**CHAPTER EIGHT**

1. **The Development of Econometrics and Empirical Methods in Economics**

**EMPIRICAL ECONOMICS**

Almost all economists believe that economics must ultimately be an empirical discipline, that their theories of how the economy works must be related to (and, if possible, tested against) real-world events and data. But economists differ enormously on how one does this and what implications can be drawn afterward. We will distinguish four different approaches to relating theories to the real world: common-sense empiricism, statistical analysis, classical econometric analysis, and Bayesian econometric analysis.

* Common-sense empiricism is an approach that relates theory to reality through direct observation of real world events with a minimum of statistical aids. You look at the world around you and determine if it matches your theoretical notions. It is the way in which most economists approached economic issues until the late nineteenth century; before then, most economists were not highly trained in statistical methods, the data necessary to undertake statistical methods did not exist, many standard statistical methods that we now take for granted had not yet been developed, and computational capabilities were limited. Common-sense empiricism is sometimes disparagingly called armchair empiricism. The derogatory term conveys a sense of someone sitting at a desk, developing a theory, and then selectively choosing data and events to support that theory. Supporters of commonsense empiricism would object to that characterization because the approach can involve careful observation, extensive fieldwork, case studies, and direct contact with the economic events and institutions being studied. Supporters of common-sense empiricism argue that individuals can be trained to be open to a wide range of real-world events; individuals can objectively assess whether their theories match those events. The common-sense approach requires that economists constantly observe economic phenomena, with trained eyes, thereby seeing things that other people would miss. It has no precise line of demarcation to ultimately determine whether a theory should or should not be accepted, but it does have an imprecise line. If you expected one result and another occurred, you should question the theory. The researcher’s honesty with himself or herself provides the line of demarcation.
* The statistical analysis approach also requires one to look at reality but emphasizes aspects of events that can be quantified and thereby be subject to statistical measure and analysis. A focus is often given to statistically classifying, measuring, and describing economic phenomena. This approach is sometimes derisively called measurement without theory. Supporters of the approach object to that characterization, arguing that it is simply an approach that allows for the possibility of many theories and permits the researcher to choose the most relevant theory. They claim that it is an approach that prevents pre considered theoretical notions from shaping the interpretation of the data. The statistical analysis approach is very similar to common-sense empiricism, but unlike that approach, the statistical approach uses whatever statistical tools and techniques are available to squeeze every last bit of understanding from a data set. It does not attempt to relate the data to a theory; instead, it lets the data (or the computer analyzing the data) do the talking. As the computer has increased researchers’ capabilities of statistically analyzing data, the approaches of common-sense empiricism and statistical analysis have diverged.
* The classical econometric approach is a method of empirical analysis that directly relates theory and data. The common-sense sensibility of the researcher, or his or her understanding of the phenomena, plays little role in the empirical analysis; the classical econometrician is simply a technician who allows the data to do the testing of the theory.
* The Bayesian approach1 directly relates theory and data, but in the interpretation of any statistical test, it takes the position that the test is not definitive. It is based on the Bayesian approach to statistics that seeks probability laws not as objective laws but as subjective degrees of belief. In Bayesian analysis, statistical analysis cannot be used to determine objective truth; it can be used only as an aid in coming to a subjective judgment. Thus, researchers must simply use the statistical tests to modify their subjective opinions. Bayesian econometrics is a technical extension of common-sense empiricism. In it, data and data analysis do not answer questions; they are simply tools to assist the researcher’s common sense.
* These approaches are not all mutually exclusive. For example, one can use commonsense empiricism in the initial development of a theory and then use econometrics to test the theory. Similarly, Bayesian analysis requires that researchers arrive at their own prior belief by some alternative method, such as common-sense empiricism. However, the Bayesian and the classical interpretations of statistics are mutually exclusive, and ultimately each researcher must choose one or the other. Technology affects not only the economy itself but also the methods economists use to analyze the economy. Thus, it should not be surprising that computer technology is making major differences in the way economists approach the economy and do empirical work. As one observer put it: Had automobiles experienced the same technological gains as computers, Ferraris would be selling for 50 cents. Wouldn’t that change your driving habits? The computer certainly has changed economists’ empirical work, and it will do so much more in the future. Bayes’s ideas had little impact on the early development of classical statistics, but he is honored today because of his seminal insight.In some cases, technology has merely made it easier to do things we have already been doing. Statistical tests, for example, are now done pro forma by computer programs. Recursive systems with much more complicated dynamics are finding a wider audience. Baysesian measures are beginning to show up in standard computer software statistical programs. Another group of economists is using a VAR (Vector Auto Regression) approach. They simply look to the computer to find patterns in data independent of any theory. Another set of changes is more revolutionary than evolutionary.
* Recently a group of empirical economists have been focusing more on agent-based modeling. These are simulations in which local individual optimization goals of heterogeneous agents are specified and modeled. But instead of being deductively determined, the results are simulated to determine the surviving strategies. In these simulations individuals are allowed to build up institutions and enter into coalitions, providing a much closer parallel to real-world phenomena. Another change that we have seen is the development and use of a technique called calibration in macroeconomic models. Models are not tested empirically; instead, they are calibrated to see if the empirical evidence is consistent with what the model could have predicted. In calibration, the role of simple general equilibrium models with parameters determined by introspection along with simple dynamic time-series averages is emphasized. Statistical “fit” is explicitly rejected as a primary goal of empirical work. There is debate about precisely what calibration shows, but if a model cannot be calibrated, then it should not be retained.
* A final change has been the development of a “natural experiment” approach to empirical work. This approach uses intuitive economic theory rather than structural models and uses natural experiments as the data points

**THE RISE OF ECONOMETRICS**

By the 1960s, Mitchell’s approach to empirical analysis for the macroeconomy was supplanted by the econometric approach in both microeconomics and macroeconomics. There were a number of reasons why the mainstream turned away from Mitchell’s methodology and toward econometrics: (1) the further development of statistical and econometric methods, which avoided some of Moore’s problems; (2) the strong desire on the part of the profession and the society for precision in implementing and testing theories; (3) the development of mathematical economics; (4) the hope that econometrics would turn economics into an exact science; and (5) brilliant and strong-willed advocates of the econometric methods who proselytized for this approach.

**E.J. Working and the Identification Problem**

One of the developments that pushed forward the econometric approach in microeconomics was E. J. Working’s (1900-1968) approach to the identification problem. A simple correlation between price and quantity that provides a “good fit” of the data has little meaning, because economic theory states that price and quantity are determined by an interaction of supply and demand. Has one found a supply curve or a demand curve? Working showed that if one could independently specify supply, so that one precisely knew the supply relationship and how it would shift, the derived points would estimate a demand curve. Alternatively, if one independently specified the demand relationship, one could estimate a supply curve. If one could not independently specify either, then one could not estimate either a supply or a demand curve without additional information. This “solution” to the identification problem made it possible, in principle at least, to specify empirically static relationships even if ceteris paribus conditions did not hold. It was believed that as calculating technology improved (which it has done with computers), better relationships between static theory and empirical theory and empirical measurement would be forthcoming.

**Keynesian Theory and Macroeconometrics**

It was not developments in microeconomics that primarily propelled econometrics forward in the 1930s; it was developments in macroeconometrics. The Great Depression turned economists’ thoughts to macroeconomics. By the late 1930s, Keynesian theory was sweeping the field, and there were strong efforts to provide satisfactory explanations for, and policies to address, the Depression. Thus, the history of econometrics in the 1930s through the 1960s focuses on macroeconometrics. The interest in macroeconomic modeling in the 1930s was logical. During this time macroeconomics was enormously influenced by Keynesian macroeconomics, and there were attempts to find empirical counterparts to the Keynesian theory. A number of estimates of the multiplier were derived. Colin Clark estimated the multiplier at somewhere between 1.5 and 2.1; Kalecki estimated it at about 2.25. Of course, the multiplier made sense only if Keynesian theory made sense, so there was a strong push to determine empirically whether Keynesian theory was correct. There were many attempts to measure the relationship between consumption and income, what Keynes had called the “consumption function.” During this period there was also a loss of faith in the automatic tendency of economic forces to push the economy toward full employment and a corresponding increased interest in central planning. Such central planning required one to estimate relationships in the economy. Thus, it is not surprising that important work took place in institutes like the Netherlands Central Planning Bureau.

**Ragnar Frisch, Jan Tinbergen, and the Development of Large Macroeconometric Models**

One of the most influential econometricians of the late 1920s and early 1930s was the Norwegian economist Ragnar Frisch (1895-1973). Frisch was a highly trained mathematician who made contributions to both macro- and micro- econometrics and played an important role in redirecting empirical economics away from the institutional approach and toward an econometric approach. In fact, it was he who coined the term econometrics. Although Frisch made some important discoveries in microeconometrics (he carried out a conclusive mathematical treatment of Working’s identification problem and showed that the ordinary least squares estimator was biased), it was his contribution to macro- econometrics that accounts for his importance. Together with Jan Tinbergen, he played an important role in creating the field of macroeconometrics by developing a macroeconometric model of the economy. Frisch’s primary work is found in his book Statistical Confluence Analysis by Means of Complete Regression Systems (1934). Here he argued that most economic variables were simultaneously interconnected in “confluent systems” in which no variable could be varied independently; he worked out a variety of methods to handle these problems. Jan Tinbergen (1903-1994), a friend of Frisch, was recruited by the League of Nations in 1936 to undertake statistical tests of business-cycle theories. His report was published in 1939 under the title Statistical Testing of Business Cycle Theories. This work focused on developing dynamic macroeconomic theories from the data and testing them. Tinbergen developed a theory of the business cycle, or model of the macroeconomy, that exhibited cyclical tendencies. Econometricians such as Frisch and Tinbergen recognized that econometric work in macroeconomics was conceptually far more difficult than econometric work in microeconomics. In microeconomics one was worried about identification with two separate structural equations, supply and demand; in macroeconomics, theory suggested that there was a large system of interdependent equations that underlay macroeconomic forces. Somehow, the researcher had to extend the microeconomic analysis almost ad infinitum for large numbers of equations, specify a system of structural equations, and test those equations. It was to this task that Frisch and Tinbergen directed their analysis, and both won Nobel Prizes for their contributions. Like Moore’s, their purpose was more than simply testing the validity of a theory: they were interested in policy. They believed that if they could specify a structural set of equations describing the economy, they could thereafter determine a set of policies to change the structure of those equations and through those policies achieve desirable results in the economy. Tinbergen’s work evoked serious criticism from both John Maynard Keynes and Milton Friedman, both of whom objected to the entire process and the implications drawn from it. They argued that Tinbergen’s estimation procedures made use of the same data to derive the model that were used to test among possible competing theories, which would make the normal tests of statistical significance irrelevant. Their views represented the conviction that econometrics cannot replace educated common sense. Significant questions were raised about macro-econometrics even at its initial stages