A Keynesian critique of the new "enfant terribles" of quantitative finance

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Abstract
The paper evaluates criticism on the part of the authors Nassim Taleb and Elie Ayache, directed at mainstream quantitative finance theory and practice. In particular, it examines the philosophical basis for these attacks, comparing each with the alternative afforded by Keynesian conceptions of decision-making under uncertainty. While Taleb's concerns are congruent with Keynesian conceptions of uncertainty, it is argued that Ayache has no grounds for distinguishing in a Keynesian manner between short-run and long-run expectations, due to the fact that he bases his arguments on a radically skeptical approach informed by the Speculative Realism of Quentin Meillassoux.

1. Introduction
This paper has been motivated by recent critiques of specific approaches taken to decision-making under risk within the quantitative finance discipline. It will focus on the work of Elie Ayache and N. N. Taleb, which has highlighted the importance of the "Black Swan" phenomena.

When Taleb first released his popular text, many critics failed to address the foundational nature of the attacks that he mounted against orthodox practices of risk-management. Instead, they blunted his critique by subsuming it within an increasingly conventional narrative of 'fat-tailed' densities and power-law scaling of stochastic processes. At the other extreme, Ayache took on responsibility for a more radical, targeted, and anti-foundational critique, which he extracted from more the wide-ranging, but also less well defined aspects of Taleb's work.

Ayache has sought support for this radical critique of quantitative finance theory in the writings of the 'Speculative Realist' philosopher, Quentin Meillassoux. At the end of the nineteenth century Stephane Mallarmé and Friedrich Nietzsche both promoted an anti-foundational conception of chance or probability—a view that was subsequently taken up by philosophers such as Alain Badiou and Gilles Deleuze—and it is to Meillassoux that Ayache turns, to justify his own notions of "the end of probability".

In contrast, this paper draws on the Keynesian critique of the 'Benthamite calculus of probabilities'—specifically, Keynes's distinction between short-run and long-run expectations—to argue, first, that there is little in the critiques made by Ayache and Taleb, that cannot already be found in Keynes; and second, that this very distinction, in Keynes's work, provides a more insightful framework for thinking about economic decision-making under conditions of uncertainty.

2. The Tale of Taleb: the Black Swan
In his response to his critics Taleb (2009) argues that the central lesson from decision-making is that it is exposure (payoff) that creates complexity rather than knowledge of the relevant statistical distribution or actual model representation. More specifically, he observes...
that knowledge with respect to the truth or falsity of an event matters less than the consequences that such an event might have. To illuminate this observation he offers the example of a turkey that is fed well for one thousand days. Unfortunately for the turkey, the Thanksgiving holiday arrives on the 1001st day. With the wisdom of hindsight, it can be appreciated that this event has extreme consequences for the turkey, much like Bob Bernanke, Governor of the Federal Reserve Board, into a state of quiet confidence by the length and tranquility of the “Great Moderation”. In this light, Taleb hones in on the point of his turkey fable: in the aftermath of a financial crisis, the losses of a thousand financial institutions on the basis of a single error or tsunami-type event rippling through financial markets could well eclipse all the cumulative profits of these same institutions.

In his response to the critics, Taleb (2009b) has identified a variety of errors common to those dismissing the arguments of Black Swan. The essential problem in his mind concerns the degradation of knowledge when it comes to rare events. For Taleb (2011b), the solution is to take what he describes as the ‘fourth quadrant approach’, which ranks decisions based on the severity of the potential estimation error of probability times the consequence. In this light, Taleb (2009b) observes that much of the criticism of his popular book was condescending in amounting to a smug riposte that “we already know all about ‘fat tails’ and don’t need to be told about their implications”. Other critics, while complaining that the work was ‘too popular’, clearly had not read the accompanying technical notes in the text. In many cases errors arose because readers were mislaid by the popular ‘packaging’ and had merely scanned the material with too much (or not enough) baggage. As a result, concepts in the text were often blended with pre-formed ideas (including those on skepticism, empiricism, Knightian uncertainty, chaos theory etc.)

Taleb (2009b) notes in passing that even the title of his book could be misunderstood, observing that J. S. Mill’s original notion of a ‘black swan’ was strictly logical rather than statistical. Moreover, the issues addressed in the text should not be reduced to concerns over the possibility of Popperian falsification. Crucially, he emphasizes the point that power law scaling and examples from chaos theory were used merely as technical illustrations. He further notes that some critics merely engaged in knee-jerk reactions that amounted to an outright denigration of ideas sourced outside their own favored ‘Risk Management circle’.

In his response to these critics Taleb (2009b) clarifies the basis for his critique of quantitative finance theory. He first points out that rare events cannot be estimated from empirical data due to the very fact that they are rare. Second, he observes that although such events are less frequent, they also have much greater impact than is usually anticipated. He goes on to introduce a distinction between two ‘worlds’—Extremistan and Mediocristan—based on the notion that events within Extremistan depart from the usual assumptions underpinning the Central Limit Theorem: the notion of independently and identically distributed random events. The resulting non-linearities, positive feedback effects, presence of scaling effects, or absence of asymptotic ceilings which would otherwise limit the magnitude

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1 While Keynes acknowledges Frank Knight’s contribution to the definition of uncertainty in The General Theory, his own conceptions of uncertainty depart from those of Knight in the following sense: Knight privileges difficulties in determining the relevant state space over those of assigning probabilities to each state. He argues that this commercial ability is possessed by some entrepreneurs and only they can recognise it other whom they might subsequently hire. Market selection ensures that firms run by such entrepreneurs will prosper against their rivals. In contrast, Keynes held to the view that neither market selection nor processes of learning (collaborative or otherwise) would overcome uncertainty, which he conceived as featuring incomplete knowledge of the characteristics of an indeterminant processes. In other words, neither learning nor selection could transform uncertainty into a species of risk. This is clearly an ontologically grounded rather than a strictly epistemological conception of ignorance in the face of economic uncertainty.
of random events arising in the tails of the relevant distributions are reflected in ‘fat-tailed’ distributions. In turn, these imply that less than 0.1% of risky events cause at least half of the losses (or of greater concern in financial markets, tail-events are of sufficient magnitude to wipe out cumulative gains accruing since the last ‘tsunami’ took place). Taleb illustrates these arguments in the following diagram.

Fourth Quadrant

<table>
<thead>
<tr>
<th>APPLICATION/DOMAIN</th>
<th>SIMPLE PAYOFFS</th>
<th>COMPLEX PAYOFFS</th>
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<tbody>
<tr>
<td>DOMAIN 1</td>
<td></td>
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</tr>
<tr>
<td>&quot;THIN-TAILED&quot;</td>
<td>Extremely robust to Black Swans</td>
<td>Quite robust to Black Swans</td>
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<tr>
<td>MEDIOCRISTAN</td>
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<tr>
<td>DOMAIN 2</td>
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<tr>
<td>&quot;FAT-TAILED&quot;</td>
<td>Quite robust to Black Swans</td>
<td>Extremely fragile in response to Black Swans</td>
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<tr>
<td>EXTREMISTAN</td>
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Taleb’s (2011c) ‘fourth quadrant’ approach entails decisions that give rise to complex payoffs made within a probabilistic world characterized by extreme fragility in the face of ‘Black Swans’ or infrequent events of very large magnitude and impact.

For empirical confirmation of his claims Taleb (2009a) turns to a series of real-world data sets representing 29-40 years of daily log returns data (which, together, represent some 20 million data items). His statistical analysis of these time-series reveals the absence of stability in estimation of tail events (i.e. estimated distributions do not predict satisfactorily out of sample). For example, in tests for non-normality, the maximum contributions to the fourth noncentral moment, coming from largest observations range between 0.2 and 0.8 for many of the series, whereas the contribution for a Gaussian series should be ~0.006 for sample sizes n = 10,000 (Taleb, 2009a: 746).

Significantly, measures based on minimum least squares (or the $L_2$ norm) fail in Extremistan, and Taleb (2009a: 747) points out that this problem extends well beyond that of estimating parameters of Gaussian distribution to include use of variance, linear regression,

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2 For scalable distributions (represented by the power law $P[X > x] = Kx^{-\alpha}$) Taleb (2009: 752) observes that there is no requirement for the ratio of exceedences (i.e. the cumulative probability of exceeding a certain threshold) to decline. Moreover, expectations of higher order moments ($\alpha$) explode, and the ratio of mean-deviation to variance is highly unstable. In particular, this undermines the validity of VaR methods. While the presence of power law distributions may lead to a decrease in the probability of rare events, their magnitude will be larger. He also warns that the inverse problem becomes more acute when estimating power law processes. Nevertheless, he qualifies the pertinence of these observations by noting that although fractal powers are a useful way to discuss these aspects; this does not mean that the world actually conforms to power scaling (Taleb, 2009: 754).

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measures based on the conditional expectation above a threshold value, and Gaussian copulas that rely on correlation. He also observes that 'fatness' is conserved under aggregation.

For Taleb (2011b), the requirement to estimate the tail distributions of rare events must confront the Inverse problem, which arises because we observe individual events, rather than probability distributions (so that goodness of fit rarely extends outside the sample of observations).

Accordingly, given the restricted nature of the set of observations, a wide variety of distributions could correspond to any exact realization. Inverse problems, Taleb (2011b) observes, are more acute in the presence of non-linearities and cases where distributions are non-parsimonious with respect to the small sample properties of estimators, and also when the problem of survivorship bias interacts with the high impact characteristics of rare events. Furthermore, in Extremistan, Taleb warns (2009a: 749-50) asymptotic properties do not work well pre-asymptotically, “Theories can be extremely dangerous when they were derived in idealized situations, the asymptote, but are used outside the asymptote (at its limit (say, infinity or the infinitesimal).”

The very notion of an historical event, he suggests, lacks meaning in Extremistan. Outside the standard textbook case of a casino, he notes that observers never face a single probability of an event, because the magnitude of damage associated with an extreme event can vary dramatically (e.g. engaging in a war, or 'losing more than a million dollars'—or perhaps $20 million, 30 million, or even 50 million?; and even closer to home, the sub-prime crisis—because no observer could be sure about 'how far it would go!'”). In other words, in a fat-tailed environment, rare events can be less frequent (e.g. exceeding one standard deviation) but those that do occur usually matter more!

When it comes to issues pertaining to the specific philosophy of probability the researcher adopts, a distinction can be made between objective, subjective, and inter-subjective approaches. Taleb himself argues against “objectivity” as it implies “randomness” can ultimately be reduced by knowledge and analysis. It will be argued below that Taleb’s anti-objectivist position, as he describes it, is congruent with that articulated by Whitehead and Keynes, who each argue that fundamental uncertainty has an objective basis1.

Taleb (2011b) goes on to consider the ‘Problem of Induction, Causation, and Complexity’ arguing that the complex systems found in Extremistan are characterized, first, by a great degree of interdependence between variables of concern, which are characterized by at least three dimensions of variation: temporal (where the variable depends on its own past), horizontal (where variables depend on each other), and diagonal (where the variable also depends on the past of other variables). Second, they feature positive reinforcing feedback loops. Here, 'fat-tails' obtain because the usual workings of the Central Limit Theorem are prevented due to the fact that perturbations are not dampened with the passing of time. Third, non-linearities in the data-generating process accentuate fat-tails. In summary, complexity, as defined above, is seen to characterize processes in Extremistan.

Taleb (2011b) identifies other consequences of complexity including: the breakdown of the Aristotelian distinction between induction and deduction (because variables interact within a stochastic rather than a fixed terrain); and the engendering of illusions of causality (which he likens to the problems of cascading failure in within a large power grid); which

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1 Here, Taleb interprets “objectivity” to mean “risk” in the sense of a known distribution whose parameters can then be estimated with confidence. The Keynesian notion that fundamental uncertainty has an objective basis also implies that uncertainty cannot be transformed into risk merely through the acquisition of more knowledge.
finally, in response, give rise to behavioural practices that favour historia (i.e. the recording of facts without any attempt at describing causation. In other words, a focus on how things are rather than why things are, or the epilogism of the medical empiricist accompanied by the application of non-parametric and robust techniques).

In two recent papers questioning the relevance of the Black and Scholes model of option pricing Haug and Taleb (2010) and Derman and Taleb (2005) conduct an historical analysis of option trading and pricing practices to argue that certain kinds of options have been traded as far back as the Sixteenth Century and that traders deployed a variety of heuristics, including techniques based on Put-Call parity, to price these derivatives in ways that not only replicate the Black-Scholes formula, but result in more realistic option prices. The crux of their argument is that the dynamic replication approach does not work as well as students of quantitative finance have been taught, and that traders largely avoid using these dynamic replication techniques in practice.

In more recent efforts to fine-tune the arguments in “Black Swans” Taleb (2011a) turns to errors in the estimation of the sample properties of distributions. In “The Future has Thicker Branching Tails than the Past”, Taleb (2011a) argues that we must take into account uncertainties associated with measurement of distributional parameters (e.g. an issue frequently ignored when estimating, for example, measures of dispersion in the Gaussian distribution). If the Gaussian density function is represented by $\phi(\mu, \sigma, x)$ for value $x$, mean $\mu$, and standard deviation $\sigma$, Taleb (2011a) argues that the second and $n^{th}$ order stochastic standard deviation can be represented as follows:

$$f(x) = \int_{0}^{\infty} \phi(\mu, \sigma, x)(\sigma^E, \sigma_1, \sigma) d\sigma$$

$$f(x)_N = \int_{0}^{\infty} \int_{0}^{\infty} \ldots \int_{0}^{\infty} \phi(\mu, \sigma, x)(\sigma^E, \sigma_1, \sigma_2, \sigma_3, \ldots, \sigma_N) d\sigma_1 d\sigma_2 d\sigma_3 \ldots d\sigma_N$$

Taleb (2011a) goes on to consider a discretization of the stochastic standard deviation, identifying three pertinent regimes. In regime 1: the estimation error is a constant, $\sigma$, which is multiplicative over time. This gives rise to a Power law density with infinite variance. In regime 2, the stochastic standard deviation is characterised by a decay process, $\sigma(N) = \lambda^N \sigma(1)$, which yields a significant, but relatively benign, convexity bias, which collapses to Gaussian case for small values of $\lambda$ close to 1. Finally, in regime 3, the errors are non-multiplicative, which gives rise to a recursion: $\sigma(1 \pm \sigma(1))(1 \pm \sigma(2))(1 \pm \sigma(3))(\ldots)$ featuring mild convexity.

In his concluding comments Taleb (2011a) suggests that regime 1 pertains to temporal processes, while regimes 2 and 3 relate to thin-tailed instances (e.g. as would typically apply in the case of sampling theory) with strong a priori assumptions on error interactions. In the conclusion, I argue that this viewpoint comes fairly close to the views of Keynes.

With this background, in the following section I interrogate Eli Ayache’s more radical reinterpretation of Taleb’s arguments, focusing in particular on Ayache’s philosophical presuppositions.

3. Elie Ayache’s “Nail in the Coffin” of Conventional Finance Theory

In his paper “Nail in the Coffin”, Ayache (2011) sets the scene for a radical critique of conventional finance theory by developing a more radical position to that set out by Taleb in his discussion of ‘Black Swans’. Ayache(2011) condenses Taleb’s analysis down to three major
attributes of ‘Black Swan’ phenomena: (a) they are outliers; (b) they have an extreme impact; and, (c) they change the context, thus requiring construction of new explanations after the event.

Ayache’s (2011) response is to dismiss the first of these attributes because we should expect improbable events to take place from time to time, then reject the second because the combination of a larger impact with a smaller probability of occurrence should be no surprise because this outcome is entirely compatible with Gaussian distribution. Accordingly, he only accepts the third attribute as one that is truly distinctive, when it is interpreted as representing an unforeseeable, unprobabilizable change of context, which therefore undermines the ‘domain-specificity of our thinking’. In other words, this unpredictable change embodies the ‘unknown unknowns’ insofar as the particular event under consideration lies outside our ‘tunnel of probabilities’. Ayache concludes that we are obliged to look beyond probabilities and conventional forms of ‘representational knowledge.

In Ayache’s (2011) attempt at the ‘completion’ of Taleb’s analysis he contends that we must find the ‘right level of critique’ to address the impact, both probabilistic and impact-related, of Black Swans. In his eyes, this requires the adoption of a suitable philosophy of both temporality and hermeneutic (not empirical) interpretation of the event. He briefly turn to Heidegger in justifying this claim pointing to the latter’s concern with ‘interpretative events’ which have the power to affect how beings are revealed to the acting subject (i.e. by affecting the manner of both the opening and closing of our being-in-the-world). These events precipitate the very crises in which meaning emerges, but they are intrinsically of an unpredictable nature because they render every aspect of our experience immune to the previous order of meaning. As such, they, can only happen for a ‘being-there’ (i.e. in Heideggerian terms, for an entity like we are, whose own being is ‘at issue’ for it). For us, under the influence of such events, the resulting reflexive narratives are concocted not for our past, nor for some ‘similar future’, but for our time and our existence, which we can only understand from the perspective of our situated finitude and being-in-the-world.

In his article, “The End of Probability”, Ayache (2010) argues that when we situate ourselves in the real world of singular events, contingency can only be viewed as irreducible to any underlying states of world, that is, singular events can only surpass the limit horizon that we have constructed on the basis of the previously known range of possible states. In this situation we are compelled to deal with contingency, pure and simple. But when it comes to translating this conception of absolute contingency into a finance-related context, Ayache (2010) observes that, if states of world were prices then prices of contingent claims would also be states of the world that are entirely different from those of the underlying. He goes on to suggest that if the market for contingent claims concerns what happens to a claim before its maturity, it therefore depends not just on underlying, but on such things as the volatility of underlying, the volatility of its volatility, and so forth. Along these lines he further observes that vanilla options are never traded alone, but always in the company of barrier options, variance swaps, options on variance, cliquets and so on. Accordingly, as the market evolves, each renewed calibration determined by the complete range of traded options changes the calculated ‘risk-neutral distribution’ determining the discounted expectation of relevant payoffs.

Ayache (2008a,b) turns for inspiration to French philosophical writing about the event, which is conceived by Nietzsche and Mallarme as a ‘dice throw’ affirming chance both through the uniqueness of each cast, and through the totality comprised by the ‘throw of all throws’ for which the being of the cast is invariant in its productive determination. As such, the event is defined by the absence of principle. For Gilles Deleuze, the “great cast” is a genetic virtuality of
which entities are but the particular and contingent actualizations. Nevertheless, it is in the Speculative Realist philosophy of Quentin Meillassoux, that Ayache finds the precise notion that he is seeking: that of the event as absolutely contingent⁶.

In rendering this conception of the event more concrete Ayache (2010) turns to the important duality holding between the forward and the backward perspective on contingent claims. While probabilistic methods for pricing options are backward looking (e.g. the Black and Scholes partial differential equation system can price options for all the times occurring between the option’s maturity and its preset time), asset pricing models are forward looking (e.g. the forward equation produces the price of all call options of different maturities and strike prices as seen from present spot and the present time). Hence, the relevant state variables are both the strike price and the time to maturity (each of which are represented be marks written upon a contingent claims). Ayache also observes that the forward equations better for both calibration and subsequent recalibration.

In summary, the philosophical well-springs of Ayache’s Critique have primarily come from Quentin Meillassoux’s notions of ‘absolute contingency’. In Taleb’s case, we can perhaps discern the workings of an undisclosed naturalism; a naturalism which he could conceivably share with Speculative Realists such as Iain Hamilton Grant⁵.

Instead, I would advise Taleb to embrace a more persuasive process-theoretic interpretation of Keynesian fundamental uncertainty, which highlights the structural conditions of its constitution, its sources, and character. In my view, this would be powerful and efficacious than accepting either a phenomenological approach (i.e. one based on either a subjective or an inter-subjective understanding of uncertainty framed in terms of personal belief and the subsequent assignment of odds to prospective events) or a narrowly hermeneutic approach to the “interpretative event”⁶.

4. Elements of a Critique

In seeking to construct an alternative philosophical basis for an anti-foundationalist Realism, therefore, I would argue that we can more gainfully turn to other thinkers such as Alfred North Whitehead for our articulation of our all important notions of pattern and structure; even patterns which may or may not be endlessly repeated, and which might or might not support estimation using a stable statistical distribution. From the perspective of the social rather than the natural sciences, there are fundamental structural reasons for doubting the ontic stability and regularity of economic processes, which go well beyond the social

⁴ For Meillassoux, the notion of absolute contingency serves as the vehicle for a quasi-Humean critique of the Kantian circle of objectivity (i.e. it undermines the anti-realist argument that the knowing subject can only know things existing-for-him rather than things-in-themselves and, in addition, the anti-idealist argument that
⁵ See Grant’s contribution in Bryant et al., 2011. Grant, for his part, endorses the Objective Idealism of Schelling on the grounds that Objective Idealism is a form of Realism; though one he leavens with contributions from the neuro-cognitive sciences (including, of course, applications unique to the field of behavioural finance), and evolutionary biology, and a Realism that has benefitted from various transportable insights taken from the literature on the fractal geometry of nature and other forms of complexity.
⁶ See Gilles (2006) for an exposition of the inter-subjective and Tversky and Wakker (1995) for a subjective approach to decision-making under uncertainty. In my review of research motivated by Constantino Tsallis (Juniper, 2006), I have argued that the thermodynamics of far-from-equilibrium systems offers the opportunity to reconcile objective and subjective conceptions of uncertainty. This is because the very same (generalized- or q-exponential) functional forms can be seen to characterize both the Kolmogorov-Sinai entropy measure of the dynamic complexity of “close-to-chaos” systems (i.e. the objective conception) and the distortion functions that are the expression of aversion to uncertainty (i.e. the subjective conception) in cumulative prospect theory.
constructivist mantra that our social reality itself alters as a result of a change in our conceptions of this reality.

Relevant structural characteristics of our commercial world of production, distribution and exchange include the presence of non-constant returns to scale. As a consequence, it would be impossible to construct a Ricardian 'standard commodity' whose value would be rendered immune to the effects of shifts in the distribution of income between workers and capitalists. This vertiginous anti-foundationalism stands in stark contrast to the views of 'progressive' neo-Ricardian and 'conservative' neo-Walrasian theorists of General Equilibrium, with their concern for existence, uniqueness, and stability (in decreasing order of importance, if not to say likelihood)\(^7\).

Another structural characteristic is that of arbitrage, which, as a notion, is clearly situated at a higher level of generality than of an equilibrium defined solely by the elimination of excess demand (Ellerman, 2000). The surjective (and thus entirely unhelpful) nature of the relevant mappings in case of the latter, has been confirmed by numerous commentators including, somewhat ironically, Debreu himself, as well as by Mantel and Sonnenschein. Keynes, for his part, was more than happy to make use of the arbitrage concept in the General Theory, but only when speaking of the short run.

Another key stumbling block, in structural terms, is afforded by the important distinction between ontological rather epistemic forms of uncertainty. Irrespective of whether Winslow (1989) is correct in his arguments that Whitehead's process philosophy influenced the views of Keynes on the objective nature of uncertainty, between the writing of the Treatise on Money and the General Theory, a closely related conception must surely have grounded the latter's distinction between expectations over the short-run (governing remuneration from the sale of goods and labour services) and those over the long-run (governing the return on long-lived financial and real assets).

Whitehead, for his part, adheres to a nested ontology stipulating that entities are more stable at more generic rather than more specific levels of determination. This nesting has a clear temporal dimension insofar as efforts to forecast phenomena in the near future can benefit from access to more information and the fact that more factors can be treated as fixed rather than variable. In efforts to forecast further into the future, more factors of influence are variable rather than fixed and there is less relevant information available. Needless to say, interactions between many of the now-variable factors will conceivably be complex and non-linear in nature. From this perspective, Taleb's distinction between the worlds of Mediocristan and Extremistan could, justifiably, be viewed as mirroring Keynes's distinction between short-run and long-run expectations. Ayache, however, would have difficulty in justifying distinctions of this kind on the basis of his conception of radical contingency.

From such a long-run perspective, moreover, it would be desirable to bring real rather than just financial assets into the picture, which is something quantitative finance theorists seem to resist. Minsky's approach to unbundling the Keynesian marginal efficiency of capital schedule, which separately examines influences over both the supply price and demand price for capital (including borrowers' and lenders' risk) would be a good place to start, because fluctuations in investment can indirectly influence asset prices due to their effect on the dividend stream (as mediated by shifts in the point of effective demand). By the same token, the work of both Minsky and Kalecki highlights the important role of external finance, which can vary in magnitude relative to the nominal flow of goods and services in such a way that it

\(7\) See Andrews (1996) for an anti-foundationalist interpretation of the Sraffian critique of marginalism.
can spillover into asset price inflation and deflation (Duménil and Lévy, 2011). Accordingly, researchers should, whenever possible, account for this two-way interaction between markets for financial assets and markets for physical capital (i.e. buildings and structures as well as parts and equipment).^a

References:

^a In his paper on the financial instability hypothesis Minsky (1992) explicitly notes that “The financial instability hypothesis incorporates the Kalecki (1965)-Lévy (1983) view of profits”. Nevertheless, the stock-flow-consistent modelling approach of Passarella (2011) cautions against any simplistic focus on gearing ratios, as measures of financial fragility, because asset price inflation and processes of securitization can camouflage or mask increasing leverage on the part of firms or households.

^b Of course, there are mainstream models which achieve this coupling by welding real business cycle models onto asset-pricing models (e.g. Brock, 1982), but here, the causality is entirely one way from a dubious model of production with output determined by perturbations to the “real forces of productivity and thrift” to an equally dubious model of asset pricing which is constructed with regard to a pre-given dividend process. For their part, the more audacious catastrophe-theoretic models of asset pricing (Brock and Hommes, 1998) entirely ignore the real side of the equation.


