The Current Crisis and the Culpability of Macroeconomic Theory

Paul Ormerod

October 2009[1]

Volterra Consulting

135c Sheen Lane, London SW14 8AE, UK

pormerod@volterra.co.uk www.paulormerod.com

1. Introduction

One of Keynes's most well known statements refers to the power of ideas. In his 1936 magnum opus, *The General Theory*, he wrote "practical men, who believe themselves to be quite exempt from any intellectual influences, are usually the slave of some defunct economist. Madmen in authority who hear voices in the air are distilling their frenzy from some academic scribbler of years back."

A great deal has been written about the role of 'practical men' in the current financial crisis, whether bankers, regulators or politicians. I focus here on the role of ideas, and specifically of ideas in economic theory.

It is the ideas at the heart of modern macroeconomics which provided the intellectual justification of the economic policies of the past 10 to 15 years. It is these ideas which the current crisis has falsified. The dominant paradigm in macroeconomic theory over the past 30 years has been that of rational agents making optimal decisions under the assumption that they form their expectations about the future rationally - the rational agent using rational expectations, or RARE for short.

This is not the place to set out a detailed critique of the RARE view of the world. The specific focus is on the way in which mainstream economics deals with risk and uncertainty. It is this which is at the root of the problems, both for the discipline of economics and, much more importantly, for the economy itself and the financial crisis.

[1] Expanded version of a paper presented to the Annual General Meeting of the British Academy of Social Sciences, London, July 2009. I am grateful to Bridget Rosewell, Geoff Hodgson, Brian Loasby, Bob Rowthorn and members of both the Academy of Social Sciences and the Accumulation Society for helpful comments

2. Risk and uncertainty: historical background

Some of the best known names in economic thought made an important distinction between risk and uncertainty. The person who formalised the distinction was Frank Knight in Chicago, his key book on the topic being published in 1921. Knight is much less well known than two other names I am about to mention, but of such stature that Milton Friedman described him as 'one of the most original and influential social scientists of the twentieth century'.

Knight essentially argued that the concept of risk applied in circumstances where we know, or at least have a very good idea of, the probability distribution of possible outcomes. But where our knowledge of this is imprecise or even absent altogether, uncertainty is the relevant concept. So, for example, placing money on a fair roulette table is risk. We know the exact probability of each of the various outcomes on which we can bet. Uncertainty would arise, for example, if we bet but not only did not know how many numbers there were on the wheel, but even whether the ball would be spun on it at all. The essential feature of true uncertainty is that it is incalculable, no matter how smart we may be. Practical situations may be closer to the uncertainty paradigm than to that of risk because, for example, we may have too small a sample of events to estimate a probability or, more generally, we have inadequate knowledge about the causal mechanisms involved in any given situation.

Keynes believed that uncertainty was the more important of the two, and that it was the key reason for the business cycle, the booms and busts of capitalism. In the *General Theory* he wrote: 'the outstanding fact is the extreme precariousness of the basis of knowledge on which our estimates of prospective yield [of a new investment] have to be made … If we speak frankly, we have to admit that our basis of knowledge for estimating the yield ten years hence of a railway, a copper mine, a textile factory, the goodwill of a patent medicine, an Atlantic liner, a building in the City of London amounts to little and sometimes to nothing; or even five years hence'. On a purely rational calculation, very few investments would ever be carried out, very few new firms started, since most such ventures fail. It is the irrational optimism of the investor, the entrepreneur, which enables them to happen, the belief that he or she has a better idea, a better concept, which is bound to succeed.

Hayek went even further believing that there are inherent limits to knowledge which no amount of intellect can overcome. His 1974 Nobel lecture, for example, is entitled 'The Pretence of Knowledge'. On this view, inherent and inescapable uncertainty pervades the economy. In many ways, Hayek is an intellectual precursor of modern complex systems theory.

Although Hayek has suffered a form of guilt by association in that his work has been cited approvingly by rational expectations theorists, his analysis of the business cycle is in many ways similar to that of Keynes – though they did differ over policy matters. Hayek certainly thought that general equilibrium should be the foundation of business cycle theory. However, the theory

had to be extended considerably in order to be able to explain the persistent fluctuations in aggregate output. Firms and governments operate in such a complex environment that not only are their expectations often proved wrong, but they are unable to learn sufficient from the past in order to avoid the same mistake in future. The level of uncertainty is so high that even the central bank cannot learn to offset expectations by changes in monetary policy in order to smooth out the cycle and restore equilibrium.

Modern macroeconomic theory failed in its appreciation of *both* risk and uncertainty.

3. Rational agents, rational expectations (RARE)

The appropriation by economics of the word 'rational' to describe the behaviour of agents – individuals, firms, governments – in its core view of how the world operates is a great propaganda coup. Who, after all, would want to be thought irrational, or even have the temerity to suggest models in which agents behaved irrationally?

As it happens, as noted above some of the greatest thinkers in economics such as Keynes and Hayek did not subscribe to the RARE view of the world. But such heresies have long been purged from the canon, and it is rare – in the normal English sense of the word – to meet a young economist who has read any of the works of these two economists in the original. It might also be added that virtually the entire discipline of psychology, to say nothing of much of anthropology and sociology, suggests that behaviour which approximates the RARE assumptions is at best a very limited special case of how humans really do behave.

Rational expectations do not require that an agent's predictions about the future are always correct. Indeed, such predictions may turn out to be incorrect in every single period, but still be rational. The requirement is that on average over a long period of time, expectations are correct. Agents are assumed to take into account all relevant information, and to make predictions which are on average unbiased. Deviations from perfect foresight in any given period are an inherent feature of this behavioural postulate, but such deviations can only be random. If there were any systematic pattern to the deviations, the agent would be assumed to incorporate the pattern into his or her expectations. Again, on average over a long period, such expectations are correct.

It will be apparent that the theory is difficult to falsify to someone who really believes in its validity. Even the most dramatic failure to predict the future, such as the 2008 financial crisis, can be explained away as a random error. A rational expectations enthusiast can still continue to maintain the correctness of the theory by simply assuming that over some (theoretically indeterminate) period of time, on average agents' expectations prove accurate.

An assumption of the theory is that, as part of the set of information being processed, the agent is in possession of *the* correct model of the economy. Indeed, on the logic of the theory itself, if the model being used to make predictions were not correct, the forecasts would exhibit some sort of bias, some systematic error, and agents would realise that it was wrong.

It might reasonably be argued that it is difficult to subscribe to the view that agents understand the correct model of the economy given that economists themselves differ in their views as to how the economy operates. For example, in the autumn of 2008, many prominent American economists, including a number of Nobel Prize winners, vigorously opposed any form of bail-out of the financial system, arguing that it was better to let banks fail. Others, including decision makers at the Federal Reserve and Treasury, took a different view entirely.

The response of the academic mainstream has been to insist that there have been strong moves towards convergence within the profession on opinions about macroeconomic theory, a theme taken up in section 5 below. By implication, anyone who takes a different view and is not part of this intellectual convergence is not really a proper economist.

But first of all, a discussion is merited on a real-life example of a model, widely used in finance by both practitioners and policy makers, which has not only been shown to be wrong, but has been known to be wrong for some considerable time. It is specifically wrong in the way in which risk is measured. And this incorrect assessment of risk played an important role in the financial crisis. So, in apparent complete contradiction to the RARE assumption that agents know the true model of the economy, a bad model was used in an absolutely critical sector of the economy.

4. Pricing risk: the fat tail problem

The value at risk (VAR) of any portfolio of financial assets is a measure of the potential loss on the portfolio over a specified time horizon. It has been, since the 1990s, in widespread use in financial institutions and regulatory bodies. A typical VAR calculation will estimate the amount of money at risk over the next day with a probability of either 1 per cent or 5 per cent.

It is a very seductive concept. Within minutes of the close of trading in London, say, or New York, the board of a company can be given a number which purports to give the amount of money at risk on the company's portfolio the next day with a specified probability.

The calculations essentially involve two steps. The first is the core of the approach. For an individual asset, the probability of the price the next day (or over any other chosen period) changing from the current price by specified amounts is calculated.

The second step then allows for any cross-correlations between the individual assets. A collection of assets may very well have less risk than any individual asset. Stock and bond prices, for example, tend to move in opposite directions. Harry Markowitz received the Nobel Prize in economics in 1990 for his work in this area, the so-called mean-variance analysis which is a key part of modern portfolio theory. As it happens, there are serious problems with the scientific validity of the usual way in which the cross-correlations are calculated (see for

example Laloux et.al. 1999 and Plerou et.al. 1999). But the focus here is on the way the probability of change in the price of an individual asset is calculated in most VAR systems.

This process seems to be a straightforward risk calculation. There is an enormous amount of data on which to calibrate the probability distribution of price changes of most assets. So it seems to be the same sort of problem as working out the probability of, say, shaking two sixes (or two fives or whatever) with a couple of fair dice.

In practice, it was widely assumed that price changes follow the normal, or Gaussian, distribution. For the most part, they do. When we examine the evidence and look at actual price changes, they seem to follow this well-known pattern. But there is a subtle and profound difference. The chances of seeing a one inch or 20 foot tall man are almost literally zero, because human heights (for each gender) are very well approximated across the entire distribution by the normal distribution. But the chances of seeing the share price equivalent of these are definitely not zero. The chances are not high, but they really do happen.

In the jargon, this sort of pattern is known as 'fat tails'. The further we move from the average, the more we get into the 'tails', in other words the parts of the distribution where the number of times we see such values is very low. We have the bulk of the price changes we observe in the 'body' of the distribution, as it were, and just a few examples in the tails, which are only thinly populated. With the normal distribution, this fades away quite quickly, so the 'tail' disappears in practice once we move a reasonable distance away from the average. If the tail is 'fat', it does not mean we see lots of examples of really big changes. But we do see more than we would if the pattern of changes really did follow this 'normal' distribution.

This may seem esoteric. Yet it is at the very heart of the financial crisis. Everything seemed just fine, and the money rolled in. Until one day, a 20 foot tall man appeared. An underlying price changes by an amount which is effectively ruled out by the assumption of normality. Almost all Value-at-Risk systems became worthless, as indeed did some entire companies when the 20 foot man appeared.

The phenomenon of 'fat tails' in price changes has been known since 1900, when Louis Bachelier presented his doctoral thesis in Paris. Admittedly, his work languished in obscurity for decades, but in the final quarter of the 20th century, evidence for the fat tail phenomenon began to pour in. The initial discoveries were by another French mathematician, based in America for much of his life, Benoit Mandelbrot (Mandelbrot 1963). During the 1990s, the stream became a flood as some of the world's most distinguished statistical physicists began to take an interest in financial markets. Gene Stanley at Boston and editor of the world class journal *Physica A*, Rosario Mantegna at Palermo, Jean-Philippe Bouchaud in Paris, Yi-Cheng Zhang at Fribourg, these plus a host of their fellow scholars and graduate students examined the data on price changes in financial markets. And they found fat tails literally everywhere. Far from being unusual, the exception, fat tails were the norm. Large numbers of top quality academic papers

became available on the Internet, each demonstrating the existence of fat tails in some particular aspect of financial markets.

Despite this overwhelming scientific evidence, fat tails were largely ignored in the financial markets. The result was that the potential for volatility, and in particular the potential for large changes in the prices of financial assets, was systematically underestimated. So here we have a model, used by the world's largest financial institutions, used by regulators, which was not just wrong, but known to be wrong. But even so, a true devotee of RARE might be tempted to argue that this was not a refutation of the theory, but evidence in its favour, because agents have now learned that the Gaussian assumption on the distribution of asset price changes is wrong!

5. Convergence and complacency in macro-economics

The intellectual challenges posed by the core model of conventional economics dominated the subject for 100 years from 1870 to the early 1970s. This is the so-called general equilibrium model, 'general' because the theory purports to describe how equilibrium – supply equal to demand – can arise not just in one or two individual markets, but generally across the economy as a whole, in *all* markets. The technical details need not concern us, but the intellectual and mathematical challenge of this problem was immense. No fewer than 7 out of the first 11 winners of the Nobel Prize in economics received it for their work on general equilibrium. Eventually, by the early 1970s, the problem had finally been solved completely.

I say 'completely' but it is important to realise that the theory in this guise related to an economy with a fixed amount of resources, whether of land, labour, energy or capital. The theory essentially told us about the optimal, the most efficient, allocation of a given set of resources. But it was about a static and not a dynamic, growing economy.

The major project of the past 30-odd years has been to try to use equilibrium theory and RARE to explain the dynamic fluctuations in output which have been observed in the developed, market-oriented economies ever since the Industrial Revolution[2]. Given that these fluctuations are persistent both over time and across countries, they represent a serious challenge to a *Weltanschauung* based on the concept of equilibrium.

The first major attempt was 'real business cycle' (RBC) theory, developed in the 1980s. RBC has been very influential in mainstream economics, with its seminal authors Finn Kydland and Edward Prescott receiving the Nobel Prize in 2004.

According to this theory, periods of high or low growth– the booms and busts of everyday parlance – are initiated by random shocks to the economy. There are many problems with this

[2] A statistical classification of the size and duration of recessions under capitalism since 1870 is given in Ormerod (2009)