

# Calculating Risk and Uncertainty

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*First draft. Comments welcome. Please don't quote.*

## Abstract

'Risk as uncertainty' and 'risk versus uncertainty' are the two, thoroughly antithetical, epistemologies that underpin 20th Century economic theory, based on the distinction of uncertainty as probabilistic, and as non-probabilistic. Keynes and Hayek share the theoretical position of non-probabilistic uncertainty, and both take as a point of departure the problem of knowledge as a major challenge for economic organisation.

Given this fundamental communality, why do their policy conclusions differ so radically? For Keynes, rational calculation cannot be accommodated by the market and requires government intervention whilst Hayek argues that the market is solely capable of dealing with uncertainty efficiently. Why were both then overturned by the 'risk as uncertainty' equivalence, which made way for the mathematisation of economics as well as for the birth of modern finance theory? What is the relevance of their epistemological stance in regard to the current global financial crisis, which has reintroduced incalculable uncertainty as a major obstacle to risk management? This paper seeks to address these questions within the context of liberal governance.

## **Introduction**

'Risk as uncertainty' and 'risk versus uncertainty' are the two antithetical epistemologies that shape economic theory in the 20<sup>th</sup> century. Two of the most prominent economists of the century, John Maynard Keynes and Friedrich August von Hayek, both share a fundamental interest in genuine uncertainty, yet the policy conclusions they derive could not be more antagonistic. Moreover, between 1930 and 1970, at the same time that their respective political influence reached its zenith, genuine uncertainty was disposed with in economic theory, and reduced to risk as numerically determinate probability (Lawson 1988:50), giving rise as a consequence to the birth of modern finance theory.

This paper will investigate how come, given their fundamental communality in such a critical aspect, Hayek and Keynes derive diametrically opposed solutions regarding the theoretical nature and agent of calculation. It will then expose the complex developments that lead to the conceptual equivalence of uncertainty and risk from the middle of the century onwards. It will show how, again, the theoretical conception of risk had enormous practical and political influence. Finally, the paper will reflect briefly on the re-introduction of incalculable uncertainty, which seems to have taken place with the global financial crisis 2007-2009, and situate the risk-uncertainty debate in the general problem of liberal science.

## **A common uncertainty?**

The differentiation between risk and uncertainty in economic theory is often traced back to Frank Knight (1921), whose distinction between risk as numerically measurable, and uncertainty as immeasurable, has become commonplace in the modern literature on risk and uncertainty (Wakker 2006). Knight states: “A *measurable* uncertainty, or “risk” proper, as we shall use the term, is so far different from an *unmeasurable* one that it is not in effect an uncertainty at all (1921:20)”. This true uncertainty, expressed in irredeemably unique estimates with no valid basis of any kind and fundamentally different from risk measured by relative frequency probability, gives the “characteristic form of “enterprise” to economic organization as a whole” (Ibid. 232). It should be noted that mathematical probability was not the first theory of risk, as 16<sup>th</sup> and 17<sup>th</sup> century jurists writing on aleatory contracts had already produced a learnt literature on the subject (Daston 1988). Although the most prominent, Knight was also only one of many theorists in insurance and economics who since the end of the 19<sup>th</sup> century through to the 1940s vividly discussed the concepts of risk, probability and uncertainty, and the possibility of quantitative measurement (see McGoun 1995). Carl Menger for example already at the beginning of neo-classical theory proposed an improved understanding of economic processes through a differentiated understanding of risk and uncertainty (Kessler forthcoming).

Both Hayek and Keynes share Knight’s opposition to the possibility of statistical measurement of uncertainty, and both emphasise the role of conventions and estimates in the economic process. They also both diverge from Knight in making an epistemological argument as opposed to his ontological “real indeterminacy of reality”. Keynes’s famous quote reads:

“By ‘uncertain’ knowledge, let me explain, I do not mean merely to distinguish what is known for certain from what is only probable. The game of roulette is not subject, in this sense, to uncertainty...The sense in which I am using the term is that in which the prospect of a European war is uncertain, or the price of copper and the rate of interest twenty years hence...About these matters there is no scientific basis on which to form any calculable probability whatsoever. We simply do not know.” (1937: 213-14)

Like Keynes, Hayek makes uncertainty a principal theme and point of departure of his economic analysis. He distinguishes from scientific knowledge the crucial body of “very important but unorganized knowledge, the knowledge of the particular circumstances of time and place, which “by its nature cannot enter into statistics” (1945:5). Statistics “by abstracting from minor differences between things, by lumping together...items which differ as regards location, quality, and other particulars” (ibid) is not the kind of knowledge relevant for the countless daily decisions, the “constant deliberate adjustments...made every day in the light of circumstances not known the day before” – not the kind of knowledge required to ensure the continuous flow of goods and services.

The conclusions for economic organisation however could not be more different: For Keynes, uncertainty made the long-term expectations of investment and liquidity preference necessarily irrational, informed by ‘animal spirits’ and different states of confidence, and “whim or sentiment or

chance”(1936: 162-3)“. The reasons why people held money for example, were not only for transaction, but also motivated by speculation and precaution, depending on the emotional outlook taken towards the future. Hence long-term expectations can bear no relation to underlying economic reality. Moreover, the systematic dis-coordination of economic activity that irrational forces in the economy imply requires correction through exogenous governmental intervention, notably changes in public spending and taxation.

Hayek on the other hand, did not consider uncertainty a source of disorder in the market. Because no total account of knowledge can ever be aggregated, it follows that it cannot be conveyed to any central planning authority or government. However, though practical and specific, this knowledge of itself is still limited, and needs to somehow take into account the relevant patterns of changes of the larger economic system. Here Hayek makes an interesting specification regarding the uncertainty impeding on the entrepreneurial decision:

“There is hardly anything that happens anywhere in the world that *might* not have an effect on the decision he ought to make. But he need not know of these events as such, nor of *all* their effect ...It is always a question of the relative importance of the particular things with which he is concerned”(1945:7).

The solution to the problem of dealing with *relevant* uncertainty is presented in form of the price system - “rates of equivalence (or “values”, or “marginal rates of substitution”) that is, by attaching to each kind of scarce resource a numerical index which cannot be derived from any property possessed by that particular thing but which reflects ...its significance in view of the whole means-end structure”(Ibid. 9). The concentration of relevant information contained in prices enables entrepreneurial decisions without having “solved the whole puzzle *ab initio*” (Ibid. 11). But the calculation effected by the price system, the numerical transposition and abstraction of dispersed, partial and local knowledge, is very different from the statistical calculus. It is an objectification of subjective estimates, a calculation able to take into account constant change. Where Keynes considers radical contingency *per se* an exogenous distortion of and insurmountable obstacle for rational economic organization, for Hayek that part of radical contingency *relevant* for economic decisions is efficiently accommodated by the decentralized operation of the market.

Hayek’s epistemic argument for the impossibility of planning took place in the socialist calculation debate, but the ordo-liberal orientation he represented linked protectionism, state socialism, the war economy and Keynesianism into one systematic whole, where any one element of economic intervention steered by a central authority would necessarily induce the others.<sup>1</sup>

To understand the different implications of uncertainty in Keynes and Hayek, a closer look at the underlying philosophical positions is illuminating. While both economic theories are founded on an epistemological argument of how knowledge is produced and distributed in society, their understanding and appreciation of human reason is in fact very different.

In Keynes's view, knowledge is justified true belief. While the acquaintance of new facts and direct

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<sup>1</sup> Hayek, Röpke and others took Roosevelt’s New Deal, the English Beveridge Plan, and Soviet Socialism and argued that the same principles were at work, and ultimately would result in Nazi-type autarchy as the final point towards which an economy and a politics unable to overcome their contradictions are carried. See Foucault, M. (2008) *The Birth of Biopolitics*, p.110

knowledge occurs by 'intuition' in a near-phenomenological manner, the justification of knowledge takes place by assessing the logical relation between propositions, in line with logical positivism (See Kessler forthcoming). But as Butos and Koppl capture aptly, an

„unknowable future nullifies the force of Cartesian reason. Thus, endogenous mechanisms cannot be relied upon to extricate the system from unemployment equilibrium. Keynes, despite dismissing the applicability of Cartesian rationalism as a force from within the system, still retains it as an epistemological authority. But now such authority enters as an exogenous constructivist element in the form of government intervention.“ (Butos and Koppl 1995:40)

For Hayek on the other hand, knowledge is practice; it is "knowing how" rather than "knowing that" (Ryle 1949). Human action is driven by traditions, rules and customs, which have evolved from a "process of selection that could take account of more factual circumstances than individuals could perceive, and in consequence tradition is in some respects superior to, or 'wiser' than, human reason" (Hayek 1988, p. 75). Limits on knowledge also follow from the self-referentiality of human cognition as such, as "any apparatus of classification must possess a structure of higher complexity than is possessed by the objects which it classifies, which implies that the brain can never fully explain its own operations" (Hayek 1952, p. 185). For Hayek, defining knowledge according to Cartesian (justificationist) criteria "errs by assuming the existence of an infallible epistemological authority" (Butos and Koppl 1995: 35). As another Austrian economist, Lachmann, ironically states: "(Keynes claims that) we cannot leave investment decisions to businessmen in the private sector because they do not know enough about the future to make their "parting with liquidity" worthwhile. By contrast, when government spending on public works is under consideration, the debilitating uncertainty goes into remission" (Garrison 1984).<sup>2</sup>

Whereas Keynes sees the market as field of action in which rational calculation had to cede much ground to animal spirits, Hayek sees the market as the principal cause for what little rationality animates men's actions. It is "in general not rationality which is required to make competition work, but competition, or traditions which allow competition, which will produce rational behaviour" (Hayek 1979, p. 76). The reliability of our knowledge of the future, of our long-term expectations, does not depend so much on the rationality of our projections as on the properties of the economy's selection processes. It is even the "unintended consequences" of economic practices that are responsible for the emergence of social institutions such as money, law, market, states etc (Kessler forthcoming: 25), reaching a degree of complexity, which could never have been achieved by deliberate planning.

The crucial difference is hence an opposition between Keynes's adherence to the rationalist tradition<sup>3</sup> and its claim to true knowledge wielded from uncertainty through the power of reason, and Hayek's emphasis of knowledge as practice and subscription to the Popperian view that all knowledge is a fallible interpretation of experience, hence only imperfect knowledge of reality is possible and the only

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<sup>2</sup> See <http://www.auburn.edu/~garriro/r8lachmann.htm>

<sup>3</sup> Although it clearly is a rationalism accounting for an unknowable future in contrast to the rationalism of the classical theory which he condemns as adhering to a "Benthamite calculus" and its assumption that all probabilities can be given a numerical representation (See also Kessler forthcoming: 15). Likewise, Keynes objected to the concept of utility as the calculability of human pains and pleasures.

certainty of knowledge consists in its falsifiability (Delanty 2005). From that follows the respective exogeneity or endogeneity of long-term uncertain expectations to the market process, and the necessary counterbalance or distortion associated with 'rational' governmental intervention. For Keynes, uncertainty holds only in the long distance, whereas for Hayek it is present in all knowledge.

### **Risk-uncertainty equivalence and the birth of modern finance**

The formal incorporation of risk and uncertainty into economic theory first took place in 1944 in John von Neumann and Oskar Morgenstern's *Theory of Games and Economic Behaviour*. In 1738 Daniel Bernoulli had redefined expectation as the product of the probability of the outcome and what later became known as its utility. Von Neumann and Morgenstern axiomatically proved Bernoulli's notion of expected utility as the sum of utilities from outcomes weighted by the probabilities of outcomes, and suggested a way to numerically measure utility. Epistemological uncertainty was hence transformed into ontological risk, as a distribution function over known possible states of the world.

The identification of uncertainty with risk in post-war economics was theoretically driven by two major forces, which combined turned the subject of economics into its present form: *First*, as stated by Backhouse, the definitive mathematization of economics since the 1930s represents a major new departure in the subject – despite the long history of the use of mathematics in economics which included not only Marx but also Keynes: The *General Theory* was at the time considered a highly mathematical book which arguably explains its broad rejection by the older generation of economists (Backhouse 2002). *Second*, economic theory underwent a crucial redefinition of both its discipline and methodology: The theoretical basis to von Neumann and Morgenstern's approach was provided by Lionel Robbins' (1933) argument that economics was not distinguished by its subject matter – it was not about the buying and selling of goods, not about unemployment and the business cycle – but instead dealt with a specific aspect of human behaviour: the allocation of scarce resources between alternative uses. The *Theory of Games and Economic Behaviour* thus represented the first consistent and predictive theory of *choice* under uncertainty, strongly objecting to the view that the human and psychological elements of economics prevented a mathematical treatment of human behaviour under uncertainty.

Of equal significance was Friedman's (1953a) seminal article *Methodology of Positive Economics*, which stated that economic theory should be viewed as "an 'engine' to analyse [the world], not a photographic reproduction of it (1953a:35)", engaged in the impossible task of the faithful recording of empirical facts. It followed that

"Truly important and significant hypotheses will be found to have 'assumptions' that are wildly inaccurate descriptive representations of reality...A hypothesis is important if it 'explains' much by little...if it abstracts the common and crucial elements from the mass of complex and detailed circumstances...and permits valid predictions on the basis of them alone. To be important, therefore, a hypothesis must be descriptively false in its assumptions...Factual evidence can never 'prove' a hypothesis; it can only fail to disprove it (1953:14)."

As Oliver Kessler remarks: "Today, the identity of economics as a discipline is built on a particular method and mode of reasoning, not on the subject under consideration" (2007: 118). The pragmatic

emphasis on testing and prediction can be identified as a further cause for the indifference to a conceptual distinction between risk and uncertainty.

Thus, the uncertainty, which had only been introduced into economic theory in the 1930s, was rendered into calculable form and hence reduced to risk. A hugely important result as well as motor of this development was the birth of modern finance theory: Markowitz (1952) and Sharpe (1964) were “largely responsible for the institutionalization of the probabilistic measurement of risk in finance and accounting and won Nobel prizes for their efforts in modern portfolio theory and the capital asset pricing model” (McGoun 1995:514). It is telling that in his history of risk and uncertainty, Bernstein leaves the discipline of economics in 1952 (the year of the publication of Markowitz’s article ‘Portfolio Selection’) and continues his story for the rest of the book in the discipline of finance. With the subsequent development of the Black-Scholes Option Pricing formula, which allowed the quantification and hence pricing of derivatives risk, modern finance theory can be said to be *the* science of the quantification of uncertainty.

Today’s mainstream assumption of risk as uncertainty equivalence is however not to be regarded the result of a linear process. While these aspects on the one hand influenced and re-enforced each other, they were on the other conflicting, contradictory, and paradoxical. It was Keynesian economists such as Hicks and Hansen, attempting to reduce the central claims of the General Theory to a set of equations and thus producing the famous IS-LM model, who were the most active drivers of the mathematisation of economic theory. In the process of formalisation they obliterated the distinction between risk and uncertainty (Weatherson 2002:47), leaving out Keynes’s discussion of dynamics and expectations.<sup>4</sup> By the 1960s, many economists had (mistakenly) come to believe that Keynesian macroeconomic policies had made the business cycle a thing of the past” (Backhouse 2002:236).

Mathematical Keynesians such as Samuelson further stood in sharp disagreement with the methodological move of Friedman’s *Methodology of Positive Economics* and argued that it is

“fundamentally wrong to think that unrealism in the sense of factual inaccuracy even to a tolerable degree of approximation is anything but a demerit for a theory or hypothesis...The fact that nothing is perfectly accurate should not be an excuse to relax our standards of scrutiny of the empirical validity that the propositions of economics do or do not possess” (quoted in MacKenzie 2007:11).

Friedman on the other hand opposed the mathematical treatment of finance and voiced doubts over whether Markowitz’s doctoral work of the portfolio theory belonged to the discipline of economics (Ibid). Finally, Backhouse points out that “Keynesian macroeconomic planning of the type that governments tried to use during the post-war decades was made possible by the revolution that took place in national accounting and the provision of statistics during the inter-war period and the Second World War” (2002: 291). These paradoxes and contingencies go some way to explain how a vital element of Keynes’s theory was lost at the same time that his practical impact thrived.

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<sup>4</sup> Weatherson holds that this was in part due the informal presentation of Keynes’s view on uncertainty in the *General Theory*.

## **Return of uncertainty?**

The quantification of uncertainty that culminated in the theoretical milestones of modern finance theory has had almost unprecedented political and practical impact. The most pertinent demonstration of this has been put forward by Donald MacKenzie's (2006; 2007) work on the 'performativity' of economic theory. MacKenzie demonstrates that the widespread use of the theory of option pricing had such an impact on financial practice that "its assumptions – originally greatly at odds with the empirical reality of markets – became less unrealistic" (2007:56). Fischer Black himself stated in 1989 that "Traders now use the formula and its variants extensively. They use it so much that market prices are usually close to formula values even in situations where there should be a large difference (quoted in De Goede 2005:130-31). The Black-Scholes formula was heralded as the "scientific discovery of financial truth" (Ibid. 131) and is at the heart of the enormous growth of global derivatives markets since the end of the Bretton Woods System, which still bore Keynes's design. Together with the efficient market hypothesis, the formula was further legitimated by the assumption that derivatives reduced societal risk through dynamic hedging: A broker quoted by Marieke de Goede states: "The more we trade, the better off the society is because the less risk there is" (Ibid.)

The global financial crisis beginning in 2007 as a consequence of defaulting American subprime mortgages, and quickly spreading through the global intertwined channels created through securitisation and CDO and CDS derivatives in particular, has put the confidence put in probabilistic numerical risk assessment to a sudden halt. Incalculable uncertainty is said to have returned in the form of a 'black swan', an unexpected tail-risk event, falsifying the normal distribution, in the form of correlation not grasped by risk models, as well as in the form of irrational 'greedy' speculation.

It is difficult to predict what lessons economic and financial theory will draw from this crisis. This paper will instead conclude by a brief reflection on what Walter Lippmann termed the 'debacle of liberal science', which in some way permeates the debate on risk and uncertainty in 20<sup>th</sup> century economic theory and political discourse and practice. This debacle is the result of a contradiction between liberalism and science. Lippmann (1937) states:

"To the debacle of liberal science can be traced the moral schism of the modern world which so tragically divides enlightened men. For the liberals are the inheritors of the science which truly interprets the progressive principle of the industrial revolution. But they have been unable to carry forward their science; they have not wrested from it a social philosophy which is humanly satisfactory. The collectivists, on the other hand, have the zest for progress, the sympathy for the poor, the burning sense of wrong, the impulse for great deeds, which have been lacking in latter-day liberalism. But their science is founded on a profound misunderstanding of the economy at the foundation of modern society, and their actions, therefore, are deeply destructive and reactionary. So men's hearts are torn, their minds are divided, they are offered impossible choices. They are asked to choose between the liberals who came to a dead stop – but stopped on the right road up to wealth and freedom and justice – and the collectivists who are in furious movement – but on a road that leads down to the abyss of tyranny, impoverishment, and general war."

This mistrust of science is echoed by Röpke for whom the “scientific elimination of the human element in political and economic practice” was symbolised by the industrial-technological application to society of an attitude of mind which is “the outcome of a mixture of the hubris of the natural scientist and engineer mentality of (...) those who would construct and organise economics, the State and society according to supposedly scientific laws and blueprints” (quoted in Foucault 2008:127).

As Foucault (2008) demonstrates, this neo-liberal aversion to positivism represents a sharp break with the naturalism of the Physiocrats, and hence with classical liberalism, which constituted the market as a realm to be left alone by the state so that it could unfold according to its own nature. For neo-liberals, competition was not natural but had to be artificially produced by constant active state intervention – however not in the economy, but in society – and the *Ordnung* or framework of the economy. This then points to an unexpected common aversion to *laissez-faire* in Keynes and Hayek. A crucial insight of Foucault’s is that that the ordo-liberal economic doctrine was moreover the only way in post-war stateless and occupied Germany to *re-legitimize a state* – on the premise that it was governed by its economic principle (2008: 117ff).

## **Conclusion**

Different conceptualizations of risk and uncertainty in 20<sup>th</sup> century economic theory in part mirror an inherent schism between modern and liberal forces, which in O’Malley’s words is the tension between “the modernist illusion of control through risk-based expertise” (2004:176) and the liberal emphasis on uncertainty as the locus of freedom. Both Keynes and Hayek distanced themselves from a positivism, which gained prominence again in the 2<sup>nd</sup> half of the 20<sup>th</sup> century. But where Keynes moved to logical positivism and retained a rational desire to continuously reduce uncertainty, Hayek’s post-positivist stance holds uncertainty to be an inextricable part of all knowledge. Where Keynes’s political agent of calculation is the state in an attempt to correct the irrational tendencies of the economy, any intentional rational pretense of calculation for Hayek and the ordo-liberals ultimately leads to totalitarian disaster. Yet their ultimate political line of separation is not a simple state-market dichotomy, but different kinds of state intervention and rationales. As Bryan Magee (1974:81) summarizes the logic of neo-liberalism: “The maximum possible (...) freedom is an optimum, not an absolute, for it has to be restricted if it is to exist at all. The governmental intervention which alone can guarantee it is a dangerous weapon: without it, or with too little, freedom dies; but with too much of it, freedom dies also.”

(3,761 words)

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