The Experimental Study of Asset Pricing Theory

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The Experimental Study of Asset Pricing Theory

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Abstract

This monograph sets the stage for experiments by first examining a sample data set that looks very much like the typical historical data one gathers from the field, only it was actually generated in the laboratory so that we know what really went on. The example demonstrates how misleading the traditional analysis can be. It then moves on to discuss risk aversion, since asset pricing theory builds on risk aversion. The issue is — is there enough risk aversion in the laboratory given typical levels of compensation? Asset pricing theory also builds on competitive markets and competitive equilibrium, but these are actually purely abstract notions, without any suggestion of how to generate them in practice. The article builds on the path-breaking experimental work of Vernon Smith and Charles Plott who demonstrated that certain trading institutions indeed allow us to bring about competitive markets and competitive equilibrium. The author presents the main findings — first concerning simple static asset pricing models, moving on to dynamic pricing theory, and the implications of ambiguity aversion. Asset pricing theory rarely discusses how markets reach equilibrium, but experiments shed new light on price behavior during equilibration, as well as

on off-equilibrium allocation dynamics. This monograph also examines information aggregation and competitive markets for loan and insurance contracts, where adverse selection may preclude equilibration, and even when not, the resulting allocations may be Pareto sub-optimal.

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1

Introduction

This monograph is devoted to the experimental study of asset pricing theory. It is based on a series of lectures I gave at the Austrian Central Bank in June of 2009, which themselves were distilled from lecture notes I have been using for Ph.D. classes in asset pricing at the California Institute of Technology (Caltech) and the Ecole Polytechnique Fédérale Lausanne (EPFL).

Experimentation in asset pricing is both rare and novel, so some justification is in order before we start. The goal of experimentation is twofold. First, experimentation is meant to evaluate the science behind asset pricing theory. Indeed, complete scientific validation at some point does require experimentation, otherwise, to quote the late Hannes Alfven (Nobel prize in physics), we are "likely to go completely astray into imaginary conjecture." I will give a pointed example of this in Section 2, not in physics, but in the domain of asset pricing. It is interesting to note that Alfven was an astrophysicist, and astrophysicists, like finance scholars, get most of their data from the field. But unlike the latter, astrophysicists do insist on verifying the principles behind their attempts to interpret field data using laboratory experiments, even if the latter are only miniscule compared to real-world (or should I say real-universe?) phenomena. Like astrophysicists, finance scholars interpret field data through the lens of particular theory (e.g., competitive equilibrium), without being able to verify independently that this lens is appropriate. Only laboratory experiments can give us the confidence that our inference is correct.

The second goal of experimentation is to come to a deeper understanding of asset pricing theory. My own experience with experiments confirms that one cannot appreciate all the ramifications (and the beauty) of asset pricing theory without thinking through how one could generate it in the laboratory. To paraphrase the late Richard Feynman (another Nobel prize in physics): "One cannot understand theory if one cannot create it." Indeed, my own attempts to "create" the Lucas equilibrium (Lucas, 1978) in the laboratory led me to realize that some claims in the literature about it (Judd et al., 2003) were misguided (Bossaerts and Zame, 2006). While others (Berrada et al., 2007) evidently did not need experiments to realize the same, in my experience, few students of asset pricing theory appreciate the true nature of our asset pricing theory. For instance, equivalence results like the claim that static, complete-markets allocations can be implemented in incomplete markets by allowing re-trading (Duffie and Huang, 1985), are really not "equivalent," because vastly different notions of competitive equilibrium are being compared. (We shall discuss this very example in more detail later on.)

To set the stage, we first discuss, in the next section, a sample data set that looks very much like the typical data set finance scholars gather from the field; only, it was actually generated in the laboratory. We shall attempt to interpret these data as we would do with field data, only to realize that our interpretation is completely false. We know this because we know how the data were generated in the laboratory.

The subsequent section will discuss risk aversion. Asset pricing theory builds on risk aversion. Without risk aversion, models like the CAPM or Lucas' dynamic asset pricing model are vacuous. The issue is: will there be enough risk aversion in the laboratory given typical levels of compensation? And if so, how do we interpret this in view of Rabin's theoretical claim (Rabin, 2000) that we should *not* see risk aversion, or, to put it differently, that it *cannot* be risk aversion?

Section 4 is equally foundational. Asset pricing theory builds on competitive equilibrium. Competitive equilibrium is an abstract notion; it does not tell us how we can get there. How, then, will we get to it in the laboratory? Here, we will build on the path-breaking work of Vernon Smith and Charles Plott who demonstrated that certain trading institutions indeed allow us to generate competitive equilibrium [while prior attempts, with different institutions, had failed (Chamberlin, 1948)]. As it turns out, the successful trading institutions are complex, and require powerful software that only recently has become available. (It will be interesting to note that many real-world financial markets have been adopting the very trading mechanisms that we have been using in the laboratory.)

After that, we will be ready to discuss the main findings, first concerning simple static asset pricing models, moving on to dynamic pricing theory, and the implications of ambiguity aversion. Asset pricing theory rarely discusses how markets reach equilibrium (although market microstructure purports to shed light on it), but, as we shall see next, experiments shed new light on price behavior during equilibration, as well as on off-equilibrium allocation dynamics. We will also discuss information aggregation (although I prefer to call it information "amplification" for a reason that I will make clear), and, lastly, markets for loan and insurance contracts, where adverse selection may preclude equilibration, and even when not, the resulting allocations may be Pareto sub-optimal.

The review ends with concluding remarks.

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