

# Beyond Mechanical Markets

ASSET PRICE SWINGS, RISK, AND THE ROLE OF THE STATE

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## *Epilogue*

If there is such a thing as growing human knowledge, then we cannot anticipate today, what we will only know tomorrow.

—Karl R. Popper, *The Poverty of Historicism*

### WHAT CAN ECONOMISTS KNOW?

Market outcomes (such as asset prices) or overall levels of economic activity, consumption, or investment result from the decisions of many individuals. In analyzing how outcomes unfold over time, Hayek, Knight, Keynes, and other early modern economists related their accounts to individual decisionmaking. Their profound insight was to place nonroutine change and market participants' imperfect knowledge at the center of economic analysis. This focus led them to discover the limits of economists' *own* knowledge—and thus of economics itself.

Knight's arguments concerning the importance of "radical uncertainty" led him to question the relevance of standard probability theory for understanding profit-seeking decisions. He argued that such decisions "deal with situations which are far too [non-routine] . . . for any sort of [unique] statistical tabulations to have any value for guidance" (Knight, 1921, p. 198). The key implication of this claim is that standard probabilistic portrayals of individual decisions—which presume that their future consequences, and

the likelihoods attached to each, can be fully specified in advance—cannot adequately characterize how profit-seeking individuals respond to change and how market outcomes unfold over time.

Keynes (1921, 1936) shared Knight's profound doubts concerning the usefulness of standard probability theory for understanding change in individual decisionmaking and market outcomes: we "cannot depend on strict mathematical expectation, since the basis for making such calculations does not exist" (Keynes, 1936, pp. 162–63). The importance that Keynes attached to the role of uncertainty concerning both outcomes and probabilities played a key role in his analysis of financial markets and their influence on the broader economy, particularly investment.

Likewise, Hayek (1945, p. 519–20) argued that "the economic problem of society is a problem of the utilization of knowledge which is not given to anyone in its totality," implying that no mathematical model can fully mimic what markets do. This observation led him, in his Nobel lecture, to refute the scientific pretense of economic analysis that purports to account for individual decisionmaking and market outcomes with models that assume away imperfect knowledge:

Our capacity to predict will be confined to . . . general characteristics of the events to be expected and not include the capacity for predicting particular individual events. . . . [However,] I am anxious to repeat, we will still achieve predictions which can be falsified and which therefore are of empirical significance. . . . Yet the danger of which I want to warn is precisely the belief that in order to be accepted as scientific it is necessary to achieve more. This way lies charlatanism and worse . . . I confess that I prefer true but imperfect knowledge . . . to a pretense of exact knowledge that is likely to be false. [Hayek, 1978, pp. 29, 33]

### THE SEARCH FOR OMNISCIENCE

Hayek's admonition was directed at the post-1945 Keynesian econometric models, which grew out of the purported formal-

ization of Keynes's ideas and were estimated by statistical methods on the basis of historical data. Around the time of Hayek's Nobel lecture, the applicability of these models for policy analysis had come under severe criticism, either for portraying market participants' forecasting behavior with mechanical rules, which did not take into account contemplated changes in policy, or for disregarding such behavior's effects on aggregate outcomes altogether.<sup>1</sup>

Rational Expectations models, which were becoming highly influential at the time, were proposed by their advocates as a way to remedy this flaw in Keynesian econometric models. But the Rational Expectations models were as mechanical as their Keynesian predecessors.<sup>2</sup> Because their portrayal of individuals' forecasting behavior is woefully inadequate, Rational Expectations models were unsuitable for analyzing how market participants would respond to the contemplated changes in economic policy. Remarkably (given that they were developed by Hayek's successors at the University of Chicago), these models were, moreover, fully predetermined, and thus perpetuated "the pretense of exact knowledge" that Hayek criticized so scathingly in his Nobel lecture.

With the emergence of the Rational Expectations Hypothesis, macroeconomics and finance theory moved from the early modern position that standard probabilistic descriptions have hardly any value for understanding individual behavior and market outcomes to the opposite extreme. The contemporary approach presupposes that in principle there are no limits, beyond a few random error terms, to economists' knowledge. To be sure, economists do recognize that the current state of knowledge is not sufficiently advanced to yield a single probability distribution that would adequately capture "the mechanics of economic development" (Lucas, 2002, p. 21). But the discovery of such a fully pre-

<sup>1</sup>For a discussion of this revolutionary juncture in contemporary macroeconomics, see Lucas (1995).

<sup>2</sup>In contrast to his followers, Lucas (1995, p. 253) seems to recognize this point and traces his approach back to Tinbergen's (1939) development of macroeconomic models.

determined account of history remains the primary goal of the research program of contemporary economists.

Faith that better fully predetermined models hold the key to adequately predicting all future changes and their consequences is puzzling not only with respect to adherents of the Rational Expectations Hypothesis. When behavioral economists, who uncovered many important empirical failures of Rational Expectations models, formalized their insights, they followed their conventional predecessors by doing so with fully predetermined models.

#### SHARP VERSUS CONTINGENT PREDICTIONS

Contemporary economists' aim to find a model that could predict the complete set of future market outcomes and probabilities is not the first such endeavor in the social sciences. In his seminal refutation of the claim that "historicism" might one day enable social science to "predict the future course of history," Karl Popper pointed out that any such approach is futile "to the extent to which [historical developments] may be influenced by the growth of our knowledge" (Popper, 1957, pp. xi–xii).

Because market outcomes—especially outcomes in financial markets—crucially depend on changing understandings of the process and psychology that underpin those outcomes on both the individual and aggregate level, our critique of contemporary macroeconomics and finance theory can be viewed as further refutation of the historicist's vain ambition. Although Popper was strongly critical of attempts to develop fully predetermined accounts of history, he was quick to point out that his

argument does not, of course, refute the possibility of every kind of social prediction; on the contrary, it is perfectly compatible with the possibility of testing social theories—for example economic theories—by way of predicting that certain developments will take place under certain conditions. It only refutes the possibility of predicting historical developments to the extent to

which they may be influenced by the growth of our knowledge.  
[Popper, 1957, p. xii]

### RECOGNIZING OUR OWN IMPERFECT KNOWLEDGE

How can economic analysis remain open to the importance of market participants' revisions of their interpretation of outcomes while still generating predictions that are empirically significant? How can it recognize the importance of nonroutine change and imperfect knowledge while continuing to portray individual and aggregate behavior in mathematical terms? The continued relevance of macroeconomics and finance theory to real-world markets and policy analysis depends on its ability to articulate answers to these questions; Imperfect Knowledge Economics offers a response.

Early modern economic analysis, particularly that of Keynes, is sometimes interpreted as claiming that economic decisions, particularly those in financial markets, stem only from erratic "animal spirits." Of course, if this were the case, no economic theory that aims to account for outcomes in these markets with mathematical models and confront hypotheses rigorously with empirical evidence would be possible. As Edmund Phelps (2008, p. A19) put it, "animal spirits can't be modeled." Indeed, Akerlof and Shiller's (2009) book, which argues that animal spirits, broadly defined, are the key to understanding macroeconomic outcomes and swings in asset prices, does rely on a narrative mode of analysis instead of mathematical models.

Imperfect Knowledge Economics stakes out an intermediate position between erratic animal spirits and the contemporary presumption that change and its consequences can be adequately prespecified with mechanical rules. In contrast to the contemporary approach, the mathematical models of Imperfect Knowledge Economics explore the possibility that change and its consequences can be portrayed with qualitative and contingent conditions. These conditions are context-dependent, and as discussed

in Chapter 9, the qualitative regularities that they formalize become manifest—or cease to be relevant—at moments that no one can fully predict.

Imperfect Knowledge Economics therefore does not adopt the extreme view, often associated with Knight, that uncertainty is so radical as to preclude economists from saying anything useful and empirically relevant about how market outcomes unfold over time. Indeed, departing from the position of Knight and Keynes, we make nonstandard use of probabilistic formalism.<sup>3</sup> This approach facilitates the formalization of qualitative conditions that make up Imperfect Knowledge Economics models and the mathematical derivation of their qualitative and contingent implications. However, Imperfect Knowledge Economics recognizes the importance of early modern arguments that market participants (and economists) have access to only imperfect knowledge of the causal factors that may be useful for understanding outcomes.

Because their restrictions on change are qualitative, IKE models represent outcomes at every point in time with myriad probability distributions. In this sense, every such model is open and reflects the fact that, as Popper put it, “Quite apart from the fact that we do not know the future, the future is objectively not fixed. The future is open: *objectively open*” (Popper, 1990, p. 18, emphasis added).

The qualitative and contingent predictions generated by our IKE model of asset-price swings exemplify what Popper would regard as a feasible goal for economic theory. Although our model predicts that, under “certain conditions,” an asset price will undergo a sustained movement in one direction, it does not predict when such upswings or downswings will begin or end.

Beyond building on Popper’s insights concerning the possibility, scope, and character of predictions in the social sciences, our model of asset-price swings exemplifies Hayek’s (1978, p. 33) claim that, “Our capacity to predict will be confined to . . . general

<sup>3</sup>For a mathematical exposition, see Frydman and Goldberg (2010a).

characteristics of the events to be expected and not include the capacity for predicting particular individual events.” Although an IKE model, by design, stops short of predicting “particular individual events,” such as when the swing will begin and end, it does generate predictions concerning their “general characteristics”—for example, that they tend to be quite persistent. Thus, by examining the persistence and related features of swings in asset prices and risk implied by alternative models, an economist may compare explanations of economic phenomena. Johansen et al. (2010) and Frydman et al (2010b,c) develop such an approach to econometric testing and conclude that our IKE model of swings in currency markets provides a significantly better account of exchange rate movements than standard and bubble models based on the Rational Expectations Hypothesis.<sup>4</sup>

These studies show that, despite placing imperfect knowledge and nonroutine change at the center of economic analysis and limiting our ambition solely to generating qualitative predictions, Imperfect Knowledge Economics may still yield “predictions which can be falsified and which therefore are of empirical significance” (Hayek, 1978, p. 29).

#### IMPERFECT KNOWLEDGE ECONOMICS AS THE BOUNDARY OF MACROECONOMIC THEORY

In Frydman and Goldberg (2007) and our recent technical studies, we show how IKE models shed new light on salient features of the empirical record on asset prices and risk that have confounded international macroeconomists for decades. In this book, we focused on how recognizing the centrality of nonroutine change and imperfect knowledge enables us to understand better

<sup>4</sup>Our approach to testing the implications of Imperfect Knowledge Economics versus Rational Expectations models of swings makes use of Cointegrating VAR Methodology and Inference, developed by Soren Johansen and Katarina Juselius in many papers over the last two decades. For book-length treatments, see Johansen (1996) and Juselius (2006).

how financial markets, particularly equity markets, help society allocate capital, and why asset-price swings are an integral part of this essential process.

Imperfect Knowledge Economics also provides a new way to explain why asset-price swings sometimes become excessive, and shows how the hitherto neglected relationship between financial risk and price swings can help us to understand how excessive price swings come to an end. This analysis provides a conceptual framework for prudential policy aimed at dampening excessive price swings and thus reducing the social costs inflicted when they reverse direction.

Although the application of Imperfect Knowledge Economics to financial markets appears promising, it is too early to claim broader usefulness for this approach in macroeconomic and policy modeling. If qualitative and contingent regularities can be established in contexts other than asset markets, the nonstandard probabilistic formalism of Imperfect Knowledge Economics can show how to incorporate them into mathematical models and confront them with empirical evidence. However, when revisions of forecasting strategies (or more broadly, change on the individual and aggregate levels) cannot be adequately characterized with qualitative and contingent conditions, empirically relevant mathematical models of how market outcomes unfold over time may be beyond the reach of economic analysis. In this sense, Imperfect Knowledge Economics provides the boundary to what modern macroeconomics and finance theory can deliver. How far, and in which contexts, this boundary can be extended is the crucial open question suggested by this book.