that is out of step with economic

performance as the government can measure it. Or put differently, after accounting for economic

performance as measured by a large number and lags of economic indicators, the remaining

variation in media tone may drive consumer sentiment, above and beyond the influence of

economic performance. We examine the evidence on this score next.

<Figure 2>

In the first column of Table 2, we present results from a regression of consumer

sentiment purged of economic causes (i.e., "extra-economic" consumer sentiment) as a function

of contemporaneous media tone purged of these same economic indicators (i.e., "extra-

economic" media tone), controlling for lagged values of purged sentiment. The Cumby-

Huizinga p-value shows that the model is well behaved, with white noise residuals. The results

of the model indicate that extra-economic consumer sentiment is moderately persistent; current

sentiment month is a function of the previous month's sentiment, even after controlling for

economic indicators. We also see a semi-annual and annual seasonality in purged sentiment

reflecting the intuition that sentiment depends on the month we are in. We are more (or less)

optimistic in December than in January, for example, and sentiment this January (February, etc.)

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is related to the previous January (February, etc.). The model accounts for about 51% of the

variation in purged sentiment.[12]

< Table 2 >

Of particular interest is the effect of extra-economic media tone on extra-economic

consumer sentiment. The effect is moderate in size and highly significant. When purged tone

becomes one point more positive, consumer sentiment becomes more positive by .19 points in

the short run. To estimate the long-term effect, we divide the coefficient for purged tone by one

minus the coefficients of the lags of purged sentiment $(0.187 / (1 - (0.645 + 0.133 + 0.030)) =$

$1.944)$. Thus, the long-term effect of the same one-point increase in purged tone is just less than

2 points. A standard deviation increase in extra-economic tone (2.5 points) leads to an expected

increase in extra-economic sentiment of nearly one point in the short term and roughly 5 points

in the long run—approximately equivalent to a standard deviation in purged sentiment. To

determine whether these effects are large effects or small, consider that the purged consumer

sentiment retains the same unit of measurement as the raw sentiment series. Thus, when we

calculate that a standard deviation increase in extra-economic media tone yields roughly 5 points

of long-run movement in extra-economic sentiment, this also means that the raw sentiment

measure moves roughly 5 points. Given that the standard deviation of the raw sentiment

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[12] As an alternative (and nearly equivalent) strategy, Table 2 also shows a single equation model

of consumer sentiment where each of the economic indicators and each of the lags identified

above are included on the right hand side of the equation, along with our original media tone

series and lagged values of the dependent variable to capture the inertia in consumer attitudes.

The estimated effect of media tone using this single equation model is nearly identical (0.191) to

that using the multistage process.

measure is about 13 points, this effect appears as both large and politically meaningful. These

results suggest consumer sentiment responds to media cues above and beyond the economic

factors that drive them both.

Discussion

We have two central findings, each with important implications. First, we have demonstrated

that the mass public's collective economic attitudes are tethered to economic reality to an extent

greater than reported in previous research. The lion's share of consumer sentiment is explained

by economic fundamentals; recall that the saturated model accounted for 85 percent of the

variance in the ICS. In other words, there is a high degree of correspondence between what

people perceive and the reality that (normatively) should be producing it. Our finding in this

regard stands in rather stark contrast to previous research. As noted by Achen and Bartels

existing research typically reports more modest relationships between economic performance

and economic attitudes, which implies that mass opinion about the economy is "subject to

considerable vagaries" (2016, 107). In contrast, we have shown that economic attitudes are very

strongly related to what actual performance warrants. Likewise, the saturated model also

accounted for a substantial amount of the variation in the tone of media coverage of the

economy. The fact that economic performance measures account for so much of the variance in

economic media tone is reassuring to those that see the proper role of the media as providing

information about the "true" state of the economy (and to those concerned that consumer

evaluations should reflect economic performance).

Second, however, we have provided evidence suggesting that economic attitudes are also

shaped by the portion of media coverage that deviates from economic performance (as captured

through government measures), or what we have termed extra-economic media coverage. Our evidence relying on an analysis of residuals from saturated models of media tone and attitudes suggests that the effect of economic media tone on consumer sentiment is, in fact, causal. Economic evaluations are not fully determined by economic performance. And when evaluations stray from the economic fundamentals, we can trace their movement to media coverage that is more or less positive than economic performance measures would predict.

The fact that extra-economic media tone has a direct causal effect on consumer confidence may in some cases be the result of news outlets performing a public service by accurately conveying aspects of real economic conditions that the government's measures simply fail to capture. In other cases, news outlets may be (unintentionally) leading the public astray, for example by giving disproportionate attention to dips in the economy, especially when those dips can be described in sensational terms that will draw in readers. Thus, a key task for future research is an empirical assessment of the systematic causes of this extra-economic media coverage.

Whatever their sources, how and how much do extra-economic signals in the tone of media coverage matter? Empirically our evidence suggests they can move consumer sentiment a substantial amount, and even more so when they persist for several consecutive months, as they often do. But the significance of this effect also depends, at least in part, on the consequences of economic evaluations for economic and political outcomes. We speculate that a causal role for the tone of media coverage on economic evaluations above and beyond economic performance may be concerning for at least two reasons. First, any distortions in coverage (extra-economic media tone that does not capture economic reality) could lead voters to reward and punish candidates and incumbents not merely for how the economy actually performs, but for

perceptions of the economic performance that are non-economic in their origins. Second, there are significant downstream consequences of that portion of extra-economic media tone that strays from economic realities for consumer behavior. If economic evaluations drive behavior in the marketplace, the consequences of "irrational optimism and pessimism" may lead to a mutually-reinforcing cycle in which consumer behavior becomes detached from economic reality. For instance, if economic attitudes become overly pessimistic, consumer spending may drop, economic performance may weaken, news coverage may become more negative, and consumers may become still more pessimistic. This sequence of events—coupled with a negativity bias in the news—could make it much harder for the economy to recover from recessions (and more prone to them in the first place). Clearly, significant normative (and political) implications hang in the balance of the causal effects of irrational economic media coverage on economic attitudes.

Table 1. The Economic Causes of Consumer Sentiment (ICS) and Media Tone, January 1980-April 2014

|	ICS	Media Tone
Block of Coefficients	**p-Value for Block F-tests**	
Consumer Price Index (monthly, quarterly and annualized growth rates)	0.000	0.027
Real Disposable Income Per Capita (monthly, quarterly, and annualized growth rates)	0.000	0.379
Number of Jobs Added (monthly, quarterly and annualized growth rates)	0.000	0.088
Real S&P 500 (monthly, quarterly and annualized growth rates)	0.000	0.000
Index of Lagging Economic Indicators (monthly Quarterly, and annualized growth rates)	0.875	0.015
Index of Coincident Economic Indicators (monthly Quarterly, and annualized growth rates)	0.000	0.000
Unemployment Rate (monthly)	0.000	0.000
R^2	0.848	0.680

Note: Cell Entries are block F-tests for the joint significance of excluding lags 0, 1, and 2 (and in the case on unemployment lag 12) from the unrestricted equation for ICS and Media Tone. The p-value represents the probability that the block of variables does *not* help explain Consumer Sentiment (column 1) or Media Tone (column 2).

Table 2. Modeling the Index of Consumer Sentiment (ICS), January 1980-April 2014

|	Residual ICS	ICS
ICS (t-1)	0.645***	0.649***
	(0.038)	(0.040)
ICS (t-6)	0.133***	0.131***
	(0.040)	(0.037)
ICS (t-12)	0.030	0.090**
	(0.038)	(0.034)
Residual Media Tone (t)	0.187**	
	(0.071)	
Media Tone (t)		0.191**
		(0.065)
Constant	0.013	-0.004
	(0.177)	(0.175)
Observations	398	410
Cumby-Huizinga (12 Lags), p-value	0.630	0.276
$R^{2\text{ Adjusted}}$	0.512	0.935
RMSE	3.52	3.28

Note: The dependent variable for the regression in column (1) is the residual series from the regression reported in Table 1, which purged the ICS series of its economic influences. The dependent variable for the regression in column (2) is the raw Index of Consumer Sentiment. Estimates of the (57) economic variables are not presented to save space. Standard errors in parentheses + p<0.10, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Figure 1. Tone of Economic News Coverage by Month, 1980–2014
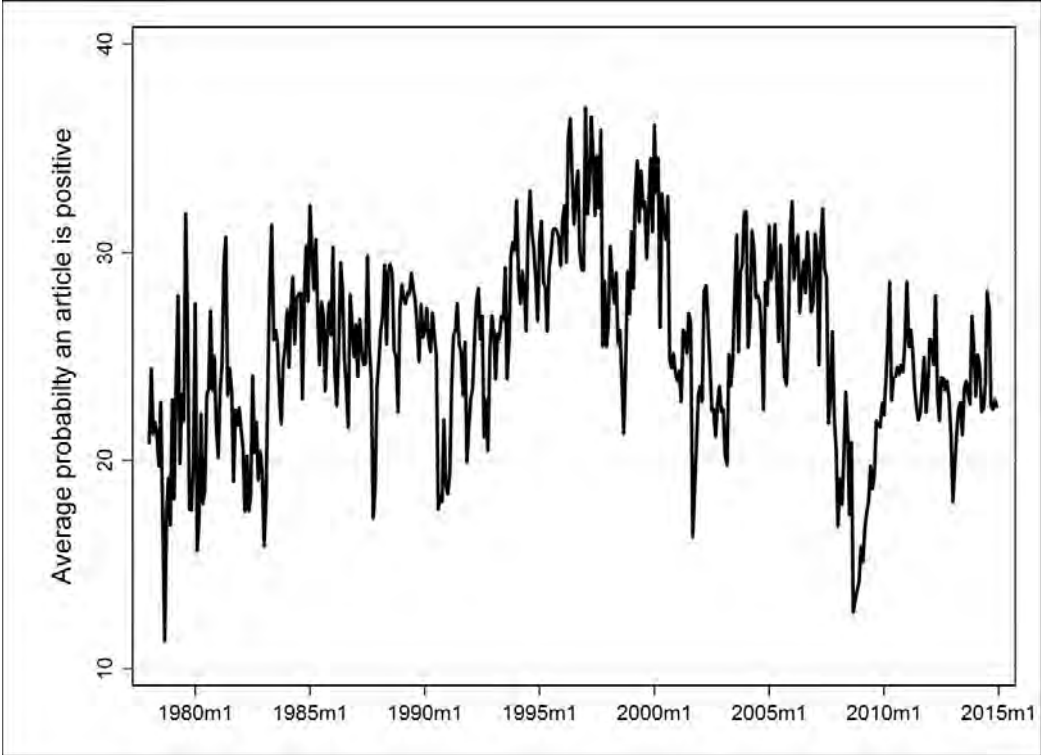
Note: For each month from 1980m1 through 2014m12 this figure reports the estimated probability that a news article about the economy is positive. See text for details.

Figure 2. Residual Series: Consumer Sentiment (ICS) and Tone of Economic News Coverage
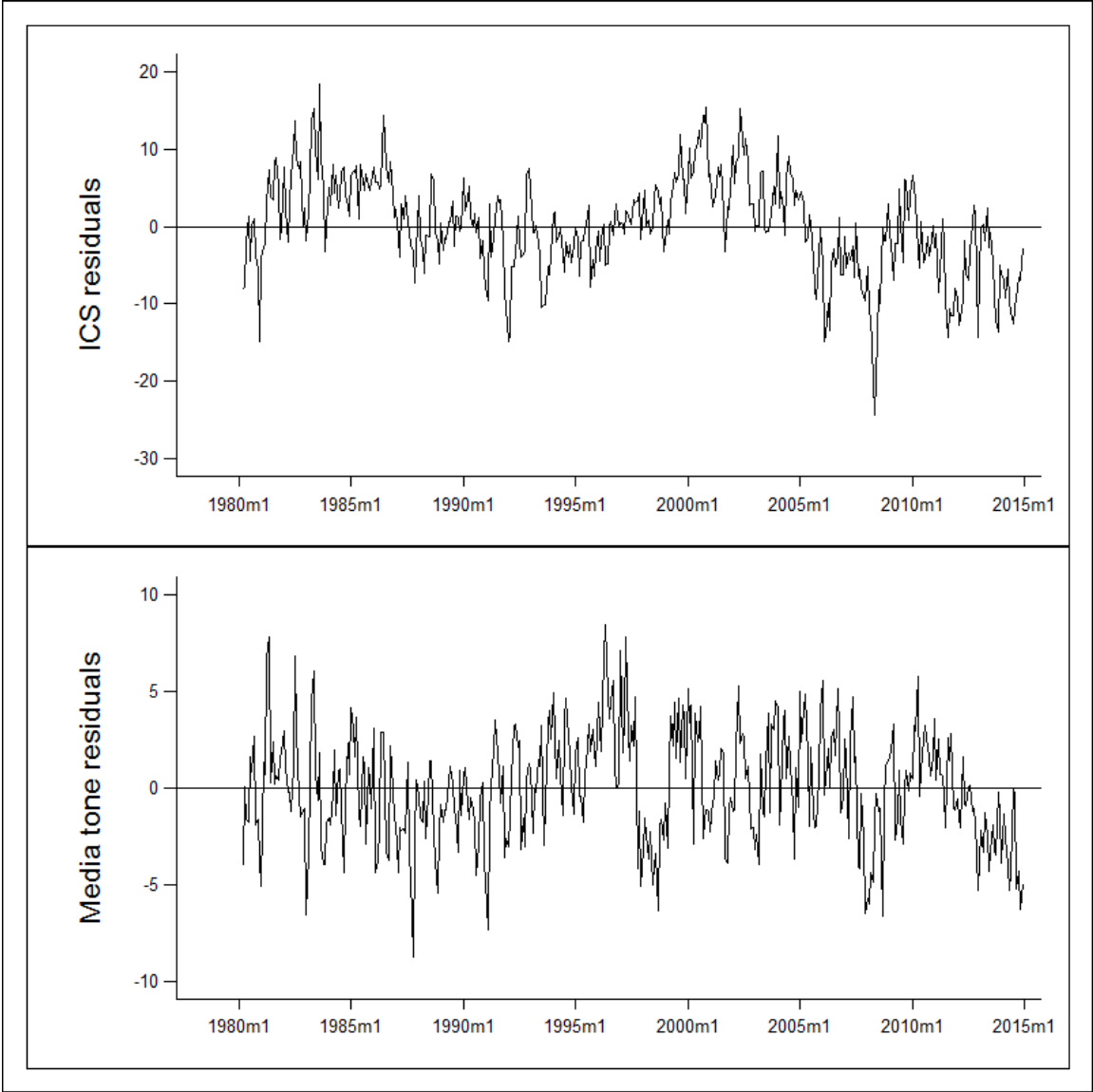
Note: The ICS and Media Tone residuals are produced from the regression reported in Table 1, which purged both series of the effects of economic performance. See text for details.

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Appendix

Table A1. Descriptive Statistics, 1980-2014

	Obs	Mean	Std Dev	Min	Max
Index of Consumer Sentiment (ICS)	420	85.82	12.82	51.7	112
Tone of Economic News	420	25.74	4.38	12.72	36.94
"Extra-Economic" ICS	410	0.00	5.03	-18.59	14.01
"Extra-Economic" Tone	410	0.00	2.48	-6.79	6.71

Figure A1. The Observed Tone of Economic Media Coverage, and Tone as Predicted by Economic Performance Measures, 1980-2014.
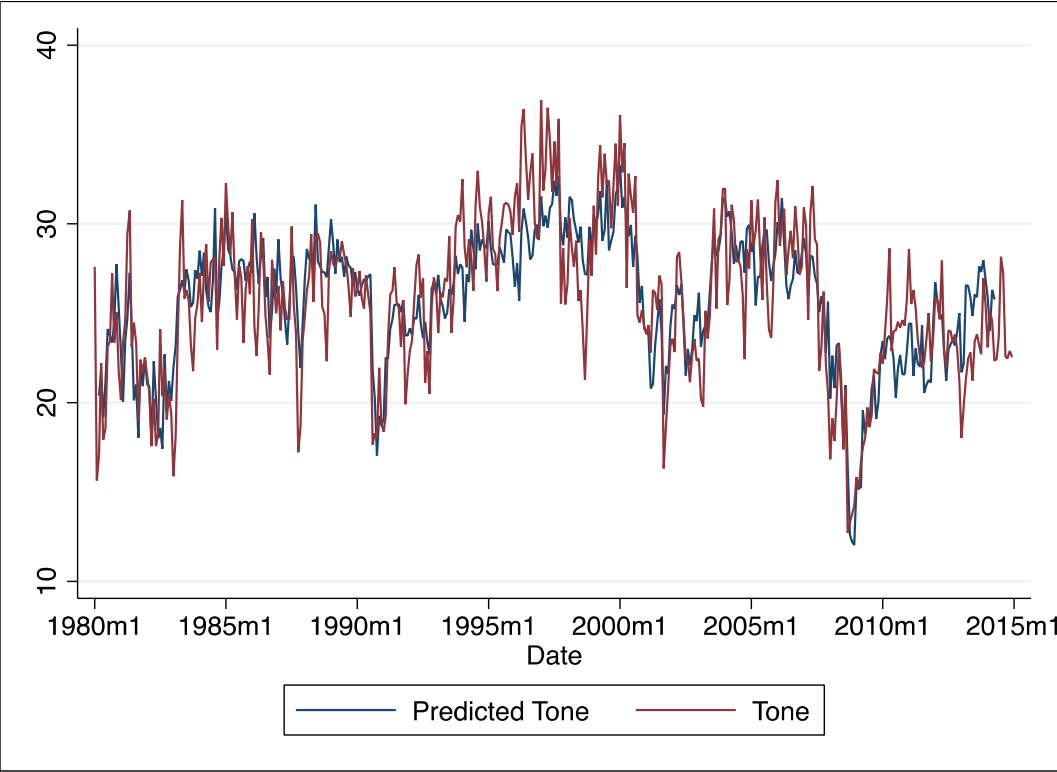
Figure A2. Observed Index of Consumer Sentiment (ICS), and ICS as Predicted by Economic Performance Measures, 1980-2014.