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Uncertainty, Expectations, and the Future: If We Don't Know the Answers, What Are the Questions?

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## Uncertainty, expectations, and the future: if we don't know the answers, what are the questions?

Expectations about the future are critical in the study of economics. The belief in the existence of the future explains why agents engage in activities such as saving and investment, why they are willing to make loans, and why they are willing to accept intrinsically worthless money in exchange for goods and services. The future would matter even if it were known with complete certainty, but the fact that it is known only with uncertainty, if it is known at all, makes its representation and effects even more complex.

Keynes was one of the first economists to emphasize the significance of the uncertain nature of the future, and in his 1937 *Quarterly Journal of Economics* article defending *The General Theory*, uncertainty about the future assumed a central role. Within the Keynesian model, uncertainty about the future enabled fluctuations in investment spending and liquidity preference, both of which are behaviors intrinsically related to the future that could occur autonomously and independently of current objective circumstance. This critical interaction between uncertainty and expectations therefore enabled autonomous fluctuations in aggregate demand, and in doing so elevated the importance of expectations in Keynesian economics.

Recently, expectations have again been at center stage in economics, this time in the form of the rational expectations (RE) hypothesis associated with New Classical macroeconomics (NCM). RE has shifted the focus of interest away from the Keynesian concern with the effect of expectations about an uncertain future on investment spending and liquidity preference, to the effect of expectations on the real consequences of monetary and fiscal policy. Thus, aside from making tech-

The title paraphrases the last words of Gertrude Stein as recorded by Alice B. Toklas. The author is Assistant Professor of Economics, New School for Social Research, New York.

nical innovations in the modeling of expectations, RE has also shifted the focus of inquiry. The irony is that this new interest in expectations has been directed toward discrediting the policy prescriptions of Keynesian economics, which is where interest in the effects of expectations about an uncertain future originated.

The deconstruction of Keynesian economics pursued by RE/NCM has in turn raised multiple issues concerning the adequacy of the treatment of expectations about the uncertain future in RE/NCM models. These issues raise deep epistemological questions about the very nature of knowledge, and what can be known. They include issues of how we think about uncertainty, how we represent it, how people behave in the presence of uncertainty, what are the effects of economists' constructions of uncertainty on agents' behaviors, can agents' understandings of the world be different from those of economists, and what does this imply for the representation of those understandings in economic models? It is to these issues that the current article is addressed.

### **Representations of uncertainty**

Considerations of the uncertain future raise questions of how we represent uncertainty in economic models. Are representations that use "probabilistic" concepts appropriate, and if so, what is the nature of probability? This latter question concerns whether probability is an "object of knowledge" (to be discovered, learned about as part of external reality) or a "type of knowledge" (a construction that has no existence outside the body of social knowledge).

Lawson (1988) creates a useful two dimensional taxonomy constructed upon a division between measurable versus immeasurable probability and constructivist versus realist knowledge. This taxonomy is illustrated in figure 1. The columns distinguish the realist position (probability as an object of knowledge) from the constructivist position (probability as a construct of knowledge), while the rows distinguish uncertainty as a matter of measurable probability from uncertainty as a matter of immeasurable probability. Each box can then be identified with a particular intellectual stance. Realist/measurable probability is the mainstream rational expectations stance identified with Muth (1961) and Lucas (1976).<sup>1</sup> Realist/immeasurable probability corresponds to

<sup>1</sup> Even if, at any moment in time, agents do not fully know the probability distribution, they can form conditional best estimates, and over time their estimates converge to the actual probabilities through a process of Bayesian updating.

Figure 1 A taxonomy of different positions taken on the nature of probability and the nature of uncertainty (from Lawson, 1988)

	Probability as a construct of knowledge	Probability as an object of knowledge
Uncertainty is a situation of measurable probability	Friedman–Savage	Muth–Lucas
Uncertainty is a situation of immeasurable probability	Keynes	Knight

Frank Knight's (1921) view of uncertainty. In the Knightian view uncertainty, which corresponds to a situation with immeasurable probability, is contrasted with "risk," which corresponds to a situation with measurable probability. The position of Friedman and Savage (1948; Savage, 1954), which is identified with the subjectivist probability school, corresponds to the constructivist/measurable probability frame. Lastly, Keynes' (1936, 1937) position is identified with the constructivist–immeasurable probability frame. For Friedman and Savage the nature of the construction is that agents' probability estimates are based on factors including purely private feelings and beliefs, and it is this that makes them constructivists rather than realists. Keynes' constructivism is epistemologically more radical, since he argued that probability statements are simply logical relations between two sets of propositions, where these relations are a feature of the way we think about the world rather than a feature of some real world independent of human thought.

Having identified the fundamentally different ways in which the notion of uncertainty has been conceptualized, the critical issue becomes what are the implications of these differences for the construction of economic theory? Amongst contemporary economists, Post Keynesians have paid the most attention to the potential significance of these differences. Davidson (1982, 1991) has been the leading exponent of the Post Keynesian position, and his distinction between "ergodic" and "nonergodic" processes emphasizes the significance of immeasurable uncertainty. Ergodic processes can be thought of as "risky" processes

moving through time, and in which uncertainty is measurable through the rules of standard probability theory: nonergodic processes refer to processes moving through time with immeasurable uncertainty, and for which probability statements are not applicable. However, though Davidson has emphasized the distinction between measurable and immeasurable uncertainty, the Post Keynesian position on constructivist versus realist knowledge appears less well defined. The current article contends that this issue is central to any critique of mainstream discussions of expectations and decision making under uncertainty, and it is to this issue we now turn.

### **The implications of constructivism for economists' constructions of decision making in the presence of an uncertain future**

The Friedman–Savage position has been most fully articulated in connection with the expected utility maximization hypothesis. Within their framework, the probabilities agents assign to potential outcomes are given a constructivist interpretation, but the decision making criterion of agents (expected utility maximization) is treated as being objective - that is independent of knowledge and social context. Within this framework decision making in the presence of uncertainty is potentially loosely hinged, so that investment spending and liquidity preference can fluctuate autonomously, despite the adoption of the apparent anchor of an expected value maximization criterion. After all, probability estimates are constructions, and these can fluctuate autonomously and independently of current circumstance, causing the type of fluctuations Keynesians believe to be the causes of the business cycle.

The Davidson (1991) approach to decision making under uncertainty, with its emphasis on the nonergodicity of history and real-world processes, denies the possible relevance of any form of probabilistic based approach to decision making. Davidson therefore rejects the Friedman–Savage approach despite the fact that it can allow Keynesian style autonomous fluctuations in spending and liquidity preference. At this stage a possible reconciliation between these apparently contradictory positions can be achieved by extending the constructivist element beyond the confines of formation of probability estimates, to include the entire role of probability in decision making by both households and firms. This is a subtle point. Just as agents construct “subjective” probability estimates (perhaps out of nothing, perhaps on the basis of

some features they deem to be important), so, too, where and how they use these constructed estimates is itself a product of social construction.

The implications are clear. If business schools teach prospective managers to adopt expected profit maximization as the appropriate corporate decision-making criterion, then over the course of time corporate decision making may come to be based upon this criterion, at least in external appearance. The same is true of household decision making: if schools and the media teach the adoption of decision making based upon some form of expected value maximization, then household decision making will become influenced and guided by this form of thinking. It doesn't matter that there may be no objective grounds for forming estimates of probabilities, and that these estimates are pure constructions. The external form of decision making, and the associated reasoning, will tend to have the appearance of expected value maximization. In this case, despite the fact that the world may actually be characterized by nonergodic processes, the social construction of decision making may be such that the reasoning associated with actual decision-making processes may be of the type one would associate with an ergodic world. The world may be Davidsonian, yet its external appearance can take on a Friedman-Savage character.

This possibility raises the important point that economics is a generative body of knowledge. The ideas of economists influence the behavior of economic agents, and may change their behavior in many ways. Of this there are numerous examples; two of which that are quite striking are the extensive application of stock betas following the development of the capital asset pricing model, and the changed response of interest rates to money supply announcements following the development of interest in money supply effects that occurred in the late 1970s. The constructions of economists therefore change the economy itself, and the more socially influential economists are, the more economics is likely to generate changes in behaviors.<sup>2</sup> This raises two points, both of which will be important when we address the issue of representing expectations within economic models. The first is that when economists represent economies, they need to locate the position of economic knowledge since this itself influences behaviors within the economy.

<sup>2</sup> This comment may be viewed as a meta-theoretical version of Lucas's (1976) original critique of policy economics based on large scale structural econometric models. For Lucas, as policy changed, behavior could change. Now we are claiming that as economic knowledge changes, where this includes the Lucas critique itself, behavior may change.

The second is that since the constructions of economists can change the economic behavior of agents over time, this in turn means that at any moment the thinking of economists may be different from the thinking of non-economists who are the object of economists' studies.

Returning to the issue of decision making in an uncertain world, the possibility that the knowledge constructions of economists may affect the external form of decision making then raises issues of how substantive these effects are. Some forms of economic knowledge may result in deep structural changes that affect the way we organize the sequence of transactions, the type of market arrangements we have, and the nature of laws governing property, production, and exchange. Other forms of economic knowledge may just produce superficial changes that affect appearances rather than substance. This may be the issue with regard to expected value decision making. Thus, Davidson might argue that since the world is nonergodic, probabilistic-based decision making can never be relevant. In this case, to the extent that agents adopt the outward appearance of an expected value maximization approach to decision making, this is simply a "ritual" that agents go through so as to render their behavior consistent with the knowledge constructions promulgated by economists and business schools. The reality underlying actual decisions is not the ritual of expected value maximization, but rather it is the "gut feeling" or "animal spirits" of the investing entrepreneur: or as Davidson (1991) writes, the real decision rule is "damn the torpedoes, full speed ahead." Alternatively, the decision-making constructions of economists may have real effects to the extent that the decision-making process is changed, and new inputs are sought for this process. For Post Keynesians, the former is closer to reality.

### **Expectations and the rational expectations revolution**

Prior to the RE revolution, adaptive expectations (AE) constituted the standard approach to modeling expectations. Within this framework, expectations of a variable were modeled as a distributed lag of past values of the variable, with the restriction that the sum of the distributed lag coefficients equal unity. The strengths of the approach were that it recognized the role of the past (history) which made sense both epistemologically and structurally: after all, our learning is through experience, and our experience tells us that the world is structurally relatively stable in that today's outcomes are not vastly dissimilar from yesterday's.



The criticisms of AE were its atheoretical nature, and the fact that expectations were formed without reference to current information about the future. The atheoretical nature meant that expectations were formed without reference to any underlying view of the way the economy works: while the lack of reference to current information meant that agents formed expectations without taking account of information known to be economically relevant.

These criticisms were formalized by Muth (1961) in a simple commodity market demand and supply framework. A simplified version of the model is as follows:

$$(1) \quad D_t = a - bp_t,$$

$$(2) \quad S_t = c + dp_t^e + u_t,$$

$$(3) \quad D_t = S_t,$$

$$(4a) \quad p_t^e = E_t[p_t|I_t],$$

$$(4b) \quad p_t^e = p_{t-1},$$

where  $D_t$  = demand in period  $t$ ;  $S_t$  = supply in period  $t$ ;  $p_t$  = price in period  $t$ ;  $p_t^e$  = expected period  $t$  price at the beginning of period  $t$ ;  $u_t$  = independent normally distributed with zero mean shock to supply in period  $t$ ;  $I_t$  = information set of suppliers at the beginning of period  $t$ ; and  $a, b, c, d$  = parameters of demand and supply functions.

Equations (1), (2), and (3) are the demand and supply equations, and the market clearing condition. Equation (4a) determines the expected price on the basis of rational expectations, while equation (4b) determines price on the basis of adaptive expectations.

Under RE, the expected price, price forecast error, and expected price forecast error are, respectively:

$$(5a) \quad p_t^e = (a-c)/(d+b),$$

$$(6a) \quad p_t - p_t^e = -u_t/b,$$



$$(7a) \quad E_t[p_t - p_t^e | I_t] = 0.$$

Under AE, the expected price, price forecast error, and expected price forecast error are, respectively:

$$(5b) \quad p_t^e = p_{t-1},$$

$$(6b) \quad p_t - p_t^e = [a - c - u_t - (d + b)p_{t-1}]/b,$$

$$(7b) \quad E_t[p_t - p_t^e] = [a - c - (d + b)p_{t-1}]/b = 0.$$

Comparing solutions (5a) through (7a) with (5b) through (7b) reveals some of the claimed advantages of RE over AE. In particular, the rational expectations solution is formed with reference to an underlying view of the world as reflected in the model held by agents. Expectations are consistent with this theoretical view in that they are the expected outcome predicted by the model: expectations are therefore “model-consistent.” Second, expectations incorporate all economically relevant information known to the agent. Thus, if suppliers expected demand to be larger because of a preannounced government purchase plan, then suppliers would incorporate this information in their price expectations by adjusting the parameter “a” to reflect the government’s purchase intentions. In an analogous fashion, the rational expectations solution does not include effects that are known to be economically irrelevant, while the adaptive expectations solution may. For instance, if there was a drought last period that temporarily forced up last period’s price, rational expectations would completely discount the drought effect as economically irrelevant. However, adaptive expectations has agents mechanically assuming that last period’s high drought price will repeat this period.<sup>3</sup>

A third strength of the RE version is that the expected forecast error is zero, so that agents do not systematically over- or underpredict the price. This is not the case in the AE version. When prices are high (negative

<sup>3</sup> Note that RE does not claim that droughts have no longer-term effects on prices. This is perfectly possible in another model if there are inventory effects. However, in the above (purely illustrative) model which is assumed to correspond to agents’ beliefs about the structure of the economy, there are no such effects so that agents would not anticipate them.

supply shock) last period, agents overpredict this period's prices: when prices are low last period (positive supply shock), agents underpredict this period's prices. *Prima facie*, this type of forecast error pattern would seem inappropriate since it is systematic, and agents can presumably learn to recognize and correct for it. Lastly, a common and incorrect criticism of RE is that agents' expectations are always correct. This is not so, as can be seen from equation (6a) in which the forecast error depends on the size of the random supply shock: what is true is that the expected forecast error is zero.<sup>4</sup> The one exception to this is in non-stochastic models, in which case rational expectations is identical to perfect foresight since the expectation is the solution of the deterministic model.<sup>5</sup>

The above arguments make the case in favor of RE over AE. Without doubt RE has many desirable properties that seem appropriate for the characterization of expectations in a market-based economy. It seems likely that Keynes, who was an active participant in financial markets, would have approved of such features as the incorporation of all information and news believed to be economically relevant: a Post Keynesian theory of expectations should surely include these features. However, having acted as a booster for RE, in the next section we address the problems and deficiencies of RE. These problems relate to some of the issues raised earlier in connection with uncertainty and economic knowledge. Once corrected, a more persuasive and palatable version of RE emerges. Such a version might better be labeled "endogenous rational expectations": it is a theory of expectations that incorporates the strengths of rational expectations, while addressing the concerns with the nonergodicity of real-world processes and the constructivist nature of economic knowledge.

Before turning to the development of a Post Keynesian theory of endogenous expectations, we briefly discuss the policy implications of RE. For the most part the RE hypothesis has been developed in the context of new classical macro models, and these models deny that systematic monetary policy can be used to affect the level of economic activity. This policy neutrality proposition has predisposed some Post

<sup>4</sup> Shiller (1978) details the other statistical properties of rational expectations forecasts.

<sup>5</sup> In connection with this, one might add that the popularity of AE in the 1960s stemmed from the fact that RE was such an unrealistic representation of expectations in deterministic models. In effect, RE was only rendered plausible by the adoption of stochastic modeling methods.

Keynesians to reject RE, but Tobin (1980) has argued forcefully that this proposition follows from the market clearing assumptions of the models, rather than from RE.

These issues can be illustrated with the following simple income-expenditure model given by

$$(8) \quad Y_t = C_t + I_t,$$

$$(9) \quad C_t = a + bY_t,$$

$$(10) \quad I_t = c - di_t^e,$$

$$(11) \quad i_t = i + u_t,$$

where  $Y_t$  = period  $t$  real output;  $C_t$  = period  $t$  real consumption expenditures;  $I_t$  = period  $t$  real investment expenditures;  $i_t^e$  = expected nominal interest rate;  $i_t$  = nominal interest rate (inflation is assumed to be zero);  $i$  = target nominal interest rate;  $u_t$  = independent normally distributed disturbance with zero mean; and  $a, b, c, d$  = parameters.

In this case the rational expectation of the target interest rate is

$$(12) \quad E_t[i_t] = i,$$

and the actual value of output is

$$(13) \quad Y_t = [a + c - di]/(1 - b).$$

This is a totally Keynesian model. Now anticipated interest rate policy is fully effective, and unanticipated policy has no effects. The propositions of NCM regarding policy effectiveness are in fact completely reversed: anticipated policy matters, unanticipated policy does not. This is reasonable since economic outcomes depend on behavior, and behavior is predicated upon expectations: policy that leaves expectations unaffected therefore does not affect behavior and activity.

As such, the model illustrates that there is no reason for Post Key-

nesians to reject RE out of hand. It incorporates many sensible features that are not incompatible with the Post Keynesian project.

### **Knowledge, constructivism, and expectations: a theory of endogenous rational expectations**

In the previous section it was argued that RE contained a number of desirable properties regarding the formation of expectations, and that RE was not inconsistent with Keynesian policy effectiveness propositions. In this section we turn to criticisms of RE. These turn out to be quite profound, and their resolution produces a significant weakening of the stringencies of the RE hypothesis as it is currently recognized.

At the core of the notion of RE lies the idea of “model-consistent” expectations: that is, expectations must be consistent with the underlying view (model) of the economy held by agents. One line of objection to this argument has been to ask which model, since there is no unanimity (even among professional economists) about the representation of the economy? This criticism focuses on heterogeneity, and the need to incorporate multiple different agents in macro models. It is certainly a valid criticism that applies to more than just the issue of expectations.

The staunch RE response has been that there is a “single true” model upon which all agents ultimately converge. This is a strong epistemological position, and one that a postmodernist would certainly reject. Knowledge, including economics, is a social construction, and the extension of knowledge is a battle ground of persuasion between groups offering competing constructions. This battle is fought at every level including the message, battling for control of academic institutions, and battling for control over the rules of good scholarship. Under this view the emergence of a single economic view is unlikely. It certainly has not happened in practice: there is difference among academic economists, and there is difference among market participants.

An even more fundamental critique concerns the question of how economists can recognize the “true” model. For RE economists, econometric techniques are claimed to provide the means for ultimately nailing down the true model. However, here too the quest is futile. The very data that are used in regression estimates are themselves the product of theoretical constructions. Moreover, regression analysis is itself a social construction, and subject to social negotiation like everything else. These negotiations include issues such as the use of linear versus nonlinear estimation methods, or ordinary least-squares versus maxi-

mum likelihood. More importantly, all regression techniques rely on the choice of an objective function: should we minimize the sum of squared residuals, or the sum of absolute deviations, or the sum of residuals to the power of four? Each of these objective functions is a social construction, and each produces a different version of the so-called “single true” model.

Another, deeper criticism of RE can be directed against the manner in which the notion of model consistency has been applied. Behind this critique is a tension concerning the relationship of the economist to economic agents. In effect, an economic model that embodies agents’ expectations implicitly embodies two models. One model is that held by the agents whose expectations are being modeled by the economist: the other model is that held by the economist. With regard to application of the principle of model consistency, one would want the expectations of each to be consistent with their own model, but there is no reason for their expectations to be the same. Agents’ expectations should be consistent with the model held by agents, and economists’ expectations should be consistent with the model held by economists, but there is no requirement that they hold the same model, and therefore there is no requirement they hold the same expectation. Indeed, such a situation is highly implausible: economic agents are not economists. This is not to say agents are irrational, but rather that their understanding takes a different form. For instance, agents tend to understand the immediate implications of their own actions, and of actions of others in close proximity. They have a weaker understanding of “intermarket spillovers” and “multiplier” type effects, the origins of which may be several stages removed.

Having recognized the distinction between economist and economic agent that must be present in any economic model embodying expectations, we now make the situation even more complex by introducing a dynamic element. This is because over time there is an interaction between economists and economic agents. Thus, not only is each making independent changes to their own model, but each may come to adopt parts of the other’s model. Here we are back to the generative nature of economics, since agents may adopt the ways of seeing developed by economists. For instance, it is likely that rational expectations, and the concomitant development of best linear prediction methods, has affected the behavior of real-world market participants. Similarly, the economist does not work in a vacuum, and the thoughts and concerns of economic agents feed back on the constructions of economists: the

fads and fashions in economic research are evidence of this. Indeed, an argument could be made that RE/NCM is itself, in part, a product of conservative social and political developments in society at large.

So much for high theory: now to practice. What can we require about agents' expectations for modeling purposes? In this connection a reasonable set of requirements might be:

- i. Agents' expectations should incorporate knowledge that agents have *and* believe to be economically relevant.
- ii. Agents will not persist with methods of expectation formation that generate "systematically" incorrect forecasts *and* which agents know to be systematically incorrect.

These axioms of expectation formation recognize that expectations are bound up with knowledge, learning, and error recognition. A key point is that expectation errors can persist if agents do not know about them, and getting them to recognize errors as systematic mistakes is itself an act of persuasion. Even then, one could add the caveat, that agents will only make adjustments if it is not too costly to do so. These axioms therefore incorporate the strengths of rational expectations, while allowing for difference between economists and economic agents, and allowing for the generative role of economic knowledge. In effect, they constitute a theory of "endogenous rational expectations." Expectation formation evolves over time, not only as new information arrives, but also as knowledge and methods of interpretation change: not only are expectations subject to revision, but the method of expectation is also subject to revision.

Given the above, what is the agenda for future research? First and foremost, it is necessary to build models that account for both the economist and the economic agent. Any model involving expectations must embed a minimum of two models, a "submodel" representing the agents' view, and an "encompassing" model representing the economist's view.

Thus, in building an economic model, the economist must model the decision making of economic agents which is in part predicated on their expectations: this requires the submodel which captures the views of these agents. In the event that agents are heterogeneous, it is necessary to have more than one submodel—one for each class of agent. These agents and their submodels then need to be embedded in an encompassing model that reflects the way the economist sees the operation of the economy. This encompassing model will likely differ from the sub-

model, since economists are technically trained professionals who understand and represent the economy differently from non-economists. This contrasts with rational expectations as represented in new classical macroeconomics, which assumes away the difference between economists and economic agents, and just treats everyone as if they were economists.

This last point has implications for the form of the submodel. Economists use mathematical models as their primary representational device, and are trained in the use of representational techniques such as simultaneous equation modeling: in addition, they are theoretically informed of such concepts as multipliers and intermarket spillovers. This is not so for non-economists, who are therefore likely to use different representational devices, and have different theoretical constructions. For instance, static expectations, perhaps with an “add-factor” adjustment to capture current events, may well characterize the way non-economists think. Such adjusted static expectations are rational expectations in that they are consistent with the view of the economy *held by the agent*. Of course it is not the view held by the economist, and they are therefore not the same expectations as those held by the economist, and are irrational *when seen from the standpoint of the economist’s model*. The exact form of the submodel therefore remains an open issue: it is one that invites a whole new line of research involving such tools as surveys and questionnaires, tools that enable economists to directly investigate the agents whose cognitive processes need to be modeled within the encompassing model.

An example of this approach to expectations is Keynes’ view of “conventional” expectations, of which he wrote:

In practice we have tacitly agreed, as a rule, to fall back on what is, in truth, a *convention*. The essence of this convention—though it does not, of course, work out quite so simply—lies in assuming that the existing state of affairs will continue indefinitely, except in so far as we have specific reasons to expect a change. [1936, p. 152]

The “convention” therefore represents the nontechnical vision of economic agents: it takes account of information about the future believed to be economically relevant, and is affected by economic knowledge which may influence the factors agents wish to consider. In unusual economic times this convention is likely to break down and change. Economists can also contribute to the breakdown of the convention by developing new ideas, and directing economic agents’ attention to new



issues. Such breakdowns are fully consistent with the axioms of endogenous rational expectations outlined earlier. Effectively, they represent a change in belief about the correctness of the existing convention (model), and this prompts a search for a new convention.

Once the above approach to expectations is accepted, the issues then become those familiar to the current debate. What is the structure of the economy, and is it characterized by a Keynesian closure (demand-determined equilibrium) or a new classical closure (labor market clearing)? Whose expectations matter, and where do they enter the model? What are the variables that agents form expectations about? Finally, there is the new need to create submodels capturing the way agents think about the economy, and then to place these submodels in encompassing models. This enterprise is likely to be a continuing one, since given the value-laden nature of knowledge constructions and the multiplicity of theoretical interpretations, economists themselves are unlikely to find agreement on a single encompassing model.

Lastly, within a framework of endogenous rational expectations in which the constructivist nature of economic knowledge is recognized, the issue of uncertainty can be readily accommodated. What matters is the view (model) of the economy that agents hold, and it is this view that structures agents' expectations. At no stage is it necessary to introduce probabilistic concepts for the construction of these expectations. However, this is not to say that agents will not talk in such terms. The world may be nonergodic, and yet, given the character of economic knowledge, agents may go through the "ritual" of expected value calculations. Yet that is all it is, for behind the construction of subjective probabilities lie the "gut feelings" and "animal spirits" that determine these subjective probabilities, and are therefore the real driving force of decision outcomes.

## Conclusion

Expectations of the uncertain future have long been central to Keynesian economics. In recent years expectations have again been at center stage in economics, this time in the form of rational expectations. The current article has argued that rational expectations embodies a number of desirable features, particularly its emphasis on the role of agents' knowledge and the inclusion of all known information believed to be economically relevant. However, the article then argued that RE, as currently practiced, was a deficient representation because of its failure

to distinguish between economist and agent, and its failure to recognize the constructivist and generative nature of economic knowledge. The recognition of the constructivist dimension to economic knowledge then linked the issue of expectation formation to the debate over the relation of probability and uncertainty, and showed how despite the nonergodic character of the world, rationalization of decision making in the presence of uncertainty could take on the appearance (but not the substance) of expected value maximization.

The article concluded by arguing for “endogenous rational expectations.” This form of expectations imposes weak restrictions on (1) the use of knowledge and information by agents, and (2) the persistence of systematic errors. It also forces a recognition of the distinction between economist and agent, which shows up in the distinction between “sub-model” and “encompassing model.”

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