Macroeconomic Methods

A Summary by Lucas Engelhardt

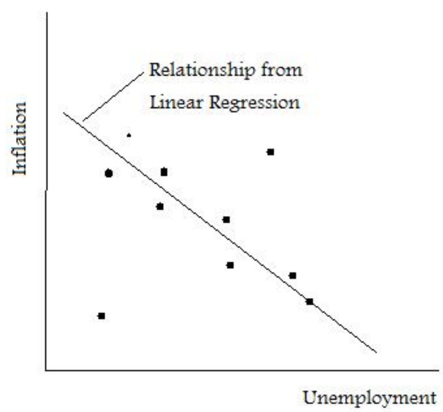
1 Introduction

How does one DO macroeconomics? This question is nearly as important as any other in macroeconomic science. This is a brief overview of various methods, along with their advantages and disadvantages. Finally, I describe the current consensus in what use of these methods is generally appropriate.

2 Econometrics

Econometrics is one approach to macroeconomics. Taking the data as a starting point, through various econometric methods (from simple ordinary least squares methods to more advanced "methods of moments") the data is used to provide information about the relationships of macroeconomic variables.

Example:



Take data points (ex: black dots above), and "run a regression" (take econometrics for details). The result is a "best fit" relationship.

Benefits: Econometric methods do well matching the model to the data. They are designed to match the data as closely as possible, so that makes sense.

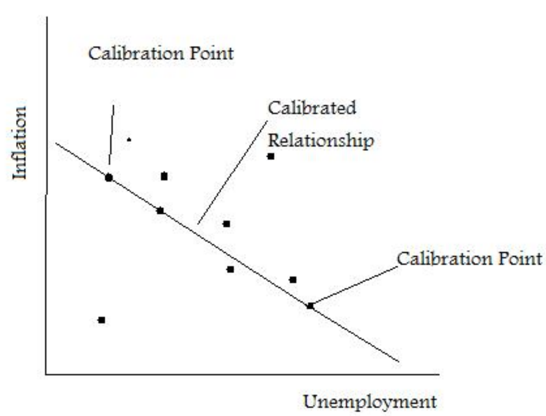
Critique: Robert Lucas has a famous critique of the use of simpler forms of econometrics for policy analysis. The key is that econometric methods implicitly assume that the "rules of the game" are staying the same so that the behaviors driving economic patterns will not change, keeping the relationships stable.

However, when one changes policy, one does change the “rules of the game”. It is sensible that people will respond to these changes by changing their behavior, making the previously performed econometrics useless. After all, they estimated relationships assuming that the rules of the game were staying the same. But, changing policy changed the rules of the game, so the estimated relationships are not valid.

3 Calibration and Simulation

Calibration and Simulation are similar to econometrics in some ways. Both consider the data to be very important in informing economic theory. The major difference is that, using econometrics, the model is designed to come as close as possible to all of the data. The test of the model is how well it fits the “average data point”. (Measures like R^2 are designed to do measure this sort of thing.) With calibration and simulation, the model is designed to match a very small number of data points exactly. Then, the model is tested by how well it matches the remaining data. If it matches the remaining data very well, then the model is considered to be “good”. If it matches the remaining data poorly, then the model is considered to be poor.

Example:



Relationship is derived to fit two points exactly. Then, the goodness of the fit is tested by examining the remaining points. In reality, the method is often more sophisticated than this. Usually, calibration and simulation is used when standard econometric techniques won’t work (for example, if you have a complicated system of equations that is difficult to sort out in the data).

Benefits: Actually provides a test of the model’s ability to predict outside of sample. (Milton Friedman claimed that “The test of a model is its ability to predict.”) From that, it can sidestep the Lucas critique sometimes. However, other times it is just as susceptible to the Lucas critique.

Critique: Intentionally ignores potentially useful data. Also, sensitive to which data points are chosen for a perfect match. After all, choosing "the right" two points can result in the model being accepted, while choosing "the wrong" two points can result in the model being rejected. This objection is generally overcome by matching an average for one moment in the data (correlation between inflation and output, for example), and then comparing a simulated average for another moment (correlation between output and unemployment).

4 Formal Mathematical Modeling

In formal mathematical modeling, the economist makes certain assumptions about the mathematical relationships between certain variables, and then uses mathematical principles and rules to arrive at conclusions. Generally, this has two possible purposes. One is to develop relationships between observable data that can be used for econometric or calibration/simulation methods. The other is to derive qualitative relationships that have some degree of certainty.

Examples:

Type 1: Suppose we have data on after tax income and consumption, but not savings. We may propose the following: $Income = Consumption + Savings$ (since those are the only two things you can do with income). $Savings = a + b * Income$ with $b > 0$ (That is, savings increases with income, and there is some portion of savings that doesn't depend on income.) Mathematically, we can then get: $Income = Consumption + a + b * Income \Rightarrow (1-b) * Income = Consumption + a \Rightarrow Income = \frac{1}{1-b} * Consumption + \frac{a}{1-b}$, which is a form that can be rewritten as $Income = \beta_0 + \beta_1 Consumption$, which is suitable for regression once we add in that ϵ.

Type 2: Using the same equations as before: $Income = Consumption + Savings$, $Savings = a + b * Income$, but assuming $0 < b < 1$. We can then derive a relationship between consumption and income that looks like: $Consumption = (1-b) * Income - a$. Because $0 < b < 1$, we can say that when income increases, consumption will increase, but less than dollar for dollar. This is true for any value of a, and any value of b that satisfies the assumptions, as long as the two equations that we assumed hold.

Benefits: Econometrics and, to a lesser extent, Calibration/Simulation is not very good at determining causation, and are constrained to working with only correlation. Formal Mathematical reasoning can get around this limitation and actually provide causal links.

Critique: Deirdre McCloskey authored a famous critique of this method. Essentially her argument is that formal mathematical reasoning rests on the truth of the assumptions. But, the assumptions are generally obviously false. After all, it is probably true that Savings increases with Income. But, it is probably not true that Savings is a stable, linear function of income. McCloskey generally doesn't have a problem with using these methods, as long as the results are not given more certainty than they deserve, which, in her mind, is relatively little. Rather, we should use mathematical reasoning only to get results that can be used for calibration. Then, the formal mathematics should be treated not as certain, but as providing a "story" that can explain the observed phenomena.

5 Informal Verbal Reasoning

The last method is informal verbal reasoning. This is probably the oldest method in economics (read Adam Smith!), and is still advocated by some as the best. The idea is simple. Rather than formalizing economic reality into simplified mathematical models for formal mathematical reasoning, econometrics, or calibration, economic reality is spoken of in verbal terms with very limited appeal to math. Underlying the present-day use of this method is generally a McCloskey sort of concern about the falsehood of mathematizing economics. Mathematization, by necessity, requires certain simplifying assumptions if the equations are going to be useful. According to advocates of informal verbal reasoning, these simplifications often miss important pieces of economic reality that are not easy to capture mathematically, and that are obscuredy by the data.

Example: When after tax income increases, consumption will increase, but less than dollar for dollar. For any dollar of income, a person can increase either their savings or their consumption. Savings can be used for future consumption, for example during retirement or unexpected times of lost income or higher expenses than usual. Because there are good reasons to increase both savings and consumption, people will increase both. As a result, the additional dollar of income will not be used fully for consumption, though consumption will increase.

Benefits: There are certain economic realities that are difficult to capture mathematically (for example, the complexity of capital structure). Verbal reasoning doesn't have the same sorts of limitations. As long as there is a clear concept, vocabulary can be developed for describing it. While this is technically true for mathematics as well, using math is often a waste of time when the problem is more complicated in a mathematical form than in a verbal form.

Critique: The reason for verbal reasoning is its own critique. Verbal reasoning is used because mathematical reasoning is limited. However, because mathematical reasoning in these topics is limited, it is difficult to do any empirical tests or to develop any mathematically precise predictions.

6 Combining the Techniques: a Usual Approach

The preceding discussion only considered the techniques in isolation. Naturally, the weaknesses of each is highlighted when it is in isolation. However, isolating these techniques from each other would send a false message of how economics is actually done, most of the time. Naturally, there are some who prefer a single method to the exclusion, or near exclusion of all others, but these are in the minority. In reality economics is done something like this:

1. Observe an economic reality (perhaps through "stylized fact" or perhaps through econometric technique).
2. Develop a conceptual theory to explain the reality (verbal informal reasoning)
3. Translate the conceptual theory into mathematical terms (formal mathematical reasoning)
4. Use the mathematical version to either do econometrics or calibrate and simulate

In the end, the hope is generally to develop both a predictive framework and an intuitive understanding.

7 Personal Note

I tend to agree with those who call themselves "Austrian economists". Generally, Austrians would criticize the standard process as follows: (1) The step from conceptual theory to mathematical theory involves unrealistic assumptions, almost by logical necessity, but certainly in practice. (2) The step from conceptual theory to statistical/empirical methods involves more assumptions that may or may not be realistic. Also, because economic data is the result of complex phenomena, most standard statistical techniques are likely to be invalid, at the very least because of omitted variable bias, though other biases are not unlikely.

Austrians tend to suggest an alternative that they call "Causal-realism". The causal-realist approach focuses on uncovering cause-and-effect relationships that explain real economic phenomena, rather than explaining these phenomena from assumptions that may or may not be realistic. In the terms spoken of here, this is a specific type of verbal reasoning.