Public Opinion as Nowcast: Consistency and the Role of News Uncertainty

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Abstract

The purpose of this note is to consider the effect of perception noise when voters form public opinions. We provide a simple theoretical framework which will form the basis to investigate empirically the effect of news uncertainty on voters' attentiveness when forming public opinion, or nowcasts. An attentive voter will consistently update their information set. Therefore, if voters' nowcasts are consistent, any revision of the nowcasts must only reflect new information. We specifically consider how news uncertainty may affect voter attentiveness. The paper focuses on US presidential competence and popularity indices. We find that the nowcasts are consistent during periods of low news uncertainty but highly persistent when news uncertainty is high.

Keywords: Public Opinion Polls, Perception Noise, Voters' Nowcasts, Random Walk, Non-linear Time series analysis

I: Introduction:

Public opinion of incumbent governments' competence and their relative popularity are the voters' assessment of the incumbent's performance and ability. Of course, these opinions are formed under imperfect, or partial, information. Effectively, the voter forms a nowcast, or an *a posteriori* forecast, of the incumbent's ability to manage the macroeconomy and deliver policy goals. These issues have been heightened by the sub-prime financial crisis of 2007/08 and the ensuing Great Recession.

The purpose of this note is to assess how perception, or observational, noise affects the forming of public opinion. The focus of this note is deliberately narrow but, nevertheless, an important and novel contribution to the existing literature. Specifically, we consider how perception noise volatility affects the way voters update their opinions, where the perception noise volatility is captured by news uncertainty. We outline a simple theoretical framework to explore how inattentive voters form their opinion of the incumbent governments. A voter is consistent, or semi-strong efficient, if they fully update their information set with the relevant information required to for their perception in each period. So, a rational voter (regardless of their information set or the source of their information) will consistently update their information set. Hence, if consistent, their nowcast will only reflect the newly available information in each period. Nevertheless, the information they draw their perceptions from is affected by perception noise. Specifically, uncertainty around news will affect the forming of their nowcast, or public opinions. We consider the role of news uncertainty and how it may affect the rational voter's attentiveness. We provide a micro-founded macro-model that encapsulates the representative voter's behavior.

The theoretical model provides a framework to explore empirically the voters' inattentiveness when forming public opinion. The model implies a non-linear relationship between public opinion updating and common, or shared, news uncertainty. If the public opinion is formed consistently it should follow a simple random-walk process. This conveys that the voter is able to fully utilise all the relevant information when updating their opinion. In the present analysis, the random walk test is extended to a non-linear context as we allow it to vary with common news uncertainty levels, that is by distinguishing between high and low uncertainty levels. The ensuing empirical investigation uses the non-linear Time-Varying Smooth Transition Autoregressive (TV-STAR) estimation technique. The results clearly indicate that when new uncertainty is low, voters form their public opinion as a random-walk process. Hence, during low new uncertainty periods their public opinion (or nowcast) of incumbent governments are consistent. On the other hand, during periods of high news uncertainty their public opinions tend to be very persistent.

The empirical analysis paper will focus on US presidential competence and popularity indices. These indices depict collective opinion that proxy the representative voter's public opinion. We focus on two indices collected and managed by two different organizations; notably the incumbent 'competence' and 'popularity'. These collective opinion polls are compiled by the Survey Research Centre, University of Michigan and Gallup respectively. In a related research, using the competence index, Easaw (2010) considered the role of voters' perceived views of news when forming opinions about the incumbent government's competence in managing the macroeconomy. The empirical investigation found that there is a tendency for voters to display pessimistic bias as the impact of perceived bad news tended to persist considerably longer than good news. Easaw and Ghoshray (2007) also found that

voters' views of government competence varied with different US Presidential administrations.

The context for these related researches is the notion of voter inattentiveness. Aidt (2000), while challenging the notion of voter's paradox of ignorance, suggests that egotropic voting behavior may render this phenomenon less significant. He also attempts to reconsider the concept of the paradox of ignorance by arguing that information has valuable investment considerations. This is reinforced in a recent paper Matejka and Tabellini (2016), which explores the notion of a *rationally inattentive voter*, highlighting the subjective nature of voter attentiveness. The effects of the subjective preferences are amplified when voters tend to pay more attention when stakes are higher. They also argue that voters' ignorance is not uniform as certain voters are more informed – from whom others may draw upon. Indeed, there is evidence to indicate that the voter has adequate understanding and knowledge of the macroeconomy. The notion of opinion leaders is well established (Katz and Lazarsfeld, 1955). Indeed, more recently models have used the idea of opinion leaders' perceptions spreading through the population using epidemiological models (see Carroll, 2006) and via social learning and networks (see Easaw and Mossay, 2015)

Duch and Stevenson (2010), on the other hand, maintain that the openness of the economy may makes it more difficult to attribute cause. They explore the notion of incumbent competence as a voters' signal extraction exercise. Voters, observing unexpected shocks to the economy, can attribute the extent of the shocks that are due to incumbent competence. However, this becomes more tenuous the more exposed the economy is to the effects of global trade and, hence, the openness of the economy.

The role played by economic news to inform the inattentive voter has been extensively studied in van Dalen et al (2018). They contend that economic news informs voters understanding of the economy and shape their economic perceptions using three distinct mechanisms. Firstly, there is the 'alarm bell' approach where headlines and extensive news coverage of the economy when economic developments are dramatic. Secondly, the 'elaboration-inducing' approach takes a news-telling technique, thereby, making its audience process information for extensively and, finally, the 'mental short-cut and heuristic' approach attempts to domesticate news. This has the effect of making governments accountable for economic development by the voters. The 'mental short-cut and heuristic' approach has the greatest impact on voters' perception of incumbent competence.

In summary, the current literature on voter inattentiveness argue that voters draw their economic news directly through the news media and/or, indirectly, through social learning in networks. The subjective nature of voter preference will also determine the type of information set they rely on, and this is influenced by both their preference for media outlets and/or social networks.

As highlighted earlier, a typical voter is poorly informed about public policies but a rational, or forward-looking, one will consistently update their information set. So, we assess whether their updating is affected by increasing news uncertainty, that is perception noise volatility. This issue is particularly pertinent in the aftermath of the financial crisis of 2007/08 and ensuing Great Recessions. The reporting of economic news and policy debates have increased in prevalence but so too has news uncertainty.

Modelling public opinion formation as *a posteriori* forecast, or nowcast, while accounting for perception noise and using the Kalman filter approach, is also novel in this

literature. This approach has been more commonly used to model agents forecasting macroeconomic variables (see Coibion and Gorodenchenko, 2015 and Easaw et al, 2016 and references therein). The incorporating of perception noise is to be distinguished with other recent approaches to modelling noise in the dynamics of opinion formation. For instance, Pineda et al (2009) allow agents free will, which is introduced as noisy perturbations, to change their opinion. On the other hand, Mas et al (2010) distinguished between two types of noise. The 'interactive noise' captures random chances that agents may interact even when their opinions are not similar, whereas the 'opinion noise' refers to random influences that lead to arbitrary opinion changes. The latter is extended to the 'adaptive opinion noise' where the impact of noise is not constant but adaptive.

An important proviso for the present analysis is as follows: we accept the subjective nature of individual voter's public opinion. But, as highlighted earlier, the scope and purpose of the paper is to assess whether voters (regardless of how their respective opinions may differ) update their public opinions based solely on information in the current period. So, information is updated each period and the respective opinions are consistent. Consistency is an important aspect of voter inattentiveness. Hence, to this end, focusing on the behavior of a representative voter does suffice. This also matches the dataset used for the empirical analysis. The dataset depicts collective opinion, and is meant to illustrate the representative voter's public opinion. Furthermore, the index of news uncertainty captures the volatility of common news perception error. These issues will be further elaborated the subsequent section.

The outline of the paper is as follows. Section II introduces a simple model of voters' public opinion formation in the presence of imperfect information due to perception noise. We subsequently proceed to test voters' nowcast based on a random-walk, or semi-strong efficient,

hypothesis. The results are outlined and discussed in Section III and the summary and concluding remarks are drawn in Section IV.

II: Public Opinion, Nowcast and Imperfect Information: The Model

In this section we introduce a simple micro-founded macro-model of how voters form public opinions and perceptions by extracting signals from imperfect information which are transmitted via the news media and social networks[1]. These signals contain perception noise. The volatility, or variance, of this perception noise is the key source of news uncertainty[2].

The incumbent government's actual competence evolves dynamically due to permanent innovations to their competence. There are two ways to think about incumbent governments' competence. On the one hand, in established democracies such as the US, administrations change with regular intervals and the difference between these administrations are reflected by permanent innovations. On the other hand, individual administrations can have key policy changes. This may be a result of changes to their key personnel (both leaving and arriving). Also, unexpected adverse events (such as the sub-prime financial crisis of 2007-08) may reveal new aspects of the administration's ability and competence, These, too, can be reflected by permanent innovations. The volatility, or variance, of these permanent innovations is another source of uncertainty when forming public opinions.

Incumbents' actual competence and popularity (C_t) follows an AR (1) process:

$$C_t = \delta C_{t-1} + \nu_t \qquad \text{where } 0 < \delta \leq 1 \qquad (1)$$

[1] Fan and Cook (2003), following an established tradition of using economic news reported in the press, predict the time trend of US sentiments index based on variables used in discussions of the economy in the media.
[2] This is consistent with other recent assessments of informational uncertainty (see, for example, Bracha and Weber (2012) and Smithson (2008))

δ where is the coefficient capturing persistence and v_t is an *iid* zero-mean permanent innovation to incumbent competence with $Var(v_t) = \sigma_v^2$. [3] We further assume that the *ith* voter, who receives news via the media and social networks, does not observe C_t but receives the signal y_{it}, which is defined by the following perception equation[4]:

$$y_{it} = C_t + \omega_{it} \tag{2}$$

where ω_{it} is a *iid* zero-mean individual voter perception noise such that $Cov(\omega_{it}\omega_{jt-k})$ is equal to zero when *i*=*j* and *k*>0 (that is, individual noises are not serially correlated, $Cov(\omega_{it}\omega_{it-k}) = 0 \ \forall k > 0$). When *i*=*j* and *k*=0, however, the variance of noises is defined by: $Cov(\omega_{it}\omega_{it}) = \sigma_\omega^2$. The noise variance can also be generalized; it can vary by individual voter *i* and over time *t*. Perception noise may be correlated simultaneously in *t* across voters. Hence, when *i*≠*j*, $Cov(\omega_{it}\omega_{jt-k}) = \sigma_{ij}^2$ if *k*=0 and $Cov(\omega_{it}\omega_{jt-k}) = 0$ if *k*>0. The existence of simultaneous covariances across voters suggests that the individual perceptions of incumbent competence can be contemporaneously related across voters. For instance, individual's perceptions can be influenced by the same provisional information releases, via the news media. In the absence of noise, that is when σ_ω^2 tends to zero, *ith* voter's perceptions are closer to each other and they are almost perfectly informed about C_t. Individual's perception errors ω_{it} are assumed to be unrelated with the permanent innovation of incumbent component υ_t.

[3] Permanent innovations can be both negative and positive.
[4] The economic variables and targets by which voters can assess incumbent competence maybe clear but as Lott and Hassett's (2014) analysis clearly shows they are subject to bias media reporting.

The *ith* voter's perception noise comprises of two forms of noises: a common perception noise κ_t and an idiosyncratic perception noise μ_{it}:

$$\omega_{it} = \mu_{it} + \kappa_t \tag{3}$$

All sources of information about the incumbent competence contain a common perception noise κ_t. Unexpected and adverse political and economic events, for example events surrounding the credit crunch leading up to the financial crisis in 2007-8 and its aftermath, can result in delays or distortions when receiving pertinent information regarding the incumbent's competence. Such distortions or delays relate to common perception noise leading to common news uncertainty. As discussed in the introduction, the inattentive voter has only partial information and this could be due to their respective preferences and biasness. The *ith* voter's is likely to source information from specific media outlets and social network. These sources of information may have additional idiosyncratic perception noise μ_{it} [5]. For instances, in the present context of common news uncertainty, the index is constructed drawing from 10 national newspapers (see sub-section IV.1 for details). Information transmitted via the reports of all the 10 newspapers will contain common perception noise and, in addition, it is possible that individual newspapers will transmit idiosyncratic perception noise.

Hence, the individual voter must form estimates, or nowcast, of incumbent competence. They must also decide when to update their estimates. In the case of the latter, this will depend on the precision of the signals they receive via the news media and social networks. When a voter forms a contemporaneous opinion about the incumbent government under imperfect

[5] It is important to note that while the source of the information may be subjective and bias, the perception noise is not.

information, they form an *a posteriori* state estimate (or nowcast) in the current period *t*, $F_{it}C_t$. They rely on current information and it depends on the knowledge of the perception equation: y_{it}. So, it becomes a question of how precise the current signals are. At this point, we introduce a Kalman filter framework with the specific objective to estimate the optimal *a posteriori* state estimate $F_{it}C_t$. It is formed as a linear combination of the *a posteriori* estimate in the previous period ($F_{it-1}C_{t-1}$) and the weighted difference between the actual perception y_{it} available in *t* and its prediction made in *t-1*:

$$F_{it}C_t = F_{it-1}C_{t-1} + G\left(y_{it} - F_{it-1}C_{t-1}\right) \tag{4}$$

where the weight is the Kalman gain *G* and $0 \le G \le 1$. Notably, the Kalman gain *G* represents the relative weight the voter places on new information relative to previous forecasts. Equation (4) can also be rearranged as the weighted sum of the new information and the past nowcast:

$$F_{it}C_t = Gy_{it} + (1-G)F_{it-1}C_{t-1} = G(C_t + \omega_{it}) + (1-G)F_{it-1}C_{t-1} \tag{5}$$

As argued earlier, the focus of the paper is not to highlight the differences in individual opinions. Indeed, the underlying premise of the model is that individuals have different information sets, which can be sourced differently. The key focus of the paper is to consider whether voters update their perceptions, or nowcasts, consistently and how this may be affected by common news uncertainty[6]. Therefore, we focus on the average, or representative voter's, public opinion or nowcasts (F_tC_t)[7]:

[6] This is also congruent with the data used for empirical analysis in next section.
[7] When using a micro-founded macro-modelling approach this common way to determine the average agent's forecast of macroeconomic variables (see, for example, Coibion and Gorodenchenko, 2015, pp 2650)

$$F_t C_t = G y_t + (1-G) F_{t-1} C_{t-1} = G(C_t + \kappa_t) + (1-G) F_{t-1} C_{t-1} \qquad (5')$$

where $\sum_{i=1}^{N} \frac{F_{it} C_t}{N} = F_t C_t$, $\sum_{i=1}^{N} \frac{F_{it-1} C_{t-1}}{N} = F_{t-1} C_{t-1}$ and $\sum_{i=1}^{N} \frac{\mu_{it}}{N} = 0$

The role of uncertainty and the formation of public opinion is best understood by examining the nature of the Kalman gain. As indicated in equation (5), the Kalman gain combines the new information with the past predictions to obtain the *a posteriori* estimate $F_t C_t$. The optimal weight (G) inattentive voters place on new information when forming public opinion is derived by minimizing the variance of the nowcast error or, $\min E(C_t - F_t C_t)^2$). The *a posteriori* forecast error can be re-specified, by substituting $F_t C_t$ with equation (5') as follows:

$$C_t - F_t C_t = C_t - \left[F_{t-1} C_t + G\left(C_t + \kappa_t - F_{t-1} C_t \right) \right] = (1-G)(C_t - F_{t-1} C_t) - G\kappa_t \qquad (6)$$

Subsequently, given that the covariance between the *a posteriori* errors in period *t* and *t-1* is zero[8], using equation (6) we can rewrite the *a posteriori* error variance $E\left(C_t - F_t C_t\right)^2$ as the weighted sum as follows:

$$E\left[(1-G)(C_t - F_{t-1} C_t) - G\kappa_t\right]^2 = (1-G)^2 E(C_t - F_{t-1} C_{t-1})^2 + G^2 E(\kappa_t)^2 \qquad (7)$$

Finally, setting the derivative of the *a posteriori* error variance with respect to G equal to zero: $-2(1-G)E(C_t - F_{t-1} C_t)^2 + 2GE(\kappa_t)^2 = 0$, we define the optimal gain G on the basis of two variance components: the volatility of the nowcast error if the voter does update the previous

[8] We assume: $E(\kappa_t \left[C_t - F_{t-1} C_{t-1}\right]) = 0$, this is consistent with our earlier definition that individual perception noises (ω_{it}) (which also includes common perception noise κ_t) are not serially correlated.

period's nowcast $E\left(C_t - F_{t-1}C_{t-1}\right)^2$, and the volatility of the common perception error $E(\kappa_t)^2$, as follows: $G = \frac{E(C_t - F_{t-1}C_{t-1})^2}{E(C_t - F_{t-1}C_{t-1})^2 + E(\kappa_t)^2}$. The former volatility is due to the permanent innovation (ν_t) and the latter is the result of news volatility that transmits common perception error. So, G decreases with greater news volatility or uncertainty. Indeed, the weight the inattentive voter will place on new information in the current period depends on the trade-off between volatility of the nowcasts error (based on the previous period's nowcast) and the volatility of the common perception error. When $E(\kappa_t)^2 = 0$, $G = 1$implying that $\kappa$is a constant, and, thereby, the update of voter nowcast from one period to the next takes place instantly[9].

If information is revealed perfectly and $G = 1$equation (4), which has now been averaged, will be:

$$F_t C_t = y_t \text{ or } F_t C_t = C_t + \kappa$$

Notably, the public opinion (or nowcast) only contains information available in the current period. On the other hand, if $G < 1$ public opinion will have information from the previous period or, to put in another way, previous period's public opinion will persist: $F_t C_t = G y_t + (1-G) F_{t-1} C_{t-1}$. When the nowcast only contains information available in the current period and $G = 1$it is deemed to consistent. Indeed, in the context of the voter

[9] Please note that we use the term 'popularity' as the public's, or voters', perception of the incumbent's overall competence or administrative ability. This will be clearer when we describe and discuss the data in the next section

inattentiveness literature, voters are least inattentive or perfectly attentive during periods of low news volatility or uncertainty.

A simple test of the consistency of a nowcast is to test whether it evolves as a simple random walk process:

$$F_t C_t = \rho F_{t-1} C_{t-1} + \varepsilon_t$$

or $$\Delta F_t C_t = (\rho - 1) F_{t-1} C_{t-1} + \varepsilon_t \qquad (8)$$

The nowcast is consistent, or a random walk process, if: $\rho = 1$. This implies that previous period nowcast cannot predict the nowcast in the present period as the nowcast is based solely on information in the present period and, thereby, voters display semi-strong efficiency. If $\rho < 1$, then the nowcast is persistent.

IV: Empirical Analysis and Results:

As discussed in the preceding section, the updating will depend on news uncertainty or imperfect information and this relationship is non-linear. Therefore, the linear specification (8) can be extended to a non-linear specification. The structural change, or regime switching, behavior could be captured using smooth transition regression (STR) models. The regime-switching issue, allowing for structural change, can be generalized as follows:

$$\Delta F_t C_t = (\beta_0 + \beta_1) F_{t-1} C_{t-1} (1 - F(\vartheta_t)) + (\beta_0^{'} + \beta_1^{'}) F_{t-1} C_{t-1} (F(\vartheta_t)) \qquad (9)$$

where β_1 and $\beta_1^{'}$ estimates $(\rho - 1)$ in the two regimes and ϑ_t is a distinct transition variable, which in the present context denotes news uncertainty . The transition variable is depicted as a logistic function;

$$F(\vartheta_t) = [1 + \exp\{-\gamma(\vartheta_t - \tau) / \hat{\sigma}(\vartheta_t)\}]^{-1} \quad \gamma > 0, \tag{10}$$

Specifying the transition variable as a logistic function (as it is a monotonically increasing function of ϑ_t) enables us to capture any effect on how voters form nowcasts that are due to the changing level of news uncertainty. The switch between the two regimes $F(\vartheta_t) = 0$ and $F(\vartheta_t) = 1$ is captured by the parameter γ. It can be smooth (for relatively small γ) or abrupt, like a threshold (large γ). The location of the switch, or transition, between the two regimes is given by the threshold parameter τ. We closely follow the Time-Varying Smooth Transition Autoregressive (TV-STAR) model, with one transition introduced by Lundbergh et al (2003).

The rest of the section considers the estimation and implications of public opinion as a consistent nowcast and how news uncertainty, which proxies imperfect information, affects their attentiveness. The empirical analysis considers both the linear and non-linear models respectively.

IV:1: Data and Empirical Results:

The household-based survey data used in the current analysis is that compiled by *Survey Research Center*, University of Michigan, (*SRC*) for the US and has been available since January 1978. The number of households surveyed varies each month. The number of households surveyed peaked in November 1978 with 1479 and the smallest number of households to be surveyed was in November 1992 with 492. Since January 1987, each month on average of 500 households have been surveyed. In each month about 45% of the respondents have been previously interviewed while 55% are new respondents. The

samples for the *SRC* are statistically designed to be representative of all US households, excluding those in Alaska and Hawaii[10].

The exact wordings of the surveys conducted by the *SRC* that we are concerned with are:

"As to the economic policy of the government - I mean steps taken to fight inflation or unemployment – would you say that the government is doing a good job, only fair, or a poor job?"

The index for government competence (F_tC_t) is computed using relative scores, that is the percent of those surveyed giving favorable ('good job') replies minus the percent giving unfavorable ('poor job') replies plus 100.

The compiled indices, essentially, reflect the nowcast of the majority surveyed. The collective opinion is used as a proxy for the representative household's subjective opinions regarding the macroeconomy. The sample covers the period from January 1985 to July 2017.

Gallup has reported on presidential job approval since 1938, and for the vast majority of that history (1938-2008), this reporting was based on reporting job approval ratings from discrete, multiday surveys. From 2009-2017, Gallup measured presidential approval using daily sampling and interviewing on its tracking survey, reporting the results as three-day rolling averages. In 2018, Gallup measured presidential job approval using weekly sampling and interviewing on its tracking survey, reporting the results as weekly averages. The 2017 three-day rolling averages were replaced in the trend by 2017 weekly averages to maintain consistency in reporting on Donald Trump's presidency. In 2019,

[10] Further details pertaining to the *SRC* series can be obtained at the respective websites; http://www.sca.isr.umich.edu.

Gallup is returning to its 1938-2008 practice of reporting job approval ratings from its discrete, multiday surveys.

Until 1989, Gallup conducted interviews using face-to-face interviews and since Gallup has conducted all of its polls by telephone. From 2008, Gallup's national Random Digit Dialing (RDD) telephone samples included cellphone interviews for the first time, with most interviews still conducted on landline telephones. The proportion of cellphone interviews has since steadily increased.

In the present analysis we also use the recorded relative score[11]. With regards to the popularity index, we use the measure compiled by Gallup for the US, where they ask a straightforward question:

"Do you approve or disapprove of the way [president's name] is handling his job as president?"

We use the percentage of approvals as reported by Gallup. Over the sample period, the frequency of the survey and data varies from monthly to weekly and, more recently, daily. Therefore, when there are more than one surveys in a month, we use the last recorded survey of that month. The sample covers the period from January 1985 to August 2017. As before, the compiled collective opinion is used as a proxy for the representative household's subjective opinions.

Finally, the news uncertainty data relates to recently compiled news coverage about Policy-related Economic Uncertainty. Commonly referred to as the *Bloom Index* and compiled by Bloom et al (see Baker et al, 2015), it compiles an index of Economic Policy

[11] The Gallup measure and methodology are available at: *https://news.gallup.com/interactives/185273/presidential-job-approval-center.aspx*

Uncertainty and the news uncertainty is a component of this overall index, which is available separately as a disaggregated index. To measure policy-related economic uncertainty, Bloom et al construct an index from three types of underlying components. One component quantifies newspaper coverage of policy-related economic uncertainty. A second component reflects the number of federal tax code provisions set to expire in future years. The third component uses disagreement among economic forecasters as a proxy for uncertainty.

In the present paper, we focus on the first component. A monthly index is compiled following search results of 10 large newspapers in the US. The newspapers included in our index are USA Today, the Miami Herald, the Chicago Tribune, the Washington Post, the Los Angeles Times, the Boston Globe, the San Francisco Chronicle, the Dallas Morning News, the New York Times, and the Wall Street Journal. From these papers, Bloom et al construct a normalized index of the volume of news articles discussing economic policy uncertainty. Bloom et al search the digital archives of each paper from January 1985 to obtain a monthly count of articles that contain the following triple: 'uncertainty' or 'uncertain'; 'economic' or 'economy'; and one of the following policy terms: 'congress', 'deficit', 'Federal Reserve', 'legislation', 'regulation' or 'white house' (including variants like 'uncertainties', 'regulatory' or 'the Fed'). Hence, to meet their criteria, an article must contain terms in all three categories pertaining to uncertainty, the economy, and policy[12].

The dataset pertaining to the public opinion depicts collective opinion and illustrates the representative voter's public opinion. In addition, the index of news uncertainty captures

[12] An extensive discussion of the construction of this index can be found in Bloom et al (2015).

the volatility of common news perception error. The Figures 1 and 2 outline the indices under consideration and Table 1 provides the respective descriptive statistics:

Figures 1, 2 and Table 1 [about here]

The competence and popularity indices clearly co-move. This is consistent with the economic voting literature which advocates that the ability of incumbent governments to manage the macroeconomy is a crucial consideration for voters' approval and, subsequent, voting intentions. Also, as expected, the news uncertainty index rises and most volatile from the end of 2007. The next peak is in August 2011 when the United States House of Representatives passes legislation to raise the debt ceiling and avert the 2011 U.S. debt ceiling crisis. Prior to mid-2001, the index displayed low volatility. This increases sharply in late 2001, which coincides with September 11th and the month of September 2001 depicts the peak of news uncertainty. There is another sharp increase in March 2003 at the start of the invasion of Iraq.

The empirical results are outlined in Tables 2 and 3 below:

Tables 2 and 3 [about here]

Tables 2 and 3 outline the linear and non-linear estimates respectively. The linear results, reported in Table 2, clearly indicates that voters form their nowcast inconsistently. Hence, they display inattentive behavior and semi-strong efficient hypothesis is rejected. In the case of the popularity index (Column 1), the estimated $(\rho - 1)$ is -0.0489, implying that $\hat{\rho} < 1$. The estimated $(\rho - 1)$ for the competence index (Column 2) is -0.0332 which also implies that the $\hat{\rho} < 1$. While the persistence of both public opinions are high, the voters' perception of incumbent competence ($\hat{\rho} \approx 0.97$) is marginally more persistent that their view of incumbent popularity ($\hat{\rho} \approx 0.95$). In both cases there is a significant positive drift.

Turning our attention to the non-linear estimates, we find some interesting results with useful insights into voter inattentiveness when forming nowcast. The results distinguish between Regimes 1 and 2, which corresponds to levels of news uncertainty below and above the estimated threshold $\hat{\tau}$ respectively. In the case of the popularity index (Columns 1 and 2), the estimated threshold for the news uncertainty index is 105, which is slightly below its mean (see Table 1). The response of the nowcast indicates that it acts as a heavyside variable ($\hat{\gamma}$ is insignificant). Below the estimated threshold of 105, the public opinion follows a random walk and, therefore, is consistent. Conversely, above the threshold (as news uncertainty is increasing), the nowcast now has an estimated $\hat{\rho} < 1 (\hat{\rho} \approx 0.88)$ with a significant drift. The estimates imply that voters, when forming popularity nowcast of the incumbent, is consistent (or semi-strong efficient) when news uncertainty is low and inconsistent or persistent when news uncertainty is high. A similar pattern is observed for the voters' nowcast of incumbent competence (Columns 3 and 4), albeit at a higher threshold level of 128, which is above its mean for the sample period. Above this threshold level, the perceived incumbent competence persistence was marginally higher than the popularity index ($\hat{\rho} \approx 0.89$), also with a significant positive drift. The voters' nowcast of incumbent competence reverts to a random walk and is consistent when news uncertainty is low or below the threshold.

IV: Summary and Concluding Remarks:

The purpose of this research note is focussed narrowly. We consider an important implication of rational voter behavior; specifically, their attentiveness. We consider how perception noise volatility affects the way voters update their opinions. The perception noise volatility is captured by news uncertainty. A rational voter, regardless of their information set

or source of information, will consistently update their information set when forming opinions about incumbent competence and characteristics. Hence, despite the subjective nature of their respective opinions, their opinions will be consistent, and it only reflects information available in the current period.

The information they draw their perceptions from is affected by perception noise. Specifically, uncertainty around news will affect the way they form their nowcast, or public opinions. We consider the role of news uncertainty and how it may affect voter attentiveness. We provide a micro-founded macro-model that encapsulates the representative voter. This forms the basis to investigate empirically the voters' attentiveness when forming public opinion, or nowcasts. The relationship between news uncertainty and public opinions is non-linear. We use a non-linear time series estimation procedure, specifically Time-Varying Smooth Transition Autoregressive (TV-STAR) model, which enables us to distinguish between periods of high and low news uncertainty. We find that the public opinion, or nowcasts, are consistent during periods of low news uncertainty but highly persistent when news uncertainty is high. Voters display semi-strong efficiency when updating their public opinion, or nowcast, when new uncertainty is low.

We conclude that the representative voter when forming public opinion pertaining to incumbent competence and abilities, similar to agents forming macroeconomic forecast, are affected by informational rigidities, or inattentiveness. In the case of the voter, they appear to be affected only during periods of high news uncertainty and, therefore, they are rationally inattentive.

References:

Aidt, T., (2000) "Economic voting and information." *Electoral Studies*, 19, pp. 349-362.

Baker., S, N. Bloom and S.J. Davis, (2015) "Measuring Economics Policy Uncertainty", *National Bureau of Economic Research Working Paper* No. 21633.

Bracha, Anat, and Elke U. Weber. (2012) "A Psychological Perspective of Financial Panic." *Federal Reserve Bank of Boston Public Policy Discussion Papers*, 12–7.

Carroll, C.D, 2006, "The Epidemiology of Macroeconomic Expectations" in Larry Blume and Steven Durlauf, eds., *The Economy as an Evolving Complex System, III*, Oxford University Press.

Coibion, O. and Y. Gorodnichenko (2015), "Information Rigidity and the Expectations Formation Process: A Simple Framework and New Facts", *American Economic Review*, Vol. 105, No. 8, pp. 2644-2678.

Duch, R A and Stevenson, R. (2010) "The Global Economy, Competency, and the Economic Vote", *The Journal of Politic*s, 72(1) pp. 105-123.

Easaw, J and A. Ghoshray. (2007). "Confidence or Competence? Do Presidencies Matter for Households' Subjective Preferences?" *European Journal of Political Economy, 23(4),* pp. 1025-1037.

Easaw, J, (2010) "It's all 'bad' news!: Voters' perception of macroeconomic policy competence", *Public Choice*, Vol. 145, Issue 1–2, pp 253–264

Easaw, J, and Mossay, P., (2015) "Households forming macroeconomic expectations: inattentive behavior with social learning", *The BE Journal of Macroeconomics* 15 (1), pp. 339-363.

Easaw, J., R. Golinelli and S. Heravi (2016), "Inflation Forecasts and Uncertainty", paper presented at the 36th *International Symposium on Forecasting*, Santander, Spain, 19-22 June 2016.

Fan, D, and Cook, D., (2003) "A differential equations model for predicting public opinions and behaviors from persuasive information: Application to the index of consumer sentiment.", *Journal of Mathematical Sociology*, Vol 27(1), pp. 29-51.

Katz, E and P. F. Lazarsfeld, 1955, *Personal Influence; the Part Played by People in the Flow of Mass Communications*, Glencoe, IL: Free Press.

Lott J R and Hassett, K A., (2014) "Is newspaper coverage of economic events politically biased? *Public Choice*, Vol. 161, Issues 1-2, pp 65–108.

Lundbergh S., Teräsvirta T.& van Dijk D. (2003) “Time-varying smooth transition autoregressive models”, *Journal of Business & Economic Statistics* 21: 104– 21.

Mäs, M, M, A. Flache1 and D. Helbing (2010), “Individualization as Driving Force of Clustering Phenomena in Humans”, *PLoS Computational Biology*, 6(10), pp. 1-8

Matejka, Filip and Tabellini, Guido (2016) “Electoral Competition with Rationally Inattentive Voters”. *CESifo Working Paper*, No. 5849

Pineda, M., T R., and Hernandez-Garcıa, E. (2009), “Noisy continuous-opinion dynamics”. *Journal of Statistical Mechanics*, P08001.

Smithson, Michael. (2008) “Psychology’s Ambivalent View of Uncertainty.” In *Uncertainty and Risk: Multidisciplinary Perspectives*, edited by Gabriele Bammer and Michael Smithson, 205–17. London: Routledge.

Van Dalen, A, H. Svensson, A. Kalogeropoulos, Albaek, E A. and A, De Vreese, (2018), *Economic News: Informing the Inattentive Audience*, Routledge, New York and London.

Table 1: Average and standard deviation for Competence, Popularity and New Uncertainty Indices (January 1985 – August 2017)

	Average	Standard Deviation
Overall		
Competence	89.412	21.834
Popularity	52.018	11.969
News Uncertainty	110.145	40.217

Table 2: Linear Estimates

	(1)	(2)
:	Linear	Linear
Estimation method:	OLS	OLS
Dependent Variable:	Popularity	Competence
$(\rho - 1)$	**-0.0489** **	**-0.0332** **
	(0.0221)	(0.0139)
constant	**2.5060** **	**2.9612** **
	(1.1868)	(1.3069)
AIC	3.25	3.52
SC	5.06	5.78
Diagnostics (p-values)		
Normality	0.000	0.000
ARCH	0.863	0.352

Notes : (a) ***1% signifiance **5% signifiance, (b) Standard errors in parenthesis
(c) AIC: **Akaike information criterion and SC: serial correlation**

Table 3: Non-Linear Estimates

	(1)	(2)	(3)	(4)
:	Non-Linear	Non-Linear	Non-Linear	Non-Linear
Estimation method:	MLE	MLE	MLE	MLE
	Regime 1	Regime 2	Regime 1	Regime 2
Dependent Variable:	Popularity	Popularity	Competence	Competence
$(\rho - 1)$	**0.0390**	**-0.1202** **	**0.0077**	**-0.1132** **
	(0.0221)	(0.0458)	(0.0169)	(0.0244)
constant	**-2.0420**	**6.2916** **	**-0.9436**	**9.9937** **
	(4.5603)	(2.4529)	(1.6187)	(2.1491)
γ		**3.1432**		**500.000**
		(5.2060)		(0.0659)
τ		**105.616****		**128.541****
		(21.419)		(1.0619)
AIC	3.25		3.49	
SC	5.01		5.65	
Diagnostics (p-values)				
Normality	0.0000		0.0000	
ARCH	0.8007		0.6699	
Parameter constancy	0.7493		0.9535	
Remaining nonlinearity	0.7322		0.7148	

Notes : (a) ***1% signifiance **5% signifiance (b) Standard errors in parenthesis
(c) AIC: **Akaike information criterion and SC: serial correlation**

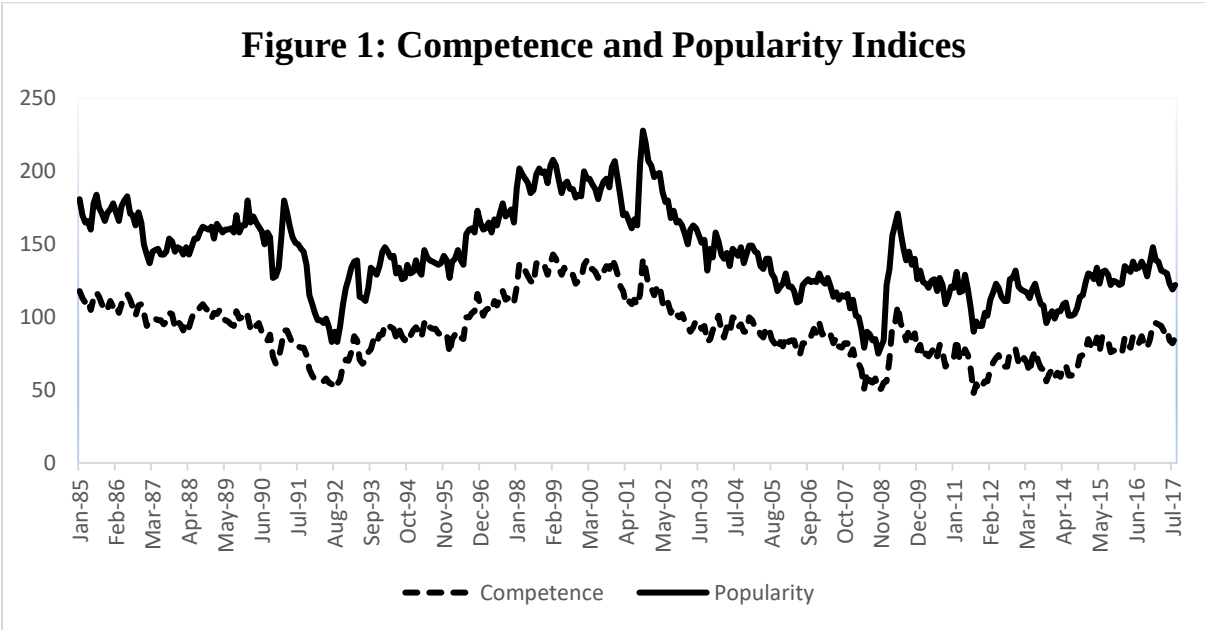
Figure 1: Competence and Popularity Indices
250
200
150
100
50
0
Jan-85
Feb-86
Mar-87
Apr-88
May-89
Jun-90
Jul-91
Aug-92
Sep-93
Oct-94
Nov-95
Dec-96
Jan-98
Feb-99
Mar-00
Apr-01
May-02
Jun-03
Jul-04
Aug-05
Sep-06
Oct-07
Nov-08
Dec-09
Jan-11
Feb-12
Mar-13
Apr-14
May-15
Jun-16
Jul-17
Competence
Popularity

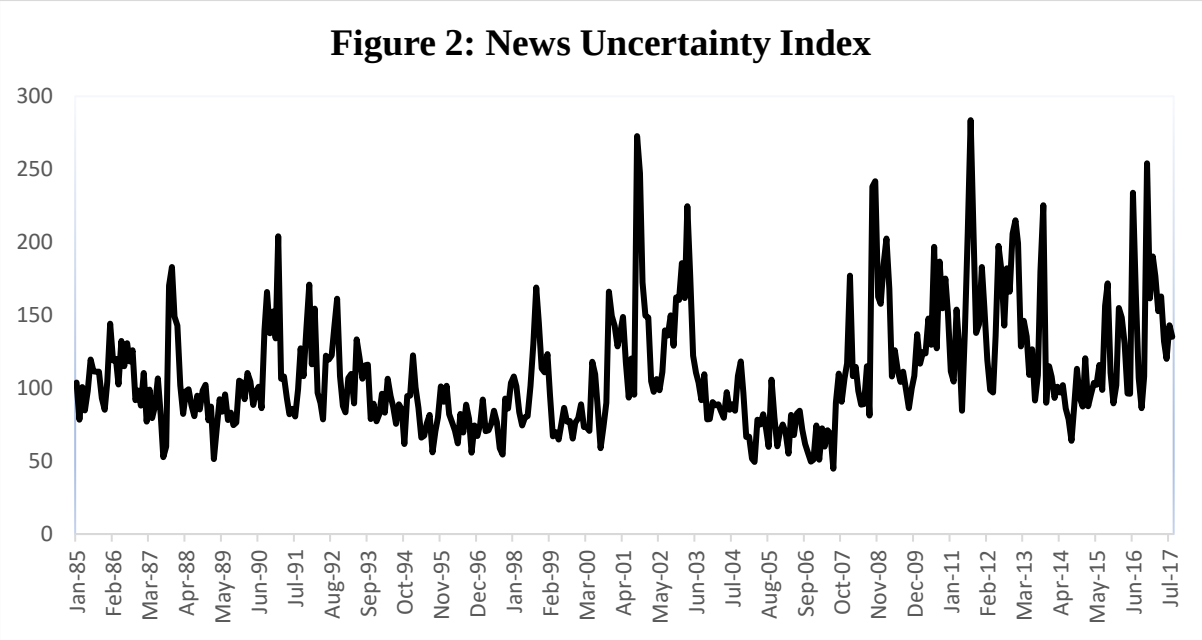
Figure 2: News Uncertainty Index
300
250
200
150
100
50
0
Jan-85
Feb-86
Mar-87
Apr-88
May-89
Jun-90
Jul-91
Aug-92
Sep-93
Oct-94
Nov-95
Dec-96
Jan-98
Feb-99
Mar-00
Apr-01
May-02
Jun-03
Jul-04
Aug-05
Sep-06
Oct-07
Nov-08
Dec-09
Jan-11
Feb-12
Mar-13
Apr-14
May-15
Jun-16
Jul-17