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Edited by G.C. Harcourt and P.A. Riach



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IS THERE A PLACE FOR RATIONAL EXPECTATIONS IN KEYNES'S *GENERAL THEORY*?*

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EXPECTATIONS IN *THE GENERAL THEORY*

It is a commonplace that what is widely known as 'Keynesian' economics is not the economics that John Maynard Keynes develops in *The General Theory of Employment, Interest and Money*. In one of the many ironies of the history of economic thought, the new classical macroeconomics attacked 'Keynesian' economics – and is widely regarded as having dealt both it and the economics of *The General Theory* a body blow – over its treatment of expectations (see, for example, Lucas and Sargent 1979). Yet nowhere do hydraulic Keynesian models and their econometric successors differ from *The General Theory* more than in their treatment of expectations.¹

Where expectations are either ignored or modelled by simple extrapolative devices in the macroeconometric models of the 1940s to 1970s, they command centre-stage in *The General Theory*. Of the three principal functions of Keynes's analysis of aggregate demand, two depend essentially on expectations. Keynes's investment schedule depends upon the comparison of the market rate of interest with the marginal efficiency of capital – that is, of the discount rate that makes the *expected* stream of future revenues equal to the current supply price of capital goods (Keynes 1936: ch. 11; hereafter abbreviated to *G.T.*). His liquidity preference function is the aggregation of individual liquidity preferences, which depend, in turn, after accounting for money required for transactions purposes, on whether individuals *expect* interest rates to fall, producing *expected* capital gains and a preference for bonds, or to rise, producing *expected* capital losses and a preference for money (*G.T.*: ch. 13). The consumption function, the third member of the Keynesian triumvirate, is usually – and not incorrectly – thought to depend principally on current income. Even so, Keynes carefully analyses the importance of *expected* future incomes and *expected* capital gains on current consumption (*G.T.*: ch. 8). It would not be misleading to say that he anticipated the permanent-income and life-cycle hypotheses. Expectations are important elsewhere in *The General Theory*. For example, Keynes argues that flexible money wages will not necessarily clear the labour market

because of perverse expectations in which cuts in the market wage generate a belief that further cuts are likely (*G.T.*: ch. 19, esp. p. 263).

Keynes distinguishes between *long-term* and *short-term* expectations (*G.T.*: 46–7). The distinction mirrors Marshall's distinction between the long run, in which factors of production are all variable, and the short run, in which the firm's capital equipment is fixed. Keynes argues that an entrepreneur consults his long-term expectations in determining the amount of his investment in plant and machinery, and consults his short-term expectations in determining the scale of his current output.

Macroeconomic equilibrium for Keynes is defined using short-term expectations: '[T]he aggregate supply price of the output of a given amount of employment is the *expectation* of proceeds which will just make it worth the while of the entrepreneurs to give that employment' (*G.T.*: 24, emphasis added). Similarly, the aggregate demand function relates the number of men employed to the proceeds entrepreneurs *expect* to receive from their employment (*G.T.*: 25). The intersection of the aggregate supply function and the aggregate demand function determines the point of effective demand, which is the 'point [at which] the entrepreneur's *expectations* of profits will be maximised' (*G.T.*: 25, emphasis added). The point of effective demand is an equilibrium since firms have no incentive to alter the scale of their output or employment.

Although the point of effective demand is a short-run equilibrium, it is long-term expectations that do the work in determining aggregate demand. It is the long-term expectations of other people that determine what demands entrepreneurs should expect in the short run. Changes in long-term expectations govern changing levels of investment through the marginal efficiency of capital and the interest rate through liquidity preference, and may even affect consumption. Investment and consumption together form the largest component of aggregate demand. Thus, far from dismissing long-term considerations as in the common misconstrual of his famous remark, 'in the long run we are all dead', Keynes's position is in fact that the long run is always with us (*G.T.*: 50, 51).²

If it were founded only in Marshall's distinction between different variabilities of factors of production, the distinction between long-term and short-term expectations would be one of degree, not of kind. In Keynes's usage, however, the distinction is more fundamentally between quantifiable and unquantifiable (or partially quantifiable) expectations or probabilities. On the one hand, Keynes believed that short-term expectations could be quantified relatively accurately; on the other hand, long-term expectations were founded on a precarious basis. In *The General Theory* (*G.T.*: 149, 150) he writes:

Our knowledge of the factors which will govern the yield of an investment some years hence is usually very slight and often negligible. 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.

While in the short term, quantifiable risk and the calculus of probabilities may be of some use, Keynes, in his 1937 précis of *The General Theory* in the *Quarterly Journal of Economics*, emphasizes the 'uncertainty' of long-term expectations:

By 'uncertain' knowledge . . . 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 expectation of life is only slightly uncertain. Even the weather is only moderately uncertain. 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, or the obsolescence of a new invention, or the position of private wealth owners in the social system in 1970. About these matters there is no scientific basis on which to form any calculable probability whatever. We simply do not know. Nevertheless, the necessity for action and for decision compels us as practical men to do our best to overlook this awkward fact and to behave exactly as we should if we had behind us a good Benthamite calculation of a series of prospective advantages and disadvantages, each multiplied by its appropriate probability, waiting to be summed

(*C.W.* XIV: 113, 114)³

Beyond the issue of whether it is possible to attach numerical probabilities to expectations, the quotation refers to another dimension of expectations crucial to Keynes's analysis: *confidence*. Keynes argues that the marginal efficiency of capital depends separately on the probabilities of various prospective yields and the confidence with which those probabilities are held. He relates confidence to the intuitively appealing, but difficult to explicate, notion of the 'weight of argument' borrowed from his *Treatise on Probability* (1921/*C.W.* VIII: ch. 6; see *G.T.*: 148).

Expectations for Keynes are not single-valued. In the short term, an entrepreneur may consider a range of possibilities, each with a probability attached. Keynes suggests that this is easily dealt with through the idea of a certainty equivalent: that expectation which if held with certainty would yield the equivalent behaviour to the range of actual expectations with their associated probabilities (*G.T.*: 24, fn. 3).

It is not clear in *The General Theory* whether Keynes believes that long-term expectations can be dealt with in the same way. He does suggest in later writings that there is an equivalent expectation that would rationalize any action *ex post*, although he does not seem to suggest that such expectations

play any role in decisions to act (*C.W.* XIV: 289).⁴ What is clear in *The General Theory* is that even if long-term expectations were certainty equivalents, they would not be certain, because of the low weight of evidence on which they are formed. Entrepreneurs are faced with the necessity of choice. And Keynes argues that, in the absence of weighty evidence, conventions or arbitrary rules or psychological factors govern expectations and choice. Long-term expectations and, consequently, investment is, on Keynes's view, extremely precarious. The accumulation of capital can be explained only by confidence of entrepreneurs in excess of the weight of available evidence. Thus:

In former times, . . . investment depended on a sufficient supply of individuals of sanguine temperament and constructive impulses who embarked on business as a way of life, not really relying on a precise calculation of prospective profit . . . Business men play a mixed game of skill and chance, the average results of which to the players are not known by those who take a hand. If human nature felt no temptation to take a chance, no satisfaction (profit apart) in constructing a factory, a railway, a mine or a farm, there might not be much investment merely as a result of cold calculation.

(*G.T.*: 150)

In a similar vein, Keynes writes:

Most, probably, of our decisions to do something positive, the full consequences of which will be drawn out over many days to come, can only be taken as a result of animal spirits – of a spontaneous urge to action rather than inaction, and not as the outcome of a weighted average of quantitative benefits multiplied by quantitative probabilities . . . [I]f the animal spirits are dimmed and the spontaneous optimism falters, leaving us nothing but mathematical expectation, enterprise will fade and die; – though fears of loss may have a basis no more reasonable than hopes of profit had before.

(*G.T.*: 161–2)

It has been argued by Patinkin (1976a: 142), among others, that Keynes does not have a theory of expectation formation. If what this means is that Keynes does not have a single mechanical algorithm for the generation of expectations, this is no doubt true. In the *Treatise on Probability* (*C.W.* VIII: 413–18), Keynes rejects the foundations of the Bayesian argument. He does not recant in *The General Theory* nor does he offer any alternative formulaic approach.⁵ Instead, Keynes subsumes the formation of short-term expectations to his general views on induction. In the *Treatise on Probability* (*ibid.*: ch. 27), Keynes argues that in sufficiently stable, homogeneous environments statistical methods unveil recurrent facts about populations. Extrapolations of such facts, something like the weighted

averages of adaptive expectations in common use before the rise of rational expectations, are, in Keynes's view, a perfectly adequate basis for forming short-term expectations. In *The General Theory*, Keynes regards the formation of short-term expectations as a second-order concern, and assumes, for purposes of exposition, that short-term expectations are always fulfilled.⁶

Again, long-term expectations are a different matter. Because the evidential basis on which we might form long-term expectations is so slender, while the necessity for choice in questions that inextricably involve long-term expectations is so compelling, Keynes argues that we fall back on conventions. In particular, Keynes argues that we adopt the convention that expectations are held constant until we have a positive reason to alter them. Keynes specifically rejects the interpretation that an expectation is constant because there is an equal probability of a rise or fall in its value (*G.T.*: 152). This rules out the modern interpretation that expectations follow a random walk. In the *Treatise on Probability* (1921/*C.W.* XIV: ch. 4), Keynes had argued that equiprobability arguments could succeed only with specific causal knowledge, say, knowledge of the uniform construction of a die. The appeal to convention in *The General Theory* can be seen as appealing to the same insight.

Long-term expectations are held constant because there is little weight of evidence supporting a change. But, because this weight is so little, small but positive reasons, reasons which provide a causal case, justify changes in expectations. Long-term expectations are precarious in that they may change a great deal for relatively slight reasons. Still, Keynes denies that long-term expectations are the result of nothing but irrational psychology:

On the contrary, the state of long-term expectation is often steady . . . We are merely reminding ourselves that human decisions affecting the future, whether personal or political or economic, cannot depend on strict mathematical expectation, since the basis for making such calculations does not exist; and that it is our innate urge to activity which makes the wheels go round, our rational selves choosing between the alternatives as best we are able, calculating where we can, but often falling back for our motive on whim or sentiment or chance.

(*G.T.*: 102, 103)

One final feature of Keynes's treatment of expectations in *The General Theory* deserves emphasis. While Keynes recognizes the aggregate consequences of expectations for interest rates or national income, he does not aggregate expectations themselves. The expectations of individuals are heterogeneous – and fundamentally so.⁷ Thus, Keynes recognizes that it is only diversity of opinion about expected values of financial assets that permits trades without massive swings in asset prices (*G.T.*: 172). Similarly, an aggregate liquidity preference function requires diverse expectations

(*G.T.*: 197–9). People will either hold speculative money balances or bonds, depending on whether they expect interest rates to rise or fall. To turn this individual analysis into an aggregate function that smoothly maps the holdings of money against the interest rate, requires that different individuals expect different interest rates to prevail.⁸

A SECOND EDITION?

Had Keynes written a second edition of *The General Theory* in 1938, how might his treatment of expectations have changed? I will suggest two changes. Keynes himself suggests the first change; the second is implicit in some of Keynes's writings.

In a set of rough notes from his 1937 lectures, Keynes (*C.W.* XIV: 181) writes:

I now feel that if I were writing the book again I should begin by setting forth my theory on the assumption that short-period expectations were always fulfilled; and then have a subsequent chapter showing the difference it makes when short-period expectations are disappointed.

As observed on p. 223, short-term expectations are typically assumed to be correct in *The General Theory*. Keynes saw a need for a subsequent chapter because he wanted to clarify the proper role of expectations in his analysis, and because he wanted to relate his analysis more closely to alternative views.

For Keynes (*C.W.* XIV: 179–81), effective demand is a matter of expectations; it is not on a par with realized income. Realized or actual income and, in particular, the disparity between it and previously expected income is important only to the degree that it is useful information in the formation of short-term expectations of future income.

Keynes (*C.W.* XIV: 181–3) faults Robertson for regarding the income of the previous period as *the* constraint on the expenditure of today:

Expenditure is determined partly by yesterday's income, partly by today's, partly by expectations of tomorrow's and by many other things too. What primarily matters is the expectation of expenditure formed by the entrepreneur beforehand and secondarily by the gradual revisions of this expectation in the light of experience.

(*C.W.* XIV: 181, 182)

While acknowledging the desirability of discussing economic behaviour under disappointed short-term expectations, Keynes nevertheless believes that the issue is secondary. He does not repent of his tactic of treating short-term expectations as fulfilled. Hawtrey, he argues, disregards the fundamental factors in dynamic change – presumably the state of long-term

expectations – in order to concentrate on the ephemera that 'is better described as the higgling of the market' (*C.W.* XIV: 182).

More speculatively, I suggest that Keynes might have used his notion of weight to clarify and extend the role of liquidity preference in a second edition of *The General Theory*. Money is the most liquid of assets. 'Money', Keynes writes, '... is, above all, a subtle device for linking the present to the future' (*G.T.*: 294). And the most salient feature of the future is that it is unknown; our long-term expectations of the future are for Keynes, as we have seen, hardly quantifiable and rest on evidence of low weight. Financial assets in a monetary economy, to varying degrees, allow us to keep our options open in the face of the dark future.

Surprisingly, Keynes treats liquidity preference as a matter of risk and certainty-equivalence. As a result, we would seem justified in carrying away from *The General Theory* a notion of the liquidity-preference function as smoothly mapping interest rates on to the demand for money, and as supporting the simple manipulations of the supply of money that are the standard fare of the IS–LM model of the 'Keynesian' textbook. Yet, even in *The General Theory*, Keynes acknowledges that risk and liquidity have been conflated, and notes 'the difference [corresponds] to the difference between the best estimates we can make of probabilities and the confidence with which we make them' (*G.T.*: 240). Still, the distinction affects the substance of *The General Theory* relatively little.⁹

Keynes, however, continued to think about the question of weight and confidence. In a letter to Hugh Townshend in 1938 (*C.W.* XIV: 293–4), he again distinguished the risk premium, the higher-than-average return one expected to receive as a compensation for bearing risk, from the liquidity premium, a payment that does not on average produce a greater return, but provides comfort and confidence in the face of the unknown. I speculate that Keynes would, given an opportunity, have made better use of the fundamental notion of the liquidity premium in a manner similar to that developed more recently by Hicks (1974: ch. 2), Bernanke (1983) and Makowski (1989). The central point in these treatments is that liquidity is about keeping options open in the face of ignorance. Waiting produces information that will permit a better choice when long-term expectations do not possess a firm evidential base. Thus, when confidence collapses and animal spirits can no longer outweigh uncertainty, the psychic reward to waiting rises. Entrepreneurs hold back on investment, not because their cold calculations of return have altered, but because they would be more comfortable with a less cloudy view of the future and choose to wait for it.¹⁰ Simultaneously, they keep their options open by shifting to more liquid assets – money being the extreme. The conclusions of the modern literature are, first, that the IS curve (marginal efficiency of capital) and the LM curve (liquidity preference) are not independent; and, second, that there might be a liquidity trap, operating not because the demand for money

routinely becomes elastic at low interest rates (a situation of which Keynes – *G.T.*: 207 – denied knowing any practical examples), but because money is the most flexible form in which to lodge purchasing power – whatever the interest rate – when entrepreneurs are waiting for the evidence that would restore confidence in particular capital projects. Given his concern with the notion of confidence, I fancy that Keynes would have wanted to clarify its role in something like this way in a second edition.

RATIONAL EXPECTATIONS

Keynes, of course, did not write a second edition of *The General Theory*. Expectations were ignored in the early development of ‘Keynesian’ economics. Gradually, they were reintroduced – for example, into the analysis of consumption with the permanent income hypothesis (Friedman 1957) and into the analysis of money demand (Cagan 1956). And although in the recent work cited above (p. 225) ideas congenial to Keynes’s concern with confidence and weight of evidence have been developed, they are out of the mainstream. Instead, the single most important development with respect to expectations in modern macroeconomics is the introduction around 1970 by Robert Lucas, Thomas Sargent and others of John Muth’s idea of rational expectations.

Muth’s (1961: 4–5) formulation runs: ‘Expectations . . . tend to be distributed, for the same information set, about the prediction of the theory (or the “objective” probability distribution of outcomes).’ If an expectation differed from what the theory suggests, then either the theory is incorrect or one’s expectation is failing to use the information contained in the correct theory. Rational expectations are thus sometimes viewed as ‘model-consistent’ expectations.

Rational expectations are usually noted with a formulation such as

$${}_{t-1} X_t^e = E_{t-1}(X_t | \Omega_{t-1}), \quad (14.1)$$

which says that the expectation of X formed at time $t-1$ is the mathematical expectation of X conditional on all the information available at time $t-1$. The information set Ω_{t-1} in any theoretical account includes the model postulated by the theory. In empirical applications, equation (14.1) is sometimes treated – independently of a particular model – as a regression of X_t on the variables in Ω_{t-1} . The residuals from such a regression are definitionally uncorrelated with X_t ; the fitted values can then be treated as the expected values, provided that no information omitted from the regression is correlated with the residuals.

In the interpretation of rational expectations as model-consistent expectations, equation (14.1) is embedded into the model and Ω_{t-1} consists of the model itself and its variables. In this form, as in the empirical interpretation, expectations cannot systematically differ from realizations: in

stochastic models rational expectations are not always correct, but they can differ from the actual values only by a serially uncorrelated error. In either interpretation, the rational expectations hypothesis is usually justified heuristically by the observation that any reasonable person would not persist in identifiably systematic mistakes, so that actual expectations should closely approximate rational expectations.

The rational expectations hypothesis was introduced into macroeconomics by the new classical school (see Hoover 1988). In the past quarter century, however, it has become the common property of all macroeconomists – valued by some more than others. Within the new classical school, the rational expectations hypothesis was centrally identified with three important theoretical developments.¹¹

First was the *policy-ineffectiveness proposition*. Milton Friedman (1968) and Edmund Phelps (1967) argued that there was a natural rate of unemployment unaffected by aggregate demand policies. This was equivalent to claiming that the Phillips curve and the aggregate supply curves were vertical in the long-run. Friedman and Phelps maintained that inflationary policies might stimulate output and employment in the short run as workers, misperceiving the price level, would regard an increase in their nominal wage as an increase in their real wages when it was, in fact, a fall. This stimulus could not last, in Friedman’s and Phelps’s view, because workers’ expectations would adapt.

Lucas (1972a) and Sargent and Wallace (1975, 1976) used the rational expectations hypothesis to argue that workers’ misperceptions and the resulting stimulus could be, at most, random and could not be systematically exploited by monetary and fiscal authorities. Fischer (1977) and Phelps and Taylor (1977) demonstrated that rational expectations were necessary but not sufficient for policy ineffectiveness. The vertical long-run Phillips curve (or natural rate hypothesis) was also needed. They demonstrated in models of staggered contracts that rational expectations and policy effectiveness were in fact compatible.

The second important development was the *policy non-invariance proposition* or ‘Lucas critique’ (Lucas 1972a, 1976). Lucas argued that estimated macroeconomic models do not represent the true structure of the economy. Instead, their equations relate aggregates that are composites of the microeconomic behaviour of firms, consumers and policy-makers. In a rich description of such agents, each would form expectations using something like equation (14.1). Solving the model would generate some rule for forming expectations from available data. Among the information in Ω_{t-1} would be the perceived policy rules of the government. If the government adopted new policy rules, then the rules for forming expectations would themselves change. Aggregating up to the level of the macroeconomic model, its equations too would show ‘structural breaks’. Lucas argued that ‘Keynesian’ macroeconomic models, because they failed to

incorporate rational expectations, could not reasonably be used for policy analysis because their equations – however well they appeared to fit the data – would not be stable in the face of the very policy regime they were used to analyse.

The third important development tied rational expectations to game theory. Barro and Gordon (1983a, 1983b), following Kydland and Prescott (1977), argued that policy under rational expectations must be ‘dynamically consistent’: that is, what appears optimal today must turn out to be optimal tomorrow. In their illustration, the monetary authorities dislike inflation, but are willing to trade some inflation for lower unemployment. With a vertical long-run Phillips curve, unemployment can be reduced only if inflation is unexpected. If the authorities announce that they will pursue a zero inflation policy, and if people believe them, then they will be tempted to renege on their announcement and lower unemployment through higher inflation. To do so would be to lose credibility; but, under rational expectations, people understand that the temptation is too great for them to resist. Only at a higher rate of inflation, at which the loss to further inflation exactly balances the gain to unemployment, will there be no temptation to cheat. People with rational expectations will treat only this higher inflation policy as credible, and policy will inevitably converge on it. Unfortunately, since there is a natural rate of unemployment and no permanent gains to inflation, this high-inflation equilibrium is inferior to one with zero inflation and the same level of unemployment.

ANTICIPATIONS OF RATIONAL EXPECTATIONS

Rational expectations was such a striking feature of the new classical revolt against ‘Keynesian’ economics that for a long time economists such as Lucas, Sargent, Wallace, Barro, Kydland and Prescott were commonly referred to as ‘rational expectationists’. The misleading belief that their main results derive principally from the rational expectations hypothesis persists in some quarters even today. This belief is misleading because the most characteristic feature of the new classical school is its adherence to the assumption of continually clearing, perfectly competitive markets as a basis for macroeconomics. Policy is ineffective in the long run because the economy is assumed to be fully employed. Rational expectations extends that result to the short run, because it rules out over-employment due to systematically mistaken perceptions about real wages and prices. There is no doubt that, were Keynes alive today, he would still reject the assumption of continuous full employment as a basis for macroeconomics. Keynes would then have no truck with the policy-ineffectiveness proposition. The general principle of dynamic consistency would be more congenial and would fit in with his move toward rules in the conduct of policy.¹² He

would none the less not have been able to accept the underlying economic assumptions of Barro and Gordon and the related natural-rate models.

This leaves policy non-invariance (the Lucas critique) and, of course, rational expectations itself. Surprisingly perhaps, Keynes anticipated rational expectations, and may well have embraced it in limited circumstances. As early as 1923 in the *Tract on Monetary Reform*, Keynes wrote of ‘intelligent anticipations’. He argued that people, especially those engaged in business, use their intimate knowledge to form expectations in such a way that, although they make errors, their errors are not pervasive and are insufficient to explain cyclical fluctuations (*C.W.* IV: 18). Bradley Bateman (1994: ch. 4) argues that Keynes abandoned ‘intelligent anticipations’ by 1930 as part of a sea-change in his views on probability and confidence. According to Bateman, Keynes abandoned his notions of probabilities as Platonic entities expressing the objective logical relationship between evidence and conclusions in favour of Frank Ramsey’s thorough-going subjectivism. Whether and to what degree Keynes’s views changed are hotly debated among Keynes scholars (see O’Donnell 1989: esp. 138–48; Carabelli 1988: ch. 6). It is enough here to observe that, in his analysis of Hawtrey’s theory of the cycle (cited on pp. 224–5 above), as late as 1937 Keynes continued to deny that pervasive expectational errors were the cause of cyclical fluctuations. Furthermore, as noted earlier, in *The General Theory* itself, Keynes assumes that short-term expectations are fulfilled. How he might have analysed the effects of expectational errors and whether that analysis would have been consistent with rational expectations is impossible to say, given the sparse details in his lecture notes. That he regarded the issue of short-term expectational errors as second-order is none the less clear.

One of the more surprising results in the history of the rational expectations hypothesis was the realization, first by Muth (1960) and then in other contexts by Lucas (1972a) and Sargent and Wallace (1973), that schemes in which expectations are formed by fixed weights on lagged variables could be fully consistent with rational expectations. Many people thought, for example, that a test of the natural-rate hypothesis would be to regress real output on the current and numerous lagged values of the money stock. If all the coefficients summed to a value insignificantly different from zero, then it could be presumed that the natural-rate hypothesis was true, because the effect for output of an increase in the stock of money would be zero in the long run. If the sum of coefficients was not zero, then it could be presumed that the natural rate hypothesis was false. Lucas (1972a) showed that this conclusion was false: if the natural-rate hypothesis were true by assumption, and the monetary authority created money according to a constant percentage growth rule, then the coefficients on lagged values of money in an output regression would not sum to zero. Lucas’s conclusion is related to the policy non-invariance proposition. A regression of

output on lags of money is not a deep structural equation. Rather, it conflates the *ex hypothesi* true (natural-rate) aggregate-supply curve, the aggregate-demand curve and – through rational expectations – the rule for money creation, which governs the development of the price level over time. Lagged money appears in the regression equation because expected prices help to determine deviations of output from the natural rate, and the rational expectation of prices depends on the rational expectation of the money stock, which in turn depends on lagged money because the authorities set tomorrow's money stock as a fixed percentage increase over today's money stock.

Keynes does not offer Muth's or Lucas's argument in any detail. Nevertheless, he clearly understands the main point. For example, in his 1940 rejoinder to Tinbergen's reply to his review of Tinbergen's book on the statistical testing of theories of the business cycle, Keynes (*C.W.* XIV: 319) remarks: 'I understand well enough that his method can deal with time lags with expectations of the type that the future will resemble the very recent past.' This is of a piece with Keynes's general approach that, as we saw above (pp. 222–3), subsumes the formation of short-term expectations to his general views on statistical induction, and imagines that short-term expectations are correct to a first approximation.

A consequence of Lucas's analysis is that adaptive expectations may sometimes coincide with rational expectations. Keynes understood the essence of this point. But, like Lucas, Keynes also understood that this is a special case that requires a constant policy regime. Keynes (*C.W.* XIV: 319) follows up his concession to Tinbergen on the approximation of expectations with a question: 'How does [Tinbergen] deal with expectations of change?' In his review, Keynes (*C.W.* XIV: 306–18) had questioned among other things whether Tinbergen's equations represented the 'deep structure' of the economy, and whether they were stable in the face of a changing economic environment. In posing this new question, Keynes suggests what is essentially the narrow version of the Lucas critique – that is, that estimated aggregate econometric relationships will not be stable because expectations of changing economic environment cannot be accounted for adequately using a set of fixed weights on lagged variables.

Demonstrating not only a general understanding of policy invariance but also the specific context of many new classical analyses, Keynes argued in *The General Theory* (*G.T.*: 198–99) that open-market operations would alter not only the money supply directly but also the demand for money, because people's expectations would change with their changing understanding of the policies of the central bank and the government. In general, the liquidity preference function, he believed, would be discontinuous, shifting with the 'news' – changing expectations of policy or the economic environment. Keynes's understanding of policy non-invariance was, like his understanding of the formation of short-term expectations, of a piece

with his general views on induction established long before *The General Theory*. He wrote in 1925:

It is dangerous . . . to apply to the future inductive arguments based on past experience, unless one can distinguish the broad reasons why past experience was what it was. Otherwise there is a danger of expecting results in the future which could only follow from the special conditions which have existed in the . . . past.

(*C.W.* XII: 248)

Lucas could not have put the point more lucidly. Taken in conjunction with Keynes's general dissent from econometric modelling expressed most clearly in his review of Tinbergen, that Keynes was not a 'Keynesian' in the sense of Lucas and Sargent (1979) is manifest.

Keynes was not a 'Lucasian' either. Lucas (1976: 108–9) points out that giving a large weight to the most recent data is a way of improving economic forecasts. Similarly, Keynes (*G.T.*: 51, 148, *passim*) observes that people typically give undue weight to the most recent data or to the *status quo*. Lucas and Keynes observe the same phenomenon; but, for Lucas, it is an *ad hoc* response to the problem of policy non-invariance, revealing a deep flaw in formal modelling; whereas for Keynes, it is a conventional stratagem used to short-circuit our inevitable ignorance of the long term.

THE LIMITS OF RATIONAL EXPECTATIONS

Keynes understood the essential message of the rational expectations hypothesis long before it was formulated by Muth, and he clearly would have approved of its use in demonstrating the policy non-invariance proposition. He would nevertheless not have been a 'rational expectationist'. The most important reason is that rational expectations – as it is understood in modern macroeconomics – cannot accommodate Keynes's fundamental distinction between short-term and long-term expectations.¹³

Although Keynes understood the basis and some of the implications of the rational expectations hypothesis long before it bore that name, he would not have used it in the way that the new classicals typically have themselves done. Early new classical models of the business cycle had sought to explain fluctuations in output as the product of expectational errors.¹⁴ It soon became apparent that these fluctuations were too serially correlated or persistent to be simple random deviations from a natural rate of output. The new classicals then proposed a series of models with the common feature that random expectational errors were propagated by long-lived capital: an unanticipated shock to the money supply not only increases output but also shifts the natural rate of output temporarily higher; re-adjustment to equilibrium occurs immediately if there are no further random shocks; but the natural rate itself adjusts only slowly back to its steady-state

level as a sub-optimal stock of capital is optimally depreciated.¹⁵ Essentially, to explain persistence, the new classicals graft rational expectations on to the neoclassical growth model of Robert Solow (1956).

We know that Keynes would not himself have adopted the new classical modelling strategy because he clearly sketched out and criticized the argument in his 1937 article in the *Quarterly Journal of Economics*. Keynes (*C.W.* XIV: 112) argued that Marshall, Pigou, Edgeworth and other 'classicals' followed Ricardo and, fundamentally, analysed only long-period equilibrium. Nevertheless,

[t]his does not mean that [the classical]s were dealing with a system in which change was ruled out, or even one in which disappointment of expectations was ruled out. But at any given time facts and expectations were assumed to be given in a definite and calculable form; and risks, of which, though admitted, not much notice was taken, were supposed to be capable of an exact actuarial computation. The calculus of probability, though mention of it was kept in the background, was supposed to be capable of reducing uncertainty to the same calculable status as that of certainty itself; just as in the Benthamite calculus of pains and pleasures or of advantage or of disadvantage . . .

(*C.W.* XIV: 113)

As we have already seen, Keynes had no objection to applying the calculus of probabilities to expectations in the short term; but what the classicals have done is to attach short-term methods for forming expectations to otherwise long-run models. On Keynes's analysis, the new classicals, joining the rational expectations hypothesis – the quintessence of the calculus of probabilities applied to expectations – to the neoclassical model of long-run growth, adopt the same strategy. Keynes (*C.W.* XIV: 115) believes that the classicals, however, have fallen into a trap: 'I accuse the classical economic theory of being itself one of those pretty, polite techniques which tries to deal with the present by abstracting from the fact that we know very little about the future.' He would no doubt believe that the new classicals – as in so much else – had repeated their forebears' error.

One of the prettiest of the polite techniques employed by the new classical macroeconomics is the representative agent. The economy is assumed to be governed by the microeconomic optimization problem of a single agent who treats national income as his own budget constraint. Representative-agent models could represent the economy accurately only if the conditions of exact aggregation were fulfilled. Essentially, all agents would have to be identical with homothetic preferences, so that the poor were effectively scale models of the rich. Such conditions are absurd. They produce puzzles that highlight the limits of representative-agent models. For example, if all agents have identical preferences, constraints and expectations, how can we explain asset trading? Keynes (*G.T.*: 199) clearly

understood that the assumption of identical information, much less identical preferences or constraints, would be enough to inhibit trade in financial assets. In this, he anticipated the recent interest in 'noise trading', which seeks to avoid the odd consequence of rational expectations applied to financial markets (for example, Black 1987: ch. 14).

The appeal of the representative-agent model is that it is analytically tractable. To maintain tractability such models typically assume a single good with a single production function (or at the most a few goods). Keynes, on the other hand, argued for heterogeneity on this dimension as well. In a representative-agent model, rational expectations (the calculus of probabilities) is easily joined with the production constraint to cast the investment problem in a present-value framework. Keynes (*G.T.*: 137–41) recognizes the equivalence of his preferred concept of the marginal efficiency of capital with the expected discounted present value of the marginal product of capital in a world in which capital is physically homogeneous. Recognition that capital is not, in fact, physically homogeneous is one of the features that undermines mathematical tractability and closure of formal economic models. The necessary complexity and intractability of an adequate economic model is one of the elements that undermines the evidential base necessary to form long-term expectations; and, in turn, the difficulty of forming long-term expectations in a numerical manner subject to the calculus of probability undermines the formation of tractable formal models. Precision about expectations or economic structure is for Keynes impossible. In a letter to G.F. Shove in 1936, Keynes (*C.W.* XIV: 2) writes: 'But you ought not to feel inhibited by a difficulty in making the solution precise. It may be that part of the error in the classical analysis is due to that attempt. As soon as one is dealing with the influence of expectations and of transitory experience, one is, in the nature of things, outside the realm of the formally exact.'

Keynes argues that in the face of difficulties in forming long-term expectations people typically apply different techniques than the inductive extrapolations used in forming short-term expectations. In the 1937 *Quarterly Journal of Economics* article (*C.W.* XIV: 14), he mentions three techniques. First,

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.

Second, we use market information – prices and output – as correct summary statistics for future prospects based on currently available information. Third, we suppress our individual judgements in favour 'of those of the rest of the world which is perhaps better informed'. Adherence to conventions replaces any attempt to form individual assessments. In *The General Theory*

(158) Keynes puts it thus: 'Worldly wisdom teaches that it is better for reputation to fail conventionally than to succeed unconventionally.'

Considering these strategies in relation to the rational expectations hypothesis provides at once a view on Keynes's probable attitude towards modern developments in the treatment of expectations and a deeper understanding of the differences between three strands of new classical thinking. The second technique is the closest to typical modern applications of rational expectations. Indeed, it is essentially the basis for the efficient-markets view of financial markets. Prices fully reflect available information so that there are no residual arbitrage opportunities.

The first technique is related to the second. Were it not for Keynes's insistence on non-numerical probability, the first technique would suggest that the development of expectations, because they fully incorporate available information (second technique), followed a random walk. Such a hypothesis has proved important, not only in the analysis of efficient financial markets, but also in, for example, Hall's (1978) work on consumption functions with rational expectations.

Interpreted in this way, the first technique is essential to the sort of rational expectations modelling associated with Sargent (1978, 1981; also see Hansen and Sargent 1980). Sargent seeks to solve the policy non-invariance problem by formulating explicit structural models that account for rational expectations. The evidential base for expectations formation in such models is extremely narrow. Some variables are described as governed by exogenous processes. Expectations are formed conditional on these variables and the hypothesized structure of the model. That this is a narrow base is evident if one contrasts such modelling to so-called 'strong' tests of the efficient-markets hypothesis in which one asks if changes in the price of a financial asset are predictable using *any* variable – not just those singled out as key in a formal model. Modelling on the narrow evidential basis of a formal econometric model amounts to adopting Keynes's convention of ignoring changes that cannot be processed easily through the calculus of probabilities. And Sargent (1984) is explicit on this point: policy analysis proceeds on the assumption that a policy change once made is in place forever, even though there may be further regime changes in the future.

Just as Ramsey rejected Keynes's notion of non-numerical probabilities, a second strand of new classical analysis associated with LeRoy argues that there is no reason to treat policy changes as beyond probabilistic analysis.¹⁶ LeRoy accepts the subjectivist view (essentially Ramsey's view) that probabilities can always be assigned to any future event. He argues that the fact that a policy regime has changed in the past means that a rational person would not place a zero probability on another change of regime, and that these probabilities should be incorporated into the rational expectations within a formal model. What Keynes stigmatizes as a 'pretty, polite technique', LeRoy holds up as a requirement of logical consistency.¹⁷

The third strand associated with Lucas is diametrically opposed to LeRoy's 'fundamentalist' interpretation of the rational expectations hypothesis, and is ultimately the closest to Keynes. Like Keynes, Lucas distinguishes between quantifiable risk and unquantifiable uncertainty.¹⁸ Rational expectations can deal with risk, but not with uncertainty. Where Keynes and Lucas differ is in their assessments of the limits that this distinction places on economic analysis. Lucas (1977: 15) expresses a view that Keynes would never concede: 'In cases of uncertainty, economic reasoning will be of no value.' Lucas, however, is true to his word. Unlike Sargent, Lucas does not estimate structural models subject to rational expectations. Instead, in his empirical analyses he concentrates on long-run or steady-state properties and uses techniques such as cross-section regressions on temporally averaged data, two-sided moving averages and calibration methods that might transcend particular structural models and the exact transition dynamics implied by rational-expectations models.¹⁹ Essentially, Lucas accepts that rational expectations cannot cope with the sort of changes that generate policy non-invariance, and he wants to let the economy settle down after any such change before again applying analysis based on the rational expectations hypothesis.²⁰

Why, then, is Lucas so insistent upon the rational expectations hypothesis in formal economic models? Perhaps it is simply a taste for the formal and precise. Perhaps it also a matter of convention: Lucas (1987: 13, fn. 4) defends the rational expectations hypothesis not on grounds of realism or even because the economy behaves 'as if' it were true, but as a consistency criterion for economic models. In contrast, Keynes's conventions are about the substance of the economy and not about the form of models. Keynes was always willing to give up the possibility of a formal, tractable model if he could replace it with a – perhaps imprecise – causal account that would permit him to say something about economic policy. While understanding the intellectual basis for what eventually became the rational expectations hypothesis, Keynes would dissent from most versions of it. Surprisingly, his analysis of expectations is remarkably close to Lucas's. Where they differ most is in Lucas's willingness to allow our ignorance of the future to set a limit to policy action. In contrast, Keynes is, to paraphrase his own description of the entrepreneur, of a more sanguine temperament; imbued, in matters of economic policy, with a spontaneous urge to action, unimpeded by the fragile calculations of rational expectations.

NOTES

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1 The term 'hydraulic Keynesianism' is due to Coddington (1983: ch. 6).

2 Keynes's comment, which long predates *The General Theory*, is directed at

Marshall and aims, not to deny the importance of the long run, but to underscore how easy it is to say something sensible about the long run that ignores vital immediate concerns. Although perpetuating the misconstrual of Keynes's remark, Rostow (1980: esp. Preface) notes the Marshallian roots of the idea that the long run is always with us.

- 3 The distinction here is not between insurable and uninsurable risk – that is Knight's distinction (see LeRoy and Singell 1987). So long as risks can be ordered, even if not all of them can be given a numerical probability, insurance may be rationally extended (see *C.W.* VIII: 23).
- 4 Bateman (1994: ch. 5) acknowledges that many such rationalizations are *ex post*. He also argues that Keynes is clearly committed to treating long-term expectations on the basis of certainty equivalents. The evidence seems much less decisive to me.
- 5 Cf. Bateman (1994: ch. 5).
- 6 Kregel (1976) argues that in different parts of *The General Theory* Keynes employs three of the twenty-seven possible analytical strategies that differ as to whether long-period expectations are constant or shifting, whether short-period expectations are realized or may be disappointed, and whether long-period and short-period expectations are independent or interdependent.
- 7 By the time of *The General Theory*, Keynes may or may not have abandoned his view that probabilistic relations were objective in favour of Ramsey's subjectivism (see p. 229). If he did, expectations are obviously radically heterogeneous; and, even if he did not, no two people will have the same information set and therefore have the same 'objective' assessment of the probabilities.
- 8 See the discussion of representative agent models on pp. 232–3.
- 9 Keynes's failure to use this distinction to great effect may explain the manner in which later economists interpreted *The General Theory* and sought to develop a Keynesian position. Tobin's (1958) analysis of liquidity preference in terms of risk and return provides but one example.
- 10 Pindyck (1991) provides a survey of some modern attempts to model investment under uncertainty, in which keeping options open is an important consideration.
- 11 These three developments are essentially the new classical agenda of the 1970s. While the new classical macroeconomics has continued to flourish since then, and its subsequent developments (e.g. real-business-cycle models or growth models with increasing returns) have continued to use rational expectations, the rational expectations hypothesis itself is not seen as the central feature of these developments.
- 12 Keynes (*G.T.*: 203) provides an instance of this preference with respect to monetary policy. See also Bateman (1994: ch. 6) and Meltzer (1988).
- 13 O'Donnell (1989: 45, 265–6) and Darity and Horn (1993) claim that Keynes has a wider theory of rational expectations of which the new classicals theory is a special case. This is within the spirit of my interpretation in this paper.
- 14 Lucas (1972b, 1973); see also Hoover (1988: ch. 3).
- 15 See, for example, Lucas's (1975) monetary model or the non-monetary or real-business-cycle models of Kydland and Prescott (1982) and their followers.
- 16 Cooley *et al.* (1984) and LeRoy (1994); also see Sims (1982, 1986a, b).
- 17 Sims (1982, 1986a, b) agrees with the essence of this point and finds in it a defence of his use of vector autoregression techniques in the face of the Lucas critique.
- 18 Lucas attributes the distinction to Frank Knight, explicitly denying that it is Keynes's (see interview with Lucas, in Klamer 1984: 44). LeRoy and Singell

(1987), however, argue persuasively that Knight's distinction is between insurable and uninsurable risks and is fundamentally different from Lucas's distinction which is in fact attributable to Keynes (cf. note 4 above).

- 19 See, for example, Lucas (1973, 1980, 1986, 1988a).
- 20 Lucas thus concentrates on what LeRoy (1994) calls 'stationary expectations' rather than rational expectations.