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UNCERTAINTY, PROFIT AND ENTREPRENEURIAL ACTION: FRANK KNIGHT'S CONTRIBUTION RECONSIDERED

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Frank H. Knight held two different concepts of "uncertainty" in Risk, Uncertainty and Profit *(1921). The first is based on the possibility of insuring against an outcome. This interpretation can be found in the existing literature on Knight's work. The second refers to all instances where individuals have subjective expectations about the future. This second meaning forms the basis of Knight's (1921) theory of profit and entrepreneurial action (Knight I). Knight I is limited; it provides no explanation of the incentive for entrepreneurial action. Knight's neglected later theory of profit (1942) (Knight II) highlights the deficiencies of Knight I by offering a clear incentive for entrepreneurial action. The differences between the two theories of profit reflect the impact of incorporating historical time into economic analysis.*

I. INTRODUCTION

There has been considerable discussion and disagreement over the meaning of Frank H. Knight's distinction between risk and uncertainty. There has also been extensive comment on his theory of profit and entrepreneurial action.[1] The discussion of Knight's contribution to these related literatures has been based almost entirely on *Risk, Uncertainty and Profit* (1921, *RUP* hereafter).

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[1]See for example the frequently cited statement from Baumol (1968, p. 64) that only Frank Knight (and Schumpeter) "succeeded in infusing him (the entrepreneur) with life and assigning to him a specific area of activity to any extent commensurate with his acknowledged importance."

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Departing from previous interpretations, we argue that in *RUP* Knight held two distinct definitions of uncertainty. The first, most commonly accepted definition is that ''risk'' refers to outcomes that can be insured against, and ''uncertainty'' to outcomes that cannot be insured against (J. Fred Weston 1954 and George J. Stigler 1987). The evidence in favor of this interpretation is clear. The second interpretation is derived from Knight's use of the distinction in a theory of economic activity. The largest part of *RUP* is dedicated to the description of an ideal-state theory of economic activity.[2] A characteristic of this theory is that no economic profit is earned. The next step for Knight is to relax the assumptions of the model until the desired phenomenon—economic profit—exists. Knight chooses to do this by altering the nature of the information that agents have about the future. In doing so he distinguishes between risk and uncertainty.

This method of modelling an ideal state, and then relaxing the assumptions until the desired phenomenon is observed, is the subject of much of the introduction to *RUP* (pp. 15–16). In this context *RUP* can be read as both a theory of economic activity and a demonstration of correct scientific method.

In order to arrive at our second interpretation of the distinction between risk and uncertainty we begin by making two claims. First, Knight's distinction between risk and uncertainty is between conditions in which profit cannot exist (the future is subject to risk) and conditions in which profit can exist (the future is uncertain). Second, profit is a residual that accrues to the owner of the firm, and to which no liability corresponds. These claims are well supported in *RUP*, and we consider them to be non-controversial. Given these starting propositions, and the model of the economy employed by Knight, we interpret the distinction between risk and uncertainty as being the difference between objective and subjective beliefs about the future.

The confusion over the meaning of uncertainty has masked important limitations of the theory of profit and entrepreneurial action that Knight (*RUP*) builds on the risk/uncertainty distinction (Knight I). Knight (''Profit and Entrepreneurial Functions,'' 1942, *PEF* hereafter) tacitly acknowledges these problems by developing a new theory of profit (Knight II) that is similar to the theories of Jon Bates Clark (*RUP*, pp. 32–38) and Joseph A. Schumpeter (1911).

The crucial element missing in Knight I is an incentive for entrepreneurial action. While *RUP* has been the basis of subsequent attempts at formally modelling entrepreneurial activity (Richard E. Kihlstrom and Jean-Jacques Laffont 1979), these models are subject to the same criticism, that they offer no constructive incentive for entrepreneurial action.

Knight II offers a new theory of profit, again using the distinction between risk and uncertainty. In this theory he claims that bearing uncertainty is the least important of the entrepreneurial functions, and that introducing innovation and adapting to the innovation of others are more important. In Knight II the incentive for entrepreneurial action is clear: the entrepreneur introducing innovation is able to act as a monopolist

[2]In footnote 2, p. 266, Knight makes his intentions clear. Chapter Five dealt with progress with uncertainty absent, Chapter Nine deals with uncertainty with progress absent, and Chapter Ten deals with the case where uncertainty and progress are both present. Each of these chapters is then to be treated as a formal discussion of the effects of departing the basic no-uncertainty, no-progress model described in Chapter Three.

and earn monopoly profits. Those who respond most quickly to the innovation earn some profits. Eventually a sufficient number of entrepreneurs will have entered the market and profits from the innovation will be reduced to zero.

A note on reading Knight is needed. The difficulties of reading *RUP* are well documented, as for example in Stephen F. LeRoy and Larry D. Singell Jr. (1987). For the purposes of this paper the chief difficulty is that Knight continually hedges his statements. Otherwise clear statements of meaning are often qualified with "Practically all" or "Probably" and so on. As we shall see, the distinction offered in this paper relies on the impossibility of perfect insurance, or of knowing perfectly the probability of a *real* coin landing on heads. On these points Knight is inconsistent, and the need to attribute two definitions of uncertainty to his work follows from this inconsistency.

In section two we discuss previous interpretations of the risk/uncertainty divide and present the basic argument of the distinction as being between the insurability and non-insurability of future outcomes. Knight's definition of profit and use of uncertainty are discussed in section three. In section four we claim that the distinction between risk and uncertainty as Knight uses it is between subjective and objective beliefs about the future. In section five we examine Knight's theories of profit. The role of time in the analysis of profit and in describing the entrepreneurial function is discussed in section six. This section mirrors the pessimism of earlier writers over the prospect for formally modelling the entrepreneur. Section seven provides a summary of our main arguments and a conclusion.

II. PREVIOUS INTERPRETATIONS

Leonard J. Savage finds no valid distinction between risk and uncertainty as Knight describes it (Milton Friedman 1962, p. 282). If risk refers to situations where the distribution of future outcomes is known, and uncertainty refers to situations where the distribution of future outcomes is not known, then allowing agents to form subjective beliefs about the future overcomes all problems presented by a distinction that no longer has any meaning. This interpretation has found common use in mainstream neoclassical economics.[3]

Another line of thought has claimed that the Knightian distinction is between insurable (risky) and uninsurable (uncertain) outcomes. Weston (1954, p. 155) and Stigler (1987) both offer interpretations of this type. This is the first definition of uncertainty, and is developed in Chapter Seven of *RUP*. Knight divides the future outcomes into three categories. First are outcomes to which mathematical probability applies. These include the probability of a coin landing on heads when tossed. Second are outcomes that can be grouped and the expected outcome for the group as a whole can be determined with certainty. These include the probability of a house burning down. While the probability of a fire cannot be determined *a priori*, with sufficient historical evidence it is possible to estimate the probability of a house burning down, and the expected loss resulting from fire for a large number of houses can be estimated with a high degree of accuracy. Outcomes of this type can be insured

[3]By way of example, two widely used graduate texts, Mas-Collel, Whinston, and Green (1995) and Jehle and Reny (2000), use the terms risk and uncertainty interchangeably.

against, as the individual houses can be grouped and the total loss to fire is then a fixed cost for the firm offering the insurance. The third type of outcome is those that cannot be grouped, and whose likelihood cannot be estimated from historical data. Outcomes of the first and second type are risky, outcomes of the third type are uncertain. Outcomes subject to risk can be insured against, either through traditional insurance contracts or by holding a portfolio of stocks. In a setting with subjective expectations, as long as there is sufficient agreement over the estimates of the future outcomes then the event can be insured against. This leads Stigler (1987, p. 56) to conclude that "(R)isk was characterized by the reliability of the estimate of its probability and therefore the possibility of treating it as an insurable cost."

LeRoy and Singell (1987) offer a refinement on the insurance interpretation. They claim that the distinction is not simply between insurable and uninsurable cases; rather Knight brilliantly anticipated the literature on the failure of markets as a result of adverse selection and moral hazard. In addition, they claim (p. 396) that the exclusion of insurable risk from the entrepreneur's profit is one of Knight's original contributions, ignoring Knight's (*RUP*, p. 26) own (correct) crediting of the idea to Johann H. Thünen (1842, 1850, and 1863; see Bernard W. Dempsey 1960). Noting the weaknesses in their case, and in particular that they explicitly ignore many of Knight's own statements that contradict their interpretation, they admit another, less flattering, interpretation of *RUP*: "Although we do not agree, we have much sympathy for those who take away from *Risk, Uncertainty and Profit* the opinion that Knight simply had no idea of what he was talking about" (LeRoy and Singell 1987, p. 402).[4]

Two further interpretations are closer to the mark as concerns the role of the entrepreneur, but are not complete as a full definition of uncertainty. The first, by Patrick Gunning (1993), is a final variant on the insurability approach:

> an individual's uncertainty refers only to cases in which he believes that his estimates or opinions about future profit prospects . . . are superior to the revealed appraisals made by others. It is true under such circumstances that there is no market for insurance against the individual's being wrong in his appraisals (Gunning, 1993, p. 36).

The second, by Richard N. Langlois and Metin M. Cosgel (1993), claims that the Knightian distinction is between states of the world that can be conceived of and those that cannot. Their interpretation is based on Knight's distinction between the mechanical ideal states and the biological real world, concluding that Knight's distinction "has more to do with the initial classification of random outcomes than with the assignment of probabilities to the outcomes" (Langlois and Cosgel 1993, p. 459).

Both of these interpretations hinge on the uniqueness/unknowability of future outcomes. As we shall see, these are a crucial part of the explanation for the role of the entrepreneur.

[4]In discussing the inconsistency of Knight's statements they do not consider the possibility of more than one interpretation of uncertainty.

III. THE MEANING OF PROFIT AND USE OF UNCERTAINTY

We now turn to Knight's use of uncertainty as the basis of his theory of profit. Knight (*RUP*, *PEF*) is consistent in defining profit as a residual. This is based on his discussion of the analogy of mechanical processes used in equilibrium theory in economics, a topic to which Knight (1930) returns. He notes that such processes do not produce a residual that is in any way equivalent to profit. The provision of productive services, namely labor and capital, and earning marginal products are the economic equivalent of a closed mechanical system. Profit is outside of this system; it is a residual that is not determined by any activity within the system. We can find clear statements to this effect, "... the latter are imputed, while his own income is a residual. That is, in a sense, the entrepreneur's income is not determined at all; it is 'what is left' after the others are determined" (*RUP*, p. 280, see also p. 271), and, "(I)t is thus a 'residual' income, what is left after other distributive shares are removed, and may be positive or negative" (*PEF*, p. 127).

Uncertainty is the condition necessary for profit to exist. If the future is merely risky, then profit cannot exist. Two quotes from *RUP* support this interpretation: "(I)t is this 'true' uncertainty, and not risk, ... which forms the basis of a valid theory of profit and accounts for the divergence between actual and theoretical competition" (*RUP*, p. 20). Knight continues: "... since risk, in the ordinary sense, does not preclude perfect planning, such risk cannot prevent the complete realization of the tendencies of competitive forces, or give rise to profit" (*RUP*, p. 20). Knight continues by claiming that even if the future is risky, no profit can be earned if "all the alternative possibilities are known and the probability of occurrence of each can be accurately ascertained" (*RUP*, p. 198). This point is contentious, but does not interrupt the flow of the argument and will be dealt with briefly.

Underlying the statement that risk cannot give rise to profit is an assumption that if all opportunities for reducing risk, whether by insurance, hedging or other, are used, then all outcomes will be certain and identical for all future states of the world. If the future is risky even after exhausting all opportunities for reducing risk, then there is a reward for bearing risk (assuming risk-averse agents). But this is not the same as profit, or more precisely, not profit as Frank Knight defines it. Profit is a residual; the reward for bearing risk is a factor payment for an economic activity, earned in proportion to the amount of risk borne. Thus, even though all incomes are not necessarily certain in advance, they are always a reward for a measurable function or activity.

IV. A SECOND MEANING OF UNCERTAINTY

The meaning of the second type of Knightian uncertainty is tied up in his model of the economy. Knight develops his model as a basis for criticism of J. B. Clark's dynamic theory of profit (*RUP*, pp. 32–40), expanding on it later (*RUP*, pp. 266–68). The economy is static, free from all "progressive" changes (technology, population, etc.), and exogenous forces are assumed away. When uncertainty is absent no profits can be earned. When introduced, the amount of uncertainty is determined by the length of the production period, the level of the economic activity (more complex

societies have greater uncertainty), and the extent to which uncertainty has been reduced by insurance and hedging. Entrepreneurs, facing uncertainty, must forecast demand before contracting the factors of production and producing output. The production period is strictly positive, and consumer preferences change through time. Profit arises as a result of errors in forecasting future demand.[5]

Given Knight's definition of profit, use of uncertainty, and model of the economy, our interpretation of the distinction between risk and uncertainty, as it applies to this model, is then relatively straightforward. In any instance where the expectations of the future are based on subjective beliefs there is uncertainty. Risk refers only to instances where there is certainty about the distribution of possible outcomes, and this certainty exists only in the textbook theories of perfect competition.

In order to demonstrate this definition we rely on Chapter Seven of *RUP*, and the statements made about the possibility of perfect grouping for insurance, or of knowing that a perfect coin is perfect and being perfectly randomly tossed. Having established a distinction between insurability and non-insurability based on the possibility of grouping and inferring from historical data, Knight admits that this process of grouping and estimating is not free from error:

> A great many hazards can be reduced to a fair degree of certainty by statistical grouping . . . the statistical treatment never gives closely accurate quantitative results (*RUP*, p. 215).

If this is the case, then errors in the process of grouping will result in less than perfect insurance. The outcome is not reduced to a perfectly known fixed cost, but rather something approximately the same as the estimated fixed cost. Knight's (*RUP*, pp. 247–48) discussion of the life insurance industry is similar. Mortality tables are not correct, but they are very close to correct, and all parties to a life insurance contract believe that the mortality table used is close to correct. If we allow imperfect insurance of an outcome, then when the contract is realized there will be a residual that must be borne by the owner of the firm offering the insurance contract. There will be an offsetting gain or loss to the insured parties in the form of mispriced insurance, however there is no way of observing the nature of the error in grouping or pricing the insurance except in the profit and loss of the insurer. This error, whether in grouping or pricing, results in profit precisely as Knight defines it—an amount paid other than for a productive service.

Knight then goes on to make a statement about the conditions necessary for the application of mathematical probability:

> An illustration of the first type of probability we may take the throwing of a perfect die. If the die is really perfect and known to be so, it would merely be ridiculous to throw it a few hundred thousand times to ascertain the probability of its resting on one face or another. . . .
>
> The import of this distinction for present purposes is that the first, mathematical or *a priori*, type of probability is practically never met with in business . . . (*RUP*, p. 215).

[5]Errors in the production process are also briefly considered (*RUP*, p. 202). Their only potential additional value is in overcoming problems relating to the forward selling of production.

Note the double emphasis on the need for the die to be perfect, and then for the knowledge that the die is perfect. We extend this statement only by claiming that the mathematical type of probability is never encountered, because of the impossibility of having a perfect die, and knowing that it is perfect. Any error in pricing resulting from an imperfect die results in profit. Thus, while the mathematical probability will be used to form subjective beliefs, those subjective beliefs are subject to error in the real world.

It is clear that Knight had difficulty with his definition of uncertainty. That he defined uncertainty clearly in terms of insurability and non-insurability, and then proceeded to discuss problems with producing certain outcomes in the face of either type of risk, suggest that he was not in full command of his material.

Objective beliefs, to which mathematical probability can be applied, exist in textbooks and pure theory, and it was precisely to this pure theory that the middle third of *RUP* was dedicated. This theory is remainderless in the Knightian profit sense. Any deviation from the all-knowing agent requires action based on subjective beliefs. While these beliefs may be expressed in the same way as objective probabilities, they cannot be properly described as such.

The answer to Friedman (1962) is simply that Knight always assumed that people held subjective beliefs in the face of uncertainty, but that these expectations had the same form as expectations in the face of risk: ''(T)he confusion arises from the fact that we do estimate the value or validity or dependability of our opinions and estimates, and such an estimate has the same *form* as a probability judgement; it is a ratio, expressed by a proper fraction'' (*RUP*, p. 231, author's italics). Clearly Knight considered subjective expectations to be important. Friedman's interpretation is particularly surprising given the discussion of types of future event, insurability, and the role of the entrepreneur in forming expectations where there was no basis for doing so based on mathematical probability or historical statistical evidence. Without interrogating the idea, Knight clearly had in mind that entrepreneurs formed expectations, just not based solely on probability theory or historical data.

The interpretation of Langlois and Cosgel (1993) is more extreme than the typical distinction between insurability and non-insurability and outside of the boundaries of the model used in the theory of profit. The response to their interpretation relative to the theory of profit is clear. Following from the static nature of economy, the feasible production set is constant through time. While the actual output is endogenously determined, it is an endogenously determined subset of a fixed, exogenously given feasible production set. Profit can exist in the Knightian sense even with a feasible production set that is both fixed and known to all agents, as long as actual demand is uncertain in advance.

The functioning of insurance markets is based on a different definition of uncertainty; however, it is worth noting the interpretations of Gunning (1993) and Langlois and Cosgel (1993) in relation to the entrepreneurial decision. The key decisions made by entrepreneurs are made in the face of relatively severe forms of uncertainty. As Knight describes it, ''[B]usiness decisions, for example, deal with situations which are far too unique, generally speaking, for any sort of statistical tabulation to have any value for guidance'' (*RUP*, p. 231). Thus the uncertainty faced by entrepreneurs is typically uninsurable, and the realized states of the world that result from entrepreneurial action cannot be reliably estimated in advance, but these are aspects of uncertainty, not the whole of uncertainty.

To repeat the above quote, important because it captures our interpretation exactly, the difference between risk and uncertainty ''accounts for the divergence between actual and theoretical competition.'' Textbook agents face risk; people in the real world face uncertainty. To state it differently, risk and uncertainty do not exist in any overlapping sense, either the future is uncertain, or it is subject to risk. Following this, Milo Bianchi and Magnus Henrekson's (2005, p. 361) statement that Knightian ''(R)isk is a stochastic process with a known distribution, while uncertainty has to be handled with no information'' appears incorrect on two counts. There is no risk in the real world, only uncertainty, and in the face of uncertainty we have varying degrees of information.

V. TWO THEORIES OF PROFIT

We now turn to reviewing the two theories of profit offered by Frank Knight. Knight I, developed in *RUP*, follows directly from the distinction between risk and uncertainty. Knight II, developed in *PEF*, follows a distinctly Schumpeterian line.

In both theories Knight claims the entrepreneur as the owner of the firm and the bearer of risk/uncertainty.[6] Knight (*RUP*, p. 293) justifies the claim of the entrepreneur as owner on the basis that all decisions are made by agents appointed by the owner, who bears ultimate responsibility for all decisions made within the firm. Knight (*RUP*, p. 38) reviews the claim of other writers that the owners of the factors of production bear downside risk, and that the entrepreneur claims the upside. The entrepreneur can lose his capital and have rent and wages unpaid, but these losses are incurred in his capacity as a capitalist and a worker. As an entrepreneur he faces no potential loss. Identified as the owner of the firm, he does however have claim on any cash flows that exceed the contractual obligations of the firm. Knight rejects the argument that capitalists and workers bear the downside without explanation, and insists throughout that the entrepreneur bears risk/uncertainty, both the upside and the downside.

Knight I: RUP (1921)

It is worth summarizing the elements of the theory before considering them individually and in detail. Profit arises out of short-term fluctuations, not ''progressive'' changes. Progressive changes include invention and innovation. Entrepreneurs earn profits by forecasting the future better than other entrepreneurs. In addition to forecasting the future, entrepreneurs have the responsibility of bearing uncertainty. The decision to become an entrepreneur is then based on the belief of superior ability in forecasting, as well as an appetite for bearing uncertainty. The profit itself is the result of a contracting error; the owners of the factors of production negotiate fixed

[6]Without removing the focus from Knight's work, it is worth noting that these two claims were a point of disagreement between Knight and Schumpeter. Schumpeter (1911, 1954) claims that the entrepreneur is defined by the entrepreneurial act alone. The owner of the firm has no special claim on this title. As to the distribution of profit (upside only; Schumpeter was among those arguing that the entrepreneur bears no downside risk/uncertainty), it accrues to claimants on the basis of the particular institutional arrangements. There is no reason for the claimant to be the agent responsible for the entrepreneurial action.

incomes different from their marginal value in the eventual output. Net profits for all entrepreneurs are probably negative, and this is a reflection of the likely over-optimism of entrepreneurs. Finally, this activity occurs in a very specific setting—a static economy in which production takes time, consumer preferences change over time, and all other factors are held constant.

Knight defines ''progressive'' as changes in the population, technology and business organization, wants, and the accumulation of capital. The role of innovation is perhaps the most important, as this forms the basis of Knight II and Schumpeter's (1911) theory of entrepreneurial action. To Knight long-run changes are not an important cause of profits:

> progressive changes can usually be fairly well forecast and discounted and their effects are not generally important over short periods of time. They produce relatively little real disturbance in the competitive adjustment and are not a significant cause of profit. The significant disturbances and sources of profit are rather the short-period and erratic fluctuations, and the irregularities of progressive change, not the change itself. . . . The disturbances arising from invention and improvement are due to the local and spasmodic way in which they originate, not to the general tendency (*RUP*, p. 148).

Successful entrepreneurs have characteristics that correspond with their role as entrepreneurs. The first is the ability to forecast the future: ''(M)en differ in their capacity by perception and inference to form correct judgments as to the future course of events in the environment. This capacity, furthermore, is far from homogeneous, some persons excelling in foresight in one kind of problem situations, others in other kinds, in almost endless variety'' (*RUP*, p. 241). The decision to become an entrepreneur relies not only on this inherent ability, but also on one's degree of faith in one's ability. The second attribute of the entrepreneur is a willingness to bear uncertainty: ''(A)ny degree of effective exercise of judgement or making decisions, is in a free society coupled with a corresponding degree of uncertainty bearing, or taking responsibility for those actions'' (*RUP*, p. 271).

Given the construction of the theory Knight arrives at profit as being

> a residue after deduction of the payment for the other agencies. . . . The residue . . . is not a product residue, but a margin of error in calculation on the part of the non-entrepreneurs who do not force the successful entrepreneurs to pay as much for the productive services as they could be forced to pay (*RUP*, p. 284).

The choice of the word ''error'' is perhaps unfortunate as it detracts from the role of expectations and gives profit the appearance of a mistake.

Given the construction of his theory, and the way in which entrepreneurs earn profits, it is not surprising that he comes to the conclusion that the sum of all profits is negative: ''(T)he writer is of the opinion that business as a whole suffers a loss'' (*RUP*, p. 365). This claim follows from the psychology of decision making: ''most men have an irrationally high confidence in their own good fortune, and this is doubly true when their personal prowess comes into the reckoning, when they are betting on themselves'' (*RUP*, p. 366). This leads to a winner's curse argument; those bidding highest win the use of the resources, but are also likely to have overbid. Presumably the continuing refinancing of entrepreneurs comes from adding to their ranks from previously overpaid workers and owners of capital.

While changes in technology are not important to the theory, the few remarks that Knight does make on the cause of changes in technology, and increases in output per person, are worth mentioning, if only because of the contrast with what follows in Knight's later theory (and in Schumpeter 1911). Knight (*RUP*, p. 316) recognizes that changes in technology are the result, primarily, of intentional human action: "(T)he improvement of technology and in large part the discovery of natural resources are directly willed." What Knight does not do is link this to either entrepreneurial action, or profit:

> Even when improvement in standards of living does result from the increase of wealth, it cannot be assumed that this was the motive; for as we have previously emphasized, *a permanent net increase of wealth must come from a surplus production on the part of individuals which they never plan to consume*, but expect to die and leave behind them (*RUP*, p. 320, italics added).

There is a risk here in taking Knight's ideas out of context. *RUP* was not about long-run increases in output per capita. Nonetheless, given what follows, in particular a linking of entrepreneurial action, technological change, and profit, there does appear to be some value in considering his earlier ideas on this subject.

Finally, while Knight does consider the role of calculation, noting that profit contains "an element of calculation and an element of luck in it" (*RUP*, p. 277), he does not consider the basis of the calculation. The superior forecasting ability of entrepreneurs is not subjected to any form of analysis. It is clear that the important characteristic of business decision making is that it deals with problems that are beyond the reach of mathematical probability or grouping of statistical data to handle. A large part of the cause of profit is the ability to form expectations and make judgements in the face of this type of uncertainty better than others. Knight goes on, in the third part of *RUP*, to describe the actual ways in which uncertainty is dealt with, in particular in discussing the role of the salaried manager. This raises issues beyond the scope of this paper, although it is worth noting that a substantial part of Langlois and Cosgel's (1993) paper was concerned with Knight's handling of these problems.

An objection of John R. Hicks (1931) is relevant at this point; it highlights the long-run unimportance of entrepreneurs in this theory.[7] The world that Knight describes is static; the sum of all payments to the owners of the factors of production plus entrepreneurial profits is constant. The bids of the winning entrepreneurs determine the payoffs to the factors of production. The total value of profits is then known, and the only remaining question is over the distribution of this income among the entrepreneurs. As Hicks (1931, p. 188) points out, the question over entrepreneurial action is then simply one of the distribution of the "National Dividend," and this is not interesting.

Knight I is a complete theory; however it (*RUP*) contains a number of tangents. In the shift of ideas from Knight I to Knight II the most important is the insightful discussion of monopoly (*RUP*, pp. 184–190). Here Knight considers the nature (restriction of supply) and causes (control of supply, including through the use of

[7]Hicks (1931) offers another criticism in the introduction to his paper—that Knight's theory of profit offers no explanation of the nature, magnitude, or causes of profit. We regard this as approximately equivalent to our criticism that *RUP* offers no explanation for the expectation of profit.

patents and trademarks) of monopoly. The discussion includes the classification of different types of knowledge as a basis for monopoly; it is capital attracting rent if it can be sold, and labor attracting wages otherwise. Towards the end of the discussion Knight (*RUP*, p. 188) makes the statement that "... both justice and expediency demand a fair reward for the origination of better ways of doing things, ..." noting that currently the reward takes the form of a temporary monopoly. This discussion is not integrated into the remainder of Knight I, and by discussing the reward for monopoly as a form of rent Knight avoids treating it as a form of profit.

The next step in the transition is in Knight's (1930) *Statics and Dynamics*. The first part of the paper is a discussion of the appropriateness of the use in economics of terms taken from the physical sciences. In particular, as the title suggests, the paper is concerned with the meaning of the distinction between static models and dynamic models. In the latter part of the paper he then shifts to a description of two ideal-state models. The first is the static ideal-state model of *RUP*, the second a dynamic ideal-state model. The dynamic model is described as an additional period in economic time, to be added to the periods in Marshall. Knight's concern is whether the economy can be thought of as tending to equilibrium in the long run. He concludes that it is not, and in doing so argues against the use of the mechanical analogy in economics:

> Our general conclusion must be that in the field of economic progress the notion of tendency toward equilibrium is definitely inapplicable to particular elements of growth and with reference to progress as a unitary process or system of interconnected changes is of such limited and partial application as to be misleading rather than useful (Knight, 1930, p. 167).

This leads to the final conclusion of the paper that

> Probably we must go further and reject entirely the use of the mechanical analogy, the categories of force, resistance, and movement, in discussing basic historical changes (Knight 1930, p. 168).

What Knight does not do in *Statics and Dynamics* is link the long-run changes to the decisions of economic agents. It is sufficient for his conclusion that technology (and population, and the wants of consumers) has been observed to change; he does not need to enquire into the causes of the change.

The final step in the transition is in the preface to the 1933 reissue of *RUP* (p. xxii). Here Knight explicitly relates profit and monopoly. Knight argues that competition is effective in reducing price to marginal cost only at the boundary between firms, and that within the boundary the firm is not constrained by market forces. A further idea, introduced into this discussion of monopoly, is a strong step towards historical time; changes in the size of a firm "cannot be represented by a reversible functional relation" (*RUP*, p. xxiii). By not allowing reversibility, Knight is moving towards path dependence, and real historical time, and this is in stark contrast to the reversibility of time and production implied in Knight I.

Knight II: PEF (1942)

PEF begins in a similar fashion to *RUP*, with Knight asking why profit exists. Without dwelling at length on the difference between risk and uncertainty, he claims

that profit is impossible in perfect competition; profit can only exist in "the absence of 'management' as a human activity, or as management free from error" (*PEF*, p. 128). Later, in describing the functions of the entrepreneur, Knight makes a statement that closely echoes Langlois and Cosgel's (1993) interpretation of the distinction between risk and uncertainty: "business operations are affected by various contingencies which are inherently unpredictable, or which no one would think of trying to predict, and to which no adaptation be made or is attempted" (*PEF*, p. 129).

Having explained the existence of profit, Knight moves to the theory of profit and entrepreneurial action. The entrepreneur has three functions, introducing innovation, adapting to the innovation of others, and bearing uncertainty. The introduction of innovation is claimed as the most important of the entrepreneurial functions; the bearing of uncertainty necessarily falls to the entrepreneur as the owner of the firm. This bearing of uncertainty is "apart from any constructive action" (*PEF*, p. 129).

The entrepreneur who introduces innovation is rewarded by earning temporary monopoly profits. The market responds to the innovation by copying and innovating around the original innovation. Entrepreneurs will attempt to maintain their entrepreneurial profits for example by keeping their methods secret, or taking patents on their products. Neither of these can last and part of the market process is the dissemination of information about the innovation to the market. When the information is fully public it earns a return of zero—the only return that can be associated with a free good. Early adapters earn economic profits, later adapters avoid bankruptcy.

In identifying innovation as the primary role of the entrepreneur, and monopoly profits as the incentive for entrepreneurial action, Knight is simply following Schumpeter (1911), and adds nothing to Schumpeter's analysis on the subject.[8]

Similarly, Knight's claim of a monopoly element in profit is consistent with the theory of J. B. Clark he criticized heavily in the second chapter of *RUP*. What he does add to Schumpeter is a focus on the entrepreneur as driving the market process; the market does not adapt to innovation, entrepreneurs adapt to innovation, and this is the market process. Finally, while he does not explicitly revisit the distinction between risk and uncertainty, he describes uncertainty, and continues, without justification, to insist that the entrepreneur bears uncertainty (p. 129).

Finally, it is notable that in the prefaces to two reissues to *RUP* published subsequent to *PEF*, Frank Knight made no mention of the role of the entrepreneur in introducing innovation, or of innovation as a source of profit. A possible reason is that the necessary restatement would be too great. *RUP* is a complete, coherent whole, and not subject to "fixing" in one or two areas. The distinction between risk and uncertainty would remain; a large part of the remainder would have to be rewritten.

The distinction between risk and uncertainty remains important, distinguishing between the real world and textbook theory of perfect competition, and the conditions necessary for profit to exist. What has changed is the fundamental nature of the world being described; *RUP* is static where *PEF* is dynamic.

[8]Knight does not cite Schumpeter.

VI. PROFIT AND THE ENTREPRENEUR IN TWO DIMENSIONS

The metaphor that Jacques Dreze (1985) uses to describe attempts to accommodate the firm in the general equilibrium framework can as easily be applied to the entrepreneur and theories of profit. Read ''theory of profit'' where Dreze has ''firm'':

> The firm fits into general equilibrium theory as a balloon fits into an envelope: flattened out. Try with a blown-up balloon: the envelope may tear, or fly away: at best it will be hard to seal and impossible to mail. . . . Instead, burst the balloon flat, and everything becomes easy (Dreze 1985, p. 1).

If the entrepreneur is to be reduced to acting in a static state, it is necessary that he be flattened out, that his range of functions must be severely reduced. The entrepreneur is an agent whose primary role is witnessed in the additional dimension of historical time.

Knight I makes a contribution in highlighting two aspects of the decision to become an entrepreneur: inherent ability and an appetite for uncertainty. Two notable attempts have been made at modelling these in a static, cross-sectional framework. Robert E. Lucas Jr. (1978) constructs a model in which agents of higher ability become managers, and those of greatest ability manage the largest firms and earn the highest profits. While not explicitly cast as being Knightian, it captures the inherent ability aspect of Knight I. Without constructing a formal model, T. W. Schultz (1975, 1980) extends the inherent ability aspect to consider human capital and the acquisition of ability. The second formal model, Kihlstrom and Laffont (1979),[9] treats the decision to become an entrepreneur as being based on the degree of risk aversion of otherwise homogeneous agents. This model is explicitly Knightian in its construction (Kihlstrom and Laffont 1979, p. 720). While these theories highlight (potentially) important aspects of the decision to become an entrepreneur, they are necessarily constructed using risk rather than uncertainty, and are subject to the same criticism as Knight's own; they offer no positive incentive for becoming an entrepreneur.

What is notable about Knight II is that the most important functions attributed to the entrepreneur are not derived from his original method in *RUP*. In *RUP* he explicitly considered the Walrasian equilibrium to represent the ideal state, and asked what departure from that ideal state would be sufficient for profit to exist.[10] His theory of profit was then based on this distinction. The theory in *PEF* retains the uncertainty-bearing of *RUP*, but this is de-emphasized in favor of elements that are not related to the ideal state in any way. Instead, the entrepreneur is the cause of economic change.

If his second theory of profit is more satisfactory, it is because it answers questions about the nature of profit in a more convincing manner than the first. These theories

[9]Bianchi and Henrekson (2005, p. 362) note some problems with the construction of Kihlstrom and Laffont's model, in particular that it relies on barriers to trading risk.

[10]Schumpeter (1954, p. 893 and f.) describes this method, of beginning with an ideal state and then considering the assumptions that must be relaxed in order for profit to exist, as ''the proposition from which begins all clear thinking on profits.'' He attributes this method to Walras, but in Knight's writing (*RUP*, pp. 15–16) it appears to follow more directly from the influence of J. B. Clark. Notably Schumpeter (1911) did not appear to follow this method in developing his own theory of profit.

are perhaps better regarded as a demonstration of the fundamentally different character of static equilibrium analysis and the analysis of the changes in the economy through time. If an economist's goal is to explain the causes of the wealth of nations, then the second theory is more satisfactory, and cannot be placed in a static equilibrium framework without much flattening out. By contrast, if the intention of an economist is to explain the interaction of agents in markets, the first theory is more attractive, as it offers tractability in the established equilibrium framework.

VII. CONCLUSION

Given Knight's use of the term ''uncertainty'' in his theory of profit, we interpret his distinction between risk and uncertainty as being in the contrast between textbook models of perfect competition and the real world. They are separated by the need for subjective expectations in the real world. These expectations are not formed in the absence of information as has been suggested. Rather, they are formed with partial information. Uncertainty is not the total absence of knowledge; it is all instances where the mathematical probability is not perfectly applicable. Entrepreneurial action, or business decision making, is often characterized by scarce information, either directly, or through comparison with other, similar decisions. The successful entrepreneur is special because he is able to forecast future demand accurately with very little information.

Subjective expectations of the future are sufficient for profit to exist, where profit, as Knight intended it, is a residual. It is sufficient because the realized outcomes are endogenously determined. This is not to suggest that Knight himself was in full command of the meaning of the distinction; given that he offered two different meanings for the same word it is clear that he was not.

Knight's theories of profit differ primarily by their use of time. Knight I is neoclassical in the sense of being timeless, except for uncertainty over demand at the end of the production period. No other parameters of the economy change—only the identity of the entrepreneurs, workers, and owners of capital. Built on the static model of the economy fluctuating in an unpredictable way around equilibrium, profit exists because of the need for subjective expectations in forecasting demand, and entrepreneurs specialize in doing this. Knight II is orthogonal to Knight I. Time is real in the historical sense, and entrepreneurial action changes the most important parameter: the feasible production set. The outcome of past decisions constrains current decisions, which will in turn constrain future decisions.

Austrian influences are claimed in *RUP*,[11] but this is a response to the form rather than the substance. Aside from the literary, philosophical style, the main content centers on a theory of profit that is distinctly neoclassical, in the most widely used general equilibrium sense. By contrast *PEF* is broadly Austrian in substance. It places agents in a dynamically changing, uncertain world with path-dependent outcomes and demands that they make decisions based on their subjective expectations.

[11]The back cover of the cited reprint of *RUP* contains a quote to this effect by Kenneth Boulding. LeRoy and Singell (1987) make a similar claim.

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