Some implications of uncertainty for economics

Amitava Krishna Dutt

Department of Political Science
University of Notre Dame

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1. Introduction

Individuals and organizations make decisions which have consequences in the future. These consequences are not certain. Nevertheless, their decisions take into account their views on these consequences. Many economists and other social scientists attempt to analyze how these decisions are made using the concepts of risk and uncertainty interchangeably, using the notion of probability. This approach either assumes that the outcomes of decisions can be represented by objective probability distributions which are “out there”, properties of the real world, or in terms of subjective probabilities, since people may not know the true probabilities “out there”, but they update their subjective probability distributions when the future becomes the present and they obtain new information.

This conflation of risk and uncertainty does not take into account the distinctions between them made by John Maynard Keynes and Frank Knight, among other, between the two concepts. Knight (1921: p. 13), in a well-known passage, wrote:

> Uncertainty must be taken in a sense radically distinct from the familiar notion of Risk, from which it has never been properly separated. The term "risk," as loosely used in everyday speech and in economic discussion, really covers two things which, functionally at least, in their causal relations to the phenomena of economic organization, are categorically different. ... The essential fact is that "risk" means in some cases a quantity susceptible of measurement, while at other times it is something distinctly not of this character; and there are far-reaching and crucial differences in the bearings of the phenomenon depending on which of the two is really present and operating. ... It will appear that a measurable uncertainty, or "risk" proper, as we shall use the term, is so far

> different from an unmeasurable one that it is not in effect an uncertainty at all. We ... accordingly restrict the term "uncertainty" to cases of the non-quantitative type.

Keynes (1937: 213-14), in a frequently-cited passage wrote:

> By 'uncertain' knowledge, let me explain, I do 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 term is that in which the prospect of a European war is uncertain, or the price of copper and the rate of interest twenty years hence…About these matters there is no scientific basis on which to form any calculable probability whatsoever. We simply do not know.

Although there are differences between the views of Keynes and Knight on this issue (Knight seems to focus on the distinction in an epistemological sense which concerns how and what we know about the world, whereas Keynes seems to focus on the ontological distinction about the world as it truly is), they both emphasize the difference between the two concepts and relate risk to situations in which probabilities can be calculated and measured on a scientific basis, and uncertainty to situations in which there is no basis for doing so.

The purpose of this paper is to suggest a way of examining the consequences of taking the distinction between risk and uncertainty seriously for economics and to take some steps in actually examining such consequences. As already mentioned, most of mainstream economics does not take the distinction seriously. Some economists do take it more seriously, especially the post-Keynesians, but they have frequently been dismissed as being fundamentalists who like to quote from the master and not go too much beyond him. Without taking a view on this criticism, and drawing on some of the writings of post-Keynesians, this paper will try to examine the far-

reaching implications of uncertainty for economics. Although the discussion will focus on economics, it has relevance for other related social sciences which have attempted to adapt some of the approaches used in economics.

The approach that this paper uses to analyze the implications of the distinction between risk and uncertainty distinguishes between five different dimensions of economic (and related) analysis. The first is the ontological dimension, which involves views about how the world really is, what "really" occurs in it, and how it changes. The second is the epistemological dimension, which refers to the method that is adopted to organize how one thinks about the world, that is, the organizing principles of analysis, but which is not a statement about the properties of the world. The third is the methodological dimension,[1] which has two sub-dimensions: the formal aspect, for instance, whether one uses mathematics or verbal analysis, and the forms of mathematical and verbal analysis one uses; and the empirical aspect, which concerns methods that are used to examine the relationship between the real world "out there" and the analytical approach, that is, whether one uses statistical methods or qualitative ones, and whether one uses available quantitative data or ethnographic, experimental, survey, or historical approaches. The fourth is the normative dimension, which involves what one thinks of as the appropriate goals of a good society, and relates to matters of ethics and justice. The final one is the dimension of action, which relates to what we should do and should not do, as individuals, groups, societies and global citizens, and includes appropriate policies to be pursued by governments and other organizations.

The reason for distinguishing between these dimensions is that they are in principle distinct in the sense that an approach used may make independent choices for each of the five dimensions, and because the different dimensions are often muddled, confused and confusing

and clarity can arguably gained through the distinction. This is not to say that the choices made in one dimension may affect the choices made in other dimensions both in terms of abstract reasoning and in terms of the sociologically academic activity.

These ideas can be illustrated with examples from the mainstream neoclassical economic theory. It is possible that this take the ontological view that the actual economy has smoothly functioning markets with self-interested people which leads to the full utilization of resources, the epistemological approach of organizing their analysis in terms of optimizing individuals, the formal method of mathematical modeling involving calculus, the empirical method of using econometric analysis, the goal of efficiency, and the action of little or no government intervention at the level of society. Moreover, it is likely that the goal of achieving efficient outcomes, the epistemological approach that focuses on optimizing individuals, the ontological view that individuals are self-interested and that markets "work" smoothly and therefore attain efficient outcomes (due to the first fundamental theorem of welfare economics), together with the use of econometric analysis to show that markets are in fact efficient, leads to the view that governments should do as little as possible because they only interfere with the proper functioning of markets. However, it is possible that those who adopt the epistemological approach which focuses on optimizing individuals may take the ontological view that markets do not work well due to externalities, asymmetric information and the existence of "large" market participants, use mathematical models involving game theory, value fairness in addition to efficiency, and favor government intervention in markets. It is also possible that some of these may adopt of all the views in this last sentence, except the last, because they take the view that governments are inefficient and corrupt. Finally, confusions between the dimensions can occur because of the failure to distinguish between the use of the optimizing agent as an

epistemological approach versus the ontological view that people in fact are rational, and between the ontological view that fairness is not an appropriate goal and that distributional factors do not affect how markets actually work or the rate of growth of the economy.

The rest of the paper proceeds as follows. The next section discusses more fully the distinction between risk and uncertainty. The subsequent five sections examine the five dimensions in turn, the last of them confining itself to some general comments about policies. The final section makes some general concluding remarks.

It should be remarked at the outset that the implications of uncertainty for each of the dimensions are wide-ranging and complex, and a single paper can but provide only a selective and sketchy discussion of some of the central relevant issues. It will confine its attention to some of the central ideas involved, their main implications for the five dimensions mentioned above, and how these implications compare with the approach of mainstream neoclassical economics.

2. Risk and uncertainty

The idea of uncertainty can be explained by comparing it to something that is more precisely understood, and from which, as mentioned earlier, Keynes and Knight distinguished it. Both arise from the fact that people's actions have individual consequences, which people would like to know because they will determine whether they will undertake those actions. But the future is not known with certainty, and neither are the consequences of people's actions in the future. Thus, people have to form some idea of these consequences before they decide.

A standard approach to the problem is that we may not be certain about the future, but may be able to calculate the probability distribution of the relevant outcome of our actions, and make decisions based on such distributions. This calculation may be made after collecting all the

relevant information and using some kind of model of the environment (also based on relevant information). If the environment is of the type which does not change, and repeated experiments can be made, it is possible to derive a probability distribution of relevant outcomes based on the standard scientific approach, doing repeated "experiments" and collecting data. Keynes and Knight both seem to be calling this type of situation as situation with risk, in opposition to certainty.

In simple situations these experiments may be thought of simply as taking the same action and measuring the number of times different outcomes take place and finding their frequency distribution. In more complicated situations, a model may be involved, to control for various factors and relationships between different things. Decision rules may be developed, for instance, by calculating the mathematical expectation of the outcome from the distribution and comparing it to some things about which information is available, or by taking the mathematical expectation and using some definition of risk in terms of the variance of the distribution. Decision makers may also not have complete knowledge about the model or the distribution, develop some model and probability estimates with the knowledge they have, and update their information to improve their decision-making in a Bayesian manner. All of these approaches can be thought of as being consistent with the idea of risk.

A different approach is to admit that we simply do not know, and can never know what the future will bring, because the actions are made in a changing environment, in manner which is not systematic in any sense. In such situations repeated "experiments" never take place in the same environment. The environment is always changing in unknowable ways, and these changes may even occur as a result of our (and other people's) actions which change the environment. Probability distributions that are constructed from the past experiences do not

provide us with any objective guide to what will happen in the future and, what is more, we know it. This is what Keynes seems to be referring to as a situation of uncertainty.

In such situations, people still need to make decisions and take actions. In so doing, they may still form and use probability distributions, but they know that this distributions have no "scientific" basis. Thus, they may not have much confidence in the distributions, and not give them much weight in their decision-making.

Keynes and the post Keynesian who take his views on risk and uncertainty seriously argue that many economic decisions – such as investment, asset holding, price-setting and production decisions – are made in uncertain environments. The rest of this paper analyzes what taking uncertainty serious implies for the five aspects of economics mentioned earlier.

3. Ontology

We start with ontological issues because some of what we will say on the other dimensions depends on it. Also, it is what has received the most attention from post Keynesians and others who take seriously the notion of uncertainty. The question we address here is: how does the world actually function when there the future is uncertain? For ease of exposition we can discuss microeconomic issues, that is, the behavior of individuals and groups, and macroeconomic issues, that is, the operation of the economy as a whole, in turn.

Starting with individual and group decisions, three kinds of behaviors – not necessarily mutually exclusive – have been highlighted in the literature.

First, individuals and groups can use some positive methods of decision making in an uncertain environment. Examples of such behaviors include the following:

1. Do what most other people and groups do. This may partly be because people realize that they don't have much confidence in their own ability to form judgments, and therefore rely on the judgments of others, thinking that they are better informed. Keynes (1937: 214) wrote:

> Knowing that our own individual judgment is worthless, we endeavor to fall back on the judgment of the rest of the world which is perhaps better informed. That is, we endeavor to conform with the behavior of the majority or the average. The psychology of a society of individuals each of whom is endeavoring to copy the others leads to what we may strictly term a *conventional* judgment.

It may also be explained by the fact that individuals may not want to stick their necks out and do something which is very different from what others do. It is obviously better to get bad results when everyone gets bad results, than to get bad results when most other people get good results. How could one be blamed for making a "mistake" when everyone made a "mistake", but one can certainly be blamed by others for being the only on to make a "mistake". Also, it may not be socially acceptable to make large gains when everyone else loses, because this will upset other people, and/or make them think that the gainer used some unfair means to do well.

2. Follow expert opinion. The convention here is to rely on the opinions of experts, even if one does not know that the experts have any real basis for making judgments. Perhaps they do? Or, at least one cannot be blamed for relying on experts who are supposed to know more than others. If experts follow each other, then this implies that the behavior of everyone follows the behavior of others. But if experts disagree, individual behavior may be very different.

3. Rely on current information rather than trying to form hypotheses about what will happen in the future. One reason for doing so is that we know nothing or close to nothing about the future. Keynes (1937: 214) wrote:

> We assume that the present is a much more serviceable guide to the future than a candid examination of past experience would show it to have been hitherto. In other words we largely ignore the prospect of future changes about the actual character of which we know nothing.

Examples of such behavior would be to form expectations of future profitability of investments on current profit rates, or other current determinants of profit rates, such as the profit share and the degree of capacity utilization. It is simply too complex to try to form future expectations by basing them on the past or even some notions of what may happen in the future. Another example is to rely more heavily on factors about which current information is readily available, and ignore factors about which there is little knowledge. In setting prices, for instance, firms may use hard current information about costs, and ignore soft information about demand conditions in the future, after they have produced, and therefore set the price as a markup on costs and independent of demand conditions which depend on macroeconomic conditions about which it is difficult to form opinions. A second reason for behaving in this way is that we may believe that some aspects about the present already embody judgments of others which are more or less correct. Keynes (1937: 214) wrote:

> We assume that the existing state of opinion as expressed in prices and the character of existing output is based on a correct summing up of future prospects, so that we can accept it as such unless and until something new and relevant comes into the picture.

Relying on current information does not imply that all ideas about future changes will be ignored. As Keynes argued, some new information can become available which means that existing information about the immediate past may need to be reassessed. Moreover, there may be good reason to believe that future conditions may change, and this may be taken into account by decision makers. Relying on current information does not also imply that all current information will be used: individuals can therefore rely on a small selection of current indicators.

4. Rely on instinct and gut feelings. For some decisions people may just rely on gut feelings and instincts because they know that more careful reasoning may not get them very far, and may even bog them down into paralyzed inaction. These instincts may be based on hunches and take into account information about which it there may be very little reason to base one's decisions. They may also be based on gut feelings which are based on one's own experiences. The use of heuristics that lead to this kind of behavior have been found to occur by psychologists even when there may be a scientific basis for decision-making using probabilities, as in experiments involving events in which the frequencies can be objectively calculated. People may use, for instance, the availability and representativeness heuristics, as discussed by Tversky and Kahneman (1974), which results in biased decisions (see also Ariely, 2008). In an uncertain environment it is not possible to argue that the decisions are biased, but this research does suggest that these kinds of behaviors are actually observed. People need not be predictably irrational in an uncertain environment, because it is not clear what rational means in that context.

5. Within organizations, go with discussion, consensus building and majority opinion. If "mistakes" are made, no one can be blamed, because the decisions are based on consensus. This is similar to following others, except that particular organizations may come to decisions using this method which are different from those made in other organizations.

Second, individuals and groups can take some negative actions do cope with uncertainty, that is not do certain things. Examples of this include the following:

1. Postpone decisions which can be postponed. Thus, firms may postpone investment decisions with the hope of gathering more knowledge about what will happen, or to see what others will actually do. This does not imply that they will always postpone decisions in the face of uncertainty. Perhaps after postponing decisions for a while they can make quick decisions t do something that they have postponed for a long time.

2. Maintain liquidity in a general sense rather than commit oneself to the future. This need not simply mean postponing decisions, but making the decision of always not committing oneself fully. Examples of such behavior including holding money, holding excess capacity, and diversifying one's assets rather than committing to something in particular. It may not be clear how much money to hold and how much excess capacity to have, and how much to diversify, but people can increase their holdings depending on how much confidence they have in their judgments about the future or in their courses of action. These ideas have been emphasized by Keynes (1937: 216), who wrote:

> Why should anyone outside a lunatic asylum wish to use money as a store of wealth? … Because, partly on reasonable and partly on instinctive grounds, our desire to hold Money as a store of wealth is a barometer of the degree of our distrust of our own calculations and conventions concerning the future. Even though this feeling about Money is itself conventional or instinctive, it operates, so to speak, at a deeper level of our motivation. It takes charge at the moments when the higher, more precarious conventions have

weakened. The possession of actual money lulls our disquietude; and the premium which we require to make us part with money is the measure of the degree of our disquietude.

3. Avoid actions which have a chance of making large losses or impose major costs, even if they are improbable.[2]

Third, individuals and groups can make attempts to reduce uncertainty. They can do so individually by follow habits and rules of behavior, and changing them only when there are very good reasons to change them. Rather than deliberate about every decision, they can do things as a matter of habit – such as eating a given time – and follow rules of thumb – such as setting prices based on costs and changing them when costs change. They can enter into formal contracts or enter into informal arrangements with others to reduce uncertainty. For instance, they may enter into wage contracts with their employers, so that they are not faced by the uncertainty causes by changes in wages. They can also make collective arrangements to reduce uncertainty, by developing organizations which have clear and predictable rules. An important reason why institutions exist – especially in the form of social norms and organizations – is the existence of uncertainty, because of attempts by individuals to reduce it, individually and collectively.

Which of these behaviors will actually prevail in a given situation depends on a variety of factors because, partly because they depend on social agreement which can be affected by chance events. Moreover, different types of behaviors can coexist in a given situation, with different people and groups following different behaviors, and the same people and groups following different behaviors in different parts of the economy.

These behaviors have a number of implications for the nature of individual and group behavior. First, under "normal" circumstance, behavior – due to habits, contracts, and organizational rules – is likely to follow stable patterns, despite changes in the external environment. Second, there may be sudden and unexpected changes in behavior patterns, due to changes in the environment which may even be small, caused by changes in confidence, changes in expert opinion, and tipping behavior due caused by the creation of a critical mass. As Keynes (1937: 216) wrote:

> Now a practical theory of the future … has certain marked characteristics. In particular, being based on so flimsy a foundation, it is subject to sudden and violent changes. The practice of calmness and immobility, of certainty and security, suddenly breaks down. New fears and hopes will, without warning, take charge of human conduct. The forces of disillusion may suddenly impose a new conventional basis of valuation. All these pretty, polite techniques, made for a well-panelled Board Room and a nicely regulated market, are liable to collapse. At all times the vague panic fears and equally vague and unreasoned hopes are not really lulled, and lie but a little way below the surface….

Third, different people can follow different behaviors and can change their behavior patterns. Fourth, different people and groups can have different degrees and ability to affect other people and outcomes, based on their income and wealth, and because of their ability to affect other people's judgments, as is the case of experts. Finally, there may be no clear connection between external factors – that is, factors determined by the environment at large – and individual and group responses to it.

These types of individual and group – or what can be called micro – behaviors will have aggregative or systemic – or what can be called macro – outcomes. The nature of these macro consequences and outcomes can be described with a numbers of related remarks. First, the economy can show regular patterns of outcomes, in terms of the stability of some aspects of it, or stable growth in some other things. Second, these regular outcomes can imply that resources can be unemployed. This can be explained, as in standard macro models, in terms of wage rigidity due to attempts to reduce uncertainty, holding money and excess capacity, and low levels of spending because others spend at low levels. There may be no mechanisms in the economy which can automatically take it to situations of the full utilization of its resources. Third, in these outcomes, aggregate demand – driven by expectations about the future, for instance – can have an impact on the position of the economy, in addition to what may be called supply-side factors. Fourth, even small changes in "outside" factors can lead to big changes in the economy, including financial crises, large economic declines, or inflation. These problems can be caused by sharp changes in the prices of assets, changes in business optimism and pessimism, changes in debt situations, to name a few. The timing and extent of these changes cannot be known from before, although it may be possible to find conditions which make these events more likely, such as sharp changes in borrowing and debt, or large increases in asset prices.

These consequences are very different from some of the general consequences of mainstream neoclassical macroeconomic models, which are based on probabilistic risk and often on rational expectations. They imply either that resources are always fully utilized, or that if they are underutilized, this only happens in the short run, and that in the medium and long run there are automatic market forces – or, failing that, government responses – which take the economy to situations of full utilization of resources. To the extent that resources are not fully

utilized, or not optimally allocated most mainstream economists introduce a few “distortions”, only to claim that they are empirically important, or that they can be removed by suitable institutions or by appropriate “tax-subsidy” policies.

4. Epistemology

Economists (and other social scientists) use particular ways of organizing their thinking, which are simply analytical devices, but which are not intended to be aspects of reality. This section will refer to as their epistemological approach.

The epistemological approach used by mainstream neoclassical economists can be argued to be to explain behavior and outcomes in terms of the individual optimizing agent. This has two aspects: methodological individualism, that is explaining what happens in terms of the behavior of individuals, and optimization, which involves the specification of an objective function and constraints and explaining behavior in terms of the maximization of the objective function. The approach – which can be called the maximization hypothesis – has been criticized because it is not realistic to posit that people optimize, since, for instance, following Simon, because it is costly to acquire information and because people don’t have the computational ability to maximize their objective function. If we take uncertainty serious optimization becomes impossible, because it is not possible to find the optimal solution, even in the sense of expected values if the world is uncertain and not risky in the sense that the probability distribution is known. This criticism, however, can be argued to be invalid because the hypothesis does not state that individuals actually optimize – it is not a statement about the real world – but an epistemological one to organize thinking, as a way of examining what constraints people face and what they are trying to do. As Boland (1981) argues, the approach does not involve a

statement about how individuals actually behave, because it assumes nothing about the actual objectives of people and what constraints they face, and therefore any behavior can be made consistent with the approach by choosing appropriate objectives and/or constraints.

Although this is a valid defense of the epistemological status of the optimization hypothesis, the relevance of uncertainty creates problems for it.

First, there is no particular reason to use the approach as the only way of doing "scientific" analysis and calling other approaches which do not use it *ad hoc*, as mainstream economists are wont to do (certainly as evidenced by the nature of theoretical papers accepted in the leading mainstream journals). The usual justification for insisting upon it is the notion of individual rationality, a justification that is no longer being claimed if the hypothesis is simply treated as an epistemological one and, the claim can also be rejected if it is interpreted in an ontological sense, as discussed in the previous section.

Second, even it is used as an epistemological assumption, it lends itself to being misinterpreted as an ontological assumption, as evidenced by the use of expressions like the "rational choice" approach, especially outside economics, and now increasing in economics, even among those who claim to follow heterodox perspectives, such as "rational choice" Marxists.

Third, in actual applications of the optimization approach, the implications of the model depend crucially on the optimization hypothesis as an aspect of reality. To take one example, consider the standard efficiency wage model which assumes that firms know the precise relationship between wages and the efficiency of workers, and therefore set wages at their profit-maximizing level. The model implies that free market forces will actually allow firms to choose

the efficiency wage, and therefore government interventions through minimum wage policies, for instance, will not be able to increase the profits of firms. The problem with this view, in an uncertain environment, is that firms may not know the precise relationship between wages and the productivity of workers, although may have some idea that there may be a positive relationship. They will therefore not keep the wage as low as possible, and this may be sufficient to explain involuntary unemployment. However, there is no reason to believe that they will set the profit-maximizing wage. There is good reason to believe that firms will typically set a wage at a level which, if increased, could increase their profits. This is because in an uncertain environment they may give more attention to the hard information about wages being a cost, and less attention to soft information about the possible effects of wages on productivity. If this is true, government efforts to raise wages may well have a positive effect on profits even at the level of the firm. Another example involves the possibility of firms taking on the production of goods which lead learning by doing effects, even in the absence of externalities and problems due to the availability of credit. Uncertainty about the success of production and export projects and about the strength of learning by doing effects internal to the firm may prevent firms from developing infant industries in the absence of government protection.

Finally, the use of the optimization assumption implies that, for the sake of analytical tractability, requires the use of other assumptions and simplifications, including ones about how individuals think about the future. It is not surprising then, that the standard model used by mainstream macroeconomists – in the so called new classical synthesis – is one which assumes either that infinitely-lived individuals know the future, or else know it in a probabilistic sense, as in stochastic dynamic general equilibrium models. Thus, the use of the optimization hypothesis often implies that uncertainty has to be given up.

All this is not to argue that the use of the optimization hypothesis is never useful and cannot lead to important insights. However, it is to argue that it is not the only acceptable approach to economics, and also to argue that its relative strength may be weakened if we take uncertainty seriously.

5. Methodology

Methodological issues relate to the *form* of analysis in economics and of how this analysis is related to the empirical world "out there".

Mainstream neoclassical economics has increasingly become mathematical, with theoretical analysis in highly-ranked journals using more and more "rigorous" mathematical models. It has been argued that the use of mathematics, with its precision and its tendency to provide specific results in the form of propositions and theorems, becomes unhelpful if uncertainty is taken seriously. Keynes (1921) himself recognized the problems involved in using mathematical language when dealing with what he called the "complexity" of economic processes due to the fact that these processes involved uncertainty rather than risk. He wrote that

> "In ordinary language, where we are not blindly manipulating but know all the time what we are doing and what the words mean we can 'keep at the back of our heads' the necessary reserves and qualifications and the adjustment we shall have to make later on."

In mathematical language, however:

> "we cannot keep complicated partial differential 'at the back' of several pages of algebra, which assumes that they all vanish. Too large a proportion of recent 'mathematical' economics are merely concoctions, as imprecise as the initial assumptions they rest on,

which allow the author to lose sight of the complexities and interdependence of the real world in a maze of pretensions and unhelpful symbols."

In the *General Theory* Keynes (1936) wrote after writing down some of the few mathematical equations of the book, showing the relation between changes in the price level and changes in the quantity of money: I do not myself attach much value to manipulations of this kind; and I would repeat the warning, which I have given above, that they involve just as much tacit assumption as to what variables are taken as independent (partial differentials being ignored throughout) as does ordinary discourse, whilst I doubt if they carry us any further than ordinary discourse can." Several interpreters of Keynes's method have argued Keynes's views on uncertainty and the non-atomic nature of the economy rightly made him take the view the precision and determinateness of mathematical analysis made it less useful for analyzing economic phenomena. Carabelli (1988: 157), for instance writes that "the connections traced by him between elements in the economic complex had no (either deterministic or statistical) necessity."

While Keynes and his interpreters provide us with some important warnings about the limits of mathematical analysis in understanding economic phenomena, and imply that verbal reasoning has much to contribute, they do not make the case of the unsuitability of mathematical modeling in economics. First, as discussed in section 3, in uncertain environments individuals and groups tend to follow rules of thumb and habits, follow long-term contracts and form organizations in order to reduce uncertainty in their daily lives, and these can be thought as producing fairly stable relationships between variables in the economic system, and as such, can be argued to lend themselves to mathematical formalization, and even to the use of equilibrium analysis. Second, these mathematical models need not be thought of as attempting to capture reality in a precise manner and be used for making predictions, but rather as showing rough

tendencies contingent on a number of assumptions, including those that keep constant many aspects of the economy (such as animal spirits) which are, in fact, not constant in reality. Thus, the equilibrium positions in these models, if they have them, do not represent tranquil states not reflecting uncertain environment (because there is no change in them), because what is held constant is only artificially held constant. Third, there are many mathematical models which take seriously the nature of some real world changes by not producing models with unique, path-independent equilbria, but instead using models with multiple equilibria, dynamic instability, a continuum of equilibria with path dependent processes, and hysteresis (see Dutt, 2010). These models also reveal general tendencies and not precise time paths for the economy. Fourth, the parameters in models can be thought of as "variables" in a broader mathematical model and be endogenized, although this is so only in principle. The relationships in question may not be systematic enough to be written down in the form of equations, and even otherwise the models can become too complex to say anything useful. Thus, these relationships can be discussed in a verbal manner, and the narrower mathematical model be interpreted as "nested" in the broader verbal model.

The analytical approaches used in economics – mathematical, or verbal, or a combination – obviously try to tell us something about actual economies. To the extent that economists use mathematical models and derive formal results from them, they try to relate them to the real world by "testing" them against empirical data using econometric methods. Instrumentalists such as Friedman argue that the models need not be realistic in any sense – what is really important is if they can predict correctly. Most mainstream economists do not accept Friedman's views, and attempt to check the realism of some of their assumptions and see how well the data

"fits" their models. They even take the view that if their theories do not fit the data well, the theories should be modified, or abandoned altogether.

This entire approach of trying to test models is fraught with many difficulties that are well known as need not be discussed here. We confine ourselves to a few comments. First, if the mathematical models show general tendencies at best, it is not possible to "scientifically" test their implications against empirical data. Second, econometric tests of significance make assumptions about the economy using probability distributions and may not provide proper guidance when the probability assumptions are not valid, as in a world in which the future is uncertain. Third, this does not mean that econometric tests are not of any use and should be abandoned, but rather that they should be thought as providing convenient ways of summarizing the data and looking for broad tendencies. Fourth, there may be less value in refining econometric methods to make them use less restrictive assumptions, since these methods do not overcome the fundamental issue that the future cannot be objectively thought of in probabilistic terms, than in trying to refine the meaning and measurement of data, and in thinking more carefully about the economic "models" and the causal mechanisms. Fifth, the highly contingent nature of institutions and behaviors implies that assuming a common structure over time and across regions (even allowing for time dummies and fixed effects) is problematic. Finally, economists should be far less reliant on econometric methods and more open to other methods of "looking" at the real world, using case studies, historical approaches, ethnographic methods, survey methods and the like, and using both formal statistical methods and more qualitative and descriptive methods to analyze the "data".

Needless to say, these remarks suggest that economists should not pretend to use the so-called scientific method, whether one uses this in a broad sense of using formal mathematical

models based on deductive methods, or in the more specific sense of testing falsifiable theories. There is no need to jettison mathematical modeling or statistical analysis, but there is no case for privileging these methods over others if one takes uncertainty seriously.

6. Normative issues

If taking uncertainty seriously implies that the use of the so-called scientific method, based on the value-fact dichotomy is called into question. We cannot choose between analytical approaches based only on the scientific method involving statistical analysis. We may need to bring into consideration many factors to weigh in on the usefulness and validity of different approaches and theories, and these factors can include normative considerations about what is good for society.

Many economists, of course, agree that normative issues are important, especially for making judgments about policies, but the standard method used for analyzing what is "good" is to use the notion of efficiency, which evaluates economic outcomes in terms of individual utility and the idea of Pareto optimality, according to which one should seek to improve efficiency by increasing the level of utility without reducing that of any other person, until such improvements are no longer possible and a Pareto optimal allocation is reached. Since it is not obvious what individual utility depends on, economists usually make the assumption that individuals are self interested and like more goods rather than less, and these assumptions have the clearer implication that efficiency requires maximizing the "economic pie", that is, getting much output as possible. It is not incorrect to say that economists are obsessed by the notion of efficiency. Many do, of course, concern themselves with issues of fairness involving the distribution of

utilities, income and goods, but do not wish to compromise efficiency (too much) to improve equity.

There are, of course, many problems with this approach to examining normative issues in mainstream neoclassical economics, but some problems are related directly to taking uncertainty seriously, which can suggest approaches alternative to the mainstream one.

First, the approach emphasized in mainstream economics is the consequentialist one – that is, goodness refers to what actually happens in the economy in terms of outcomes. If we take uncertainty seriously then we cannot be concerned only with consequences, because these consequences are contingent on processes which involve uncertainty, and there is no clear relationship between individual, group and societal actions and institutions on the one hand, and outcomes. Outcomes are clearly beyond our control, even in a statistical sense. Taking uncertainty seriously requires more attention to virtue and deontological ethical positions.

Second, even if attention is given to consequences, as it should – the argument made in the previous comment was about giving sole importance or even primacy to consequentialist ethics – it is unwise to examine the consequences on terms of one concept, that of individual utility or (in one takes fairness into account) social welfare functions, or even the value of total output. While this case can be made on a number of grounds, uncertainty provides an important reason. The existence of uncertainty implies that the relationship between different things is not actually deterministic or even systematic in a statistical sense, so that focusing on one consequence or consequences in terms of one metric can be problematic, because we may have reason to value a number of different "indicators". An approach which is alternative to one which focuses only on utility may be one which looks at three or four "indicators" such as the

growth rate, the unemployment rate, and the distribution of income. We may add other things we may value but the relationship of which to other things may be of a highly uncertain nature, such as the state of the environment (rather than simply taking into account the value of the environment in terms of output or utility. It is also possible that we can add "indicators" which we need not value instrinsically but which we may believe instrumentally affects other things we value intrinsically, such as the level of foreign debt or consumer debt of a country. This method of examining consequences by relying on a few instruments which are in principle measurable is close to the approach of Keynesian macroeconomists and arguably in line with Keynes's own ideas about ethics (see Brandolini, 2011).

Third, taking uncertainty seriously can lead us to rethink the focus economists focus on efficiency, reducing its importance as something which is "good". There are a number of separate but related reasons for this. One, the idea of efficiency, with its relation to individual utility levels as an input into evaluation, presupposes that individuals are actually "rational" optimizers, and that their utility functions can be used for the three purposes of analyzing individual choices, measuring the subjective well-being of individuals after they make choices, and as an input into societal judgments about what is good. If, as we have argued, the existence of uncertainty means that individuals do not even choose in a "rational" manner, it is not clear how one can use these choices to draw inferences about what is socially desirable. Two, the focus on efficiency implies that we take particular positions on the firing of "redundant" workers, on "rationalization" of firms for the sake of efficiency, changing institutions such as the degree of "rigidity" of markets, and in favor of technological change. The existence of uncertainty, with its implications that the economy typically has unemployed or underemployed resources, and the level of underemployment depends on aggregate demand, it is not at all clear

that the focus on efficiency is a good thing for efficiency (in the sense of increasing the social pie). Laying of redundant workers and making labor markets more flexible, for instance, may have the effect of increasing uncertainty and reducing aggregate demand, and thereby reducing aggregate output and employment.

Fourth, taking uncertainly seriously implies that economists should focus more on other things which are good, such as exposure and resilience to shocks and distributive justice. Exposure and resilience to shocks relates more to deontological concerns, but also has consequentialist and even utility effects if adverse shocks occur. They refer to exposing the economy to few shocks and allowing the economy to suffer less due to shocks while their effects last and also to be able to rebound after shocks. If the economy is exposed to these shocks they will have adverse consequences on people if adverse shocks in fact occur (even extremely adverse effects, especially among the poor in poor countries who live in precarious situations) and can even have adverse conditions on how people feel in terms of subjective wellbeing if they are exposed to such shocks. It is possible and even likely that attempts to increase efficiency can result in problems in terms of the exposure to, and occurance of, these shocks: for instance, increasing financial liberalization for the sake of efficiency, or making labor markets more flexible, or introducing technologies which increase average output levels but increasing uncertainty.

Distributional equality can be considered to be a more important goal of society because uncertainty severs the direct link between individual effort and individual choices on the one hand and individual incomes on the other. The idea of equality has a great deal of appeal to those who believe that unless there are good reasons to argue otherwise, it seems sensible to allow everyone to have a more or less access to resources that are important for their wellbeing.

However, ethical perspectives which take the desert perspective seriously can argue that it is unjust to insist on equality of resources if it leads to more deserving people – because of their greater contribution to society because of voluntary choices and greater efforts – and getting more. If we take uncertainty seriously it is not clear that we can argue that people and firms who do well do so entirely or mainly because of their "correct" choices or greater effort, because it is unclear, in an uncertain world what, in many situations the "correct" choices are, or whether it is greater effort that leads to higher income. Perhaps good judgment and good effort should be rewarded to some extent, but if uncertainty is important, it is much more difficult to justify the degree of inequality we have in many societies in terms of differential effort and better choices. This argument strengthens instrinsic argument in favor of an egalitarian perspective. There may also be

7. Policies

On policies, we confine our attention to a few comments of a general nature, rather than discussing the specifics of what kinds of policies are desirable.

First, policy-making in general should be interpreted more as an art than as a science or even engineering. Even if we analyze the economy in terms of precise mathematical models or econometric exercises, we cannot discover exact policy responses to problems and expect policies to have precise results. The models are no more than attempts to examine complex relationships and their implications using theoretical constructions which can help us to understand the main mechanisms at work. One should not expect them to predict what will happen if one or other parameter in the model is changed by policy. All we can do is understand what kinds of policies are likely to make it more likely in making some progress towards our goals. Unlike some policy makers we should not make precise predictions of how much output

will grow or unemployment will fall, and not be surprised too much if our expectations regarding results are not fulfilled. Of course, if the policies being adopted seem to fail repeatedly, we should be open to other ideas.

Second, the debate between those who are very suspicious of government activity for other reasons (perhaps some more or less vague conception of free markets promoting individual freedoms) and those who think of government policies as the panacea, is ill conceived. As just noted, government policies may not work as precisely expected, and frequent changes in macroeconomic policy may make the future more uncertain and create more instability. However, the expectation that unregulated free markets will solve macroeconomic problems and that more flexibility and less government intervention is better fails to take into account the well-worn issues of market failures, distributional problems and social problems, but also problems due to the existence of fundamental uncertainty and the fact that individual attempts to tame it, cope with it, and reduce it may not have socially desirable outcomes.

Third, policies should given greater attention to goals other than increasing the total pie or increasing efficiency, such as reducing the exposure of societies to adverse shocks, greater distributional equality and environmental improvements.

Fourth, it is problematic to discuss the efficacy of particular government policies in terms of the analysis of market failures as in the mainstream neoclassical approach. The approach has problems in devaluing the desirability of government interventions which may be necessary because individual optimization may solve the problems, and it can exaggerate the desirability of other interventions not only because they can increase uncertainty in the economy (as noted earlier) and have uncertain negative outcomes.

8. Conclusion

REFERENCES

Ariely, Dan (2008). *Predictably Irrational: The Hidden Forces That Shape Our Decisions*, New York: HarperCollins.

Boland, Lawrence A. (1981). "On the futility of criticizing the neoclassical maximization hypothesis", *American Economic Review*, 71, 1031-6.

Brandolini, Silva Marzetti Dall'Aste (2011). "Moral good and right conduct: A general theory of welfare under fundamental uncertainty", in Silva Martzetti Dali'Asate Brandolini and Roberto Scazzieri, eds., *Fundamental uncertainty. Rationality and plausible reasoning*, Houndmills, UK and New York: Palgrave-Macmillan, 294-330.

Carabelli, Anna M. (1988). *On Keynes's method*, New York: St Martin's Press.

Keynes, John Maynard (1921). *A treatise on probability*, London: Macmillan.

Keynes, John Maynard (1936). *The general theory of employment, interest and money*, London: Macmillan.

Keynes, John Maynard (1937). "The general theory of employment", *Quarterly Journal of Economics*, 51 (2), February, 209-223.

Knight, Frank (1921). *Risk, Uncertainty, and Profit*, Boston: Houghton Mifflin Company.

Lawson, Tony (1988). "Probability and uncertainty in economic analysis", *Journal of Post Keynesian Economics*, 11(1), Fall, 38-64.

Nishimura, Kiyohiko G. and Hiroyuki Ozaki (2007). "Irreversible investment and Knightian uncertainty", *Journal of Economic Theory*, 136, 668 – 694

Tversky, Amos and Kahneman, Daniel (1974). "Judgment under uncertainty: Heuristics and biases", *Science*, 185, 1124-1131.

NOTES

[1] The epistemological dimension just discussed is sometimes included in discussions of method, but the distinction is arguably an important and useful one and is worth emphasizing.

[2] One approach to dealing with Knightian uncertainty is to use an axiomatic approach and try to minimize the chances of the worst outcomes. See, for instance, Nishimura and Ozaki (2007) for the use of this approach. This view of decision-making under uncertainty, as opposed to probabilistic risk is used in the maximin approach (as in Rawls's theory of justice) and in realist international relations (prepare for the worst by preparing for war and increasing your military power). The discussion that follows takes this type of behavior as one possible type of behavior under uncertainty, which is similar to the behavior just discussed in the text, but not the only one.