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Using Computer Modelling As A Tool For Self-Directed Learning In Financial Economics

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Abstract

This paper presents an example of the use of a computer simulation model as a platform for self-directed student learning in the field of financial economics. Students use the simulation model as a vehicle to analyse expected outcomes for a typical capital investment as influenced by a probabilistically distributed set of possible future macroeconomic variables. The technique may be used to analyse a wide range of financial decisions, but in this example we use it to inform a decision regarding financing structure in a real estate investment.

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Keywords: Computer simulation, computer modelling, economics, financial economics, real estate finance, self-directed learning;

Introduction

This paper describes and explains how a simple computer model may be used as a vehicle for self-directed learning in the field of financial economics. I use this model at the graduate level, but similar models may be applied with equal effect at the undergraduate level, and may be applied to other fields of economics. The model does not require sophisticated technology. In this example, I use a straightforward Excel spreadsheet that students design for themselves in accordance with instructor specifications.

2. Purpose of the Model

One of the challenges that characterize the field of financial economics is to understand – and even at certain courageous moments to attempt to quantify – the relationships between macroeconomic events on the one hand, and microeconomic decisions (i.e., financial decisions) on the other. The connecting link is economic theory.

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It is a daunting task for educators to teach students what these connections are because the relationships are fluid and complex. The cause variables that allow us to structure an optimal financial decision affect each other, and they are probabilistically distributed. The construction of a model can help students to experiment for themselves with these variables, and to estimate the different effects that a changing macroeconomic environment will have for future investment outcomes.

3. The Financial Decision

In this example, students must choose between two financing options for an office building investment. The first option is a fixed rate mortgage (FRM). In this loan, the debt service payments will remain the same throughout the life of the loan. The second option is an adjustable rate mortgage (ARM), in which the debt service payments will change every year, moving up or down in response to changes in market rates.

The challenge in making this decision is that the utility of the loan depends not on what the market interest rate is now, but rather on what that rate will be in the future, and we do not know with certainty -- or anything even close to certainty -- what that rate will be. Moreover, returns generated to investors are affected by another variable that will also change in a fluid macroeconomic environment, that variable being rents. Rising interest rates will be negative for investor returns if we choose the ARM, but the net effect of the macroeconomic events causing that change may actually be positive for investors if rents also rise. To estimate the extent to which rent levels will change along with interest rates, we need to examine the fundamentals of interest rate theory.

4. Interest Rate Theory: The Fisher Model

The economic foundation for our understanding of interest rates was developed in the work of Yale economist Irving Fisher [1]. The heart of Fisher's theory is that the market interest rate we all see, the rate that Fisher called the "nominal" rate, is not the only important rate. Fisher maintained that nominal rates contain another rate, which he called the "real" rate of interest. The difference between the two is the rate of inflation, so that: Nominal Rate = Real Rate + Rate of Inflation.

Fisher's argument is simple and intuitive. If I lend money at the rate of 10%, and a 10% decline in the value of the currency occurs during the loan period, my return on the loan is really zero: I recover 10% more units of the currency, but each unit is worth 10% less. Therefore, nominal rates at any time will have two pieces: The part necessary to recover the cost of inflation, and the "real" part, which represents the true cost of capital.

Now, why is this theory important in the exercise I assigned? Let's say that nominal interest rates rise, which would be bad for the real estate investors if the ARM is used. However, if rates rise as a result of changes in price levels (inflation), then we would expect rents to rise also, and that would be good for real estate investors, so we would be seeing two influences simultaneously affecting our investment, but in opposite directions. Changes in the real interest rate, on the other hand, are normally caused by changes in macroeconomic liquidity, and risk [2]. These changes do not systematically cause rents to increase, and in fact they often cause rents to decline.

5. Complexity

The macroeconomic complexities considered above are daunting, but they do not comprise the full set of challenges to analysts. Even after we estimate relationships between interest rates and rents, we are left with the serious challenge of quantifying the way these inputs are processed within the investment to produce the results of greatest concern to investors: returns on investment. For example, these inputs will filter through the tax system. Increases in rents are fully taxable. Increased debt service is partially tax deductible, but not all of it is. Changes in rents produce changes in property value, which will affect capital gains, and capital gains are taxed at two different rates, neither one the same as regular income. Moreover, multiple measures of return are important to investors. Investors care about current returns, the returns they receive every year, and they also care about total returns, which include all sources of return over the life of the investment. These returns respond differently to changes in the economic environment, and they are measured both before-tax and after-tax.

At this point, the reader can easily imagine how difficult it would be to explain all of these relationships in a conventional lecture format. Impossible would be a good word to describe it. To meet that challenge, I use a computer model that enables students to explore for themselves the investment outcomes for a full set of possible macroeconomic events.