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Is Probability Theory Relevant for Uncertainty? A Post Keynesian Perspective

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Mainstream perspectives involving uncertainty presume that expectations are based on either a statistical analysis of past data, with market signals providing information about objective probabilities, or on subjective perceptions of these probabilities founded on the axioms of expected utility theory. For example, in the inaugural issue of this journal, Machina (1987) presented a survey of perspectives on "Choice Under Uncertainty" where the first 26 (of 30) pages are devoted to "cases where subjects have been presented with explicit (i.e., 'objective') probabilities..., and the models... possess the corresponding property of being defined over objective probability distributions" (p. 147). In his penultimate section "Is Probability Theory Relevant?" Machina mentions subjective probability models, but never indicates there are other perspectives on uncertainty that do *not* utilize probability concepts, either in terms of relative frequencies or in terms of subjective degrees of conviction. In the mainstream perspective on uncertainty, as accurately described by Machina, *probabilistic risk and uncertainty are synonymous.*[1]

[1]Machina does discuss "states of the world" models, which do not necessarily require individuals to calculate subjective probabilities; nevertheless these models are defined over probability distributions. Lawson (1988, pp. 47–48) notes, model builders "often refrain from assigning probabilities to general economic variables, but attach them, instead, to presumed different and mutually exclusive 'states of the world,' any one of which can occur... the situation is still characterized as one of uncertainty. Uncertainty, and probabilistic knowledge, for the [model builder]... go hand in hand."

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Post Keynesians (Davidson, 1978; 1982–3), following Keynes, have developed a different perspective, where probability distributions are not the basis for comprehending real world behavior under uncertainty. According to this analysis, there are many important situations where "true" uncertainty exists regarding future consequences of today's choices. In these cases, today's decision makers believe that no expenditure of current resources on analyzing past data or current market signals can provide reliable statistical or intuitive clues regarding future prospects.

From this Post Keynesian perspective, decision makers either avoid choosing between "real" alternatives because they "haven't got a clue" about the future, or follow their "animal spirits" for positive investment action in a "damn the torpedoes, full speed ahead" approach. Such demands for liquidity and/or investments are "irrational" from the standpoint of the expected utility model. Yet, people often desire to remain liquid to abstain from committing their resources *even in the long run*, and entrepreneurs often make spontaneous and seemingly arbitrary choices between alternate investments. Post Keynesians believe that this behavior is sensible and understandable only in a world where uncertainty is distinguished from probabilistic concepts.

Whenever conditions of true uncertainty prevail, human behavior may differ systematically from what is implied by the standard expected utility perspective. This paper explains how the Post Keynesian perspective differs from the orthodox probability theory approach, thereby providing a more general theory which can explain long-run decisions regarding liquidity demands, investment decisions, the existence of long period underemployment equilibrium, the long-run nonneutrality of money, and the unique and important role Keynes assigned to nominal contracts and especially the money wage contract.

Classifying Decision-Making Environments

Time is a device which prevents everything from happening at once. In every real world choice, the prospective payoff associated with any action is necessarily separated by some period of calendar time from the moment of choice. The production of commodities requires considerable time; the consumption of capital goods and consumer durables even more so. This fundamental fact of elapsing time is recognized by all real world decision makers. Hence, in a general theory of economic behavior, all economic decisions can be conceived of as occurring under one of the following three mutually exclusive environments:

1. The Objective Probability Environment

Decision makers believe that the past is a statistically reliable, and hence unbiased, guide to the future. This is the rational expectations hypothesis,

where knowledge regarding future consequences of today's decisions involves a confluence of subjective and objective probabilities.

2. The Subjective Probability Environment

In the individual's mind, subjective (or what Savage calls personal) probabilities regarding future prospects at the moment of choice govern future outcomes. These subjective probabilities need not coincide with objective distributions, even if well-defined objective distributions happen to exist.[2]

3. The True Uncertainty Environment

Regardless of whether objective relative frequencies can be shown to have existed in the past and/or subjective probabilities exist today, the economic agent believes that during the time between the moment of choice and the payoff, unforeseeable changes will occur. The decision maker believes that *no* information regarding future prospects exists today and therefore the future is not calculable. This is uncertainty (or ignorance about future consequences) in the sense of Keynes (1937, p. 113), where he wrote that by uncertainty, he did "not mean merely to distinguish what is known for certain from what is only probable. The game of roulette is not subject, in this sense, to uncertainty. . . . The sense in which I am using the terms is that . . . there is no scientific basis on which to form any calculable probability whatever. We simply do not know." Moreover, Keynes added (p. 122), "the hypothesis of a calculable future leads to a wrong interpretation of the principles of behavior." The longer the lapse between choice and consequence, the more likely individuals are to suspect that they must decide in an environment of true uncertainty.

The remainder of this paper will first contrast each of the two mainstream perspectives with the Post Keynesian view of uncertainty, and then describe some economic situations where true uncertainty is a more useful and accurate basis for economic analysis.

The Objective Probability Environment and True Uncertainty

Keynes (1936, pp. 148–50, 161) claimed that some future consequences could have no probability ratios assigned to them. Of course, as a computational matter, mechanical use of formulas permits one to calculate a value for an arithmetic mean, standard deviation, and so on, of any data set collected over time. The question is what meaning the values calculated in this way should carry in interpreting the past, and in using to forecast the future. If economists do not possess, never have possessed, and conceptually never will

[2]If subjective probabilities differ in the short run from the immutable objective functions which are presumed to exist, then, in adaptive expectations models, a learning process is imposed so that subjective and objective probabilities coalesce in the long run.

possess an ensemble of macroeconomic worlds, then it can be logically argued that objective probability structures do not even fleetingly exist, and a distribution function of probabilities cannot be defined. The application of the mathematical theory of stochastic processes to macroeconomic phenomena would be therefore highly questionable, if not invalid in principle.

Hicks (1979, p. 129) reached a similar judgement and wrote: "I am bold enough to conclude, from these considerations that the usefulness of 'statistical' or 'stochastic' methods in economics is a good deal less than is now conventionally supposed. We have no business to turn to them automatically; we should always ask ourselves, before we apply them, whether they are appropriate to the problem at hand. Very often they are not."

The objective probability environment associated with the rational expectations hypothesis presumes not only that probability distributions regarding historical phenomena have existed, but also that the same probabilities which determined past outcomes will continue to govern future events. In the context of forming expectations which do not exhibit persistent errors, it holds that time averages calculated from past data will converge with the statistical averages computed from any future time series. Knowledge of the future merely involves projecting averages based on past or current realizations to forthcoming events. The future is merely the statistical reflection of the past and economic actions are in some sense timeless. There can be no ignorance of upcoming events for those who believe the past provides reliable, unbiased, statistical information (price signals) regarding the future, and this knowledge can be obtained if only one is willing to spend the resources to examine the past!

For the rational expectations hypothesis to provide a theory of expectational formation without persistent errors, not only must the subjective and objective distribution functions be equal at any given point of time, but these functions must be derived from what are called ergodic stochastic processes. By definition, an ergodic stochastic process simply means that averages calculated from past observations cannot be persistently different from the time average of future outcomes. *In the ergodic circumstances of objective probability distributions, probability is knowledge, not uncertainty*![3] Acceptance of the presumption of an ergodic economic environment is often rationalized by the necessity of developing economics as an empirically based science (Lucas and Sargent, 1981,

[3]Nonstationarity is a sufficient, but not a necessary condition, for nonergodicity. Some economists have suggested that the economy is a nonstationary process moving through historical time and societal actions can permanently alter economic prospects. Indeed Keynes's (1939, p. 308) famous criticism of Tinbergen's econometric methodology was that economic time series are not stationary for "the economic environment is not homogeneous over a period of time (perhaps because non-statistical factors are relevant)." More recently Solow (1985, p. 328) has written: "Much of what we observe cannot be treated as the realization of a stationary stochastic process without straining credulity."

pp. xi–xii). Indeed, Samuelson (1969, p. 184) has made the acceptance of the "ergodic hypothesis" the sine qua non of the scientific method in economics.[4]

If, however, true uncertainty conditions prevail in certain decision making areas, then at least some economic processes are such that expectations based on past probability distribution functions can differ persistently from the time averages that will be generated as the future unfolds and becomes historical fact. In these circumstances, sensible economic agents will not rely on available market information regarding relative frequencies, for the future is not statistically calculable from past data and hence is truly uncertain. Or as Hicks (1979, p. vii) succinctly put it, "One must assume that the people in one's models do not know what is going to happen, and know that they do not know just what is going to happen." In conditions of true uncertainty, people often realize they just don't have a clue!

Whenever economists talk about "structural breaks" or "changes in regime," they are implicitly admitting that the economy is, at least at that point of time, not operating under the ergodic presumption that the past objective probabilities will continue to govern future events. Solow (1985) has argued that there is an interaction of historical-societal circumstances and economic events which entail continual structural breaks. In describing "the sort of discipline economics *ought* to be," Solow writes (p. 328): "Unfortunately, economics is a social science" and therefore "the end product of economic analysis is . . . contingent on society's circumstances—on historical context . . . . For better or worse, however, economics has gone down a different path."[5]

The possibility of true uncertainty, therefore, indicates that while objective probabilities and the rational expectations hypothesis may be a reasonable

[4]Samuelson (1969, p. 184) indicated that he used the term ergodic "by analogy to the use of this term in [19th century] statistical mechanics" in order to remove economics from the "realm of genuine history," and keep it in the "realm of science." The renowned biologist, Ernst Mayr (1982, p. 34), on the other hand, indicates that "the assumption of the sameness of physical sciences and biological sciences is naive and misleading . . . [O]ne loses the real significance of the respective biological sciences." Economists, like biologists, deal with animate rather than inanimate things, and hence Post Keynesians argue that the desire to make economics over in the image of the physical sciences can also be naive and misleading.

[5]New Keynesians claim that the introduction of "hysteresis" into economics addresses this problem of historical-societal impact on economics (Cross and Allen, 1988). Just as Samuelson (1969, p. 184) borrowed the ergodic concept from 19th century mechanics, so has the "hysteresis" concept been borrowed from 19th century science where it was coined to describe the process where certain metals fail to return to their original state after a magnetic charge is removed (Cross and Allen, 1988, p. 28). Introducing higher order irreversible time derivatives as state variables into a model to describe a sequential path may permit expansion of a static equilibrium model into what is labelled a "dynamic" model. The latter, however, still has the property of ergodicity which now governs processes of irreversible, but conceptually timeless repeatable patterns of change (for virgin metals). This ergodic concept of hysteresis, more relevant to inanimate objects than societal evolution, merely implies that the original static equilibrium model was incompletely specified since it omitted higher order time derivatives. Hysterisis does not deal with the impact of those societal historical changes which create a true uncertainty environment for many economic decisions.

approximation in some areas of economic decision-making, it cannot be seen as a general theory.

The Subjective Probability Environment and True Uncertainty

In the subjective probability environment, the concept of probability can be interpreted either in terms of degrees of conviction (Savage, 1954, p. 30), or as relative frequencies (von Neumann and Morgenstern, 1953). In either case, the underlying assumptions are less stringent than in the objective probability environment; for example, the Savage framework does not rely on a theory of stochastic processes. However, when the concept of probability is generalized beyond the relative frequency approach by subjectivists, then Keynes' "true" uncertainty concept (non-ergodic circumstances) can be similarly expanded to cover the case when the decision maker either does not have a clue as to any basis for making such subjective calculations, or recognizes the inapplicability of today's calculations for future payoffs.

This possible environment of ignorance regarding future outcomes provides the basis of a more general theory of choice, which can be explained in the language of expected utility theorists. In expected utility theory, according to Sugden (1987, p. 2), "a *prospect* is defined as a list of *consequences* with an associated list of probabilities, one for each consequence, such that these probabilities sum to unity. Consequences are to be understood to be *mutually exclusive* possibilities: thus a prospect comprises an exhaustive list of the possible consequences of a particular course of action.... An individual's preferences are defined over the set of all conceivable prospects." Using these definitions, an environment of true uncertainty (that is, one which is nonergodic) occurs whenever an individual cannot specify and/or order a complete set of prospects regarding the future, because the decision maker either cannot conceive of a complete list of consequences that will occur in the future; or cannot assign probabilities to all consequences because "the evidence is insufficient to establish a probability" so that possible consequences "are not even orderable" (Hicks, 1979, p. 113, 115). Hicks associates a violation of the ordering axiom of expected utility theory with "Keynesian liquidity" (p. 113n), since, for Hicks (p. 94), "liquidity is freedom" to delay action that commits claims on real resources whenever the decision maker is ignorant regarding future consequences.

A related but somewhat different set of conditions that will lead to true uncertainty can be derived from Savage (1954, pp. 10). Savage defines an event as "having every state of the world as an element" and indicates that in his integration of personal probabilities into expected utility theory, his approach "makes no formal reference to time. In particular, the concept of an event as here formulated is timeless." Savage (p. 13) presents an ordering axiom

requiring that "[i]n deciding on an act, account must be taken of all possible states of the world, and the consequence implicit in each act for each possible state of the world." In other words, the decision maker must have a preference ordering which is both timeless and complete over the set of all conceivable outcomes,[6] if a utility maximizing decision is to be made! Thus, even if a person can conceive of a complete set of prospects if the payoff is instantaneous, if he or she fears that tomorrow's prospects can differ in some unknown way, then the decision maker will be unable to order tomorrow's payoff. The ordering axiom of expected utility theory will have been violated, and Keynes's uncertainty concept prevails.

The Savage assumption of a timeless set of states may be most problematic in considering the question of unique events. If important historical economic events are a series of unique episodes, then it may be impossible to group past observations to form either subjective probabilities or relative frequencies. The past would appear to be meaningless in forming expectations about the future, since replicability would not be conceptually possible. Knight (1921, p. 233) associated uncertainty with "high degree unique" situations and noted that our presupposition regarding probabilistic (but risky) knowledge about the future is based on a belief in the uniformity and timeless consistency of nature. Savage (1954, p. 59) tackled this problem directly and claimed that subjective probabilities are even applicable to decisions involving unique events, like which person will be the next president. However, Savage's example provides a case where a Post Keynesian "haven't a clue" behavior is quite observable.

If every vote counts in an election, then *all* citizens who can order their preferences and wish to maximize their expected utility should go to the polls to vote for their choice. Even if it is admitted that the voting age population cannot calculate probabilities, Savage might argue that voters necessarily behave "as if" they formed subjective probabilities regarding which candidate would best serve the voter's self-interest. But in the real world, only about half the eligible voters cast their ballots in recent presidential elections and even fewer vote in elections for lesser offices. Most voters reveal a preference for not choosing. Not casting a ballot is irrational in the "small world" of expected utility theory, where voters are assumed to be able to evaluate all future possible consequences of their vote. Not voting, however, is understandable human behavior, when many voters simply do not know who will represent their own self-interest. The argument of nonvoters that "it doesn't really matter" can be interpreted as a statement that the evidence is insufficient to permit the nonvoter to specify all the possible consequences. Other voters, of course, may rely on animal spirits to cast their vote. Thus, when agents perceive the future as containing unique economic events, then it is possible

[6]Sugden (1987, p. 2) indicates, "The *ordering* axiom requires that the individual should have a preference ordering over the set of all conceivable prospects."

that neither the rational expectations hypothesis nor Savage's expected utility approach is applicable to explaining behavior. Post Keynesians argue that crucial investment choices can involve similar unique future outcomes.

Interestingly enough, Savage recognized (although many of his followers have not) that his analytical structure is *not* a general theory; it does not deal with true uncertainty. Savage (1954, p. 15) admits that "a person may not know the consequences of the acts open to him in each state of the world. He might be... ignorant." However, Savage then states that such ignorance is merely the manifestation of "an incomplete analysis of the possible states." Ignorance regarding the future can be defined away by accepting Savage's (p. 15) "obvious" solution of assuming that the specification of these timeless states of the world can be expanded to cover *all* possible cases. This presumption, however, begs the question of how the decision maker would know he or she had made a complete analysis of all possible states. Savage (p. 16) admits that specifying all possible states when "carried to its logical extreme... is utterly ridiculous... because the task implied in making such a decision is not even remotely resembled by human possibility." The requirement of complete specification of states and their ordering is ultimately "preposterous" (p. 16).

By making this admission, Savage (1954) necessarily restricts his theory of choice to "small world" states (pp. 82–86) in which the axioms of expected utility theory can apply as a first approximation, and hence he writes (p. 20): "[T]his theory is practical in suitably limited domains.... At the same time, the behavior of people is often at variance with the theory.... The main use I would make of [expected utility postulates]... is normative, to police my own decisions for consistency."

Mainstream perspectives, as illustrated by Machina's (1987) article, cannot deal with cases involving true uncertainty. In a Post Keynesian "large world" as opposed to Savage's small one, whenever decision makers recognize that they face nonergodic conditions and are therefore ignorant regarding the future, they will be unable to meet either the axioms of expected utility theory or those of the rational expectational hypothesis. In these circumstances, they can sensibly adopt "haven't a clue" behavior one time and "damn the torpedoes" behavior at another, even if this implies that they make arbitrary and inconsistent choices when exposed to the same stimulus over time.

Keynesian Uncertainty, Money and Explicit Money Contracts

In the real world, individuals must decide whether past experience provides a useful guide to the future. Should one presume that economic processes are uniform, consistent and timeless so that events are determined by ergodic stochastic processes, or at least by specified and completely ordered prospects? Can any sensible agent completely dismiss the fear of tragedy because of unforeseeable changes during the time between choice and outcome? Do

agents believe they are ignorant regarding the future? No rule can be specified in advance regarding how individuals decide whether they are in an objective, a subjective, or a true uncertainty environment. However, agents' perception of the environment surrounding any particular decision problem will affect their behavior.

Keynes laid great stress on the distinction between uncertainty and probability, especially in relation to decisions involving the accumulation of wealth and the possession of liquidity. The essence of his *General Theory* involves liquidity preferences and animal spirits dominating real expenditure choices. Money plays a unique role in "ruling the roost" among all assets (1936, p. 223) and money is nonneutral in both the short and long run (1933, pp. 408–11). These claims, as Keynes made obvious in his 1937 restatement (p. 112, 114) of where he saw his general theory "most clearly departing from previous theory," rested on the clear distinction between the "probability calculus" and conditions of uncertainty when "there is no scientific basis to form any calculable probability whatever. We simply do not know."

Liquidity and animal spirits are the driving forces behind Keynes's analysis of long-period underemployment equilibrium, even in a world of flexible prices. Neither objective nor subjective probabilities suffice to understand the role of nonneutral money and monetary policy in Keynes's underemployment equilibrium analysis. For Keynes and the Post Keynesians, involuntary unemployment can be explained without resorting to the deus ex machina of rigid prices, asymmetric information, or some other market imperfection typically invoked by mainstream Keynesians whose analysis always involves maximizing agents in a probabilistic world that is somehow constrained. Old mainstream Keynesianism as well as the "new Keynesian" analysis is just classical economics with some ad hoc complications. It is not surprising, therefore, that unemployment still plagues most 20th century economies, since neoclassical economists still formulate policy guidelines which are only applicable to a limited domain where agents choose "as if" they had specific and completely ordered knowledge about the future outcomes of their actions. Post Keynesian analysis steps outside this analytical small neoclassical world.

Logically consistent neoclassical economists who use probability theory must view the ubiquitous use of money contracts by modern economies as irrational, since such agreements can impede the self-interest optimizing pursuit of real outcomes by agents. Hence mainstream economists have to explain the existence of money contracts by using non-economic reasons such as social customs, invisible handshakes, and so on—institutional constraints which limit price signaling and hence slow adjustments for the optimal use of real resources to the long run.

For Post Keynesians, on the other hand, *binding* nominal contractual commitments are a sensible method for dealing with true uncertainty whenever economic processes span a long period of calendar time. These legal arrangements permit agents to protect themselves to a large extent against the unpre-

dictable consequences of current decisions to commit real resources towards production and investment activities of long duration. For example, when the uncertain future becomes the actual present, one or the other parties to a contract may discover they are unable or unwilling[7] to deliver on their contractual commitment. Legal enforcement of money contracts provides each of the contracting parties with society's assurance that they can have reasonable expectations that if the other party does not fulfull its contractual obligation, the injured party is entitled to compensation and hence will not suffer a pecuniary loss.

The social institution of money and the civil law of contracts enables entrepreneurs and households to form sensible expectations regarding the certainty of cash flows (but not necessarily real outcomes) over time. The use of purchase and hiring money contracts limits nominal liabilities to what the entrepreneur believes his or her liquidity position (often buttressed by credit commitments from a banker) can survive. Successful entrepreneurs feeling the animal urge to action in the face of uncertainty will not make any significant decisions involving real resource commitments until they are sure of their liquidity position, so that they can meet their contractual (transaction demand) cash outlays over time. By using fixed forward money contracts requiring performance and payment at specified future dates, entrepreneurs (and households) can efficiently control the sequencing use of, and payment for, resources in time-consuming production and exchange processes. The use of overlapping money contracts permits agents to cope with the unknown by controlling their cash flow position over time. When prediction is not possible, such control is eminently desirable in a money-using economy.

In Davidson (1978, 1982) and Davidson and Davidson (1988), I have shown that the existence of the institution of legally enforceable forward contracts denominated in nominal (not real!) terms creates a monetary environment that is not neutral, even in the long run.[8] Money is not merely an arbitrary numeraire or accounting device. In the real world, money is that thing that the courts determine discharges all legal contractual obligations. The possession of money provides liquidity—the ability to meet one's nominal contractual obligations when they come due. (Davidson (1982, p. 34) shows that

[7]Between the time of the contractual meeting of the minds (that is, the contract curve solution) and the time when delivery is required, an unforeseen change may occur to make the performance of the contractual obligation not in the current self-interest of the unwilling party. In the real world of true uncertainty—unlike the probabilistic neoclassical system—recontracting without income penalty whenever a buyer or seller has made (in hindsight) an error is not permitted.

[8]Tobin (1985, pp. 108–9) has written that the existence of money "has always been an awkward problem for neoclassical general equilibrium theory...[and] the alleged neutrality of money. ...The application of this neutrality proposition to actual real world monetary policies is a prime example of the fallacy of misplaced concreteness." Tobin (pp. 112–113) then associates Keynes's rejection of money neutrality presumption with Keynes's emphasis on "the essential unpredictability, even in a probabilistic sense" of the future.

the same holds true for any liquid asset—that is, any durable readily resalable for money in an organized, orderly spot market.) In an uncertain world whenever liabilities are specified and enforceable only in terms of money,[9] the holding of money is a valuable choice (Keynes, 1936, pp. 236–7).

Further, the banking system's ability to create "real bills" to provide the liquidity to finance increases in production flows is an essential expansionary element in the operation of a (nonneutral) money production economy.[10] If tight money policies prevent some entrepreneurs from obtaining sufficient additional bank money commitments to expand their working capital finance at reasonable pecuniary costs when managers (in the aggregate) wish to expand their production flows (and the liquidity preference of the public is unchanged), then some entrepreneurs will not be able to meet their potential additional contractual payroll and materials-purchase obligations before the additional output is produced and then profitably sold. Accordingly, without the creation of additional bank money, entrepreneurs will not be willing to sign additional hiring and material supply contracts and long-run employment growth is stymied, even when entrepreneurs feel that future effective demand is sufficient to warrant expansion. A shortage of money can hold up the expansion of real output, despite expected profits!

Liquid assets also provide a safe haven for not committing one's monetary claims on resources when the threat of uncertainty becomes great, as in Keynes's discussion of precautionary and speculative motives. Keynes claimed (1936, p. 237n) that the attribute of liquidity is only associated with durables that are neither readily produced by labor in the private sector[11] nor easily substitutable, *for liquidity purposes*, with goods produced by labor. Davidson (1978, pp. 221–28) provides a fuller explanation of this point.

When agents' fear of the uncertain future increases their aggregate demand for "waiting" (even in the long run), people will divert their earned income claims from the purchase of the current products of industry to demanding additional liquidity. Consequently, effective demand for labor in the private sector declines. Only in an unpredictable (nonergodic) environment does it make sense to defer expenditures in this way, as opposed to spending all

[9]For example, enforcement of labor purchase contracts in real terms is not possible in a democratic society where slavery is illegal.

[10]In a revision of his famous Keynesian counter-revolution article, Clower (1969, p. 289) recognized the fact that the creation of "real bills" must precede increases in economic activity (and therefore money cannot be neutral). He argued that "the marketing [monetary?] authority advances a nominal quantity of book [bank?] credit to one or more of the transactors to set the trading process in motion (without such initial advances, no sales order could ever be executed since no purchase order would ever be validated)."

[11]Nonproducibility implies that money and other liquid assets (like T-bills, CMAs, corporate securities) do not grow on trees. Hence, involuntarily unemployed workers cannot be hired by the private sector to harvest money, even if the marginal productivity of picking fruit from a neoclassical money tree exceeds the marginal disutility of reaching for the fruit!

one's earnings on the various products of industry being traded in free markets.[12]

This liquidity argument may appear to be similar to the view of general equilibrium "Keynesian" theorists like Grandmont and Laroque (1976), who stress an option demand for money. However, in their model and many others, money has an option value only because of very unrealistic assumptions. For example, Grandmont and Laroque (1976) assume that (a) all producible goods are nonstorable; (b) no financial system exists, which means no borrowing and no spot markets for reselling securities; and (c) fiat money is the only durable and hence the only possible store of value which can be carried over to the future. Of course, if durable producible and productive goods existed (as they do in the real world) and outcomes associated with holding producible durables were completely orderable, flexible spot and forward prices would reflect the multiperiod consumption plans of individuals and no "optimizing" agent would hold fiat money as a store of value. Say's Law would be applicable, and the nominal quantity of money would be neutral. Hence Grandmont and Laroque can achieve "temporary" Keynesian equilibrium via an option demand for money to hold over time only under the most inane of circumstances involving the absence of lasting producibles. By contrast, Keynes allowed the demand to hold money as a long-run store of value to coexist with the existence of productive durables.

Another modern approach to liquidity is that of Kreps, whose analysis of today's "waiting" (1988, p. 142) presumes that at some early future date each agent will receive "information about which state prevails" at a later future payoff date. Accordingly waiting to receive information before determining expected utilities and then spending one's claims on resources or goods is only a short-run phenomenon; long run waiting behavior is not optimal in the Kreps analysis—*unless the information is never received*! The option to wait is associated with a "preference for flexibility" until sufficient information is obtained. Although Kreps does not draw this implication, his framework implies that if agents never receive the needed information, or never know when they have complete information so that they remain ignorant regarding the future and thus in a state of true uncertainty, then they may wait forever.

Keynes (1936, p. 210), on the other hand, insisted that decisions not to buy products—to save and wait—did "*not* necessitate a decision to have dinner or

[12]Since earning income involves disutility, while producible goods are assumed to be the only scarce things which generate utility, then as long as it is presumed that probability structures governing future outcomes are, in the long run, "knowable" (that is, ergodic) by analyzing existing information, then it is not rational optimizing behavior to engage in income earning activity merely to hold, in the long run, money (or other nonproducible liquid assets) rather than spend all one's earnings on real producible goods and services. If the future involves true uncertainty, on the other hand, long-run postponement of real spending decisions is inherently sensible and empirically observable, as argued in the text.

to buy a pair of boots a week hence or a year hence or to consume any specified thing at any specified date. ... It is not a substitution of future consumption demand for current consumption demand—it is a net diminution of such demand." In other words, neither Kreps's waiting option nor the Grandmont and Laroque option demand for money explain Keynes's argument that there need not be any intertemporal consumption substitution when people wait and therefore save in the form of holding liquid assets. In the long run in an environment of true uncertainty, people may want to stay liquid and hence a long run unemployment equilibrium can exist.

There is empirical support for the Post Keynesian argument that the greater the uncertainty, the more likely that people will exhibit long run deferment of expenditures vis-a-vis spending all of one's earning on the products of industry. Danziger et al. (1982–83, p. 210) analyzed microdata on consumption and incomes of the elderly and have shown that "the elderly do not dissave to finance their consumption at retirement... they spend less on consumption goods and services (save significantly more) than the nonelderly at all levels of income. Moreover, the oldest of the elderly save the most at given levels of income."

These facts suggest that as life becomes more uncertain as one ages, the elderly "wait" more without making a decision to spend their earned claims on resources. This behavior is irrational according to the life cycle hypothesis, inconsistent with Grandmont-Laroque option demand for waiting, and not compatible with Kreps's waiting, unless one is willing to admit that even in the long-run "information about which state will prevail" may not exist, and some economic decisions are made under a state of true uncertainty.

Probabilistic analysis of waiting and option value recognize only a brief need to postpone spending over time. However, only the Post Keynesian uncertainty concept provides a basis for a long-run demand for liquidity.

Concluding Thoughts

Keynes's revolutionary analysis, where money is never neutral and liquidity matters, is a general theory of an economy which permits the unpredictability of the future in certain crucial areas of economic decision making to have important economic consequences. By contrast, neoclassical optimization requires restrictive fundamental postulates regarding uncertainty and hence constrains the analysis of expectations regarding future consequences in a way that Keynes's analysis does not. The analyst must therefore choose which system is more relevant for analyzing the economic problem under study.

For many routine decisions, assuming the uniformity and consistency of nature over time (that is, assuming ergodicity) may be a useful simplification for handling the problem at hand. For problems involving investment and liquidity

decisions where large unforeseeable changes over long periods of calendar time cannot be ruled out, the Post Keynesian uncertainty model is more applicable. To presume a universe of discoverable regularities which can be expected to continue into the future and where the neutrality of money is therefore central (Lucas, 1981, p. 561) will provide a misleading analogy for developing macro policies for monetary, production economies whenever money really matters and affects production decisions in the real economy.

Economists should be careful not to claim more for their discipline than they can deliver. Lucas and Sargent's belief (1981, pp. xi–xii), that in "*some* circumstances" the world is probabilistic, or the expected utility theorists presumption that future prospects can be completely ordered, tends to lead to the argument that individuals in free markets do not make persistent errors and they know better than the government how to judge the future. Basing general policy rules on these assumptions can result in disastrous advice for governmental officials facing situations where private sector economic decision makers believe that the future cannot be reliably predicted from past experience.

If economists can recognize and identify when these (nonergodic) economic conditions of true uncertainty are likely to be prevalent, government can play a role in improving the economic performance of markets. Economists should strive to design institutional devices which can produce legal constraints on the infinite universe of events which could otherwise occur as the economic process moves through historical time. For example, governments can set up financial safety nets to prevent, or at least offset, disastrous consequences that might occur. Government may also provide monetary incentives to encourage individuals to take civilized actions which are determined by democratic processes to be in the social interests (Davidson and Davidson, 1988). Where private institutions do not exist, or need buttressing against winds of true uncertainty, government should develop economic institutions which attempt to reduce uncertainties by limiting the possible consequences of private actions to those that are compatible with full employment, the accumulation of real capital, and reasonable price stability. Government needs to set the "rules of the game" in such a way as to eliminate the anti-social results of decision making under uncertainty, although it need not get involved in the nitty-gritty decisions regarding the allocations of real resources, like planning at the factory level.

Keynes (1936, p. 16) wrote: "The classical theorists resemble Euclidean geometers in a non-Euclidean world, who, discovering that in experience straight lines apparently parallel often meet, rebuke the lines for not keeping straight—as the only remedy for the unfortunate collisions which are occurring. Yet, in truth, there is no remedy except to throw over the axiom of parallels and to work out a non-Euclidean geometry. Something similar is required in economics." In the argument presented here, the postulate that economists must throw over is that individuals must use objective or subjective

probability distributions to make economic decisions in the face of true uncertainty. The result is a more general theory, encompassing cases of both ergodic probability and nonergodic uncertainty.

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