

Risk, Uncertainty and Financial Stability

**By
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2008 Shackle Lecture

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My first-ever essay into quasi-independent research involved an attempt to understand, explain and even possibly extend G.L.S. Shackle's model of decision-making under uncertainty. Undergraduates at Cambridge who had done well in Part 1 of the Economics Tripos were encouraged to participate in a joint student/Faculty seminar, called – as I recall – the Monday Club, and each Monday evening of term one of the undergraduates, chosen by drawing lots, was expected to present a paper. Anyhow when I drew my turn, I constructed a three dimensional graph, out of green plasticine, of Shackle's focus gain and focus loss, potential surprise, and all that. I recollect that the marks for technical merit were higher than those for artistic ability. The approximate date of that presentation was November 1958.

So it is for me fitting that some 50 years on, towards the close of my career, I am once again turning to a discussion of George Shackle, and some aspects of his contribution to economics. But, although I have always found Shackle's writing and thoughts to be entrancing and compelling, I am not myself a scholar of Shackle's place in the history of economic thought. Rather, the reason that I, and I would guess that many of you, are here this evening, is because of Stephen Frowen, who was instrumental in establishing the Shackle Foundation, for organising the Shackle lecture series, and for asking me to give this particular lecture.

Stephen, and his wife Irina, both died, the one shortly after the other, this winter. They had extraordinary and disturbed early lives, with Irina fleeing Russia, and Stephen catching both diphtheria and then severe tuberculosis as a medical orderly in a German army hospital. As Shackle himself put it, Stephen was a “gentle and quiet scholar” who “has shown himself a man of steel in face of the difficulties which this turbulent and restless century has thrown in his path.”² Not that his life afterwards became trouble free, with first his difficulties in breaking into British academic circles and then the tragedy with his only son Michael.

Anyhow Irina, and then Stephen after their marriage, migrated to this country, where they both became naturalised British subjects. Stephen, having studied economics at

¹ The author(s) wish to thank the Economic and Social Research Council for its support under research grant RES-156-25-0026.

² Shackle, G.L.S., 'Foreword' in P. Arestis (ed.), *Contemporary Issues in Money and Banking – Essays in Honour of Stephen Frowen* (London: Macmillan, 1988), pp ix-x, repeated by N. Kloten in his paper on 'Stephen Frowen – an Inspired Mediator in Turbulent Times', in J. Holscher (ed.) *50 Years of the German Mark*, (Basingstoke, Hants., UK: Palgrave, 2001), pp xxiv-xxxi, quoted on p. xxvi.

various German universities, though much disrupted by the war, moved into financial journalism in this country, first as Assistant Editor and then as Editor of *The Bankers' Magazine* between 1954 and 1960. From there he moved into academic life, which was, patently, his true vocation. Much of the early correspondence with Shackle involved Stephen's attempts to obtain academic positions, much assisted by Shackle's continuing support. As I review my own tendency to wince when I get yet another letter asking me to write a letter of reference, I can appreciate the gentle kindness that Shackle maintained.

Frowen's primary subject was Monetary Economics, and within that he took on the role of trying to explain German monetary policy to the British and UK monetary policy to the Germans. I think that I first met him in 1975, when as senior lecturer at the University of Surrey he organised a conference on 'Monetary Policy and Economic Activity in West Germany'. As Hans Tietmeyer, the then President of the Deutsche Bundesbank, said in an after-dinner speech, or 'Laudatio on the Occasion of the 75th birthday of Professor Stephen Frowen',³ at which I was honoured to be present,

His endeavours to bring about a better mutual understanding particularly of German and British monetary policy is attested by his academic work. Other evidence is his activity as an editor of several collected editions which serve this purpose, and particularly his efforts in bringing about a personal exchange of Britons and Germans, which was officially recognized by the award of the German *Grosses Bundesverdienstkreuz*, the Grand Cross of the Order of Merit of the Federal Republic of Germany, in 1993.

But you will see in the picture of Stephen, that I have shown, that he is wearing the insignia of yet another honour. Stephen was, himself, a deeply religious man, concerned about the relationship between ethics and economics. I cite his Chapter on 'International Economics as an Empirical Testing of Adequacies in Catholic Social Teaching', and the 1995 book, jointly with his friend and colleague the Reverend Francis McHugh, on *Financial Decision Making and Moral Responsibility*.⁴ For this, and his work as a senior member of the Von Hügel Institute here at this College, Stephen was awarded a Knighthood of the Pontifical Order of St. Gregory the Great by Pope John Paul II in 1996. For further testimony on Stephen, let me recommend his obituary in *The Independent* (January 10, 2008), and the moving tributes at his funeral, which his daughter Tanya Hosburn has made available.

But the reason why we are all here tonight is because of the third main focus of Stephen's work, his friendship with Shackle and his admiration and appreciation of G.L.S. Shackle's economic work and ideas. One of Stephen's books was an edition of a conference in honour of Shackle, a second was a selection of Shackle's own papers, a third was a collection of essays in memory of Shackle, and a fourth was the correspondence between himself and Shackle, entitled *Economists in Discussion*, a correspondence which continued over 40 years, between 1951 and 1992.

³ Reprinted in *50 Years of the German Mark* (ibid), pp xx-xxii, quoted on p. xxii.

⁴ See 'Stephen Frowen: Bibliographical Data', from *50 Years of the German Mark* (ibid), pp 203-212.

Stephen was my friend, and I could go on about him at considerably greater length, but I have already had a chance to do so, when I gave the Keynote Speech at the Conference in 1998 on *50 Years of the German Mark: Essays in Honour of Stephen F. Frowen*, published by Palgrave in 2001. Moreover, this is a Shackle Lecture, and I really should move on to the main subject of my lecture.

Shackle's main fields of interest were *Expectations in Economics*, the title of a collection of his early essays, and decision-making under uncertainty. In this, the main subjects of his criticism were the views that humans either could, or would, be able to estimate a probability distribution covering all possible outcomes, i.e. with the probabilities summing up to one, and then decide on a line of action that would maximise expected utility. A major problem with this was that it simply shifted the assumption of certain knowledge up one level, from assuming knowledge of all outcomes to assuming knowledge of the probability distribution of all outcomes; whereas in most actual cases the range, and probability, of future outcomes were unknown and unknowable. Of course, as Shackle admitted, there were a few cases where the data generating process could be sensibly assumed to be stationary, and the time series long enough, to estimate the true moments of the generating process, so that future outcomes could be predicted, relatively confidently, from the past. While this might be the case for many natural phenomena, from tossing coins to predicting the timing of tides and sunset, it is far less true of economic phenomena.

I have not tried to re-enact my plasticine model of Shackle's focus gain and loss. Few economists now remember the technical details of Shackle's proposed alternative construct. But what is remarkable is how close some of the modern proponents of behavioural finance and of the psychology of decision-making come to re-inventing several of Shackle's ideas with, alas, often little appreciation that he had largely got there before them.

For example there is a current, excellent book that I can recommend, by Riccardo Rebonato, whose sub-title, 'Why we need to manage risk differently', is more informative than its main title, 'Plight of the Fortune Tellers'. Incidentally the fortune tellers of this title are actually those who try to estimate a complete probability distribution of potential outcomes and then take a decision which maximises expected utility, whom Rebonato describes as 'frequentists'. Anyhow Rebonato ends, having attacked the frequentist approach, by suggesting in his concluding Chapter how a financial trader *should* make a decision. I quote (pp 244 and 246):

We are now ready to move from these key indicators of how much risk our trade has and about the nature of this risk to the choice we ultimately want to make. As I said, I strive in this respect for a cognitively resonant set of decisional crutches. "Cognitively resonant" means that these decisional tools should use the risk dialect that speaks most directly to the way human beings understand, perceive, and constructively interact with risk.

An important step in achieving these goals is defining the "worst plausible" and the "best plausible" scenarios. The terms immediately suggest that we are firmly in subjective-probability land: a worst plausible scenario, for instance, is the set of events that both the risk manager and the "trader" agree could indeed occur with sufficient probability *that they are worth worrying about*. It is

the action (the "worrying," the setting of a limit, the buying of some protection insurance) that determines the critical level of probability, not the other way round. It is the amount of insurance paid, or of profit foregone, to avoid a negative event that shows its implied subjective probability. ...

The mirror image of the worst plausible scenario is, unsurprisingly, the best plausible scenario. Identifying the worst plausible scenario is intuitive enough. But why would we want to look at the best plausible scenario as well? When we undertake a best-scenario analysis we already have in the back of our minds how much "risk" (variance, skewness, fat-tailedness, etc.) the trade has. What is all this risk for? There is no single answer, but we can try to estimate how much better than the expected return we can hope to fare if everything turns out in the best (plausible) way. If we find that such a best plausible outcome is worryingly close to what we have assumed for our expected return, we may want to pause for thought. If it is *worse than* our expected outcome, we certainly have a problem.

This is, indeed, almost pure Shackle, some 60/70 years after he made an almost identical proposal, but without, alas, any reference.

There is much current work on behavioural finance and the psychology of decision-making that dismisses, and attacks, the standard rational decision-making paradigm. Let me give you another nice example from Gerd Gigerenzer's book, entitled *Gut Feelings*.⁵ Let me quote (pp 54-55):

Marriage consultants often disapprove of people who marry the first or second partner they are engaged with, rather than looking systematically for more alternatives and experience in making such an important decision. Likewise, economists complain about the limited rationality in partner choice. When I hear similar criticisms, I ask the narrator how he found a partner. "Oh, that was different!" he tells me, and relates a story of an accidental meeting..... To date I have met only one man, an economist, who responded that he followed the Benjamin Franklin method to choose a partner. He sat down with a pencil and listed all the possible partners he could think of and all possible consequences he could imagine (such as whether she would still listen to him after being married, take care of the children, and let him work in peace). Next he put a number on the utilities of each consequence and then estimated the probabilities that each might come true. Finally, he multiplied the utilities with the probabilities and added them up. The woman he proposed to and married was the one with the highest expected utility, though he didn't tell her about his strategy. By the way, he is now divorced.

There are many behavioural finance theorists, such as for example Thaler, and also modern utility theorists, who use psychological findings and experimental methods to discover how people actually do make decisions. Perhaps the leading exponent of this work is the Nobel Prize winner, Daniel Kahneman. Some, but not all, aspects of their work was prefigured in Shackle's introspective assessments of how decisions are made. For example, in a recent paper on 'Interpretations of Utility and their

⁵ (London: Allen Lane, Penguin Group, 2007.)

Implications for the Valuation of Health',⁶ Paul Dolan and Daniel Kahneman note that "valuations [of trauma] are likely to be affected by a 'Peak-Start Rule' (Dolan and White, 2006), where respondents focus on the peak loss and the immediate loss (which in most cases are likely to occur at the same time)" (p. 223), and again, when talking about recollections of operations (p. 226), they note that,

respondents' memories of the experience were influenced primarily by the most painful moment of the procedure and the level of pain at the very end of the procedure: the duration of the procedure was largely ignored. Therefore, it appears that patients use a "Peak-End Rule", which ignores the full set of experiences and how long these experiences last (Kahneman *et al.*, 1997).

Now, as some of you may already have inferred, this is not a field in which I have done any work myself. Rather my point here is that the Shackle Foundation should invite one of those who have worked in this area to give a future lecture on Shackle as a forerunner of current ideas, and a prophet before the time was ripe. Most of this work emanates from the USA, and Shackle is not so widely known there.

Before I move on I cannot resist noting some *obiter dicta* from the same Dolan/Kahneman article which throws some light on the current fashionable school of thought that avers that the proper objective of policy is to maximise people's happiness, a position that I do not share. Let me again quote (pp 228-9),

For [various] reasons, satisfaction ratings may not provide the best proxies for the kind of experienced utility we have in mind here, and we instead need to develop measures of (or better approximations for) utility on a moment-to-moment basis. Experience sampling methods (ESM) (Stone *et al.*, 1999) and the day reconstruction method (DRM) (Kahneman *et al.*, 2004) provide promising ways of doing this.....

The DRM has been developed to overcome these problems, and asks respondents to divide the previous day into a number of episodes and then to rate different elements of affect during those activities on a 0-6 scale. Using this method, Kahneman *et al.* (2004) show that one of the biggest determinants of good feelings is sleep quality, whereas marital status and income have much smaller effects.

So clearly governments keen on maximising happiness should subsidise beds, pillows, sleeping pills and evening Horlicks. I cannot resist, however, noting that one of my daughters would have married a man, had he not snored so badly.

But let me turn to more serious matters. My concern with both Shackle's and the rational decision-making approach to the question of decision-making under uncertainty is that both focus too much on the single individual, ignore the time, effort and wear of decision-making, and make the implicit assumption that we are, in our decisions, playing a game against nature, not against each other. Let me turn first to my first two qualifications, that we are not isolated Robinson Crusoes but social animals, and that we mostly try to avoid having to make decisions. So what we mostly

⁶ *Economic Journal*, 118 (January 2008), 215-234.

do is to ask others for their advice. Indeed one of the main functions of professionals is largely to provide such advice.

Some of you may have seen the article on Science and Technology in *The Economist* (January 19, 2008), entitled 'Hitting the Spot', which reviewed some

research published in the *Proceedings of the National Academy of Sciences* by Antonio Rangel of the California Institute of Technology. Dr. Rangel and his colleagues found that if people are told a wine is expensive while they are drinking it, they really do think it tastes nicer than a cheap one, rather than merely saying that they do.

Dr Rangel came to this conclusion by scanning the brains of 20 volunteers while giving them sips of wine. He used a trick called functional magnetic-resonance imaging, which can detect changes in the blood flow in parts of the brain that correspond to increased mental activity....

The scanner showed that the activity of the medial orbitofrontal cortices of the volunteers increased in line with the stated price of the wine. For example, when one of the wines was said to cost \$10 a bottle it was rated less than half as good as when people were told it cost \$90 a bottle, its true retail price....

Nor was the effect confined to everyday drinkers. When Dr Rangel repeated the experiment on members of the Stanford University wine club he got similar results. All of which raises the question of what is going on.

There are at least two possibilities. The point of learning is to improve an individual's chances of surviving and reproducing: if the experience and opinions of others can be harnessed to that end, so much the better. Dr Rangel suspects that what he has found is a mechanism for learning quickly what has helped others in the past, and thus for allowing choices about what is nice and what is nasty to be made speedily and efficiently. In modern society, price is probably a good proxy for such collective wisdom.

My second reference on this point comes again from Gigerenzer's book (pp 217 and 219). Let me again quote:

If you ever opened a book on decision making, you have likely run across the idea that the human mind is an ever-busy accountant of pros and cons making dozens or even hundreds of decisions a day. Wouldn't it be more realistic to ask how people can avoid making decisions all the time? No mind or machine should try to make all decisions by itself, given the limited information and time at its disposal. Often it is reasonable to ask for others' advice, or not to ask at all but simply to imitate their behaviour..... As children, we imitate what Mom and Dad eat and how they talk; later in life we follow public and professional role models. Imitation is not simply a shortcut for deliberate decisions when one has little knowledge and time, but is one of the three processes – the others being teaching and language – that allow for the vast cultural transmission of information over generations....

Imitation can also pay in situations with dangerous consequences. Food choice is a case in point. Relying only on individual experience to learn which berries found in the forest are poisonous is obviously a bad strategy. Here, imitation can save your life – although it may cause false alarms....

When is imitation futile? As mentioned before, when the world is quickly changing, imitation can be inferior to individual learning. Consider a son who inherits his father's firm and copies his successful practices, which have made a fortune over decades. Yet when the environment changes quickly, as in the globalization of the market, the formerly winning strategy can cause bankruptcy. In general, imitating traditional practice tends to be successful when changes are slow, and futile when changes are fast.

Let me take that last insight back into macro-economics. Much attention has been given to the weight to be placed on forward-looking expectations. Without exception, as far as I am aware, the implicit assumption is made that this weighting is constant over time, and empirical estimates are made on the basis of an undifferentiated, single, whole data period. Instead, as my last quote underlined, the proportion of forecasters should rise at times when the return to forecasting increases, that is, at times of change and volatility. Equivalently when the system appears normal and stable, simple heuristics like 'next year will be much like last year', or in my own case, 'Martin Wolf of the FT is always right' will predominate.

As Paul de Grauwe stated in a current paper⁷,

In general the cognitive problem agents face leads them to use simple rules ("heuristics") to guide their behaviour. They do this not because they are irrational, but rather because the complexity of the world is overwhelming. In a way it can be said that using heuristics is a rational response of agents who are aware of their limited capacity to understand the world. The challenge when we try to model heuristics will be to introduce discipline in the selection of rules so as to avoid that "everything becomes possible".

Paul's model of a 'heuristic' system has the agents uncertain about which of two models is correct, and switching between models dependent on which would have given a smaller forecasting error in the previous period. But this switching process itself generates endogenous cycles, and swings in the economy that appear driven by mood changes between optimism and pessimism, akin to swings in Keynes's 'animal spirits'. Surely I do not have to describe how this same consideration both leads to, and can account for, phenomena such as herding and cascades of decisions.

Although, for my tastes, Shackle's analysis of decision-making focussed too much on the isolated (Robinson Crusoe) individual (rather than the individual within a broader society, in contact with many others faced with similar decisions, with professional (and amateur) advice easily available -- indeed a welter, or cacophony, of advice -- and with numerous role models to hand), he would, I think, have been broadly

⁷ 'The Scientific Foundation of DSGE Models', Working Paper prepared whilst at the ECB (December 2007).

sympathetic to this line of argument. In particular, he much preferred the Keynes of fuzzy animal spirits to the Keynes of quantitative probability theory.

Thus in *Keynesian Kaleidics*,⁸ pp 37-9, Shackle includes the following long passage, which I could not find it in my heart to cut, so splendid is the English prose of both Shackle and Keynes.

Keynes's dealings with uncertainty, with the essential plurality of answers which a man (if he is reasonable and cautious) is obliged to entertain concerning any question where the evidence is not unique in meaning, complete and conclusive, are bound to engage our curious attention. From the author of *A Treatise on Probability*,⁹ the earliest of all his books, we might expect a close and ingenious study of how, out of an insufficiency of knowledge, rational, logically defensible guidance can be obtained. In the *General Theory*¹⁰ there is nothing of the sort. And in that 'third edition', that ultimate distillation of the *Treatise*¹¹ and the *Theory*, which Keynes wrote in the *QJE*¹² in answer to his critics, there is something wholly different. There he tells how men deliberately and consciously, but with a powerful faculty of make-believe blind themselves to the fact of the unknown and unknowable future which lies only a little way out (in proportion to the human span) from our 'present moment', how they make life practicable and endurable by a convention:

How do we manage in such circumstances to behave in a manner which saves our faces as rational economic men? We have devised for the purpose a variety of techniques, of which much the most important are the three following:

- (1) 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.
- (2) 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 until something new and relevant comes into the picture.
- (3) Knowing that our individual judgement is worthless, we endeavour to fall back on the judgement of the rest of the world, which is perhaps better informed. That is, we endeavour to conform with the behaviour of the majority or the average. The psychology of a society of individuals each

⁸ (Edinburgh University Press, 1974), pp 37-39.

⁹ (London: Macmillan, 1921)

¹⁰ Keynes, J.M., *The General Theory of Employment, Interest and Money*, (London: Macmillan, 1936).

¹¹ *A Treatise on Money* (London: Macmillan, 1930).

¹² 'The General Theory of Employment', *Quarterly Journal of Economics*, 51 (February 1937), 209-223.

of whom is endeavouring to copy the others leads to what we may strictly term a conventional judgement.

Now, [Keynes proceeds,] a practical theory of the future based on these three principles 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.

It has long appeared to me that Keynes's expositors, commentators and critics either contrive, for the sake of their peace of mind, to leave this passage unread, or else they turn aside as men who have looked over the edge into the abyss and must endeavour to blot this dreadful vision from their mind. For this passage pronounces the dissolution of the view of business conduct as rational, as the application to men's affairs *of fully-informed reason*. Yet it is the assumption that men act by fully-informed reason that underlies the whole of value-theory; that underlies what, until forty years ago, was virtually the whole of economic theory. What is General Equilibrium, if not the outcome of a carefully-organized pre-reconciliation of rational choices? When Keynes was alive, economists had opportunities of hearing what he said, but they did not believe he really meant it. 'Equilibrium is blither' he once orally remarked. Could value-theorists be expected to understand? Keynes was not, I believe, disparaging the force and beauty, the logic, ingenuity and encompassing power to unify and simplify the economic scene, which General Equilibrium possesses. He was saying, in effect, that the world thus illuminated is an artificial, abstract and remote conception, the mere profile of a shadow of reality, entirely misleading if we take it to be the whole truth.

At this juncture I am going to indulge myself, and I hope you as well, by repeating Shackle's comments on the application of 'rational expectations'.¹³

'Rational expectations' remains for me a sort of monster living in a cave. I have never ventured into the cave to see what he is like, but I am always uneasily aware that he may come out and eat me. If you will allow me to stir the cauldron of mixed metaphors with a real flourish, I shall suggest that 'rational expectations' is neo-classical theory clutching at the last straw.

Observable circumstances offer us suggestions as to what may be the sequel of this act or that one. How can we know what *invisible* circumstances may take effect in time-to-come, of which no hint can now be gained? I take it that 'rational expectations' assumes that we can work out what *will* happen as a consequence of this or that course of action. I should rather say that at most

¹³ Taken here from Appendix 2 of *Economists in Conversation*, p. 333.

we can hope to set bounds to what *can* happen, at best and at worst, within a stated length of time from ‘the present’, and can invest an endless diversity of possibilities lying between them.

As the more astute of you may already have noted, I seem to have slipped, perceptibly, from criticism of Shackle to an appreciation that he did understand that most of us use short-cuts in a social context to avoid the pain and effort of decision-making.

Let me, therefore, move on to my final ground of criticism that is, perhaps, more firmly based. This is that Shackle tended to view decision-making as a game against nature, not a game against other people, or to put it more shortly that our decisions affect the outcomes. This is not like weather-forecasting where my decision to take an umbrella with me does not affect the probability of rain-fall, *despite* my intuitive belief that taking out insurance is as much a mechanism for stopping bad events happening as for getting paid when they do. Although my individual decision will have very little effect on aggregate economic developments, we tend, as social animals, to respond in similar ways to stimuli, and when we therefore move together as a herd, markets, if not the earth as a whole, tremble.

Let me take a nice example from a recent paper by Andy Lo and one of his graduate students at MIT, entitled ‘What happened to the Quants [quantitative investment analysts] in August 2007?’¹⁴ When there is an excess of buy, or sell, orders on the stock market, the counter-party providing the other side of the trade has to be recompensed for both risk and loss of liquidity. So strong high-frequency movements in share prices tend to go too far. In consequence quant funds could identify and profit by observing and counter-acting such overshoots. Because this strategy was profitable, many additional funds crowded into it; it became a crowded trade. That resulted in a

near-monotonic decline of the expected returns of this strategy, no doubt a reflection of increased competition, changes in market structure, improvements in trading technology and electronic connectivity, the growth in assets devoted to this type of strategy, and the corresponding decline in U.S. equity-market volatility over the last decade. In 1995, the average daily return of the contrarian strategy for all stocks in our sample is 1.38%, but by 2000, the average daily return drops to 0.44% and the year-to-date figure for 2007 (up to August 31) is 0.13%.

What happened then, Andy Lo thinks, is that one of the hedge funds playing this game decided to liquidate, possibly for an extraneous reason, such as a need to raise cash in a difficult market. But almost by definition it is holding exactly the same assets as all the other quants, so it is now selling (buying) the identical assets that the other quants are buying (selling). So for a day, or two, the quant strategy makes a huge loss, not a small gain. That in turn leads to risk-abatement measures kicking in which further penalise the holdings of that strategy, driving the chosen asset prices even further from equilibrium, and causing those prices to deviate many standard

¹⁴ A.E. Khandani and A.W. Lo, MIT Working Paper, November 4, 2007.

deviations from par. Only after a few days, when such amplifying mechanisms had been exhausted, did prices of those selected assets bounce back to equilibrium.

Whenever anyone finds something profitable to do, whether it be building canals and railways, joining the IT start-up rush, participating in the carry-trade, or lending on sub-prime mortgages, others will enter and emulate; the project will become overcrowded, behaviour will become less restrained, and crashes will occur. We know that such endogenous risk exists. Why do not more contrarians exist to pick up the pieces when such crashes occur, and thereby limit the extent of such crashes? One problem is that a contrarian faces a steady stream of small losses in the hopes of making a huge ultimate gain, but, since outsiders cannot distinguish whether a stream of small losses reflects prudence or stupidity, the contrarian tends to get fired before she is proved right. One requirement for being CEO of Citigroup appears to be that of coining memorably wrong-headed phrases. Who will forget Chuck Prince's saying, 'While the music plays, we dance. The music is still playing.'

The point that I am trying to make is that decision-making under uncertainty is perhaps even more difficult than Shackle expounded. Since we are a social animal the tendency will be for us to think and decide much as everyone else. But if we, and everyone else, are taking similar decisions, and perhaps at the same juncture, that can lead to large jumps, discontinuities in outcomes. All that has been very evident recently in financial markets, and has been the subject of much of my own current work and interest.

Finally let me turn towards my own special subject. What are the implications of all this for financial regulation? The first key point is that probability distributions, whether derived from past history or from models, such as the over-used Value at Risk (VAR) metric are largely useless for regulatory concerns, as contrasted with running normal business activity, where they are fine. Financial regulation is concerned with the risk of extreme events. Given the unknowledge of the future, combined with the endogenous risk, herding and imitation of the present moment, market moves which according to a normal probability distribution should only happen once in a millenial blue moon will tend to occur once every ten years, or even more often. In this context the past is sometimes less of a guide to the future than is our imagination; and our imagination is limited.

The motto should be that in such circumstances we should keep financial regulation simple, try to make it as counter-cyclical as possible, and attempt in the stress test exercises that we run to take proper account of endogenous risk, that is of herd-type behaviour. It almost goes without saying that this is almost the opposite of the direction that the regulatory community took in designing Basel II. If the financial regulators had spent more time reading Shackle, and, I would like to add, also the works of my colleagues at the LSE Financial Markets Group, notably Hyun Shin and Jon Danielsson, they might have made less of a mess of it. Let us hope that better sense may prevail in future! However I have been going on too long.

Let me appropriately close with Shackle's final paragraph in his paper on his own career, entitled 'A Student's Pilgrimage'¹⁵,

¹⁵ (Edinburgh University Press, 1974).

I think that there are two kinds of economics. One of them aims at precision, rigour, tidiness and the formulation of principles which will be permanently valid: an economic science. The other is, if you like, rhetorical. This word is often used disparagingly, but that is a modern unscholarly abuse. The rhetorician employs reason and appeals to logic, but he is a user of language at its full compass, where words are fingers touching the keyboard of a hearer's mind. I do not believe that human affairs can be exhibited as the infallible and invariable working of a closed and permanent system.¹⁶

¹⁶ From S.F. Frowen (ed.) *Business, Time and Thought: Selected Papers of G.L.S. Shackle* (New York University Press, 1988), 'A Student's Pilgrimage', originally published in the *Banca Nazionale del Lavoro Quarterly Review*, no. 145, June 1983, pp 107-16, here on p. 239.