Political Analysis, 8:3

Testing for the Strong Form of Rational Expectations with Heterogeneously Informed Agents

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In recent years, political scientists have tested for the existence of rational expectations (RE) using survey-based aggregate data on subjective economic perceptions. These tests suffer from several conceptual shortcomings of a nontrivial nature. In this study, the meaning of RE is clarified, and also a test for strong rational expectations (SRE) where citizens possess heterogeneous information levels is set forth. These empirical tests provide insights into what kinds of information citizens use in forming expectations from that which they do not utilize but could employ to arrive at more accurate forecasts. Using inflation expectations data for the period January 1978–December 1993, the empirical findings indicate that citizens can benefit from greater reliance on objective economic and political conditions when formulating their inflation expectations. The broader implications of this work pertain not only to the execution of RE tests in political science, but also to distinguishing which types of information people do and do not (but could) incorporate in their decision-making calculus.

1 Introduction

POLITICAL SCIENTISTS INTERESTED in both political behavior and political economy in recent years have investigated the formation of subjective economic expectations (e.g., Haller and Norpoth 1994; Krause 1997; Krause and Granato 1998; MacKuen et al. 1992; Suzuki 1992). Much of this focus can be attributed to compelling empirical evidence that subjective economic expectations affect political outcomes ranging from elections (e.g., Kiewiet 1983; Kuklinski and West 1981; Lewis-Beck 1988) to presidential approval (Clarke and Stewart 1994; MacKuen et al. 1992). By examining the process that determines mass

Author's note: A portion of this paper was presented at the 1996 Midwest Political Science Association meetings, Chicago, IL, April 18–20, 1996. I wish to thank Mary Bange, Janice Boucher Breuer, Henry Chappell, John Freeman, Jonathan Katz, Jeff Milyo, Anirudh Ruhil, Ed Wingenbach, seminar participants in the Department of Economics at the University of South Carolina, and the anonymous *Political Analysis* referees for comments on early versions of the manuscript. I wish to thank especially Jim Granato for his collaboration on a different segment of this project and his contributions to an early version of the manuscript, though he bears no responsibility for any errors or omissions that remain. I also appreciate the excellent research assistance provided by both Curtis Amick and Susan Tabrizi. The statistical analysis conducted in this study was performed in RATS (version 4.30), PCGIVE Professional (version 8.10) and EVIEWS (version 2.0). Data and documentation necessary to replicate this analysis are available at the Political Methodology website (URL address: http://www.westviewpress.com/politicalanalysis/vol8no.3.html) or by contacting the author via e-mail: George.Krause@sc.edu.

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economic expectations formation, political scientists can arrive at a better understanding of democratic accountability.

The rational expectations (RE) hypothesis is a popular theoretical vehicle in assessing the sophistication with which people process information when making judgments about the real world. RE presumes that agents utilize all available and relevant information with the purpose of avoiding systematic (i.e., permanent) errors of judgment about some objective future condition (Lucas 1972; Muth 1961). RE, however, does not presume that all information is used, or that perfect certainty exists.[1] Instead, RE maintains that agents will not make systematic errors when formulating expectations in an uncertain world and will, therefore, efficiently use information to enhance their forecasting accuracy.

The appropriate statistical testing of the RE hypothesis is of considerable interest to political scientists because theories focusing on behavioral response and information acquisition or processing are vital for understanding the responsiveness of the mass public and elected officials within a democracy. Improper testing of the RE hypothesis results in a distorted portrait of how the public forms its expectations concerning future states or conditions and, also, yields an inaccurate view of how information is utilized by the mass public. Therefore, it is important to distinguish between (1) what people already do know by taking such information into account when formulating expectations and (2) what people do not know, but should know, since their failure to use such information hinders their ability accurately to predict the future.

The central purpose of this study is to clarify the meaning of rational expectations for political science research by providing an explicit link between the theory and empirical testing of this hypothesis. The approach undertaken here is distinct in two ways from existing political science works. First, the empirical test of strong RE set forth here is grounded in economic theory and links the substantive meaning of RE to its statistical testing. In addition, this test is linked to Pesaran's (1987) linear rational expectations framework that allows for heterogeneously informed agents with varying information acquisition and processing capabilities. This framework is consistent with micro-level research on mass behavior (e.g., Delli Carpini and Keeter 1996; Ferejohn 1990) and, also, recent subaggregate mass behavior studies of expectations formation (Krause 1997; Krause and Granato 1998).

2 Empirical Testing of the Rational Expectations Hypothesis in Political Science

2.1 *Conceptual Issues*

Political science research has typically not done a careful job of making the critical distinction between adaptive expectations and rational expectations. The former refers to those expectations which are shaped exclusively from the history of a particular variable of interest (Cagan 1956). Rational expectations (RE), however, suggests that agents will form unbiased and/or efficient expectations since they do not make systematic errors in predicting future states because they utilize all relevant and available information at their disposal when formulating expectations of future conditions (Muth 1961). The focus of this study is on the proper statistical testing of efficient information utilization. RE, however, does

[1] RE is not an overly stringent test for information capabilities of actors because its very nature pertains to the "real world" of less than perfect information and the existence of uncertainty. In the special case where information is complete and uncertainty does not exist, this theory reduces to perfect foresight (see Begg 1982, Chap. 3).

not imply that there exists perfect information or certainty regarding the future. There are three conceptual problems with the empirical testing of rational expectations in existing political science applications: (1) a false dichotomy between prospective and retrospective orientations with respect to information usage; (2) failure to assess subjective expectations in relation to an objective condition or state; and (3) statistical tests that are not capable of discerning what information is used by the mass public and that which is not employed.

2.1.1 Use of Retrospective Information May Reflect Rational Expectations

Past studies presume that retrospective behavior corresponds with adaptive expectations, while prospective behavior corresponds with the existence of rational expectations (Erikson et al. 1998; MacKuen et al. 1992, 1996; Norpoth 1996a, b). Such a view is problematic since actors are capable of making systematic forecast errors period after period under prospective behavior. Actors that exhibit RE are required to use all available and relevant information, including that of a retrospective nature, if they are to make forecasts that are not systematically incorrect. Contrary to the aforementioned research, retrospective judgments may be part of an information set that can be used by actors when formulating their expectations. As a result, one can use retrospective information and still obtain empirical support for the RE hypothesis as long as one is generating predictions of the future that are not systematically wrong.[2] Simply, utilization of "retrospective" variables in and of itself is not sufficient grounds empirically to reject RE.

2.1.2 Subjective Expectations Are Not Explicitly Compared to Objective Reality

The empirical tests employed in political science are not premised on the basic theory underlying RE from the pioneering work of Muth (1961) since they fail to emphasize the ability of actors to make unbiased and accurate forecasts. For example, if actors fail to behave as Muthian agents, then the mass public cannot be treated as if they were "bankers" since their ability to act in a prospective manner is of little practical utility. This is because they would be ineffectual in holding elected officials accountable for public policies since they cannot discern between *actual* policy and *expected* policy. Thus, evidence of rationality within the context of RE viewed purely based on prospective behavior itself is logically tenuous at best given that one may possess a "forward-looking" nature, yet be permanently incorrect in his or her judgment about future states or conditions.

The crux of this dilemma is that standard political science tests are not derived from a formal theory of political–economic behavior consistent with RE. RE theory maintains that citizens form predictions of future states in such a manner that their forecasts are not biased (weak RE) or use information in an efficient manner (strong RE). This is captured by an explicit formal mathematical representation of citizens' subjective conditional expectations in relation to an objective future state or condition. Political scientists testing for RE typically fail to consider an explicit "forecast error" associated with prediction.[3] Thus, forecast accuracy and unbiasedness cannot be assessed by examining only subjective expectations in isolation from objective reality.

[2]This line of reasoning is consistent with a handful of political science studies which (ironically) have not directly tested for the rationality of expectations formation (Beck 1991; Ferejohn 1986; Clarke and Stewart 1994, p. 1118). Relatedly, Fiorina's (1981) seminal work on voting behavior demonstrates that *rational* and *retrospective* behavior are not mutually exclusive.

[3]Specifically, these tests fail to compare citizens' subjective economic prospections to objective conditions that are necessary for testing this condition (for exceptions see Haller and Norpoth 1994; Krause and Granato 1998).

2.1.3 Improper Statistical Tests Cannot Properly Discern Information Usage

Existing statistical tests of RE in political science fail to distinguish between which information is being used by actors and that which is not being used. These studies focus exclusively on subjective perceptions and their impact on expectations formation. Thus, inefficient use of information is tested by using expectation variables without considering the sources of forecast error. The conceptual problem with this approach is that it does not provide a set of variables that the mass public chooses to employ (and not to employ) when formulating economic expectations. Such analysis of RE can provide us with substantive insights, such as whether the mass public incorporates information on the party in control of the White House or the stage of the election cycle when formulating economic expectations. Brown and Maital (1981, p. 499) set forth two ways to test for strongly rational expectations (SRE):

> There are at least two empirical tests for fully (strong) rational predictions. One rather weak test regresses the current forecast error on the preceding forecast error(s). Presence of a statistically significant relation indicates that information exists which, if used, could have further reduced mean square forecast error. A second, more revealing test, which perhaps helps show what economists do *not* know, regresses the current forecast error on lagged policy and state variables whose values were known when the forecast was made.

The former test is adopted by Haller and Norpoth (1994, p. 640). This approach does not provide us with us the specific means to know what particular information the mass public is aware of because it only considers lagged forecast errors. The use of past forecast errors to predict current forecast errors is both conceptually and statistically problematic when a mismatch between the sampling interval and the forecast horizon exists such as in their study (Begg 1982, p. 73). The second approach is preferable to test for SRE, which unlike the first approach, consists of a reduced-form empirical test that is derived from formal models of economic behavior. If the assumption is that citizens use an information set and that they use all relevant and available information from it, then any additional information cannot improve citizens' forecasts under the SRE condition. But if some additional information can be used to improve forecasts, then this will lead to the rejection of SRE.

2.2 *Agent Heterogeneity*

Empirical tests of the rational expectations hypothesis generally found in political science view the electorate as a singular entity that forms economic expectations with homogeneous information capabilities. These homogeneous information-based approaches are fruitful and greatly contribute to our understanding of mass behavior. At the same time, however, these studies implicitly assume that information capabilities across the electorate exhibit modest variation at best.[4]

The macro perspective on modeling information homogeneity across the mass public differs markedly from micro-level evidence that political knowledge and sophistication do vary across the mass public (e.g., Delli Carpini and Keeter 1996; Nie et al. 1996). What is

[4]This particular issue involving the application of RE in existing political science studies is intended solely to extend the manner in which the mass public is analyzed. A sole focus on a unitary aggregate is appropriate if information processing is not of central interest and/or the substantive question being studied pertains to this level of analysis.

the basis for heterogeneous information levels? Quite simply, the acquisition of information is not a costless endeavor (Downs 1957). In order to be informed, costs of acquiring political and economic information must be incurred on the part of voters. Because more informed segments of the electorate or mass public acquire information in a less costly manner compared to less informed strata, the former group(s) will have a greater incentive to obtain more information than the latter group(s), holding all else constant (MacKuen 1984; Graber 1984).[5] Those segments of the mass public with lower levels of political sophistication often use heuristic devices (or judgmental shortcuts) as a way of becoming more informed (Ferejohn 1990, p. 11; Sniderman et al. 1991). Because information acquisition is not costless, there may exist "rational" reasons that dictate nonrational expectations formation (Shaw 1984, p. 108). Therefore, allowing for information heterogeneity among citizens relaxes an assumption inherent in macro-level empirical models that is inconsistent with the micro-level evidence.

Economists have relaxed the homogeneity assumption in testing the RE hypothesis (Frydman and Phelps 1983; Pesaran 1987). These models analyze the pricing and output decisions for firms in a decentralized market with private information (Pesaran 1987, Chap. 4). Relatedly, recent work in political science has focused on the differential manner in which economic expectations are formed (Krause 1997; Krause and Granato 1998). These studies have found that the mass public behaves differently when formulating economic expectations since information capabilities vary. Moreover, this view implies that voters possess heterogeneous preferences and exercise different decision-making rules (Rivers 1988).

2.3 *Mismatch Between Measurement Intervals and Forecast Horizon*

Testing for the existence of RE using survey-based data often entails a sampling interval for a prediction made at a smaller interval (e.g., quarterly or monthly) than the forecast interval (e.g., 1 or 5 years). This situation is commonplace in political science applications testing the rationality of economic expectations. As Krause and Granato (1998) maintain, these empirical models suffer from an overlapping data problem (Hansen and Hodrick 1980). This means that a moving average (MA) process is induced by the measurement intervals of the data set being smaller than the forecasting horizon used to predict the future value of a given variable. If such a process occurs, this may suggest that tests of statistical significance are subject to Type I error, thus leading one falsely to reject the null finding of RE.[6] The remedy is to correct the standard errors by using the method proposed by Newey and West (1987).

3 Testing for Strongly Rational Expectations with Heterogeneous Agents

Strongly rational expectations (SRE) pertain to the efficient use of all current and available information that exists in the information set (Begg 1982; Brown and Maital 1981; Mishkin 1983). Strong rationality implies efficiency because agents are unable systematically to improve their forecasts with data from an information set. Rejection of SRE means that at least some of the relevant information contained in the information set is not being fully utilized, otherwise it would improve an agent's predictive accuracy in forming expectations.

[5] It is also possible that more informed portions of the electorate acquire *higher-quality* information as well. I thank John Freeman for bringing this point to my attention.

[6] With the exception of Krause and Granato (1998), existing political science treatments fail to account for this statistical dilemma when assessing the rationality of economic forecasts.

However, rejection of SRE does not necessarily mean that forecasts are biased in accordance with violation of the weakly rational expectations (WRE) condition. Thus, WRE can be viewed as a limited form of rational behavior compared to SRE.[7] In both cases, however, the economists' view of RE is not any more demanding for "professional" market participants than it is for the mass electorate since it acknowledges that actors need not possess perfect foresight.

Understanding information utilization is important to political scientists since it has been established that information is not a costless endeavor and it is in low quantity among the mass public (Downs 1957). Investigating what information political actors do use, and what they should use, is a vital first step in addressing the issue of RE and its implications for mass behavior. These implications are centered on what information is used by citizens and, from both a positive and a normative perspective, what information can be used to help them behave in a more knowledgeable fashion.

The SRE condition implies that all relevant available information is being used in an optimal (efficient) manner by political actors. It is well established that this condition implies that forecast (or prediction) errors will occur in a random manner with a mean of zero (Begg 1982; Mishkin 1983; Muth 1961; Shaw 1984).[8] In mathematical terms, this means that the expected forecast error under SRE for a single unitary aggregate group can be written

$$E(\xi_{t+k}) = E(X_{t+k} - E[X_{t+k} \mid \Omega_t]) = 0 \tag{1}$$

where it is simply a function of the expected difference between the actual value of the random continuous variable Xk periods ahead into the future and the expected value of Xk periods ahead in the future, conditional on all available and relevant information at time t (Ω_t), which is equal to zero. One can rearrange terms in (1) to convert this expectation of the forecast error into a *conditional* expectation that is given by

$$E(\xi_{t+k} \mid \Omega_t) = E\left[X_{t+k} - {}_tX^e_{t+k}\right] = 0 \tag{2}$$

where the conditional expectation of the forecast error is simply the expected difference between the actual value of Xk periods ahead in the future (X_{t+k}) and the predicted value of Xk periods ahead in the future made in the current time period (${}_tX^e_{t+k}$), which is equal to zero by definition under the SRE condition. Equation (2) is termed the efficiency (i.e., orthogonality) principle and implies that the theoretical mean of the forecast errors (ξ_{t+k}) is zero, conditionally based on the information set available at time t (Ω_t). Thus, by regressing the actual forecast error on variables contained in the information set, one is able to discern what information is being incorporated into actors' predictions and what information could improve their forecasts if it were fully utilized.

3.1 *Empirical Testing of Rational Expectations with Heterogeneously Informed Agents: A Positive Framework*

As noted earlier, most political science research on this topic treats the electorate as a singular entity that forms economic expectations with homogeneous information capabilities. There are those who contend that analyzing a group or stratum of citizens can generate important

[7] WRE requires only that individuals form forecasts that are not systematically incorrect based on their expectation of a single variable, whereas SRE requires efficient use of information on other variables in formulating a prediction. The concept of WRE and its empirical testing are discussed elsewhere (Krause and Granato 1998).

[8] This subsumes a quadratic loss function underlying the forecasts being made by the mass public.

insights into the nature of expectations formation. For instance, MacKuen et al. (1992, p. 607) make an intuitively appealing claim that elite opinion leads the mass public to make judgments beyond their own information capabilities. Similarly, Mishkin (1983, pp. 59–60) asserts that all market participants need not behave rationally for a market to display rational expectations. Both works imply that subaggregate behavior will not necessarily reflect aggregate behavior.

A simple positive framework can provide us with a disaggregated view of the electorate broken down by informational groups. In this setup, both group-specific (*private*) and common (*public*) information is used to formulate expectations. Based upon Pesaran's (1987, pp. 276–277) linear model of RE under heterogeneous information, one can consider the mass public consisting of N "information" groups. Each group i forms expectations k periods ahead into the future on a given continuous random variable, x, at time t, according to the following rule:

$$ {}_{t}x^{e}_{i,t+k} = \theta_i E[X_{t+k} \mid \Omega_{i,t}], \qquad i = 1, 2, \ldots, N \tag{3} $$

In (3), X_{t+k} is defined as the actual value of the random continuous variable k periods ahead into the future consistent with (1), while $(\Omega_{i,t})$ is the information available to the ith stratum or subgroup at time t. This information set can be broken down into both a group-specific component, which can be thought of as accounting for information that is distinct for each informational group, and a macro component, which captures the effect of shared information among N groups, where the structure of the disaggregated information sets across these groups $(\Omega_{i,t})$ is

$$ \Omega_{i,t} = \Phi_{i,t} \cup \Psi_{t-1} \tag{4} $$

where $\Phi_{i,t}$ pertains to group-specific information, and Ψ_{t-1} refers to common or shared information. Thus the information set for the ith group at time t is a function of current available group-specific information and also lagged one-period common information.[9] For instance, if one were interested in analyzing the formation of (sociotropic) business expectations, an example of group-specific information would be current retrospective business evaluations of the ith segment of the electorate. An example of shared common information would be last period's state of the economy variables, such as the actual rate of inflation and GNP growth variables.

3.2 *SRE with Heterogeneous Agents: Linking Formal Representation to Empirical Testing*

Translating the formal characterization of SRE into an empirical specification is straightforward. Substituting a modified version of (1) that allows for information heterogeneity yields

$$ E(\xi_{i,t+k}) = E\left[x_{i,t+k} - {}_{t}x^{e}_{i,t+k} \,\middle|\, \Omega_{i,t}\right] \tag{5} $$

[9] This particular model is solved via the method of infinite regress, which eventually results in the following general theoretical solution: ${}_{t}X^{e}_{t+k} = \omega_t + \sum_{j=1}^{\infty} \theta^j F^j(\omega_t)$, where $\omega_t = \sum_{i=1}^{N} \omega_{i,t}$. Within this particular context, the ω term accounts for the impact of exogenous or predetermined variables on ${}_{t}X^{e}_{t+k}$. This solution, however, is predicated on an unobservable range of average expectations and thus will not be determinate unless certain a priori restrictions are placed on ω_t. More information on the pure theoretical solution of this particular type of model is given by Pesaran (1987, Chap. 4 and Appendix B).

where the expected value of the forecast error for a given stratum (i) is a function of the difference between the actual value of the variable k periods ahead into the future and its expectation made in the current period, conditional on the variables that are available, relevant, and contained in each information set. Substituting (5) into (4) yields

$$E(\xi_{i,t+k}) = E\left[x_{i,t+k} - {}_t x^e_{i,t+k} \mid \Phi_{i,t} \cup \Psi_{t-1}\right] \tag{6}$$

where each stratum's (i) conditional forecast error is the difference between the actual value of the variable k periods ahead into the future and its expectation in the current period, conditional on group-specific and common/shared information, respectively. Rearranging terms in (6) and transforming it into an additive linear regression model specification produces

$$E\left[x_{i,t+k} - {}_t x^e_{i,t+k}\right] = \alpha_i + \beta_{i,j}\Phi_{i,t} + \tau_{i,m}\Psi_{t-1} + \varepsilon_{i,t+k} \tag{7}$$

where the expected value of the forecast error of the given variable of interest for a given stratum *(i)* is simply a linear function of a constant term (α_i), a vector of group-specific information that varies across different informational segments of the electorate ($\Phi_{i,t}$) and its corresponding parameter vector ($\beta_{i,j}$), a shared information set that contains lagged values that are identical across all strata (Ψ_{t-1}) and its corresponding parameter vector ($\tau_{i,m}$), and a stochastic disturbance term pertaining to the ith stratum and k periods into the future ($\varepsilon_{i,t+k}$). The SRE condition holds in a statistical context when the hypothesis that the coefficient parameter vectors are jointly zero (i.e., $\alpha_i = \beta_{i,j} = \tau_{i,m} = 0$) cannot be rejected.[10] Under SRE, there will not exist information contained in the set that is capable of improving agents' forecasts if it were to be employed.[11]

4 An Application to the Mass Public's Inflation Expectations

This section employs predictions of inflation one year ahead in order to assess what the mass public does know from what they should know. Studying the formation of inflation expectations is worthwhile to students of political economy and elections since it is important to the electorate (Chappell and Suzuki 1993; Peretz 1983; Suzuki and Chappell 1996) because price expectations play a vital role in affecting changes in other key macroeconomic variables such as output, business conditions, and unemployment (Lucas 1972). Also, inflation expectations data provide a survey instrument containing an actual forecast of inflation, not simply a directional response.

The inflation expectation series from the Institute of Social Research's (ISR) Survey of Consumer Attitudes (SCA) for monthly intervals between January 1978 through December 1993 is used to test the SRE hypothesis.[12] The survey question posed to SCA respondents

[10] This type of test is standard in the economics literature, ranging from expectations formation involving forward exchange rates (e.g., Breuer and Wohar 1996) to price level/inflation forecasts (e.g., Brown and Maital 1981) to state revenue forecasts (Gentry 1989).

[11] The asymptotic properties of these single-equation empirical tests are robust to the exclusion of relevant variables from the specified information set (Brown and Maital 1981, p. 493). This is because under the rationality hypothesis, the slope coefficient vectors associated with the information set ($\beta_{i,j}$, $\tau_{i,m}$) will yield consistent estimates and should not be significantly different from zero. This means that if SRE is violated, then plim ($\hat{\beta}_{i,j}$, $\hat{\tau}_{i,m}$) $\neq 0$. It is possible that SRE may be invalid when plim ($\hat{\beta}_{i,j}$, $\hat{\tau}_{i,m}$) $= 0$ since the Pr(Type II error) $\not\to 0$ as $n \to \infty$ for these types of tests. However, it must also be noted that cross-equation empirical tests that circumvent this problem are asymptotically equivalent to their single-equation counterparts [please see Mishkin (1983, Chap. 3) for a thorough treatment of these issues].

[12] Monthly interval data are used due to issues of systematic sampling and temporal aggregation which may adversely affect the validity of statistical estimates (Freeman 1990). Actual inflation is collected and released to

is, "By what percent do you expect prices to go (up/down) on average during the next twelve months?" The objective inflation measures used to assess the forecast errors are calculated as the actual inflation rate 12 months (1 year) into the future and, also, as a moving average over the subsequent 12 months.[13]

Education is strongly related to sophisticated political behavior (e.g., Converse 1964; MacKuen 1984; but see Zaller 1992) and also serves as a proxy for public affairs competence (Delli Carpini and Keeter 1996; Krause and Granato 1998, pp. 141–143; Nie et al. 1996, p. 37). Thus, the mass public is broken down into three distinct educational groups: (1) those citizens who do not possess a high school diploma or its equivalent (LOW), (2) those citizens who possess a high school diploma (or its equivalent) but have not obtained a baccalaureate 4-year college degree (MEDIUM), and (3) those citizens with at least a baccalaureate 4-year college degree (HIGH).

4.1 *Defining the Information Set*

4.1.1 Government Policy Variables

Construction of an information set pertinent to citizens' expectations of inflation is essential in determining what citizens know as opposed to what they should know. Government policy should play a vital role in the formation of inflation expectations. As it pertains to inflation, government policy is reflected by a monetary policy instrument that is targeted by the Federal Reserve. While there are no direct measures of monetary policy, the federal funds rate, which is the interest rate member banks of the Federal Reserve System charge one another for overnight loans, is employed. This policy instrument is generally viewed as the key operating target for monetary policy (Bernanke and Blinder 1992; Goodfriend 1991). The most recently observed value of the monthly Federal Funds Rate, which occurs in month $t - 1$, is considered as an independent variable in the information set.

There have also been structural changes in the Fed's monetary policy operating regime during this sample period with the money growth rate target experiment of October 1979–October 1982. Therefore, the growth rate of the M1 measure of money stock in period $t - 1$ is included as an independent variable. In addition, the changing nature of these monetary policy regimes is captured by multiplying each intermediate target policy variable by its own respective shift dummy, which equals one during the existence of a given regime and zero otherwise in order to properly gauge monetary regimes during our sample period. If strong rationality does not hold, one would expect a positive (negative) relationship between the Federal Funds Rate (M1) and the inflation forecast error. Thus, expansionary policies lead the public to revise their inflation forecasts in an upward manner. Contractionary policies have the reverse effect.

4.1.2 Macroeconomic Indicators

Macroeconomic conditions serve as another piece of shared information that can be useful in assisting citizens to form more accurate forecasts of inflation. Economic production is an objective measure that affects the formation of inflation expectations (Brown and

the public at monthly intervals, thus the most natural time unit of inflation expectations appears to be a monthly interval.

[13]The pattern of the inflation forecast errors, based on the descriptive and univariate forecasting statistics, is consistent across both operationalizations of future actual inflation. Specifically, the mean and variance of the forecast errors, mean absolute forecast error, root mean square error, and Theil U^M-bias coefficient each decline as one moves from less to more educated strata (for more details see Krause 2000).

Maital 1981). This variable is operationalized as the Federal Reserve's Industrial Production Index (IPI) series lagged 1 month. Economic expansion should yield lower forecasts of inflation and, hence, more positive forecast errors if this information is not being utilized, since good economic prospects lead to more optimistic predictions of inflation. Conversely, increases in economic growth can serve as a signal for future inflationary pressures due to an "overheated" economy, thus resulting in systematic overprediction of inflation. The public may also use the most recent data on the Consumer Price Index (CPI) in forming their inflation forecasts. Thus the inflation rate from the prior month is included in the information set. A negative relationship between this measure and the dependent variable indicates that the public adjusts and corrects its forecast based on the previous realization.

4.1.3 Political Conditions

Political conditions may also play a role in shaping the accuracy of inflation forecasts. Republican presidential administrations are generally thought to be more concerned with keeping inflation low relative to their Democratic counterparts [Alesina and Roubini (with Cohen) 1997; Hibbs 1977; 1987; but for an opposing viewpoint see Beck 1982, 1984]. Past research on inflation expectations formation indicates that the electorate's prediction of inflation declines significantly, ranging from .81 to 1.23% under a Republican administration compared to a Democratic administration (Gramlich 1983, pp. 165–166). This partisan administration dummy measure is assigned a value of one during the period in which the forecast is made at time t where Republicans control the White House and equals zero when a Democratic president is in office. In addition, the timing of an electoral cycle may also affect citizens' ability to form rational expectations concerning price level movements. As a presidential election approaches, citizens have a tendency to generate higher inflation expectations since they perceive an economic expansion (contraction) in the period leading up to (following) an election. This variable is measured as a trend term that increases at a linear rate for 24 months following a presidential election, achieving its apex during the "off-year" elections, and then declining in value over the subsequent 24 months leading up to the next presidential election. This type of measure has been used elsewhere to assess PBC effects (Belton and Cebula 1994; Krause 1997).

4.1.4 Sociotropic and Subjective Economic Assessments

Economic perceptions are treated as the group-specific portion of the information set since the public's ability to form economic (inflation) expectations influences how they perceive economic circumstances. Past research has made a compelling case that citizens' emotional reactions regarding the economy play an important role in explaining forecasts, independent of their cognitive knowledge of the objective economy (Conover and Feldman 1986; Conover et al. 1987). Thus, citizens may use their subjective opinions of future economic conditions as *emotive* factors to forecast inflation. Although this may appear tautological, it is not, since one's perceptions of his/her pocketbook finances or the macroeconomy as a whole are posited to be related to, yet distinct phenomena from, the inflation forecast that is made by citizens.

The first measure of this type pertains to business expectations by asking respondents whether they feel business conditions will improve, stay about the same, or get worse over the next year. Consistent with prior research on this topic, the net percentage balance of "better" to "worse" responses are added to a constant value of 100 to arrive at this figure, which can range from 0 to 200. The direction of this relationship with inflation forecast errors is uncertain. On one hand, this variable should exert a positive impact on inflation forecast

errors since rosier business prospects will coincide with systematically lower inflation forecasts. Conversely, a negative relationship may transpire, reflecting economic optimism which may result in higher expected inflation due to perceived pressures attributable to future macroeconomic expansion. The second measure taps into the mass public's outlook regarding their personal pocketbook finances over the next year and is measured in the same manner (Krause 1997; Suzuki 1992). Personal financial expectations are hypothesized as having a positive effect on inflation forecast errors if they are not fully incorporated by citizens, since their personal well being will lead to systematic underprediction of inflation.

The remaining two independent variables pertain to retrospective economic evaluations and are also measured in the same fashion. The first deals with retrospective sociotropic evaluations since it asks individuals to state whether they feel business conditions are better, about the same, or worse compared to 1 year ago. The directional effect of business retrospections on inflation forecast errors is ambiguous, as is the case with business expectations. Finally, the egocentric retrospective variable asks respondents the same question with respect to their personal financial situation over the past year. If citizens are not using this information, one expects it to have a positive relationship to inflation forecast errors. Simply, an optimistic economic outlook based on a retrospective evaluation should result in a systematic underprediction of inflation if this information is not being fully incorporated ex ante into the inflation forecast.

5 Specification and Estimation Issues

In order to test for SRE and, more importantly, discern what the mass public knows from what it should know, *each* stratum has an information set that consists of other variables that may aid in forecasting future movements of the inflation rate. Each regression model is given by

$$\left(\pi_{t+k} - {}_t\pi^e_{t+k}\right) = \alpha + \beta_j \Phi_t + \tau_m \Psi_{t-1} + \epsilon_{t+k} \tag{8}$$

where the inflation forecast error $(\pi_{t+k} - \pi^e_t)$ is a function of a constant term (α) as well as a vector of group-specific (Φ_t) and shared (Ψ_{t-1}) information noted above for each stratum (i), plus a residual term 12 (k) months ahead (ϵ_{t+k}). As stated in (7), the SRE condition holds if the coefficient vectors associated with the exogenous variables are jointly zero.

In terms of statistical estimation, two issues must be considered. First, the overlapping data problem noted earlier renders statistical tests with conventional standard errors as being erroneous. In order to account for the MA process in the residuals, the standard errors for each regression equation are corrected using the Newey and West (1987) method. Specifically, a lag length of 11 months $(\ell = 11)$ is selected because the sampling interval is monthly and the forecast horizon is 12 months $(12 - 1 = 11)$.[14] Also, avoiding the possibility of a spurious regression problem is a matter of concern (Granger and Newbold 1974); therefore, unit root tests are performed on each time series specified in the regression

[14]The Newey–West procedure generates an asymptotically consistent covariance matrix (V) that equals $(X'X)^{-1}X'QX(X'X)^{-1}$, where X is a matrix of the complete set of regressors and Q is the adjusted covariance matrix of the residuals. The (i, j)th element of Q [denoted $\omega(i, j)$] equals zero except when $m \leq \ell$, where $m = |i - j|$ and ℓ is the order of the moving average process of the residuals. This method of correcting the standard errors ensures that the variance–covariance matrix is positive definite by discounting the rth-order autocovariance. This produces standard errors that are both heteroskedastic and autocorrelation-consistent [please see Krause (2000) for the appropriateness of this method compared to GLS estimation of an explicit MA(11) process].

models to determine whether they were stationary in levels.[15] In those instances where series exhibit evidence of a stochastic trend, a first-differencing transformation of the series is performed to ensure stationarity.[16]

6 Empirical Results

The OLS estimates (with Newey–West corrected standard errors) for the subaggregate and aggregate results appear using both the 12-month ahead and the moving average measures of inflation forecast error appear in Tables 1 and 2, respectively. The serial correlation statistics also uncover significant residual correlation that is attributable to the overlapping data problem.[17] The hypothesis that the regression coefficients are jointly equal to zero is clearly rejected based on a chi-square test statistic in all instances at $p \leq .001$. Thus, each regression equation indicates that information is not efficiently used by citizens in a manner consistent with SRE. This rejection of RE with subjective data on the rate of change in the price level is consistent with prior research by Haller and Norpoth (1994), among others.[18] Inspection of the overall chi-square test statistics for each of the disaggregated group models in Tables 1 and 2 reveals that the degree to which the SRE condition is violated is simply negatively related to educational attainment. Alternatively stated, as education level rises, citizens' capability of striving toward forming inflation forecasts consistent with SRE (though never obtaining it based on the empirical evidence presented here) also increases.

Across both estimated empirical models, the least educated group (LOW) appears either explicitly or implicitly to incorporate information on M1 growth during the Monetarist Experiment era,[19] actual economic growth (via industrial production), lagged actual inflation, and subjective sociotropic economic perceptions when forming its inflation expectations. On a certain level, this group of citizens appears to behave as if they are sophisticated by incorporating the prior month's M1 growth, economic growth, and actual inflation into their inflation forecasts. What may explain these seemingly counterintuitive results for these particular sources of information? One plausible general explanation is that they are taking cues from more educated/informed brethren in an implicit fashion. After all, MacKuen et al.

[15] The results of the unit root tests are discussed in the companion document (Krause 2000).

[16] This involved taking the logged first difference (i.e., percentage change) of the economic variables and simply taking the first difference of the economic perception variables.

[17] These serial correlation tests are based on the OLS residuals. It is important to note that the Newey–West or any other covariance matrix estimation approach involves only correcting for the coefficients' standard errors, and not altering the model's residuals.

[18] Only the most educated stratum yields any empirical evidence that is suggestive of unbiased predictions of future inflation associated with WRE (Krause and Granato 1998). Although the empirical evidence in favor of WRE for this group is modest, the degree of inflation forecast unbiasedness noticeably declines as one moves from more educated to less educated strata.

[19] This result is rather intriguing since one would not typically expect the least educated segment to take into account variations in M1 growth when formulating their inflation expectations. One possible explanation for this result is that during the Monetarist Experiment era, citizens with less than a high school education were more attuned to the link between Fed policy and inflation than they would have been otherwise due to the high inflation problem both experienced and perceived [especially for the least educated relative to more informed groups (see Krause and Granato 1998, p. 142, Fig. 1)]. Part of this heightened awareness may be attributed to both the substantial media coverage of this issue during this period and greater concern over this economic policy problem. Furthermore, the least educated citizens do not behave any more informed than their more educated brethren since the latter also incorporate this information in some manner when formulating inflation forecasts. Thus, it is possible that during the Monetarist Experiment monetary policy was a much more salient public issue than it was otherwise during this sample period.

Table 1 Empirical tests of "strong" rationality (*efficiency* hypothesis) by educational stratum: Objective and subjective information (12-month-ahead measure of future actual inflation, January 1979–December 1994)

Coefficient	*LOW (no HS diploma)*	*MEDIUM (HS diploma/ some college)*	*HIGH (at least baccalaureate)*	*AGGREGATE (all respondents)*
Constant	−12.08	−11.19	−5.63	−4.13
	(2.98)	(4.62)	(3.80)	(2.87)
(FFR growth ∗ FFR regime change)$_{t-1}$	0.08	0.01	0.01	0.07
	(0.08)	(0.06)	(0.06)	(0.08)
(M1 growth ∗ M1 regime change)$_{t-1}$	−0.59	−0.63	−0.84	−1.36
	(0.49)	(0.53)	(0.59)	(0.66)
Industrial production growth$_{t-1}$	0.02	0.01	0.03	0.04
	(0.03)	(0.03)	(0.03)	(0.02)
Inflation$_{t-1}$	−0.06	−0.06	−0.16	−0.21
	(0.09)	(0.08)	(0.07)	(0.09)
Election cycle$_t$	0.12	0.09	0.10	0.08
	(0.05)	(0.05)	(0.05)	(0.06)
Republican president$_t$	−2.74	−2.98	−3.49	−2.14
	(1.41)	(1.41)	(1.46)	(1.38)
Business expectations$_t$	−0.01	−0.04	−0.04	−0.04
	(0.02)	(0.02)	(0.01)	(0.02)
Personal financial expectations$_t$	0.05	0.05	0.05	0.01
	(0.03)	(0.06)	(0.03)	(0.05)
Business retrospections$_t$	0.04E-01	0.06	0.03	0.07
	(0.01)	(0.03)	(0.01)	(0.03)
Personal financial retrospections$_t$	0.05	0.08	0.04	−0.02
	(0.02)	(0.03)	(0.02)	(0.02)
χ^2 ($\alpha = \beta_j = \tau_m = 0$) (df = 11)	354.90	267.94	210.29	172.01
	(0.00)	(0.00)	(0.00)	(0.00)
χ^2 ($\beta_j = 0$) (df = 6)	13.44	8.01	13.83	21.71
	(0.04)	(0.24)	(0.03)	(0.00)
χ^2 ($\tau_m = 0$) (df = 4)	13.57	34.10	28.18	11.75
	(0.01)	(0.00)	(0.00)	(0.02)
Adjusted R^2	0.18	0.26	0.26	0.17
SEE	3.31	3.00	2.95	3.09
Durbin–Watson statistic	1.28	1.10	1.15	1.06

Note. Each value is rounded off to the nearest hundredth decimal place. Standard errors inside parentheses are computed by the Newey–West method, which is robust to the serial correlation problem induced by the overlapping errors problem noted by Hansen and Hodrick (1980). Those variables (excluding the election cycle trend and the Republican president dummy) that exhibit a $I(1)$ process were differenced in order to obtain stationary series. Details on the unit root tests used to determine whether the variables analyzed here should be treated in levels or first- differences/logged percentage changes are given in Table C of the Companion Document (Krause 2000).

Table 2 Empirical tests of "strong" rationality (*efficiency* hypothesis) by educational stratum: Objective and subjective information (12-month-ahead measure based on moving average of future actual inflation, January 1979–December 1994)

Coefficient	*LOW (no HS diploma)*	*MEDIUM (HS diploma/ some college)*	*HIGH (at least baccalaureate)*	*AGGREGATE (all respondents)*
Constant	−10.05	−8.15	−4.53	3.01
	(1.80)	(3.26)	(2.34)	(2.03)
(FFR growth ∗ FFR regime change)$_{t-1}$	0.08	0.02	0.02	0.06
	(0.04)	(0.03)	(0.03)	(0.04)
(M1 growth ∗ M1 regime change)$_{t-1}$	−0.23	−0.30	−0.56	−0.83
	(0.33)	(0.30)	(0.36)	(0.44)
Industrial production growth$_{t-1}$	0.03	0.03	0.04	0.05
	(0.02)	(0.01)	(0.01)	(0.01)
Inflation$_{t-1}$	0.08	0.07	−0.02	−0.05
	(0.08)	(0.07)	(0.05)	(0.07)
Election cycle$_t$	0.07	0.04	0.04	0.03
	(0.04)	(0.03)	(0.03)	(0.04)
Republican president$_t$	−1.84	−1.97	−2.51	−1.36
	(1.03)	(0.99)	(0.86)	(0.97)
Business expectations$_t$	−0.01	−0.03	−0.04	−0.04
	(0.02)	(0.02)	(0.01)	(0.02)
Personal financial expectations$_t$	0.04	0.03	0.05	0.01
	(0.02)	(0.04)	(0.02)	(0.02)
Business retrospections$_t$	−0.03E-01	0.02	0.02	0.03
	(0.01)	(0.01)	(0.01)	(0.01)
Personal financial retrospections$_t$	0.04	0.06	0.02	−0.01
	(0.02)	(0.02)	(0.01)	(0.01)
χ^2 ($\alpha = \beta_j = \tau_m = 0$) (df = 11)	588.30	264.86	165.81	287.36
	(0.00)	(0.00)	(0.00)	(0.00)
χ^2 ($\beta_j = 0$) (df = 6)	28.57	29.96	39.99	22.14
	(0.00)	(0.00)	(0.00)	(0.00)
χ^2 ($\tau_m = 0$) (df = 4)	16.56	27.63	37.15	15.94
	(0.00)	(0.00)	(0.00)	(0.00)
Adjusted R^2	0.23	0.39	0.49	0.30
SEE	2.22	1.65	1.41	1.65
Durbin–Watson statistic	1.17	0.69	0.76	0.52

Note. Each value is rounded off to the nearest hundredth decimal place. Standard errors inside parentheses are computed by the Newey–West method, which is robust to the serial correlation problem induced by the overlapping errors problem noted by Hansen and Hodrick (1980). Those variables (excluding the election cycle trend and the Republican president dummy) that exhibit a $I(1)$ process were differenced in order to obtain stationary series. Details on the unit root tests used to determine whether the variables analyzed here should be treated in levels or first differences/logged percentage changes are given in Table C of the Companion Document (Krause 2000).

(1992, p. 607) assert that the public follows informed elite analysis that enables citizens to make judgments beyond their capabilities.[20]

The least educated group, however, could improve its ability to accurately forecast inflation by incorporating information contained in the percentage change in the Federal Funds Rate during periods in which the Fed targeted interest rates (Table 2), the timing of the presidential election cycle, the party controlling the White House, and its personal retrospective economic evaluations based on a 10% level of statistical significance criterion.

Specifically, a 1% rise in the rate of growth of the Federal Funds Rate from the prior month leads to an .08% underestimation of inflation under both operationalizations of this measure analyzed and presented in Tables 1 and 2. The political variables indicate that citizens' forecasts of future inflation can be enhanced by fully taking into account the timing of the election cycle and, also, which party is in control of the White House. Consistent with the alternative hypothesis, citizens do not fully consider postelection tightening and preelection loosening of monetary policy in their inflation expectations since they systematically overrpredict future inflation as a presidential election approaches. This finding corroborates previous work which indicates that the least informed segments of the mass public do not experience a "perceptual" opportunistic political business cycle when it comes to forming their economic expectations (Krause 1997).

The forecast errors associated with citizens' inflation expectations are significantly lower (by 2.74 and 1.84%) during a Republican administration vis-à-vis Democratic counterparts in the two models appearing in Tables 1 and 2. This suggests that citizens significantly overpredict (underpredict) inflation during a Republican (Democrat) administration, ceteris paribus. This is a curious result that is consistent across information groups and could well be attributable to the sample period under investigation. Specifically, it may be that the mass public has a "mean-reverting" psychology regarding the manner in which they form inflation expectations, where the high inflation of the late 1970s through the end of 1980 (during the Carter administration) led citizens systematically to underpredict actual inflation and then systematically to overpredict inflation during the remainder of the sample period, when actual inflation was quite low (Allais 1966). These findings may also reflect the fact that during the early and mid-1980s, the Reagan administration's supply-side appointments to the Fed's Board of Governors (BOG) advocated a loose monetary policy, especially compared to traditional Republican BOG appointments from previous administrations (Chappell et al. 1993). Finally, as citizens' current view of their own personal pocketbook situation improves (deteriorates) from the preceding year, they will systematically underpredict (overpredict) the inflation rate since the gap between actual and expected inflation rates should become more positive in value to reflect such an outlook.

For those with a high school education or slightly more (MEDIUM), information on lagged M1 growth rate during the Monetarist experiment, the growth in the Federal Funds Rate from the previous month, actual inflation from the previous month, and current personal financial expectations cannot improve upon the inflation forecasts of those citizens possessing a high school diploma and/or some postsecondary education based on a statistical significance criterion of $p < .10$. Across both models, neither the party of the president, personal financial retrospective evaluations, nor business retrospections are utilized to aid in predicting future actual inflation. As before, there exists systematic overprediction

[20] This same argument is made in a different context elsewhere by political scientists studying the role of information acquisition and transmission among individuals (Lupia and McCubbins 1998).

(underprediction) of inflation under Republican (Democratic) administrations. As is to be expected, both more optimistic (pessimistic) personal financial expectations and changes in business retrospections produce a systematic underprediction (overprediction) bias for inflation. The evidence pertaining to whether the presidential election cycle is fully incorporated as information by these more educated citizens relative to the least educated segment of the mass public is mixed depending upon the inflation measure assessed. Given both the joint and the individual significance of corresponding coefficients in both Tables 1 and 2, the middle group appears to differ from the least informed group in that the former set of citizens does not utilize as much information on subjective economic perceptions in a comparative fashion.

The findings for the most educated segment of the mass public possessing at least baccalaureate college degrees (HIGH) indicate that they efficiently utilize information on M1 growth from the preceding month during the Monetarist experiment by the Fed, the FFR growth rate during the non-Monetarist experiment periods, and pocketbook retrospective economic evaluations in both specifications based on a $p < .10$ criterion. This group's sophistication relies more on the use of government policy instruments, compared to the least informed segment of the mass public, in determining their inflation expectations. This finding is consistent with the design and functioning of macroeconomic models of monetary policy (Bernanke and Blinder 1992). Also, based on its use of the timing of presidential election cycles (Table 2), support is obtained for the view that the most educated segments of the electorate are relatively more cognizant of politicians' attempts to manipulate macroeconomic policy for electoral gain compared to the least informed set of citizens.[21]

The specific results appearing in each table exhibit strong similarities between the most informed and the middle informed groups. Clearly the evidence presented for the two most educated strata indicates that they could enhance their ability to predict future inflation if they were fully to incorporate information on business expectations and retrospective economic (sociotropic and egocentric) evaluations in forming their inflation forecasts. Although inflation expectations serve as a distinct economic perceptual measure from personal financial or business expectations, these results are reflective of the general declining importance (i.e., efficient information usage) attached to subjective economic assessments in the actual formation of predicting future economic conditions as one moves from less to more informed segments of the mass public.

There are two important broad points that can be made when comparing the results of the subaggregate analyses. First, there is ample evidence to suggest that citizens do not (but should) more fully rely on political conditions in formulating their inflation expectations. Specifically, the empirical results suggest that as education level rises, citizens are more apt to incorporate information on the timing of the presidential election cycle than are less educated groups. This is consistent with past research that finds that an "expectational" political business cycle is most likely for those citizens who are better (educated) informed (Krause 1997). Moreover, the results reveal that no stratum utilizes information on the president's party in their inflation forecasts. While the latter finding is inconsistent with the theoretical predictions of either traditional or rational partisan models of political economy

[21] The significance of the electoral cycle coefficient at $p < .10$ is sensitive to the inflation measure employed. However, the magnitude of this coefficient is smaller than it is for the least educated stratum, thus suggesting that the nature of this systematic bias in prediction is smaller in absolute terms. This is what one would expect given that more educated citizens are more apt to incorporate this information into their economic forecasts than are less educated counterparts.

[Alesina and Roubini (with Cohen) 1997; Hibbs 1977, 1987], it may be attributable largely to the sample period-specific reasons discussed earlier in this section.

Second, the relative importance of objective information vis-à-vis subjective information varies across different segments of the mass public. A series of Wald chi-square tests demonstrates that in both sets of models in Tables 1 and 2, the relative amount of explanatory power contributed by objective economic and political conditions compared to subjective economic perceptions per stratum is negatively associated with educational attainment.[22] This, in turn, suggests that as one moves from less to more informed segments of the mass public, citizens exhibit relatively greater (lesser) reliance on objective (subjective) information in forming their inflation expectations. This is hardly surprising given that more informed segments will be able to obtain and process greater overall information on objective conditions than their less informed brethren. Thus, the less educated will rely more heavily on their own subjective economic perceptions in order to guide the formation of their inflation expectations since they have relatively limited information capabilities on objective economic and political conditions compared to more educated segments of the mass public. Given the fact that information costs are much steeper for less educated/informed citizens compared to more educated/informed counterparts (Graber 1984; MacKuen 1984), it is not unreasonable to infer that less educated citizens may find it in their best interests to rely comparatively more on subjective perceptions that are costless than objective information that is not. For instance, it may be sensible for less informed citizens to refrain from employing objective information whose operational costs, and thus net costs, exceed those of subjective perceptions.[23] Furthermore, if heuristics allow citizens to behave in a more informed manner than they are otherwise capable of doing (Lupia and McCubbins 1998), then it is not unreasonable to surmise that those with lower information capabilities will be more apt to rely on less costly sources of information, such as subjective perceptions. Thus, the relatively greater reliance on subjective information by lesser informed citizens may serve an important heuristic purpose.[24]

Besides examining the electorate as subgroup entities, it is worth considering the sum of these strata to see if the results differ and, if so, in what manner. The final set of estimates assesses the mass public as an aggregate entity without making informational distinctions based on educational attainment (AGGREGATE). These findings differ substantially from the disaggregated results in several important ways. Use of retrospective pocketbook economic evaluations cannot significantly improve upon inflation predictions for each of the

[22] This measure was calculated by $\chi^2_{\text{Difference}} = \chi^2_{\text{Objective}} - \chi^2_{\text{Subjective}}$, where the difference in the Wald χ^2 statistic is based on this statistic when excluding each respective set of exogenous variables, where the Objective subset has 6 degrees of freedom and the Subjective subset contains 4 degrees of freedom. Thus, more positive (negative) $\chi^2_{\text{Difference}}$ statistics are associated with objective (subjective) variables that are not employed as information outweigh subjective (objective) variables. For the models in Table 1 we obtain the following $\chi^2_{\text{Difference}}$ statistics: $\chi^2_{\text{Difference–LOW}} = -.13$, $\chi^2_{\text{Difference–MEDIUM}} = -26.09$, and $\chi^2_{\text{Difference–HIGH}} = -14.35$. In Table 2 they are: $\chi^2_{\text{Difference–LOW}} = 12.01$, $\chi^2_{\text{Difference–MEDIUM}} = 2.33$, and $\chi^2_{\text{Difference–HIGH}} = 2.84$. Furthermore, in the Table 2 results the difference between objective and subjective information in predicting inflation forecast errors is positive; it is significant for the least educated group ($\chi^2_{\text{Difference–LOW}}(2) = 12.01$, $p < .01$) but not for the two more informed strata ($\chi^2_{\text{Difference–MEDIUM}}(2) = 2.33$, $p = .63$; and $\chi^2_{\text{Difference–HIGH}}(2) = 2.84$, $p = .43$); thus providing more detailed support for the assertion that those with less than a high school degree (or its equivalent) exhibit relatively greater use of subjective compared to objective sources of information in their actual prediction of future inflation.

[23] See Suzuki (1991, p. 638) for an analogous argument concerning the rationality of economic voting.

[24] Alternatively, there may exist a more complex causal relationship involving the use of objective and subjective variables in predicting inflation expectations that explicitly captures the specific nature of this heuristic. Exploring this issue, however, is beyond the scope of this article.

disaggregate groups (based on a $p < .10$ criterion) yet is capable of doing so when viewed as a unitary electorate. Conversely, while it appears that each of the three groups most educated marginally fail to employ information on the timing of the presidential election cycle and the party of the current presidential administration (see Table 1), these comparable results demonstrate stronger support that this information is fully utilized by citizens in their inflation forecasts. Both business expectations and business retrospections are efficiently utilized by those who have not graduated from high school, but this is not the case for either of the two more informed groups. In the latter instance, the unitary aggregate results are consistent with those citizens possessing at least a high school diploma or its equivalent. Finally, it is important to note that the relative reliance on objective versus subjective information in the unitary aggregate mass public case indicates empirical support that is consistent with those who possess less than a full high school education (LOW) and is inconsistent with the two more informed groups (MEDIUM and HIGH).[25] This implies that a unitary aggregate focus in this particular empirical setting appears to underestimate noticeably the importance attached to the use of objective political–economic information in forecasting future inflation.

7 Conclusions

What is meant when one maintains that the public forms expectations of political and/or economic conditions in a manner that is rational? Political science studies examining the formation of economic expectations with survey-based data have viewed RE as being consistent with prospective behavior (Erikson et al. 1998; MacKuen et al. 1992, 1996; Norpoth 1996a, b; but see Krause and Granato 1998). In this study, it is shown that a prospective orientation cannot necessarily be equated with rational expectations (or rational behavior) since the former concept suggests that individuals are capable of making systematic mistakes in prediction, whereas this is not possible if the latter concept is in fact true. Relatedly, it is also possible for voters to incorporate relevant and available retrospective information in the formulation of their expectations and still obtain evidence in favor of the SRE hypothesis.

This article makes three main contributions to the study of rational expectations in political science research. First, an attempt is made to clarify the meaning of rational expectations for political science research. Second, a formal-based empirical test of efficient information utilization consistent with rational expectations theory is proposed. Concurrently, an empirical test based on a linear RE positive theoretical framework that allows for information heterogeneity across the mass public is set forth. This involves relaxing the common assumption that the mass electorate exhibits homogeneous information capabilities found in past macro empirical studies. The information heterogeneity formulation is more consistent with the micro-level evidence which finds that political knowledge and sophistication do vary across the mass public (Delli Carpini and Keeter 1996; Nie et al. 1996).

The empirical results of this study contain implications for future research on mass behavior. Although the existence of SRE is clearly rejected in all empirical models tested in this study, not all subaggregate components (or strata) of the mass public use identical information when forming expectations concerning future inflation. When the subaggregate analysis is compared to the aggregate results, there is some evidence of aggregation bias by considering the mass public as an entity with homogeneous information capabilities.

[25] The differences in the Wald test chi-square values for these respective models are $\chi^2_{\text{Difference–AGGREGATE}}(2) = 9.96$ ($p < .01$) in Table 1 and $\chi^2_{\text{Difference–AGGREGATE}}(2) = 6.20$ ($p = .08$) in Table 2.

Furthermore, a positive relationship between educational attainment and the relative use of *objective* information vis-à-vis *subjective* information in forming inflation expectations is uncovered. Conversely, less informed (educated) segments of the mass public will typically rely more heavily on subjective information such as economic perceptions than on objective information including government policy instruments and both economic and political conditions. The explanation for such behavior is simple. As the information capabilities of the mass public rise, objective information is easier to process since the better educated are more apt to acquire such information and have an easier time processing it (Ferejohn 1990, p. 11; Graber 1984; MacKuen 1984). It is also true, however, that the lower information capabilities of a particular segment of the mass public may require this group to use their subjective economic perceptions of the macroeconomy and their personal financial situation as heuristic guides or judgmental shortcuts to overcome the informational limitations that they experience when formulating inflation expectations (Lupia and McCubbins 1998; Sniderman et al. 1991).

From a normative perspective, such information can be used for instructive purposes in order to assist citizens in making more informed political–economic choices by pointing out those sources of information which are not being utilized that can serve to facilitate improved prediction of future conditions and outcomes. Inferences concerning rational behavior are also important for understanding the degree of sophistication exhibited by the mass public and policymakers. This study has linked the formal theory of rational expectations to its empirical testing. Future research examining the rationality of the electorate in political science must place greater care in employing properly designed empirical tests of the rational expectations hypothesis for our understanding to progress in a manner that is consistent with the true meaning underlying this theory of behavior.

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