CONCLUSION

Economists assume that consumers smooth out real consumption over time. Thus, they are puzzled by the absence of indexed financial instruments that would help consumers achieve that goal. In an economy with stable real income, the benefits of indexed instruments are easy to demonstrate, as the variance of a portfolio with indexed bonds is less than the variance with nominal bonds. Thus, macroeconomists, who believe that the shocks to the economy are mostly nominal, advocate indexation.

With stable nominal income, the results are very different. A market for indexed bonds exists in an economy characterized by real shocks only if the real rate on indexed instruments is lower than the real rate on nominal instruments.

If agents are uncertain about the nature of their incomes, however, these conclusions must be modified. Neither instrument dominates the other when both command the same real rates. Thus, given the costs of innovation and the lack of familiarity of consumers with price-indexing, there is no incentive to abandon nominal instruments in favor of indexed instruments.

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 ROLE OF EMPIRICAL ANALYSIS

however, it is the certain knowledge about those events. Furthermore, the knowledge that the assumption of probability requires rests, in part, on the possibility of replication. But because historical time rules out replication (since it implies an inability to hold other things equal or constant through time), and because the presence of ignorance precludes the possession of knowledge of future outcomes and sufficient knowledge about the present and the past, the application of probability in dealing with these issues has to be discarded.

At first, in the construction of a model for a given period in the past (which may come up to include the present), the investigator (or the decision-maker who is investigating prior history for purposes of making a decision in the present) can proceed much as if he were exploring a situation in which ignorance did not exist. A differential or periodic equation model could be built up, its time paths studied, and one time path identified with observed reality for the period. If, for example, the investigator is studying the behavior of a decision-maker, then the investigator might say that the decision-maker behaved "as if" his behavior were determined according to the investigator's model. Then, by extending the model beyond the intended period, the investigator could examine some of the possibilities that might transpire at subsequent dates. However, it must be understood that once the time period for the initial expansion is enlarged, the investigator is actually dealing with a different world. The presumption is that it would be necessary to construct a separate model or explanation of the second world and that this will not be the same as that of the first. In addition, as time passes, the investigator may have more information available for his study, his own background may have changed, and the environment in which he is doing his study may have modified. For these reasons, the model he now builds to explain what he sees may well be different from the original. In particular, when exploring an historical process or the movement and change of a phenomenon over time from some date in history to the present, as time moves on to reveal the unpredictable novelty that enters the fabric of life, the model explaining that phenomenon must necessarily undergo significant alteration.

To illustrate the kind of model that an investigator might construct, consider the Shackle-Vickers model of decision-making in ignorance. In this model, the decision-maker has certain choice options, each of which is associated with its own possible outcomes contingent on unknown future events. For each option, let the decision-maker determine an incomplete collection of all future outcomes that he can imagine as resulting from the selection of the option. Although the residual hypothesis (defined as the class of all outcome possibilities that the decision-maker is unable to imagine and symbolically represented as the null set) is not an element of this collection, it is still a subset of it. Since the decision-maker is assumed to define a potential surprise function for each subset of the collection of imagined outcomes, it follows that potential surprise function is characterized for both imaginable and unimaginable outcomes. Specifically, the potential surprise of a subset is the surprise the decision-maker imagines now that he would experience in the future were an outcome to actually occur. Each potential surprise function is then translated into a potential surprise density function defined over the incomplete collection of future outcomes expressed in terms of utility values. And using the density function, it is legitimate to speak of the potential surprise of a single utility outcome. Although similar in certain respects, potential surprise and potential surprise density functions are different in both conception and in their attendant characteristics from probability and probability density functions.

The decision-maker is also assumed to define, for each choice option, an attractiveness function over the collection of all pairs consisting of an outcome and the potential surprise value identified with that outcome. The attractiveness function is not a utility function. The attractiveness of any pair reflects its power to secure the decision-maker's attention and has nothing to do with the decision-maker's preferences. The attractiveness function is taken to have sufficient properties so as to permit its maximization subject to the potential surprise function associated with the same choice option. Under the assumptions of the Shackle-Vickers model, there are actually two maximizing pairs and these serve to characterize the choice option. Finally, decisions are made among the various choice options by comparing, according to a decision index devised by the decision-maker, the two pairs that characterize each.

All of the elements of the Shackle-Vickers model -- the choice options, the imagined future outcomes the emerge from them, the potential surprise functions, the attractiveness function, and the decision index -- are unique to the moment of historical time at which the decision is made, unique to the decision-maker and, except for the set of all choice options and the decision index, unique to a particular choice option. Moreover,
the concept of potential surprise function has application beyond its definition over possible outcomes of decision options. One can conceive of an individual contemplating his potential surprise for imagined outcomes associated with all kinds of happenings and behaviors that he observes in reality.

II

In discussing the role of empirical analysis under conditions of ignorance and historical time, it may be helpful to begin by identifying some kinds of inquiry that, although legitimate in the world to which probability relates, are not possible when ignorance is present. Perhaps the most obvious of these is probabilistic prediction. Such prediction requires the use of a theoretical model and past data to discern trends in decision behavior probabilistically, and then the extrapolation and projection of these trends into the future. One way to do this is when using a static simultaneous equations model to estimate the coefficients of reduced-form equations of the model from the data. Predictions of values of the dependent variables are obtained from equations of the model with the data. Predictions of values of the dependent variables are obtained from equations of the model from the data. Predictions of values of the dependent variables are obtained from equations of the model from the data. In order to estimate such a procedure in a way that is faithful to the traditional probabilistic methodology, it is necessary to know that the model described in this chapter tomorrow is, in fact, tomorrow, not appear, and second, the probabilistic law governing error. Such knowledge, although achievable when studying, for example, the drawing of red and white balls from an urn, is not available when studying the personal decisions of the individual, political and social pressures coming from colleagues, and even how well the individual is feeling when he is calculating potential surprise values. To pass from all of these things to the potential surprise function involves an unexplained leap in the mind of the individual from the partially perceived present and past to an independently generated and unknowable future. The individual, himself, cannot say how he does it. Moreover, the elements that go into the construction of his potential surprise function, along with the process of constructing itself, change from moment to moment as historical time moves on. Thus, for example, in the process of making a decision, the perceptions and other subjective inputs that the decision-maker brings to bear may alter. Hence the potential surprise function that the decision-maker employs at the moment of decision can be quite different from that which he would have had if his perceptions and other subjective inputs had remained as they were when he first began thinking about the decision he should make. In general, although the individual is perfectly capable of stating what his potential surprise function is, he is outside the ability to reconstruct it by observing the present and the past.

The last inappropriate line of inquiry to be described here is potentially derived by analogy to probabilistic analysis (the use of distributional techniques to analyze data). Because replication is impossible, any technical method of analysis that relies on the idea of repeated sampling from a distribution has to be discarded. In particular, standard statistical (inference) sampling procedures such as hypothesis testing, estimation, and determining confidence intervals can no longer be used. Even if the probability distribution over which these methods rest were replaced by a potential surprise distribution, the methods themselves would still not hold up because the notion that each element of data is taken from the same distribution, i.e., the notion that repeated observations are produced by an ever-generating mechanism that is unchanging over (historical) time, lies at the core of each sampling procedure.

III

With all of these considerations on empirical analysis under conditions of ignorance and historical time, what role can empirical inquiry play in helping to understand situations in which both ignorance and historical time are present? There are at least three possibilities. The first role is to describe history, that is, to collect and summarize historical data. The gathered data can be in either verbal or numerical form, and summaries of the latter kind of data can be expressed in terms of means, variances, trends, tendencies, patterns, and so on, as long as these summary numbers are not interpreted in reference to (e.g., as moments of) probability distributions.

When the data are quantified, one may even "estimate" the parameters of equations in the context of historical description. Suppose, over a previous period of time, an investigator (or decision-maker) observes a universe of data which seems to suggest a linear relation between two variables. The investigator can certainly be in a straight line to the scatter by minimizing the sum of squared residuals. This, by itself, is a nondirectional approach to estimating the parameters of the relation because it does not require the assumption that the
residuals follow a law of probability. Of course, the estimates so-obtained (which are properly called "least squares" estimates) cannot be examined to determine if they are "best, linear, and unbiased" since these latter
properties have meaning only when a probability distribution is present. In any case, the fitted line can be
taken by the investigator to be part of his perception of the history of the two variables.

The second role of empirical analysis by an investigator (or, again, a decision-maker) facing ignorance in
the context of historical time is to be the springboard for nonprobabilistic predictions. Nonprobabilistic
predictions are derived from the trends, tendencies, patterns and estimated equations developed to describe
history by projecting them into the future without any assumptions concerning probability distributions. As
such, these predictions may be employed to guide the investigator's understandings of possible future
observations of the phenomena under scrutiny.

The third role for empirical analysis in situations of ignorance and historical time is the nonstatistical,
empirical falsification and corroborations of theoretical propositions and models for specific periods of history.
The extent to which a model, say, is consistent with historical fact can be investigated by informally comparing
the model and its properties to the actual history of the period — verbal or numerical. Alternatively, when
models of behavior, such as the Stackel-Buickers model described earlier, are at issue, the investigator can
question the actors to see if the theory has, or has had, any relevance for what they do.

These three roles for empirical analysis are very important both to understand and to take
action in historical-time situations of ignorance. Clearly, the main goal of the scholar is comprehension, that
is, explanation of the observed world, including behavior, action and events in it. And comprehension is not
complete without both theoretical and empirical analysis. Moreover, if an individual bases actions or
decisions on prior events or, as in the Stackel-Buickers decision-making scheme, on imagined future outcomes
(which depend, in part, on prior events) then empirical descriptions of history are crucial to his decision-
making. For they are the only source for the development of his perceptions of the past, and these perceptions
figure significantly in the formulation of his potential surprise function.

In conclusion, the preceding argument clearly raises questions about the nature of economic analysis
when ignorance and historical time are taken into account. Because, certainly, rather common, investigative
perspectives and techniques can no longer be employed; because, that is, both empirical exploration and
theory construction have to be recast in different hues, one might legitimately ask what the structure of
economic analysis would look like under these conditions. The issue has many facets and can be raised in a
variety of ways. How, for example, is Walrasian- or general-equilibrium-type analysis relevant, if at all, to
understanding a world with ignorance and historical time? Is the partial-equilibrium approach of Marshall,
who was indeed aware of both ignorance and historical time, better suited to handle the particularities they
introduce? More generally, to what extent is the use of abstraction itself an appropriate means for building
explanation and understanding in such a context? Perhaps the emphasis should focus more on historical
forms of inquiry. If so, does more attention need to be paid to the realm of promises? What is the right
mix of historiographical analysis and abstraction? How do the two methods interact to shed light on a specific
subject? And so on. Scholars attempting to deal with ignorance and historical time necessarily face questions of this
tort in their work.

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