1 The Scientific Study of Politics

OVERVIEW

Most political science students are interested in the substance of politics and not in its methodology. We begin with a discussion of the goals of this book and why a scientific approach to the study of politics is more interesting and desirable than a "just-the-facts" approach. In this chapter we provide an overview of what it means to study politics scientifically. We begin with an introduction to how we move from causal theories to scientific knowledge, and a key part of this process is thinking about the world in terms of *models* in which the concepts of interest become variables that are causally linked together by theories. We then introduce the goals and standards of political science research that will be our rules of the road to keep in mind throughout this book. The chapter concludes with a brief overview of the structure of this book.

Doubt is the beginning, not the end, of wisdom.
– Chinese proverb

1.1 POLITICAL *SCIENCE*?

"Which party do you support?" "When are you going to run for office?" These are questions that students often hear after announcing that they are taking courses in political science. Although many political scientists are avid partisans, and some political scientists have even run for elected offices or have advised elected officials, for the most part this is not the focus of modern political science. Instead, political science is about the scientific study of political phenomena. Perhaps like you, a great many of today's political scientists were attracted to this discipline as undergraduates because of intense interests in a particular issue or candidate. Although we are often drawn into political science based on political passions, the most respected political science research today is conducted in a fashion that makes it impossible to tell the personal political views of the writer.

Many people taking their first political science research course are surprised to find out how much science and, in particular, how much math are involved. We would like to encourage the students who find themselves in this position to hang in there with us – even if your answer to this encouragement is "but I'm only taking this class because they require it to graduate, and I'll never use any of this stuff again." Even if you never run a regression model after you graduate, having made your way through these materials should help you in a number of important ways. We have written this book with the following three goals in mind:

- *To help you consume academic political science research in your other courses.* One of the signs that a field of research is becoming scientific is the development of a common technical language. We aim to make the common technical language of political science accessible to you.
- *To help you become a better consumer of information.* In political science and many other areas of scientific and popular communication, claims about causal relationships are frequently made. We want you to be better able to evaluate such claims critically.
- *To start you on the road to becoming a producer of scientific research on politics.* This is obviously the most ambitious of our goals. In our teaching we often have found that once skeptical students get comfortable with the basic tools of political science, their skepticism turns into curiosity and enthusiasm.

To see the value of this approach, consider an alternative way of learning about politics, one in which political science courses would focus on "just the facts" of politics. Under this alternative way, for example, a course offered in 1995 on the politics of the European Union (EU) would have taught students that there were 15 member nations who participated in governing the EU through a particular set of institutional arrangements that had a particular set of rules. An obvious problem with this alternative way is that courses in which lists of facts are the only material would probably be pretty boring. An even bigger problem, though, is that the political world is constantly changing. In 2011 the EU was made up of 27 member nations and had some new governing institutions and rules that were different from what they were in 1995. Students who took a facts-only course on the EU back in 1995 would find themselves lost in trying to understand the EU of 2011. By contrast, a theoretical approach to politics helps us to better understand why changes have come about and their likely impact on EU politics.

In this chapter we provide an overview of what it means to study politics scientifically. We begin this discussion with an introduction to how we move from causal theories to scientific knowledge. A key part of this process is thinking about the world in terms of *models* in which the concepts of interest become **variables**[1] that are causally linked together by theories. We then introduce the goals and standards of political science research that will be our rules of the road to keep in mind throughout this book. We conclude this chapter with a brief overview of the structure of this book.

1.2 APPROACHING POLITICS SCIENTIFICALLY: THE SEARCH FOR CAUSAL EXPLANATIONS

I've said, I don't know whether it's addictive. I'm not a doctor. I'm not a scientist.

– Bob Dole, in a conversation with Katie Couric about tobacco during the 1996 U.S. presidential campaign

The question of "how do we know what we know" is, at its heart, a philosophical question. Scientists are lumped into different disciplines that develop standards for evaluating evidence. A core part of being a scientist and taking a scientific approach to studying the phenomena that interest you is always being willing to consider new evidence and, on the basis of that new evidence, change what you thought you *knew* to be true. This willingness to always consider new evidence is counterbalanced by a stern approach to the evaluation of new evidence that permeates the scientific approach. This is certainly true of the way that political scientists approach politics.

So what do political scientists do and what makes them scientists? A basic answer to this question is that, like other scientists, political scientists develop and test theories. A **theory** is a tentative conjecture about the causes of some phenomenon of interest. The development of **causal** theories about the political world requires thinking in new ways about familiar phenomena. As such, theory building is part art and part science. We discuss this in greater detail in Chapter 2, "The Art of Theory Building."

[1] When we introduce an important new term in this book, that term appears in boldface type. At the end of each chapter, we will provide short definitions of each bolded term that was introduced in that chapter. We discuss variables at great length later in this and other chapters. For now, a good working definition is that a variable is a definable quantity that can take on two or more values. An example of a variable is voter turnout; researchers usually **measure** it as the percentage of voting-eligible persons in a geographically defined area who cast a vote in a particular election.

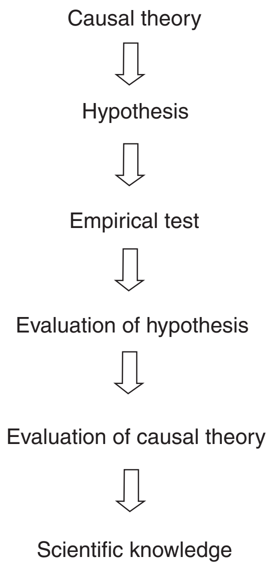

Figure 1.1. The road to scientific knowledge.

Once a theory has been developed, like all scientists, we turn to the business of testing our theory. The first step in testing a particular theory is to restate is as one or more testable hypotheses. A **hypothesis** is a theory-based statement about a relationship that we expect to observe. For every hypothesis there is a corresponding **null hypothesis**. A null hypothesis is also a theory-based statement but it is about what we would observe if there were no relationship between an independent variable and the dependent variable. **Hypothesis testing** is a process in which scientists evaluate systematically collected evidence to make a judgment of whether the evidence favors their hypothesis or favors the corresponding null hypothesis. The process of setting up hypothesis tests involves both logical reasoning and creative design. In Chapter 3, "Evaluating Causal Relationships," we focus on the logical reason side of this process. In Chapter 4, "Research Design," we focus on the design part of this process. If a hypothesis survives rigorous testing, scientists start to gain confidence in that hypothesis rather than in the null hypothesis, and thus they also gain confidence in the theory from which they generated their hypothesis.

Figure 1.1 presents a stylized schematic view of the path from theories to hypotheses to scientific knowledge.[2] At the top of the figure, we begin with a causal theory to explain our phenomenon of interest. We then derive one or more hypotheses about what our theory leads us to expect when we measure our concepts of interest (which we call variables – as was previously discussed) in the real world. In the third step, we conduct **empirical** tests of our hypotheses.[3] From what we find, we evaluate our hypotheses relative to corresponding null hypotheses. Next, from the results of our hypothesis tests, we evaluate our causal theory. In light of our evaluation of our theory, we then think about how, if at all, we should revise what we consider to be scientific knowledge concerning our phenomenon of interest.

A core part of the scientific process is skepticism. On hearing of a new theory, other scientists will challenge this theory and devise further tests. Although this process can occasionally become quite combative, it is a necessary component in the development of scientific knowledge. Indeed,

[2] In practice, the development of scientific knowledge is frequently much messier than this step-by-step diagram. We show more of the complexity of this approach in later chapters.

[3] By "empirical" we simply mean "based on observations of the real world."

a core component of scientific knowledge is that, as confident as we are in a particular theory, we remain open to the possibility that there is still a test out there that will provide evidence that makes us lose confidence in that theory.

It is important to underscore here the nature of the testing that scientists carry out. One way of explaining this is to say that scientists are *not* like lawyers in the way that they approach evidence. Lawyers work for a particular client, advocate a particular point of view (like "guilt" or "innocence"), and then accumulate evidence with a goal of proving their case to a judge or jury. This goal of *proving* a desired result determines their approach to evidence. When faced with evidence that conflicts with their case, lawyers attempt to ignore or discredit such evidence. When faced with evidence that supports their case, lawyers try to emphasize the applicability and quality of the supportive evidence. In many ways, the scientific and legal approaches to evidence couldn't be further apart. Scientific confidence in a theory is achieved only after hypotheses derived from that theory have run a gantlet of tough tests. At the beginning of a trial, lawyers develop a strategy to *prove* their case. In contrast, at the beginning of a research project, scientists will think long and hard about the most rigorous tests that they can conduct. A scientist's theory is never *proven* because scientists are always willing to consider new evidence.

The process of hypothesis testing reflects how hard scientists are on their own theories. As scientists evaluate systematically collected evidence to make a judgment of whether the evidence favors their hypothesis or favors the corresponding null hypothesis, they *always* favor the null hypothesis. Statistical techniques allow scientists to make probability-based statements about the empirical evidence that they have collected. You might think that, if the evidence was 50–50 between their hypothesis and the corresponding null hypothesis, the scientists would tend to give the nod to the hypothesis (from their theory) over the null hypothesis. In practice, though, this is not the case. Even when the hypothesis has an 80–20 edge over the null hypothesis, most scientists will still favor the null hypothesis. Why? Because scientists are very worried about the possibility of falsely rejecting the null hypothesis and therefore making claims that others ultimately will show to be wrong.

Once a theory has become established as a part of scientific knowledge in a field of study, researchers can build upon the foundation that this theory provides. Thomas Kuhn wrote about these processes in his famous book *The Structure of Scientific Revolutions*. According to Kuhn, scientific fields go through cycles of accumulating knowledge based on a set of shared assumptions and commonly accepted theories about the way that the world works. Together, these shared assumptions and accepted theories form what we call a **paradigm**. Once researchers in a scientific field have widely accepted a paradigm, they can pursue increasingly technical questions that make sense only because of the work that has come beforehand. This state of research under an accepted paradigm is referred to as **normal science**. When a major problem is found with the accepted theories and assumptions of a scientific field, that field will go through a revolutionary period during which new theories and assumptions replace the old paradigm to establish a new paradigm. One of the more famous of these scientific revolutions occurred during the 16th century when the field of astronomy was forced to abandon its assumption that the Earth was the center of the known universe. This was an assumption that had informed theories about planetary movement for thousands of years. In the book *On Revolutions of the Heavenly Bodies*, Nicolai Copernicus presented his theory that the Sun was the center of the known universe. Although this radical theory met many challenges, an increasing body of evidence convinced astronomers that Coperinicus had it right. In the aftermath of this **paradigm shift**, researchers developed new assumptions and theories that established a new paradigm, and the affected fields of study entered into new periods of normal scientific research.

It may seem hard to imagine that the field of political science has gone through anything that can compare with the experiences of astronomers in the 16th century. Indeed, Kuhn and other scholars who study the evolution of scientific fields of research have a lively and ongoing debate about where the social sciences, like political science, are in terms of their development. The more skeptical participants in this debate argue that political science is not sufficiently mature to have a paradigm, much less a paradigm shift. If we put aside this somewhat esoteric debate about paradigms and paradigm shifts, we can see an important example of the evolution of scientific knowledge about politics from the study of public opinion in the United States.

In the 1940s the study of public opinion through mass surveys was in its infancy. Prior to that time, political scientists and sociologists assumed that U.S. voters were heavily influenced by presidential campaigns – and, in particular, by campaign advertising – as they made up their minds about the candidates. To better understand how these processes worked, a team of researchers from Columbia University set up an in-depth study of public opinion in Erie County, Ohio, during the 1944 presidential election. Their study involved interviewing the same individuals at multiple time periods across the course of the campaign. Much to the researchers' surprise, they found that voters were remarkably consistent from interview to interview in terms of their vote intentions. Instead of being influenced by particular events of the campaign, most of the voters surveyed had made up their minds about how they would cast their ballots long before the campaigning had even begun. The resulting book by Paul Lazarsfeld, Bernard Berelson, and Hazel Gaudet, titled *The People's Choice*, changed the way that scholars thought about public opinion and political behavior in the United States. If political campaigns were not central to vote choice, scholars were forced to ask themselves what *was* critical to determining how people voted.

At first other scholars were skeptical of the findings of the 1944 Erie County study, but as the revised theories of politics of Lazarsfeld et al. were evaluated in other studies, the field of public opinion underwent a change that looks very much like what Thomas Kuhn calls a "paradigm shift." In the aftermath of this finding, new theories were developed to attempt to explain the origins of voters' long-lasting attachments to political parties in the United States. An example of an influential study that was carried out under this shifted paradigm is Richard Niemi and Kent Jenning's seminal book from 1974, *The Political Character of Adolescence: The Influence of Families and Schools*. As the title indicates, Niemi and Jennings studied the attachments of schoolchildren to political parties. Under the pre–Erie County paradigm of public opinion, this study would not have made much sense. But once researchers had found that voter's partisan attachments were quite stable over time, studying them at the early ages at which they form became a reasonable scientific enterprise. You can see evidence of this paradigm at work in current studies of party identification and debates about its stability.

1.3 THINKING ABOUT THE WORLD IN TERMS OF VARIABLES AND CAUSAL EXPLANATIONS

So how do political scientists develop theories about politics? A key element of this is that they order their thoughts about the political world in terms of concepts that scientists call *variables* and causal relationships between variables. This type of mental exercise is just a more rigorous way of expressing ideas about politics that we hear on a daily basis. You should think of each variable in terms of its *label* and its *values*. The **variable label** is a description of what the variable is, and the **variable values** are the denominations in which the variable occurs. So, if we're talking about the variable that reflects an individual's age, we could simply label this variable "Age" and some of the denominations in which this variable occurs would be years, days, or even hours.

It is easier to understand the process of turning concepts into variables by using an example of an entire theory. For instance, if we're thinking about U.S. presidential elections, a commonly expressed idea is that the incumbent president will fare better when the economy is relatively healthy. If we restate this in terms of a political science theory, the state of the economy becomes the **independent variable**, and the outcome of presidential elections becomes the **dependent variable**. One way of keeping the lingo of theories straight is to remember that the value of the "dependent" variable "depends" on the value of the "independent" variable. Recall that a theory is a tentative conjecture about the causes of some phenomenon of interest. In other words, a theory is a conjecture that the independent variable is causally related to the dependent variable; according to our theory, change in the value of the independent variable *causes* change in the value of the dependent variable.

This is a good opportunity to pause and try to come up with your own causal statement in terms of an independent and dependent variable; try filling in the following blanks with some political variables:

____________________________ causes ____________________________

Sometimes it's easier to phrase causal propositions more specifically in terms of the values of the variables that you have in mind. For instance,

higher _____________________ causes lower _____________________

or

higher _____________________ causes higher _____________________

Once you learn to think about the world in terms of variables you will be able to produce an almost endless slew of causal theories. In Chapter 4 we will discuss at length how we design research to evaluate the causal claims in theories, but one way to initially evaluate a particular theory is to think about the **causal explanation** behind it. The causal explanation behind a theory is the answer to the question, "why do you think that this independent variable is causally related to this dependent variable?" If the answer is reasonable, then the theory has possibilities. In addition, if the answer is original and thought provoking, then you may really be on to something. Let's return now to our working example in which the state of the economy is the independent variable and the outcome of presidential elections is our dependent variable. The causal explanation for this theory is that we believe that the state of the economy is *causally related* to the outcome of presidential elections *because* voters hold the president responsible for management of the national economy. As a result, when the economy has been performing well, more voters will vote for the incumbent. When the

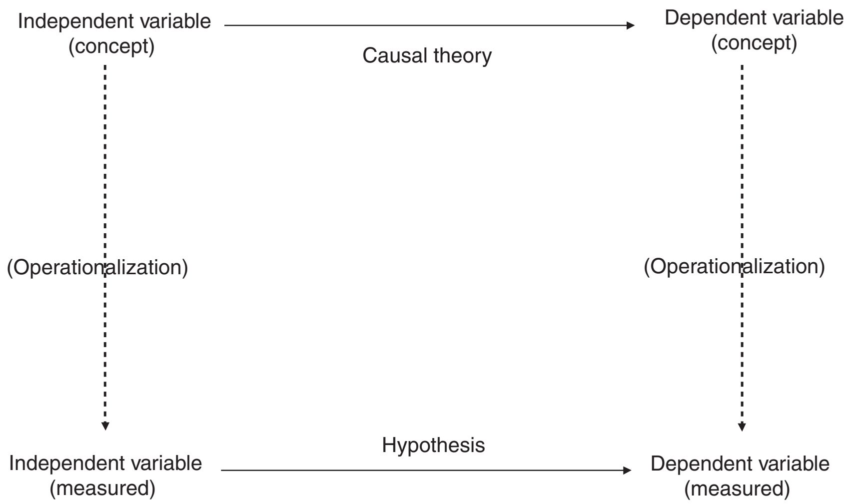

Figure 1.2. From theory to hypothesis.

economy is performing poorly, fewer voters will support the incumbent candidate. If we put this in terms of the preceding fill-in-the-blank exercise, we could write

economic performance causes presidential election outcomes,

or, more specifically, we could write

higher economic performance causes higher incumbent vote.

For now we'll refer to this theory, which has been widely advanced and tested by political scientists, as "the theory of economic voting."

To test the theory of economic voting in U.S. presidential elections, we need to derive from it one or more testable hypotheses. Figure 1.2 provides a schematic diagram of the relationship between a theory and one of its hypotheses. At the top of this diagram are the components of the causal theory. As we move from the top part of this diagram (Causal theory) to the bottom part (Hypothesis), we are moving from a general statement about how we think the world works to a more specific statement about a relationship that we expect to find when we go out in the real world and measure (or **operationalize**) our variables.[4]

[4] Throughout this book we will use the terms "measure" and "operationalize" interchangeably. It is fairly common practice in the current political science literature to use the term "operationalize."

At the theory level at the top of Figure 1.2, our variables do not need to be explicitly defined. With the economic voting example, the independent variable, labeled "Economic Performance," can be thought of as a concept that ranges from values of very strong to very poor. The dependent variable, labeled "Incumbent Vote," can be thought of as a concept that ranges from values of very high to very low. Our causal theory is that a stronger economic performance causes the incumbent vote to be higher.

Because there are many ways in which we can measure each of our two variables, there are many different hypotheses that we can test to find out how well our theory holds up to real-world **data**. We can measure economic performance in a variety of ways. These measures include inflation, unemployment, real economic growth, and many others. "Incumbent Vote" may seem pretty straightforward to measure, but here there are also a number of choices that we need to make. For instance, what do we do in the cases in which the incumbent president is not running again? Or what about elections in which a third-party candidate runs? Measurement (or operationalization) of concepts is an important part of the scientific process. We will discuss this in greater detail in Chapter 5, which is devoted entirely to evaluating different variable measurements and variation in variables. For now, imagine that we are operationalizing economic performance with a variable that we will label "One Year Real Economic Growth Per Capita." This measure, which is available from official U.S. government sources measures the one-year rate of inflation-adjusted (thus the term "real") economic growth per capita at the time of the election. The adjustments for inflation and population (per capita) reflect an important part of measurement – we want our measure of our variables to be comparable across cases. The values for this variable range from negative values for years in which the economy shrank to positive values for years in which the economy expanded. We operationalize our dependent variable with a variable that we label "Incumbent Party Percentage of Major Party Vote." This variable takes on values based on the percentage of the popular vote, as reported in official election results, for the party that controlled the presidency at the time of the election and thus has a possible range from 0 to 100. In order to make our measure of this dependent variable comparable across cases, votes for third party candidates have been removed from this measure.[5]

[5] If you're questioning the wisdom of removing votes for third party candidates, you are thinking in the right way – any time you read about a measurement you should think about different ways in which it might have been carried out. And, in particular, you should focus on the likely consequences of different measurement choices on the results of hypothesis tests. Evaluating measurement strategies is a major topic in Chapter 5.

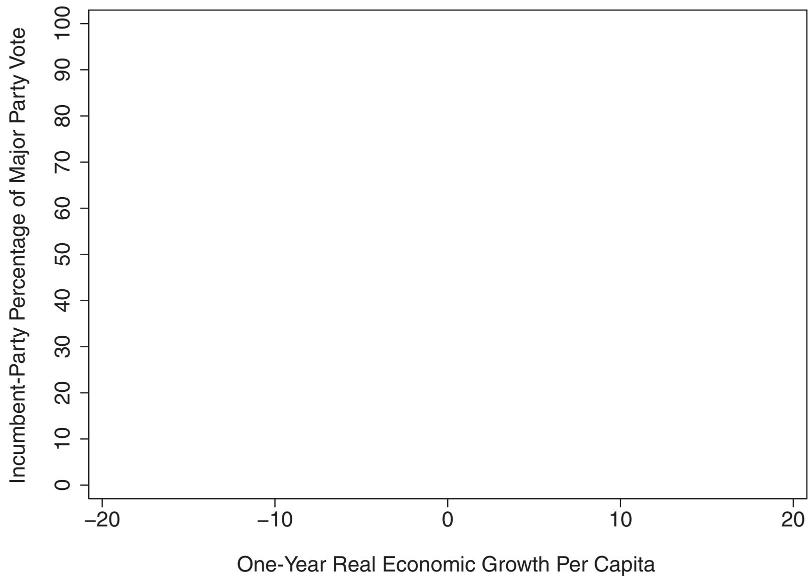

Figure 1.3. What would you expect to see based on the theory of economic voting?

Figure 1.3 shows the axes of the graph that we could produce if we collected the measures of these two variables. We could place each U.S. presidential election on the graph in Figure 1.3 by identifying the point that corresponds to the value of both "One-Year Real Economic Growth" (the horizontal, or *x*, axis) and "Incumbent-Party Vote Percentage" (the vertical, or *y*, axis). For instance, if these values were (respectively) 0 and 50, the position for that election year would be exactly in the center of the graph. Based on our theory, what would you expect to see if we collected these measures for all elections? Remember that our theory is that a stronger *economic performance* causes the *incumbent vote* to be higher. And we can restate this theory in reverse such that a weaker *economic performance* causes the *incumbent vote* to be lower. So, what would this lead us to expect to see if we plotted real-world data onto Figure 1.3? To get this answer right, let's make sure that we know our way around this graph. If we move from left to right on the horizontal axis, which is labeled "One-Year Real Economic Growth," what is going on in real-world terms? We can see that, at the far left end of the horizontal axis, the value is –20. This would mean that the U.S. economy had shrunk by 20% over the past year, which would represent a very poor performance (to say the least). As we move to the right on this axis, each point represents a better economic performance up to the point where we see a value of +20, indicating that the real economy has grown by 20% over the past year. The vertical axis depicts values of "Incumbent-Party Vote Percentage." Moving upward on this axis represents an increasing share of the popular vote for the incumbent party, whereas moving downward represents a decreasing share of the popular vote.

Now think about these two axes together in terms of what we would expect to see based on the theory of economic voting. In thinking through these matters, we should always start with our independent variable. This is because our theory states that the value of the independent variable exerts a causal influence on the value of the dependent variable. So, if we start with a very low value of *economic performance* – let's say –15 on the horizontal axis – what does our theory lead us to expect in terms of values for the *incumbent vote*, the dependent variable? We would also expect the value of the dependent variable to be very low. This case would then be expected to be in the lower-left-hand corner of Figure 1.3. Now imagine a case in which economic performance was quite strong at +15. Under these circumstances, our theory would lead us to expect that the incumbent-vote percentage would also be quite high. Such a case would be in the upper-right-hand corner of our graph. Figure 1.4 shows two such hypothetical points plotted on the same graph as Figure 1.3. If we draw a line between these two points, this line would slope upward from the lower left to the upper right. We describe such a line as having a positive slope. We can therefore hypothesize that the relationship between the variable labeled "One-Year Real Economic Growth" and the variable labeled "Incumbent-Party Vote Percentage" will be a **positive relationship**. A positive relationship is one for which higher

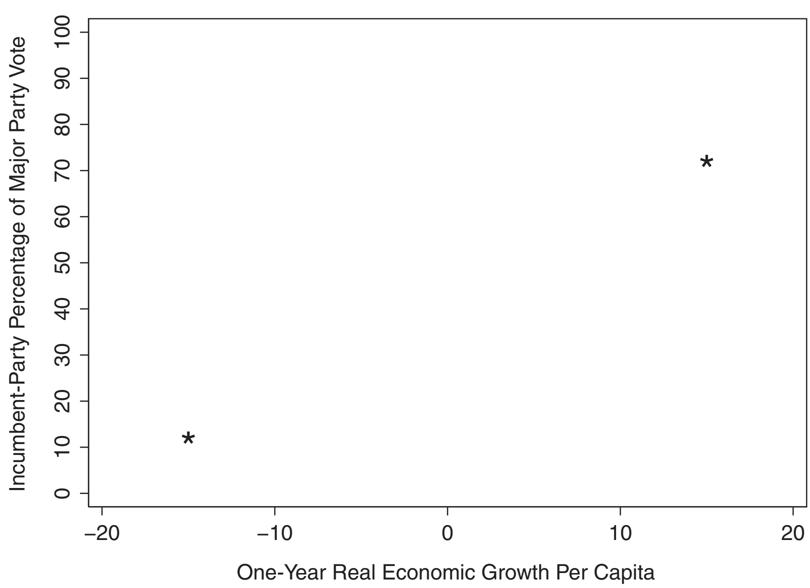

Figure 1.4. What would you expect to see based on the theory of economic voting? Two hypothetical cases.

values of the independent variable tend to coincide with higher values of the dependent variable.

Let's consider a different operationalization of our independent variable. Instead of economic growth, let's use "Unemployment Percentage" as our operationalization of economic performance. We haven't changed our theory, but we need to rethink our hypothesis with this new measurement or operationalization. The best way to do so is to draw a picture like Figure 1.3 but with the changed independent variable on the horizontal axis. This is what we have in Figure 1.5. As we move from left to right on the horizontal axis in Figure 1.5, the percentage of the members of the workforce who are unemployed goes up. What does this mean in terms of economic performance? Rising unemployment is generally considered a poorer economic performance whereas decreasing unemployment is considered a better economic performance. Based on our theory, what should we expect to see in terms of incumbent vote percentage when unemployment is high? What about when unemployment is low?

Figure 1.6 shows two such hypothetical points plotted on our graph of unemployment and incumbent vote from Figure 1.5. The point in the upper-left-hand corner represents our expected vote percentage when unemployment equals zero. Under these circumstances, our theory of economic voting leads us to expect that the incumbent party will do very well. The point in the lower-right-hand corner represents our expected vote percentage when unemployment is very high. Under these circumstances our theory

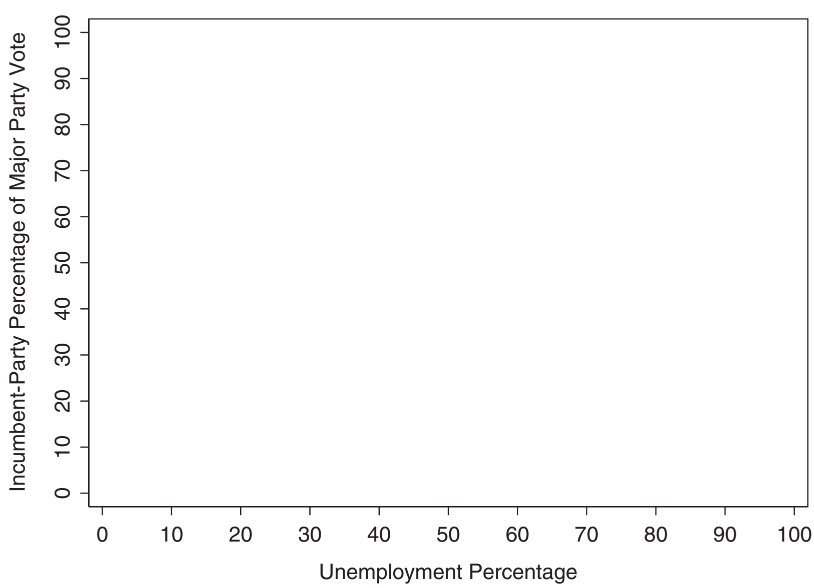

Figure 1.5. What would you expect to see based on the theory of economic voting?

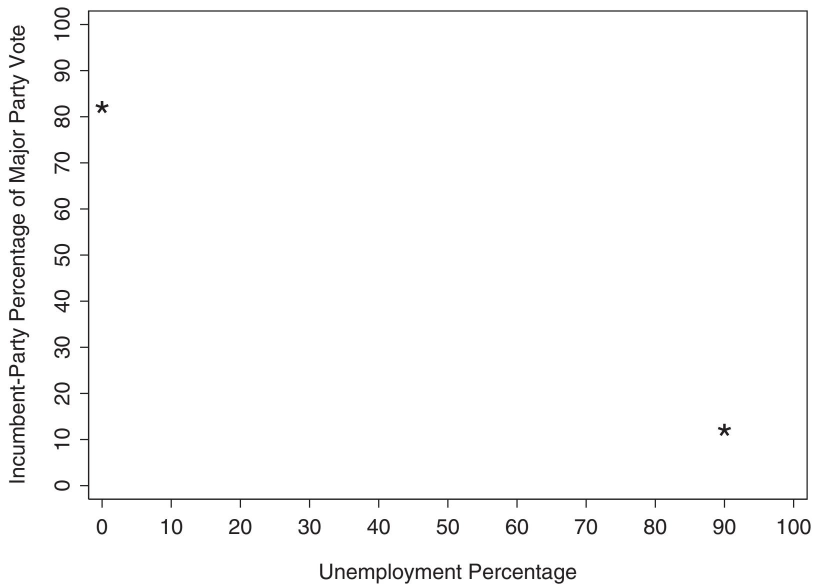

Figure 1.6. What would you expect to see based on the theory of economic voting? Two hypothetical cases.

of economic voting leads us to expect that the incumbent party will do very poorly. If we draw a line between these two points, this line would slope downward from the upper-left to the lower-right. We describe such a line as having a negative slope. We can therefore hypothesize that the relationship between the variable labeled "Unemployment Percentage" and the variable labeled "Incumbent-Party Vote Percentage" will be a **negative relationship**. A negative relationship is one for which higher values of the independent variable tend to coincide with lower values of the dependent variable.

In this example we have seen that the same theory can lead to a hypothesis of a positive or a negative relationship. The theory to be tested, together with the operationalization of the independent and the dependent variables, determines the direction of the hypothesized relationship. The best way to translate our theories into hypotheses is to draw a picture like Figure 1.3 or 1.5. The first step is to label the vertical axis with the variable label for the independent variable (as operationalized) and then label the low (left) and high (right) ends of the axis with appropriate value labels. The second step in this process is to label the vertical axis with the variable label for the dependent variable and then label the low and high ends of that axis with appropriate value labels. Once we have such a figure with the axes and low and high values for each properly labeled, we can determine what our expected value of our dependent variable should be if we observe both a low and a high value of the independent variable. And, once we have placed the two resulting points on our figure, we can tell whether our hypothesized relationship is positive or negative.

Once we have figured out our hypothesized relationship, we can collect data from real-world cases and see how well these data reflect our expectations of a positive or negative relationship. This is a very important step that we can carry out fairly easily in the case of the theory of economic voting. Once we collect all of the data on economic performance and election outcomes, we will, however, still be a long way from confirming the theory that economic performance *causes* presidential election outcomes. Even if a graph like Figure 1.3 produces compelling visual evidence, we will need to see more rigorous evidence than that. Chapters 7–11 focus on the use of statistics to evaluate hypotheses. The basic logic of statistical hypothesis testing is that we assess the probability that the relationship we find could be due to random chance. The stronger the evidence that such a relationship *could not* be due to random chance, the more confident we would be in our hypothesis. The stronger the evidence that such a relationship *could* be due to random chance, the more confident we would be in the corresponding null hypothesis. This in turn reflects on our theory.

We also, at this point, need to be cautious about claiming that we have "confirmed" our theory, because social scientific phenomena (such as elections) are usually complex and cannot be explained completely with a single independent variable. Take a minute or two to think about what other variables, aside from economic performance, you believe might be causally related to U.S. presidential election outcomes. If you can come up with at least one, you are on your way to thinking like a political scientist. Because there are usually other variables that matter, we can continue to think about our theories two variables at a time, but we need to qualify our expectations to account for other variables. We will spend Chapters 3 and 4 expanding on these important issues.

1.4 MODELS OF POLITICS

When we think about the phenomena that we want to better understand as dependent variables and develop theories about the independent variables that causally influence them, we are constructing **theoretical models**. Political scientist James Rogers provides an excellent analogy between models and maps to explain how these abstractions from reality are useful to us as we try to understand the political world:

> The very unrealism of a model, if properly constructed, is what makes it useful. The models developed below are intended to serve much the same function as a street map of a city. If one compares a map of a city to the real topography of that city, it is certain that what is represented in the map

> is a highly unrealistic portrayal of what the city actually looks like. The map utterly distorts what is *really* there and leaves out numerous details about what a particular area looks like. But it is precisely *because* the map distorts reality – because it abstracts away from a host of details about what is really there – that it is a useful tool. A map that attempted to portray the full details of a particular area would be too cluttered to be useful in finding a particular location or would be too large to be conveniently stored. (2006, p. 276, emphasis in original)

The essential point is that models *are* simplifications. Whether or not they are useful to us depends on what we are trying to accomplish with the particular model. One of the remarkable aspects of models is that they are often more useful to us when they are inaccurate than when they are accurate. The process of thinking about the failure of a model to explain one or more cases can generate a new causal theory. Glaring inaccuracies often point us in the direction of fruitful theoretical progress.

1.5 RULES OF THE ROAD TO SCIENTIFIC KNOWLEDGE ABOUT POLITICS

In the chapters that follow, we will focus on particular tools of political science research. As we do this, try to keep in mind our larger purpose – trying to advance the state of scientific knowledge about politics. As scientists, we have a number of basic rules that should never be far from our thinking:

- Make your theories causal.
- Don't let data alone drive your theories.
- Consider only empirical evidence.
- Avoid normative statements.
- Pursue both generality and parsimony.

1.5.1 Make Your Theories Causal

All of Chapter 3 deals with the issue of causality and, specifically, how we identify causal relationships. When political scientists construct theories, it is critical that they always think in terms of the causal processes that drive the phenomena in which they are interested. For us to develop a better understanding of the political world, we need to think in terms of causes and not mere **covariation**. The term covariation is used to describe a situation in which two variables vary together (or **covary**). If we imagine two variables, A and B, then we would say that A and B covary if it is the case that, when we observe higher values of variable A, we generally also observe higher values of variable B. We would also say that A and B covary if it is the case that, when we observe higher values of variable *A*, we generally also observe lower values of variable *B*.[6] It is easy to assume that when we observe covariation we are also observing causality, but it is important not to fall into this trap.

1.5.2 Don't Let Data Alone Drive Your Theories

This rule of the road is closely linked to the first. A longer way of stating it is "try to develop theories before examining the data on which you will perform your tests." The importance of this rule is best illustrated by a silly example. Suppose that we are looking at data on the murder rate (number of murders per 1000 people) in the city of Houston, Texas, by months of the year. This is our dependent variable, and we want to explain why it is higher in some months and lower in others. If we were to take as many different independent variables as possible and simply see whether they had a relationship with our dependent variable, one variable that we might find to strongly covary with the murder rate is the amount of money spent per capita on ice cream. If we perform some verbal gymnastics, we might develop a "theory" about how heightened blood sugar levels in people who eat too much ice cream lead to murderous patterns of behavior. Of course, if we think about it further, we might realize that both ice cream sales and the number of murders committed go up when temperatures rise. Do we have a plausible explanation for why temperatures and murder rates might be causally related? It is pretty well known that people's tempers tend to fray when the temperature is higher. People also spend a lot more time outside during hotter weather, and these two factors might combine to produce a causally plausible relationship between temperatures and murder rates.

What this rather silly example illustrates is that we don't want our theories to be crafted based entirely on observations from real-world data. We are likely to be somewhat familiar with empirical patterns relating to the dependent variables for which we are developing causal theories. This is normal; we wouldn't be able to develop theories about phenomena about which we know nothing. But we need to be careful about how much we let what we see guide our development of our theories. One of the best ways to do this is to think about the underlying causal process as we develop our theories and to let this have much more influence on our thinking than patterns that we might have observed. Chapter 2 is all about strategies for developing theories. One of these strategies is to identify interesting variation in our

[6] A closely related term is **correlation**. For now we use these two terms interchangeably. In Chapter 7, you will see that there are precise statistical measures of covariance and correlation that are closely related to each other but produce different numbers for the same data.

dependent variable. Although this strategy for theory development relies on data, it should not be done without thinking about the underlying causal processes.

1.5.3 Consider Only Empirical Evidence

As we previously outlined, we need to always remain open to the possibility that new evidence will come along that will decrease our confidence in even a well-established theory. A closely related rule of the road is that, as scientists, we want to base what we know on what we see from *empirical* evidence, which, as we have said, is simply "evidence based on observing the real world." Strong logical arguments are a good start in favor of a theory, but before we can be convinced, we need to see results from rigorous hypothesis tests.[7]

1.5.4 Avoid Normative Statements

Normative statements are statements about how the world ought to be. Whereas politicians make and break their political careers with normative statements, political scientists need to avoid them at all costs. Most political scientists care about political issues and have opinions about how the world ought to be. On its own, this is not a problem. But when normative preferences about how the world "should" be structured creep into their scientific work, the results can become highly problematic. The best way to avoid such problems is to conduct research and report your findings in such a fashion that it is impossible for the reader to tell what are your normative preferences about the world.

This does not mean that good political science research cannot be used to change the world. To the contrary, advances in our scientific knowledge about phenomena enable policy makers to bring about changes in an effective manner. For instance, if we want to rid the world of wars (normative), we need to understand the systematic dynamics of the international system that produce wars in the first place (empirical and causal). If we want to rid America of homelessness (normative), we need to understand the pathways

[7] It is worth noting that some political scientists use data drawn from experimental settings to test their hypotheses. There is some debate about whether such data are, strictly speaking, empirical or not. We discuss political science experiments and their limitations in Chapter 4. In recent years some political scientists have also made clever use of simulated data to gain leverage on their phenomena of interest, and the empirical nature of such data can certainly be debated. In the context of this textbook we are not interested in weighing in on these debates about exactly what is and is not empirical data. Instead, we suggest that one should always consider the overall quality of data on which hypothesis tests have been performed when evaluating causal claims.

into and out of being homeless (empirical and causal). If we want to help our favored candidate win elections (normative), we need to understand what characteristics make people vote the way they do (empirical and causal).

1.5.5 Pursue Both Generality and Parsimony

Our final rule of the road is that we should always pursue generality and parsimony. These two goals can come into conflict. By "generality," we mean that we want our theories to be applied to as general a class of phenomena as possible. For instance, a theory that explains the causes of a phenomenon in only one country is less useful than a theory that explains the same phenomenon across multiple countries. Additionally, the more simple or **parsimonious** a theory is, the more appealing it becomes.[8]

In the real world, however, we often face trade-offs between generality and parsimony. This is the case because, to make a theory apply more generally, we need to add caveats. The more caveats that we add to a theory, the less parsimonious it becomes.

1.6 A QUICK LOOK AHEAD

You now know the rules of the road. As we go through the next 11 chapters, you will acquire an increasingly complicated set of tools for developing and testing scientific theories about politics, so it is crucial that, at every step along the way, you keep these rules in the back of your mind. The rest of this book can be divided into three different sections. The first section, which includes this chapter through Chapter 4, is focused on the development of theories and research designs to study causal relationships about politics. In Chapter 2, "The Art of Theory Building," we discuss a range of strategies for developing theories about political phenomena. In Chapter 3, "Evaluating Causal Relationships," we provide a detailed explanation of the logic for evaluating causal claims about relationships between an independent variable, which we call "X," and a dependent variable, which we call "Y." In Chapter 4, "Research Design," we discuss the research strategies that political scientists use to investigate causal relationships.

In the second section of this book, we expand on the basic tools that political scientists need to test their theories. Chapter 5, "Getting to Know Your Data: Evaluating Measurement and Variations," is a detailed discussion of how we measure (or operationalize) our variables, along with an

[8] The term "parsimonious" is often used in a relative sense. So, if we are comparing two theories, the theory that is simpler would be the more parsimonious. Indeed, this rule of the road might be phrased "pursue both generality and simplicity." We use the words "parsimony" and "parsimonious" because they are widely used to describe theories.

introduction to a set of tools that can be used to summarize the characteristics of variables one at a time. Chapter 6, "Probability and Statistical Inference," introduces both the basics of probability theory as well as the logic of statistical hypothesis testing. In Chapter 7, "Bivariate Hypothesis Testing," we begin to apply the lessons from Chapter 6 to a series of empirical tests of the relationship between pairs of variables.

The third and final section of this book introduces the critical concepts of the regression model. Chapter 8, "Bivariate Regression Models," introduces the two-variable regression model as an extension of the concepts from Chapter 7. In Chapter 9, "Multiple Regression: The Basics," we introduce the multiple regression model, with which researchers are able to look at the effects of independent variable *X* on dependent variable *Y* while controlling for the effects of other independent variables. Chapter 10, "Multiple Regression Model Specification," and Chapter 11, "Limited Dependent Variables and Time-Series Data," provide in-depth *discussions of* and *advice for* commonly encountered research scenarios involving multiple regression models. Lastly, in Chapter 12, "Putting It All Together to Produce Effective Research," we discuss how to apply the lessons learned in this book to begin to produce original research of your own.

CONCEPTS INTRODUCED IN THIS CHAPTER[9]

- causal – implying causality. A central focus of this book is on theories about "causal" relationships.
- correlation – a statistical measure of covariation which summarizes the direction (positive or negative) and strength of the linear relationship between two variables.
- covary (or covariation) – when two variables vary together, they are said to "covary." The term "covariation" is used to describe circumstances in which two variables covary.
- data – a collection of variable values for at least two observations.
- dependent variable – a variable for which at least some of the variation is theorized to be caused by one or more independent variables.
- empirical – based on real-world observation.
- hypothesis – a theory-based statement about what we would expect to observe if our theory is correct. A hypothesis is a more explicit statement of a theory in terms of the expected relationship between a

[9] At the end of each chapter, we will provide short definitions of each bolded term that was introduced in that chapter. These short definitions are intended to help you get an initial grasp of the term when it is introduced. A full understanding of these concepts, of course, can only be gained through a thorough reading of the chapter.

measure of the independent variable and a measure of the dependent variable.

- hypothesis testing – the act of evaluating empirical evidence in order to determine the level of support for the hypothesis versus the null hypothesis.
- independent variable – a variable that is theorized to cause variation in the dependent variable.
- measure – a process by which abstract concepts are turned into real-world observations.
- negative relationship – higher values of the independent variable tend to coincide with lower values of the dependent variable.
- normal science – scientific research that is carried out under the shared set of assumptions and accepted theories of a paradigm.
- normative statements – statements about how the world ought to be.
- null hypothesis – a theory-based statement about what we would observe if there were no relationship between an independent variable and the dependent variable.
- operationalize – another word for measurement. When a variable moves from the concept-level in a theory to the real-world measure for a hypothesis test, it has been operationalized.
- paradigm – a shared set of assumptions and accepted theories in a particular scientific field.
- paradigm shift – when new findings challenge the conventional wisdom of a paradigm to the point where the set of shared assumptions and accepted theories in a scientific field is redefined.
- parsimonious – synonym for simple or succinct.
- positive relationship – higher values of the independent variable tend to coincide with higher values of the dependent variable.
- theoretical model – the combination of independent variables, the dependent variable, and the causal relationships that are theorized to exist between them.
- theory – a tentative conjecture about the causes of some phenomenon of interest.
- variable – a definable quantity that can take on two or more values.
- variable label – the label used to describe a particular variable.
- variable values – the values that a particular variable can take on.

EXERCISES

1. Pick another subject in which you have taken a course and heard mention of scientific theories. How is political science similar to and different from that subject?