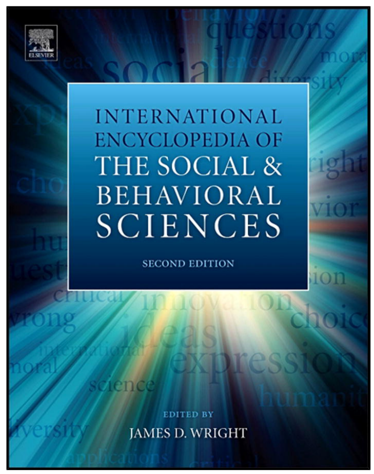

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Pooled Cross-Sectional and Time Series Analyses, in Political Science

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Abstract

Time can either be treated as a nuisance or as a substantively interesting variable across a variety of political science subfields and a wide array of research questions. The popularity of studying political phenomena over time has increased over the past 40 years. Encompassing any study where data are collected at multiple points in time, time series analysis includes studies of duration, event counts, (pseudo-)panels, repeated cross-sections, pooled cross-sections, and studies of volatility. Beginning with a discussion of the development and integration of 'long' time series methodology in the political science literature, we also briefly discuss other types of time series. We conclude with some suggestions for future research.

Introduction

While most empirical analyses in political science study cross-sectional units, the use of political data measured over time has become increasingly popular over the past 40 years. The broad category of political time series would include any study where data are collected at more than one point in time. It contains many types of analysis including longer time series, event counts, studies of volatility, duration analysis, forecasts, pooled cross-sectional time series (PCSTS), panel models, pseudo-panels, and repeated cross-sectional analyses. This article begins with a discussion of 'long' time series methods and the integration and development of these approaches into the empirical literature in political science. Following that is a brief discussion of other types of time series.

There are many ways that time can be a factor in collecting and analyzing political data. The most prevalent example is the use of a variable collected at multiple points in time. Such a variable, denoted Y_t, could be the percent of samples giving a particular answer on identical survey measures at different points in time like monthly presidential approval (e.g., Mueller, 1970), the actions of one country toward another within multiple discrete time periods like the data collected by the Kansas Events Data System (e.g., Schrodt and Gerner, 1994), a measure of government actions or performance that is collected at regular intervals such as the percent of times a president wins his battles with Congress (e.g., Lebo and O'Geen, 2011), or one of the countless other examples.

Studying a political variable over time offers many advantages. To begin, the study of political dynamics is itself interesting – studying important political phenomena over time is certainly as promising as examining variation across units fixed in time. The movement of variables such as macropartisanship (MacKuen et al., 1989) and the gender gap (Box-Steffensmeier et al., 2004), for example, tell us a great deal about the long-term movement of the electorate and make important complements to cross-sectional studies. (The choice of the level of analysis is critical when beginning any project and the appropriate level of analysis depends on the research question. If it is an atomistic question about the behavior of individuals, then analysis should be conducted at the individual level. If, however, the question is about how the citizenry, electorate, or economy moves as a whole, then macroanalysis is the most appropriate.)

The value of aggregate-level studies has been demonstrated particularly well in the economic voting literature. As Erikson, MacKuen, and Stimson note "elections are won and lost in the aggregate. And the aggregate moves at the margin; a few people doing this or that systematically produces big, sometimes shocking, aggregate effects" (2002: xix). Although Converse (1964), Campbell et al. (1960), and others find the average citizen to show little ideological constraint, the degree of constraint varies throughout the population. The well informed are more likely to have stable opinions over time and the public as a whole is responsive to social, political, and economic change because opinion averages over the well and ill informed (Kinder, 2006; Page and Shapiro, 1992). In fact, it is these more informed citizens who contribute disproportionately to movement in the aggregate. Ill-informed citizens cancel each other out (Erikson et al., 2000). Although at the individual level individuals do not appear to have mastered complex political and economic ideas, in the aggregate they do appear to have done so. (Moreover, individual-level data is plagued with problems such as response bias and measurement error, problems which are diminished when responses are aggregated (Kramer, 1983).)

Thus, time series analysis offers a useful lens into political phenomena and the method has become prevalent as a research tool. **Figure 1** presents a count of the number of articles mentioning 'time series' in the *American Political Science Review*, *American Journal of Political Science*, *Journal of Politics*, and *Political Analysis* from 1970 to 2012. From a handful of articles in the early 1970s, there has been a steady increase to around 70 articles in recent years.

The increasing popularity of time series is in large part due to increased data availability. Economists have had over half a century of rich temporal data to draw upon, but analogous data were not available for political scientists until the past few decades. Systematic data collection programs have led to the increased availability of long t time series focusing on political phenomena. Hand in hand with the growing body of data are the development of research methods that allow the study of complex dynamic relationships.

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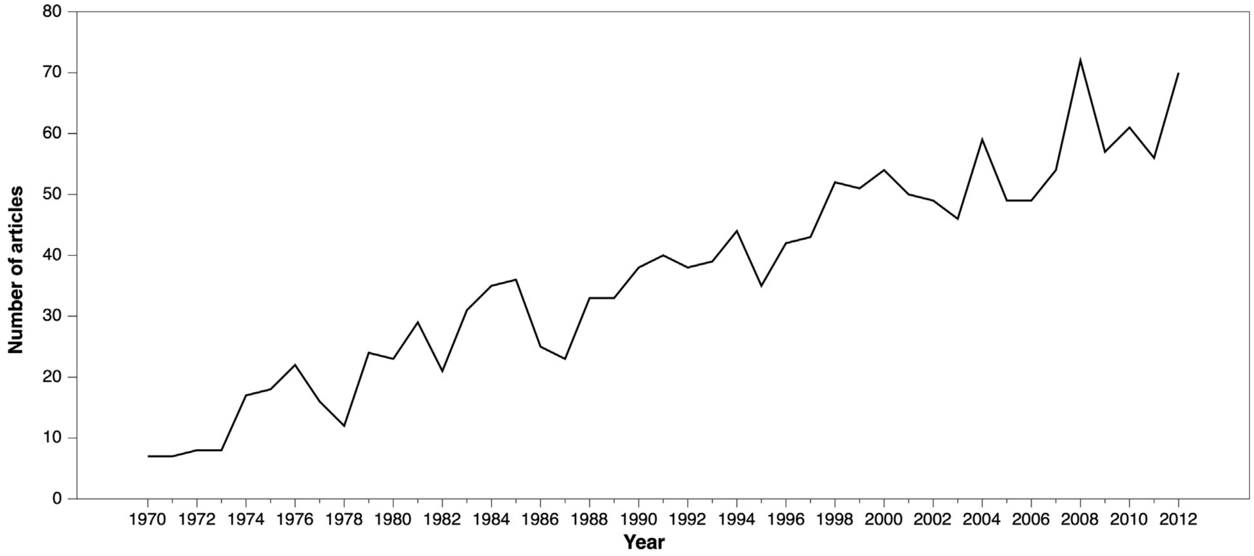

Figure 1 Time series articles per year, 1970–2012.

Advantage and Pitfalls of Time Series Analysis

Studying the evolution of data over time allows insights that prove more difficult or impossible for cross-sectional data. For one, studying just the univariate characteristics of a variable can be extremely useful. Knowing the way in which a time series's value depends on its past values means that we can make forecasts of the series's values ignorant of other predictors (Hibbs, 1977). Studying incidents of terrorism (e.g., Enders and Sandler, 2005) or the swings of the electoral pendulum (e.g., Lebo and Norpoth, 2011; Norpoth, 1996), for example, can lead to useful forecasts even without incorporating independent variables. The forecasting of elections may add independent variables to a model but will usually rely as well on identifying the pattern in a small number of data points and extrapolating to the next one. Such exercises have been an entertaining field roughly since the 1992 American presidential election (Campbell, 1992).

The ordering of observations also makes it possible to stretch beyond correlation and catch glimpses of causation. For example, if by incorporating past values of X_t we can improve our the predictions of Y_t beyond what the history of Y_t would predict, we can say that X_t 'Granger causes' Y_t (Granger, 1969; Freeman, 1983). Thus, researchers are able to study questions such as whether the economy affects economic judgments or vice versa (De Boef and Kellstedt, 2004). Multiple equation setups such as vector autoregression (VAR, Freeman et al., 1989; Sims, 1980), near-VARS (Enders, 2004), and seemingly unrelated regressions (e.g., Lebo et al., 2007) allow the study of complex dynamic relationships that might include reciprocal causality and feedback. In this way, time series analysis is protected from some critiques of observational studies developed in recent years as political scientists are paying more attention to the logic of causal inference.

But the ordering of observations also creates a range of complications. Much of the statistical theory is concerned with random samples of independent observations, but in time series, successive observations are usually not independent. In a cross-sectional survey, for example, the answers respondent #100 gives are unlikely to have any special relationship with the responses of person #101. The ordering of the observations is simply random. In time series, on the other hand, the value of a variable at time-point 100 is likely to be highly correlated with its value at time-point 101. This is a form of autocorrelation – cases nearer to each other in time will be more highly correlated with each other than observations more distant. This means that the statistical notion of identically and independently distributed observations is unlikely to hold with time series data.

This temporal dependence also means that popular techniques like ordinary least squares (OLS) encounter serious problems with time series data. This has led to an entirely separate branch of statistical methods (e.g., Box and Pierce, 1970; Box and Jenkins, 1976). Time series analysis generally takes careful steps to separate the two components of a time series: the deterministic and the stochastic. The deterministic portion is the part that is predictable based on past values and the stochastic component is what remains and might be partially explained by independent variables. Techniques like the Box and Jenkins (1976) transfer function approach build multivariate models only after first modeling how each variable depends upon its own past history (McCleary and Hay, 1980).

Political Science and Time Series Analysis

The development of time series analysis within political science has been very much aligned with popularity functions beginning in the early 1970s with the work of Mueller (1970, 1973) who studied the decay of job approval across the president's term. Mueller modeled a linear decline in popularity due to the fragmentation of a 'coalition of minorities' created during the presidential term. Subsequent research by others focused on the appropriate way to model approval as a time series. Stimson (1976) argued the effect was quadratic, rather than linear, with approval declining after the start of the term but then experiencing an uptick near the end of the term. He attributed the initial decline to the disillusionment of uninformed citizens after the buildup of expectations surrounding the election. Similarly, the subsequent increase in approval at the end of the term is a result of increasing expectations leading into the next election. Kernell (1978) argued approval does not decline solely due to time, but rather the ebb and flow of approval can be attributed to political and economic events properly specified. Likewise, Monroe (1978) criticized Stimson for misspecifying the effects of the economy by using a time counter rather than objective economic indicators and actual expenditures.

Indeed, multivariate time series methods have developed in large part in tandem with models of economic voting. The compilation of monthly series of subjective economic evaluations – Gallup data in Britain and the Index of Consumer Sentiment in the United States – led to long debates regarding identifying the most important economic factors to voter decisions. On one hand, Key (1966) claims that voters punish or reward incumbents for the state of their pocketbooks, a view that supports personal retrospective evaluations. In contrast, Sanders (1993) used personal expectations as a key to forecasting the surprise Conservative victory in the 1992 British General Election. Looking at the effects of macroopinion on the national economy, MacKuen et al. (1992) see the electorate as forward-looking 'bankers' rather than retrospectively focused 'peasants' (Norpoth, 1996). Importantly, Clarke and Stewart (1994) pushed the discipline forward by sorting through the methodological issues in the data at issue. The concept of unit roots was long studied in economics but had not made its way to political science. When Clarke and Stewart (1994) allowed for and tested this possibility they found elements of truth in both theoretical approaches – the electorate is both prospective and retrospective. Further, Clarke and Stewart (1994) introduce the concepts of cointegration and error correction (Engle and Granger, 1987) to political scientists.

Series are cointegrated if there exists a mean-stationary linear combination of the variables. This expansion of the methodological toolkit allows the study of long-run equilibrium relationship between variables that would be obscured by traditional differencing techniques (see e.g., Clarke and Stewart, 1995; Clarke et al., 1998; Clarke and Lebo, 2003). As shocks drive cointegrated series apart, an error correction mechanism can be used to capture how quickly the series return to equilibrium. Several political and economic variables are cointegrated. In their study of the South African economy, Dunne and Vougas (1999) found economic growth and military spending are cointegrated, showing the negative effect protracted military conflicts have on economic health. Noneconomic variables may also be cointegrated. For example, the norm of consensus on the Supreme Court eroded around the time of the New Deal. Calderia and Zorn (1998) show the rate of concurrences and dissents, which are cointegrated, are affected by the decline of this norm. Another set of noneconomic cointegrated series is prime minister popularity and governing party support in Great Britain (Clarke et al., 2000). In all, a variety of political variables are cointegrated and error correction mechanisms allow for the study of these complex relationships.

As in many areas of political methodology, the 1990s saw a boom of new methods and approaches to time series analysis. Aside from the expansion of tools, important work began studying the ways in which political data differed from the majority of economic time series. So many of the methods used by political science had simply been imported from work in economics without much thought regarding how the basic data generating processes between the fields might differ.

For example, Box-Steffensmeier and Smith (1996) showed the need for fractional integration methods, a small corner of econometric research, to be widely used with political data. Although series can be analyzed in level form – without transforming its values – if it is not mean-reverting the failure to account for this may result in spurious regressions where it is falsely concluded that a relationship exists between two factors.

One way to correct for this is to first difference the data, however this, too may be insufficient. While differencing the data provide significant improvement over the level-form analysis of nonstationary series, it may overcorrect by overdifferencing the data if the series is not truly a unit root, building in an moving average (MA) parameter that is not present in the data generating process. The best way to avoid overdifferencing while still making a series stationary is to fractionally difference the data. Fractional integration is theoretically motivated when heterogeneity at the individual level exists due to individual-level variation in the persistence of new information (Granger and Joyeux, 1980). Some individuals have long or perfect memory (or a strong autoregressive process) and others less so (Box-Steffensmeier and Smith, 1996). This heterogeneity at the individual level produces aggregate series that are neither stationary nor unit roots, but instead have a mix of properties. Several variables of interest to political scientists are fractionally integrated, including partisanship (Box-Steffensmeier and Smith, 1998) and presidential approval (Lebo et al., 2000). Autoregressive fractionally integrated moving average techniques allow for a series to have long, but not perfect memory. Shocks to series can persist but eventually be discounted over time.

Other Approaches to Time Series Research – Volatility, Time-Varying Parameters, and Dynamic Effects

There are multiple ways to trace the dynamics of a series or a system of series. Because the relationships studied by political scientists are extremely complex, there are many reciprocal relationships and feedback loops. One way to study the dynamic interrelationship between variables is to use an impulse response function (IRF). IRFs trace the cumulative effect of a shock to one variable as it moves its way through a VAR system (Sims, 1980). For example, Box-Steffensmeier and Smith (1996) use an IRF to determine the persistence of shocks to macropartisanship. These changes to the series decay slowly and persist the effect can be felt for years. Similar patterns are evidenced in the Republican and Democratic series, indicating that macropartisanship does change on the scale of years rather than decades or months. IRFs have also been used to study political bureaucratic adoption (Wood and Waterman, 1993), presidential rhetoric and economic performance (Wood et al., 2005), and fatalities on Israeli–Palestinian relations (Jaeger and Paserman, 2005).

Another branch of analysis goes beyond studying how time series rise and fall and looks at changes in the volatility. Although variables are often assumed to have constant error variance across time, in reality many go through different periods of stability and volatility. Volatility clustering, first studied in the financial markets, refers to that phenomena that "[w]hen volatility is high, it is likely to remain high, and when it is low it is likely to remain low" (Engle, 2003). Autoregressive conditional heteroskedasticity (ARCH) and the generalized form (GARCH) allow for modeling the variance as well as the mean of a series. This has been used primarily to study volatility in popularity functions, e.g., Gronke and Brehm (2002), using a modified ARCH approach, found volatility in presidential approval to have increased over time. The effect of events on approval volatility, however, is conditional on the partisan identification of the respondent. Positive presidential events create cognitive dissonance in out-party identifiers, leading to increased volatility (Kriner and Schwartz, 2009). Mounting wartime casualties may even increase volatility among the president's most strident supporters, as was the case with Franklin Roosevelt and federal assistance recipients during World War II (Kriner, 2006). Just as one would expect volatility to be low among those most predisposed to support the president, one would also expect macropartisanship to be relatively stable over time. However, electoral cycles and waning party identification create periods of high volatility in aggregate partisan identification (Maestas, 1997). If periods of high volatility in either presidential popularity or macropartisanship were to coincide with an election, the outcome would be much more difficult to forecast.

Other lines of research are opened when one considers that the relationship between variables may change over time in interesting and predictable ways due to circumstances such as elections, recessions, wartime, or other factors. Three common ways to test for dynamic relationships between time series are moving windows, Kalman Filter, and dynamic conditional correlations (DCC, Lebo and Box-Steffensmeier, 2008). To use a moving window estimator design, the researcher first selects the size of the window (s), and runs a model using just the first s observations. The process is then repeated in an iterative fashion as the window moves across the data, using observations 2 to $s+1$, 3 to $s+2$, etc. After model estimation is complete, the correlation (or regression coefficients) provides insight into the changing nature of the relationship. Moving windows are useful when the time period being studied is shorter or if the researcher has strong expectations of when the relationship should change over time (e.g., presidential administrations). Moving windows have been used to study the relationship between international trade and the opportunistic timing of elections (Kayser, 2006), social spending and partisanship in OECD countries (Kwon and Potusson, 2010), and economic health's effect on policy liberalism (Ferguson et al., 2013).

The Kalman Filter is a recursive system that starts with some data, points 1 to s, and then adds more data iteratively (e.g., Bond et al., 2003). Unlike the moving window, past observations are not dropped out of the analysis as new observations are added. Eventually, the coefficients converge upon the estimate one would obtain if the relationship was time invariant. Thus, a Kalman Filter allows us to see the evolution of a coefficient over time. Stimson et al.'s (1995) model of policy responsiveness, dubbed 'dynamic representation,' was estimated using a Kalman Filter. As public opinion becomes more liberal, governmental institutions respond with more liberal policy outputs. Similarly, public opinion about the president's job performance, a factor so heavily colored by partisanship that it should have little explanatory power, affects the president's legislative success (Bond et al., 2003).

A relatively new technique for political researchers is the dynamic conditional correlation model developed by Engle (2002) and introduced to political science by Lebo and Box-Steffensmeier (2008). Building on multivariate-GARCH models, DCC models allow researchers to study the direction and strength of the relationship while taking into account the volatility in the times series. One can find periods of no correlation, as well as positive and negative correlation, between two or more series. Consumer sentiment and presidential approval, for example, are two series that have nonconstant correlation (Lebo and Box-Steffensmeier, 2008). The DCC method's ability to tell what a correlation is *now* shows that, over 30 years of data, the height of correlation between presidential approval and economic sentiment was during the 1992 presidential election – it was, in fact, 'the economy, stupid.' Wars and terrorist events have sometimes even produced negative correlations between economic and political assessments.

Event History Models

Many of the data that are of interest to political scientists denote change from one 'regime' to the next. Beyond just the transition from one state to another, the factors precipitating the change may also be of interest. This leads to research questions that are focused on the timing and change as well as the ultimate outcome. Event history models, also known as duration or survival models, have grown in popularity in the social science literature since the 1990s, culminating in the publication of Box-Steffensmeier and Jones' (2004) key book on the subject (see also Box-Steffensmeier and Jones, 1997).

Initially, the temporal structure of event data was treated as a nuisance, rather than being of substantive interest. As a result the temporal ordering was ignored and post hoc corrections were applied to correct for autocorrelation in the data. In the early 1990s, Bartels and Brady encouraged political scientists to incorporate more techniques specifically designed to analyze event history data (1993). Heeding their advice, researchers began to import methods from biostatistics to measure the 'risk' that an event would occur and the likelihood of an observation's 'survival' at the end of the study.

There are several problems inherent in analyzing event data. The data are always nonnegative, leading traditional estimation methods to return nonsensical predictions. Furthermore, survival at time t is conditional on the observation having not experienced the event by time $t-1$, so this dependence must be accounted for. Finally, there is the problem of censoring. At the end of the period of study, some observations at risk will not have experienced the event. This leads to biased estimates if not corrected.

This durational framework has been applied to a variety of political science subfields. King et al. (1990) study cabinet government dissolution with a unified model that allows them to account for both the particular attributes of the cabinet as well as the stochastic event process. Although there was disagreement in the literature about the proper specification of the hazard rate, this model was later applied to the duration of governmental leaders. Alt and King (1994) found that the risk of experiencing the event, in this case the removal of the leader from power, increased over time just as it did for cabinets. While these studies included characteristics of the political system, economic factors were omitted. The addition of economic indicators such as the inflation and unemployment rates improved the predictive power of the models and showed that poor economic health contributes to the collapse of governments (Warwick, 1992).

The duration of armed conflict or peace is common event history topics in international relations. Many conflict scholars are interested in the role third-party intervention plays in the duration of civil and interstate wars. The effect of the international community on duration is conditional on both the actor and the actor's relationship with the warring parties. For instance, Aydin and Regan (2012) found that engagement by third-party state increases the duration of civil wars if the states support opposite sides of the conflict. Duration is decreased, however, if the states unilaterally support the same side. Similarly, the outcome of a conflict, e.g., negotiated settlement, military victory, and the presence of international peacekeeping forces, have also been shown to affect the likelihood of a conflict reignigting (Mason et al., 2011).

In the U.S. context, duration models have been used to study policies, institutions, and behavior. The widely used Berry and Berry model of policy diffusion was developed in the event history context (Berry and Berry, 1990, 1992, 1994). The model allows for both internal and regional characteristics to influence the adoption of new policies and has since been applied a variety of policy areas, such as the adoption of climate protection and antismoking legislation (Krause, 2010; Pacheco, 2012, respectively). Committee tenure (Katz and Sala, 1996) and tenure in office more generally (Jones, 1994) are influenced by electoral systems and the calendar. The political environment also affects the duration of presidential appointee confirmation, with the hazard function decreasing as ideological distance between the president and Congress increases (Shipan and Shannon, 2003; Segal et al., 2010). An event history framework has also been applied to the timing of voting decisions. Box-Steffensmeier and Sokhey (2010) show that political engagement, ideology, and strength of partisanship all increase the hazard rate thereby reducing the time it takes for a voter to go from 'undecided' to 'decided.'

Time Series and Cross-Sectional Analyses

In many instances, data can be collected where cases are spread both within and across time points. Cross-section data have multiple units observed at a given time point but PCSTS involves multiple cross-sections observed at different points in time. Since OLS assumes errors are independently and identically distributed, the PCSTS framework requires its own set of methods. PCSTS methods attempt to address the complex multilevel structure of multiple units observed over time. A unit x_{it} is correlated with x_{jt} by virtue of being observed at the same point. Depending on the type of cross-sectional data, x_{it} may also be correlated with x_{it-1} if the same unit is observed at multiple time points. There are several types of PCSTS data, and each structure poses different challenges to data analysts.

For starters, a true panel design involves an identical set of cases repeated over multiple time points. Panels are frequently comprised of survey respondents who are interviewed a small number of times such as a special subset of election study respondents. Panel election studies began with the Columbia school (e.g., Lazarsfeld, 1948), although repeated interviews during the course of a single campaign limited the representativeness of the sample. In addition to problems with generalizability, election panels can also suffer from attrition. A variety of factors, from frequency of contact, method of contact, and even mortality can all affect the recontact rates.

Alternatively, the same set of countries observed over the same set of years also represents a type of panel design. As with most time series methods, models for analyzing panel data were developed to handle econometric data with a large enough N to capitalize on the estimator's asymptotic properties. Methods such as dynamic panel analysis, Markov-switching models, differencing, and lagged dependent variables are available.

Deviations from a true panel fall into a range of types we can classify as pseudo-panels in which there are multiple cross-sections of data but not all cases are found in each wave. One variety of pseudo-panel structures is the unbalanced panel where some cases are observed more than once, but each observation does not appear in every time point, e.g., Carson et al. (2010) study Members of Congress running for reelection from 1956 to 2004. The range of methods available to account for time dependencies quickly dwindles here. Since some cases appear in the data but once, differencing data of using lagged variables will drop out those case and potentially cause problems of selection bias. Fixed effects by time point or panel-corrected standard errors are common, but imperfect, solutions (Beck and Katz, 1995).

Two last types of pseudo-panels are the rolling and repeated cross-sectional (RCS) designs. In both of these cases each observation appears a single time in a data set that consists of multiple waves. In a rolling design, typically an election study, the survey designers choose their set of respondents at the beginning and then roll out the survey to subsets of respondents at prespecified dates. The American National Election Studies conducted the first rolling cross-section in 1984 and it was later adopted by the Annenberg Election Study and the British Election Study.

Repeated cross-sectional designs include the wider set of designs in which observations are collected *post hoc* and assembled into a larger data set (Lebo and Weber, 2014). An RCS data set may include hundreds of months of individual-level data from consecutive public opinion surveys, or it could be Supreme Court cases nested with terms of the Court, or some other case for which the time the data are collected requires attention in the modeling framework. Lebo and Weber (2014) demonstrate how RCS data can be studied at two levels of analysis – aggregate and individual level – in a multilevel model that includes time-varying parameters. In any study where cases are nested within distinct time periods, researchers should pay close attention to the error structure to be sure model estimates are trustworthy.

Conclusion

Overall, the wide variety of data structures requires researchers to think carefully about how time plays a role in the phenomenon they study. Time can either be treated as a nuisance or as a substantively interesting variable across a variety of political science subfields and a wide array of research questions. Those treating time as substantively interesting have continued to advance time series analysis since its introduction to the field in the early 1970s. This is in part due to the increased availability of a range of data spanning sufficiently long time periods. In addition to more readily available data, traditional data sources are being measured with increasing frequency. For example, presidential approval was once only available quarterly yet is now available daily from Gallup. Similarly, the Annenberg Election Survey (The survey will resume in 2016.) tracks opinion about campaigns, candidates, and issues on a daily basis.

To date, most methods used to analyze temporal effects have been imported by political scientists from other social science disciplines. Although these methods are theoretically applicable to political phenomena, they may require tweaking to adapt them to political science data structures. Researchers should pay special attention to the properties of their data before wholesale adoption of imported techniques. Monte Carlo studies are an underutilized way to determine how an estimator responds to changes in level of integration, seasonality, and series length – all of which vary between data sources. Having a better grasp on how the methods respond to political science data allows a more informed decision about the appropriate estimator.

It should come as no surprise that unpacking the relationship between various political phenomena over time is challenging as many factors are closely intertwined. Time series analysis provides a unique opportunity to approach questions of causality using observational data. While Granger causality tests can identify if changes in one variable of interest temporally precede changes in another, it is a common misperception that these tests alone are enough to rule out endogeneity (Charemza and Deadman, 1997). Indeed, a battery of tests exist to determine if a one variable is weakly or strongly exogenous to another. If one series is weakly exogenous, there is no reciprocal causality and modeling is simpler. However, if there is unmodeled reciprocal causality, estimates become biased and inefficient. Thus researchers should explore exogeneity tests and utilize multiple equation (near-)VARs to disentangle reciprocally causal relationships where they exist.

Overall there is much to be learned from incorporating time into studies of politics. The many statistical problems inherent in data that evolve over time can wreak havoc on our understanding of political relationships. But, even setting those aside, modeling temporal effects provides interesting insights that cannot be gained from the single snapshot in time that cross-sectional analyses provide.

See also: Attitudes, Political and Public Opinion; Congress: United States; Economic Evaluations and Electoral Consequences; Event History Analysis; Party Identification and Nonpartisanship; Political Science and Polling; Survival Analysis: Introduction; Time Series: Advanced Methods; Time Series: Cointegration; Time Series: General; Time Series: State Space Methods; Time Series: Unit-Roots and Nonstandard Limiting Distributions; Voting, Explanations of: Social Class.

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