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# Knightian Uncertainty in Capitalism and Socialism

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Last year marked the centenary of the publication of Frank Knight's magnum opus, *Risk, Uncertainty and Profit*, which entails important and still neglected insights from a comparative economic point of view. Knight ([1921] 1957) famously discusses the importance of risk and uncertainty in the economy: he analyzes how economic agents deal with risk and reduce uncertainty—and he emphasizes the role of the uncertainty-bearing entrepreneur, explaining the function and importance of profits that arise under uncertainty.

Uncertainty exacerbates the problem of coordination in any economic system. Within the institutional framework of capitalism, people are rewarded with profits of a potentially unlimited nature when they deal successfully with uncertainty. In contrast, within the institutional framework of socialism, not only is it difficult to know when individuals have successfully handled the problem of uncertainty, but also the system of rewards is determined by an arbitrary decision of central planners.

In this article we compare the means by which capitalism and socialism deal with the problem of uncertainty emphasized by Knight and later developed by economists in the Austrian tradition. Whereas socialism and capitalism have been compared in many other respects in the past, the main contribution of this article

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consists in offering a comparative economic analysis of these systems' different types of uncertainty and of their capacity to reduce that uncertainty. In a world in which the idea of socialism still exerts attraction (Niemitz 2019), we shed new light on the problems of socialism. Ultimately, we show that within the institutional framework of socialism, economic agents must face an amount of unmitigated pure uncertainty that under capitalism is either completely absent or significantly reduced by profit-seeking entrepreneurs.

After the publication of *Risk, Uncertainty and Profit* Knight himself dedicated much of his research and writing to the comparative analysis of political and social institutions and a general defense of a free society. Indeed, his wider interest in social institutions permeates his work as an economist and social philosopher (Emmett 2009). And Knight addresses the way in which the problems that uncertainty poses for planning in a firm are relevant to planning for society (Emmett 2021). Nevertheless, Knight never systematically applied his concept of uncertainty to a comparative analysis of capitalism and socialism, even though he touched upon the issue and discussed problems of socialism (Knight 1939; 1940). This paper helps fill that gap.

## How Institutions Reduce Uncertainty

### *Games and Uncertainty*

A game-theoretical framework is useful for examining how institutions reduce uncertainty through the three strategies that Knight thought were essential for that purpose: consolidation of probabilities, dissemination of information, and incentives to specialize in bearing immeasurable risks.

Interactions among people can be described in the form of games. Every game is composed of the players (or agents) who participate in it, the potential strategies (or action plans) of each player, the payoffs that each player receives under each strategy, the rules—physical and social—that define the nature of the game, and the information that each player has about the other(s). For example, chess is a game with two players in which the players sequentially make strategic decisions that have certain payoffs. The number of players, the types of strategic decisions that are admissible, and the payoff linked to each type are defined by the rules of the game. If the rules were different, the game—that is, the terms of strategic interaction—would be different (von Neumann and Morgenstern [1944] 1953, 49–50).

When all players know all the information about the elements of the game, including the past decisions of other players, and all know that they all have that information, all those elements are common knowledge and, consequently, it is a game with complete and perfect information (von Neumann and Morgenstern [1944] 1953, 49–50) in which the payoff of each strategy is certain. For example, chess is a game of complete and perfect information because all the players know the structure of the game (and all know that all know it) and, moreover, actions are

taken sequentially: each player can fully observe the strategic decision of the other player before making his own decision and therefore can know perfectly what all the possible decisions he can make during his turn imply.

When, in contrast, players have common knowledge about the structure of the game but not about the past or simultaneous decisions made by the other players, it is a game of complete but imperfect information (von Neumann and Morgenstern [1944] 1953, 183): the payoff of each player's strategy is not certain, but each player knows the structure of the game and therefore also knows the totality of the potential strategies that the other players could follow and the payoff linked to each of them. That is, each player is able to estimate the expected payoff of each of the strategies based on the information available about the structure of the game. Expressed differently, since the structure of the game restricts the potential states of the world and predetermines the probability of each of them, each player can estimate the expected value of her strategy from the information she has about the structure of the game.

For example, poker is a game of complete but imperfect information. Each player knows the rules of the game and the potential card combinations of her opponents, but she does not know the specific combination of cards that each player has in each hand, so she can only estimate probabilistically the payoff of her own combination of cards. Thus, a player can estimate the probability that another player will use the five-of-a-kind strategic move in a poker game:

$$P(\textit{five of a kind}) = P(\textit{five of a kind} \mid \textit{poker})$$

Finally, when there is no common knowledge about the structure of the game, it is a game with incomplete information (von Neumann and Morgenstern [1944] 1953, 30). Information is incomplete when, for instance, some of the players do not know the number of players participating in the game, the different strategies available for each of them, the payoffs linked to each of the strategies, the rules of the game, or the information that the rest of the players have about each of these elements. In games with incomplete information, not only are the payoffs of each player not certain—as in games with imperfect information—but, as the structure of the game is also unknown, the number of states of the world is potentially infinite. Therefore, the players cannot estimate the probability distributions of the individual strategies based on the structure of the game. For example, if a player does not know whether he is playing chess, poker, blackjack, Go, or any other game, then he cannot estimate the expected value of his strategies based on the structure of the game; on the contrary, the structure of the game itself is the object of probabilistic estimation by each player:

$$P(\textit{five of a kind}) = P(\textit{five of a kind} \mid \textit{poker}) * P(\textit{poker}) + P(\textit{five of a kind} \mid \textit{blackjack}) * P(\textit{blackjack}) + P(\textit{five of a kind} \mid \textit{Go}) * P(\textit{Go}) \dots$$

If the probabilistic estimation of the game's structure could be determined from the structure of some metagame (for example, if the game the agents are playing was determined by throwing a pair of dice), the game would still be one of complete and imperfect information. But if, on the contrary, there is no metagame from whose structure the probability of the different states of the world can be determined, then probabilistic estimates are based only on the beliefs of each player (their assumptions about the different states of the world). In this case, the distribution of probabilities is personal and depends on the varying degrees of confidence players have in beliefs  $B$  (Tarko 2013):

$$P(\text{five of a kind} | B) = \sum_i P(\text{five of kind} | \text{game}_i, B) * P(\text{game}_i | B)$$

When players can determine the probability of the different states of the world from the structure of the game (or a metagame), those probabilities are objective. In other words, if the structure of the game (or the metagame) is common knowledge, the probabilities are necessarily objective, and all the agents will be able to discover them. Additionally, it is possible to speak of objective probabilities when all the agents share the same beliefs and all are conscious of that fact, so that their probability estimates based on those beliefs become identical when they possess the same information set. Conversely, probabilities are subjective when they cannot be derived from the structure of the game itself or when the beliefs of the agents are not convergent. In such a case, the probability estimates of the agents will diverge even when the agents possess the same information set (Cox 2006, 71–73).

The concepts of objective probability and subjective probability, or games with imperfect information and games with incomplete information, are equivalent to the concepts of risk and pure uncertainty as developed by Knight (Harsanyi 1967). Knight distinguishes between measurable risk and immeasurable uncertainty, which he regards as a unique kind of risk ([1921] 1957, 19–20, 48). For Knight, uncertainty is of utmost importance, and it forms the basis of his entire economic oeuvre. Not by chance, the term figures prominently in the title of his magisterial *Risk, Uncertainty and Profit*. Uncertainty is intimately tied to human nature. It is a consequence of free will ([1921] 1957, lxiii) and our incomplete knowledge (198). And “uncertainty is one of the fundamental facts of life” (347).

Measurable risk is foreseeable and can be converted into fixed costs because “the distribution of the outcome in a group of instances is known (either through calculation a priori or from statistics of past experience).” In contrast, unique risk, also called true or pure uncertainty, can be neither quantified nor converted into a fixed cost since “it is impossible to form a group of instances, because the situation dealt with is in a high degree unique” (233). Risk can be eliminated, whereas the only way to confront true uncertainty is to make personal judgments about what the future will bring.

Thus, when the probability distribution of the states of the world is objectively measurable, based on the structure of the game (or metagame) or on the common priors shared by all economic agents, we speak of risk. When, however, the probability distribution of the states of the world can only be estimated subjectively from our personal beliefs, we speak of uncertainty: “We can also employ the terms ‘objective’ and ‘subjective’ probability to designate the risk and uncertainty respectively” (233). In short, in games with imperfect information we talk about risk, and in games with incomplete information (those that cannot be reduced to games with imperfect information) we talk about uncertainty.

### *Institutions and the Reduction of Uncertainty*

Institutions are “systems of established and prevalent social rules that structure social interactions.” As systems of rules, they restrict some behaviors (through disincentives) and encourage other behaviors (through incentives), generating in the process habits that make the purposes and beliefs of economic agents more congruent (Hodgson 2006, 2). Institutions affect situations characterized by uncertainty in a threefold way.

First, institutions allow the structure of certain strategic interactions to become common knowledge: the possible and nonpossible action plans are known by all agents and therefore are susceptible of probabilistic estimation based on the structure of the game itself (and on the private information that each player has about the past or simultaneous decisions of other agents). For example, within a payment community in which a single money is used, the probability that a random buyer will use that money in his purchases is equal to 1; if the payment community accepts more than one type of money, then the probability that a random buyer will use one of the internally accepted types of money is given by the frequency of use of each of them within the payment community (unless other, more relevant information is available about the particular buyer that would allow a better estimate).

Second, and in the absence of common knowledge about the structure of the game, institutions also constitute a common prior that allows all players to converge on the same probability estimate about the action plans of others. For example, if players do not know which payment community a random buyer belongs to and how many payment communities there are, the estimate of what kind of money that random buyer will use is an entirely subjective one, based on each player’s personal beliefs about the different states of the world. However, if all players shared the belief that each random buyer belongs to the payment community of her home country (a belief that may emerge socially from an institutional convention), then all agents who share the same set of information about that random buyer (that is, everyone who knows her nationality) would converge on the same probabilistic estimate of what money she will use.

This does not mean, however, that the objective probabilities derived from a socially shared belief system reliably represent the real probability distribution of the different states of the world. Belief systems may be inadequate conceptual frameworks for understanding reality, and therefore the institutionalization of inadequate belief systems would only lead to all players making the same systematic mistake. For example, if it is not true that buyers belong to the payment community of their home country, then players will all attribute an incorrect probability to the type of money a random buyer will use, and they will make wrong budgeting decisions.

Thus, it is only when institutions convert the structure of the game into common knowledge, or when they generate and disseminate common belief systems that adequately represent reality, that institutions help to replace situations characterized by uncertainty with situations characterized by risk so that personal differences in probability estimates respond only to differences in the private information of each agent. And therefore, if the private information of each agent becomes public, none of them will be able to “agree to disagree” (Aumann 1976). Regulating situations characterized by uncertainty through reliable institutional frameworks to convert them into situations characterized by risk allows the beliefs of the players to become mutually compatible and therefore minimizes incoherence among their plans (Hayek 1937).

Following Knight, we can refer to this mechanism for reducing uncertainty as “securing better knowledge” through “structures performing the functions of furnishing knowledge and guidance.” Those structures, such as organized speculation, disseminate economic information, “making possible more intelligent forecasting of market change” (Knight [1921] 1957, 260). In other words, by homogenizing the belief systems of economic agents, institutions transform subjective probabilities into objective ones, thereby “greatly extend[ing] the scope of the environment in relation to which [economic agents] can more or less intelligently react” (261). Thus, institutions transform uncertainty into measurable risk.

However, institutions do not eliminate uncertainty from all games, because strategic interactions are not all structured through institutions that are common knowledge, nor do institutions necessarily succeed in unifying belief systems of all individuals into a reliable common prior. But even when institutions do not manage to turn all uncertainty into risk, they still reduce uncertainty in a second way: by establishing a system of social incentives and disincentives that guide action plans to improve the reliability of agents’ beliefs about the different states of the world. For example, the decision about which outputs to produce or which inputs to use to achieve productive efficiency within an economy based on the division of labor is a decision subject to uncertainty even if it takes place within a certain set of legal or monetary institutions. The beliefs of each player—her knowledge about the needs of others and about the possible technological combinations—necessarily differ not only because each of them has partial information about the different states of the world (Hayek 1945), but also because the agents’ own strategies may be oriented

toward modifying the content of those beliefs (for example, the strategy of generating previously nonexistent needs or discovering new technologies).

Yet, in cases of pure uncertainty, institutions are important because they reward players for continuously reviewing and improving their belief system, on which they build their subjective estimates of probability about the strategic interactions in games with incomplete information.

Knight referred to this mechanism of reducing uncertainty as specialization: the concentration of uncertainty management in a small group of agents specially trained for this purpose (Knight [1921] 1957, 245). So, institutions generate incentives that modulate the behavior of agents specializing as uncertainty bearers.

Finally, institutions create habits—repeated patterns of behavior—to strengthen compliance with the rules constituting the institutions (Hodgson 2006). Those habits narrow the range of actions that one can expect to happen within institutions, and therefore they enable one to estimate the probability distribution of those actions based on their frequency. For instance, in our previous example, we said that if the rules of a community of payments allow the use of more than one type of money, the probability that a random buyer will use a given type of money depends on the frequency of use of each type of money. But if it is possible to rely on historical frequencies to estimate future probabilities, it is because we may assume that the aggregate patterns of behavior within the institution will not change in a dramatic way from one day to the next. When certain strong habits exist, even if some individuals change their behavior, other individuals will tend to change their own behavior in an opposite and counterbalancing direction.

Knight called this mechanism *consolidation or grouping*: “If the distribution of the different possible outcomes in a group of instances is known, it is possible to get rid of any real uncertainty by the expedient of grouping or ‘consolidating’ instances” ([1921] 1957, 233–34). And, as already explained, the habits created by institutions help one to group individual behaviors in search of some regularity whose frequency can be estimated: “True uncertainties show some tendency toward regularity when grouped on the basis of nearly any similarity or common element” (239).

In short, institutions may reduce uncertainty in three ways: First, they may disseminate information about economic interactions (either by generating common knowledge about the structure of the game or by establishing reliable common priors). Second, they generate incentives for specialization (rewarding agents who improve the belief system based on which they make their strategic decisions). Third, they create social patterns of behavior that can be consolidated into some frequency distribution of probability.

In order to determine which economic system—capitalism or socialism—contributes most to minimizing uncertainty about the economic decisions that allow us to approach allocative efficiency and productive efficiency, it is necessary to analyze how capitalism and socialism structure social interactions to disseminate information, to generate incentives for specialization in uncertainty bearing, and to consolidate

habits. More particularly, capitalism and socialism constitute two institutional frameworks that, following Williamson (2000), establish explicit rules of the game with regard to the content of property rights, contractual autonomy, and entrepreneurship. Our aim is to study the influence of these explicit rules on the dissemination of information, on the incentives to specialize in uncertainty bearing, and on the creation of social habits.

Even though he did not employ the terminology of game theory, Knight examined these rules. The rules, structures, and methods for reducing uncertainty identified by Knight can be summarized as the enhancement of scientific information and knowledge through the historical accumulation of data, together with the consolidation, specialization, and dissemination of knowledge resulting from the specific work of entrepreneurs (Erbas 2004, 4), understood as a special class whose activity allows uncertainty to be reduced to measurable risk. Frank Knight was the first contemporary economist to systematically analyze the impact of uncertainty on entrepreneurship, investment, and social progress. In the following we apply his contributions on dissemination of knowledge, specialization, and consolidation of probabilities to the study of capitalism and socialism.

## Capitalism and Pure Uncertainty

Capitalism may be defined as a socioeconomic system with six characteristics:<sup>1</sup> (1) Individual rights and property rights are protected. (2) Markets and monetary exchanges are widespread. (3) Private ownership of the means of production prevails. (4) Most production occurs outside the house and the family unit. (5) Employment contracts and wage labor prevail. (6) There exist developed financial markets with banking and debt institutions in which property serves as collateral (Hodgson 2015).

These characteristics imply that market prices exist for many goods and services and that the price mechanism serves as an allocation system. The economic organization of the means of production is decentralized. Economic agents use market prices to allocate resources when making their individual production plans. They use their own property to complete their plans and increase their welfare, giving rise to horizontal economic relations based on voluntary exchanges. Information is decentralized, subjective, dispersed, and private, with market prices acting as vital information signals. Financial markets play an essential role in appraising the market value of real and financial assets and in consequently directing them to the use that is believed to be most important: they transmit information about the expectations of the market participants concerning the future of the economy's structure of production, thereby reducing uncertainty.

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1. Note that Knight's idea of a "free enterprise system" is compatible with Hodgson's conceptualization of capitalism (2015, 20). For a related definition of capitalism based on the business notion of capital, see Braun 2017.

### *Procedures and Methods for Dealing with Uncertainty in Capitalism*

In chapter 8 of *Risk, Uncertainty and Profit*, Knight ([1921] 1957, 239) establishes three main methods that allow the entrepreneur to deal with uncertainty: consolidation (or reduction of uncertainty by grouping cases; that is, business efforts are organized to combine a great number of instances), dissemination of knowledge, and specialization (which justifies the role of the entrepreneur). To these methods Knight adds investment in knowledge (aimed at obtaining greater control over the future), diversification (which he calls *diffusion*), and the possibility of directing business activity toward production lines that present less uncertainty. However, these methods of dealing with uncertainty should not be considered as mutually exclusive, because the procedures of specialization, consolidation, and diversification of cases are closely related and sometimes overlap.

Knight ([1921] 1957, 198–99) argues that even if entrepreneurs do not know in advance the results of their projects, they could have good priors about the future if they know all the alternative possibilities and the objective probability associated with each of them. In that case, by calculating on the basis of a large number of projects (consolidating), contingent losses can be converted into a fixed business cost by taking out insurance.

However, Knight ([1921] 1957) states that it is difficult to think of a business risk for which it is possible to calculate in advance the probability distribution across the different possible outcomes. When it is not possible, business decisions often have to deal with unique (ungroupable) situations, in which it is not possible for any method of statistical tabulation and classification to be relevant and a reference for the entrepreneur's decision-making process. As stated above, in these circumstances, since there is no valid basis for grouping cases, the calculation of objective probabilities is not possible, and entrepreneurs must resort to estimates and subjective judgments based on experience—which are susceptible to error—to deal with pure uncertainty.

In Knight's work, entrepreneurship is defined as the use of judgment under uncertainty (Foss and Klein 2005). "Knightian judgment" essentially refers to the process of forming estimates of future events based on experience, when no objective probabilities of individual outcomes are available.<sup>2</sup> Knight states that entrepreneurship represents a judgment that cannot be evaluated in terms of its marginal product (Foss, Klein, and Bylund 2011, 6) and therefore cannot be rewarded in the form of wages, but rather must be rewarded in the form of pure entrepreneurial profit.

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2. There exist several elaborations on Knight's view on entrepreneurship in the literature. Huerta de Soto (2010, 15–48) elaborates on the relationship between entrepreneurship, uncertainty, and competition. Foss, Klein, and Bylund (2011, 3) link Knight's contribution to the work of Richard Cantillon and Ludwig von Mises. Foss and Klein (2012), for their part, develop Knight's view on judgment under uncertainty as the driving force of a market economy. For a comparison of Kirzner's (1973) discovery approach to entrepreneurship and Knight's judgment-based view, see Klein and Bylund 2014.

Nonetheless, entrepreneurial judgment under uncertainty can be eased by reducing the number of degrees of uncertainty in the environment in which the entrepreneur acts. The institutions that emerge spontaneously in capitalism help to mitigate this surrounding uncertainty (Knight [1921] 1957, 254–63), particularly through consolidation, dissemination of knowledge, and specialization.

Starting with consolidation, we may distinguish three types of consolidation under capitalism: commercial consolidation, productive consolidation, and financial consolidation. In regard to commercial consolidation, Knight ([1921] 1957, 244) argues that production for the market allows for the consolidation of the preferences of numerous agents unable to anticipate their future consumption needs with precision. Consequently, the consumer leaves it “to producers to create goods and hold them ready for his decision when the time comes” (241). In this environment, the application of the law of large numbers (consolidation of uncertainties) allows entrepreneurs to “foresee the wants of a multitude with more ease and accuracy than an individual can attain with respect to his own” (241). Instead of having to guess individual preferences case by case, the grouping and consolidation of preferences by entrepreneurs who produce for the market allows for a reduction of uncertainty. Regarding productive consolidation, the existence of big companies allows the income of the factors of production to become less dependent on the production and success of a single product. Productive consolidation allows the income from all products of the company to be consolidated, thereby protecting workers and capitalists from the idiosyncratic risks of each of its products. Finally, financial consolidation occurs when capitalists build an investment portfolio with financial assets from different companies. This procedure allows for a degree of diversification of idiosyncratic risks even higher than the consolidation that occurs within a big company.

However, it cannot be denied that the entrepreneur still navigates in a sea of uncertainty and needs to resort to signals and strategies that allow her to reduce it. In this sense, Knight’s approach incorporates, albeit implicitly, the importance of the price system as an element that both consolidates preferences and opportunity costs and disseminates that information throughout the marketplace. In other words, the price system guides the productive activity of all entrepreneurs without them having to investigate, case by case, the individual preferences of each agent or the opportunity cost of each resource. By consolidating preferences or opportunity costs and transforming them into public information, entrepreneurs, through the operation of the price system, enormously reduce—but do not eliminate—uncertainty within capitalism.

Yet in Knight’s work the importance of prices as disseminators of knowledge is far from the vital importance that Austrian economists such as Ludwig von Mises and Friedrich Hayek attribute to them. For Mises and Hayek, relative prices allow for rational economic calculation in competitive market economies.<sup>3</sup> Thus, Hayek

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3. See in this respect Huerta de Soto 2010. See also Hodgson 2015 (pp. 282–314) for a critical reappraisal.

(1945) explains competition as a dynamic process of discovery. In a world characterized by the dispersion of subjective knowledge among economic agents, the information revealed by price variations induces entrepreneurs to increase the supply of those resources or goods that are relatively scarce. In this sense, relative prices act as transmitters of subjective knowledge, alerting entrepreneurs and fostering their activity.

### *Uncertainty-Bearing Specialization*

Finally, besides consolidation and dissemination of knowledge, there is specialization in dealing with uncertainty. This is the key mechanism through which Knight believes capitalism is able to cope with uncertainty. Unpredictable changes, which generate uncertainty regarding the future, account for the role of the entrepreneur as an agent with superior judgment and predictive capacity who assumes responsibility for the results of his management. These traits, which are not within the reach of all individuals, justify the existence of pure entrepreneurial profits as a peculiar source of income that rewards the responsible assumption of risk in scenarios characterized by uncertainty (Knight [1921] 1957, 310).

Knight's distinction between risk and uncertainty allows him to differentiate between scenarios in which profit cannot exist (scenarios in which risk can be insured—either through a traditional insurance contract, coverage operations, or diversification of assets—and become a fixed cost) and those in which it is possible, respectively.

For Knight, uncertainty is at the core of a correct theory of profits ([1921] 1957, 29).<sup>4</sup> Profit “arises out of the inherent, absolute unpredictability of things” (311). Profits are a residual income that remains after remunerating the contractors—that is, after paying rent to the factors of production. Without uncertainty, profits—that is, the difference between the prices of goods and their costs—are arbitrated away. In equilibrium they disappear. As it is not change as such that produces uncertainty—rather, uncertainty is the consequence of our ignorance (198)—profits are the result of our ignorance. In other words, with perfect knowledge of the future, there would be neither profit nor loss.

Entrepreneurs are troubled by their ignorance and try to cope with it in situations characterized by rivalry. Their judgments are competing ([1921] 1957, 277). If entrepreneurs are too optimistic, they will bid too much for the factors of production and incur losses. If they are too pessimistic, they will not get control of the services of the factors of production. Profits are only possible, in Knight's view, because of errors of other entrepreneurs who fail to bid factor prices higher and eliminate profits. Profits accrue to those with better judgment, while losses fall on those who are

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4. Mises (1998) also considers uncertainty the cause of profit. For the similarities between Mises and Knight on uncertainty, profit, and entrepreneurship, see Bylund and Manish 2016.

responsible for bad decisions (1940, 276). In the entrepreneurial function, control and responsibility necessarily come together.<sup>5</sup>

Nonetheless, entrepreneurs do not usually bear uncertainty in isolation. They organize their activity in companies within which individuals further specialize, mainly with regard to their differential willingness to take risks—that is, to make decisions under conditions of uncertainty. The actors with greater knowledge and management skills, and more confidence in their own judgment and decision-making capacity, specialize in the assumption of uncertainty within companies. They guarantee the payment of the contractual rents to the owners of the productive services, and they accept responsibility for the tasks of directing, coordinating, and controlling the productive groups. In the embryonic forms of business organization, in which there is no differentiation between the figures of the entrepreneur and the manager, these functions are concentrated in a smaller class of producers: the entrepreneurs.

Knight ([1921] 1957, 269) argues that the specialization of entrepreneurs and recipients of fixed contractual income, in which the latter refuse to exercise responsible control over production and limit themselves to providing productive resources, rests on the diversity of agents in terms of their degree of aversion to uncertainty. In other words, in capitalism there exists the possibility to “shirk” uncertainty by becoming a contractual income earner and making entrepreneurs bear uncertainty who are then remunerated by profits. The speculator and the entrepreneur maintain open positions in an uncertain world thereby allowing others to close or reduce their own uncertainty. More generally, within capitalism it is possible to shirk uncertainty by transforming a variable and uncertain income into a fixed promise to pay: for sure, creditors still face the counterparty risk of the debtor, but to a certain extent the variability of the income of the debtor does not affect the creditor. In addition to contractual arrangements between employers and employees, other instances of this type of uncertainty avoidance are insurances or fixed income securities within capital markets (providing fixed and contingent payments, which are relatively independent of the variable income received by the debtor).

This division of labor is the basis of the business organization and the wage system, in which differential rewards depend on the ability and willingness of agents to make judgments that support their decisions in uncertain environments. The specialization of the entrepreneurs in decision making and in bearing uncertainty leads to concentration in companies, and concentration in companies in turn implies consolidation of cases from accumulated experience, which in turn enlarges the benefits of diversification as the number of grouped cases increases. This reasoning leads Knight ([1921] 1957, 256) to conclude that specialization constitutes an application of the insurance principle to pure-uncertainty scenarios. In other

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5. For an excellent discussion of the relationship between responsibility and control, see Langlois and Cosgel 1993.

words, the specialization that results from the large-scale business organization and the activity of the entrepreneur allows the conversion of uncertainty into more measurable and therefore more controllable risks (232); however, insurance by an external entity remains impossible because of moral hazard (256).

To sum up, in a free-market capitalist system, those individuals who specialize in bearing uncertainty are those more willing and able to do so. Competition ensures that such individuals get into the position to make judgments as entrepreneurs: the capital managed by those entrepreneurs who make correct predictions about the future tend to grow, whereas the capital managed by those other entrepreneurs who commit mistakes tends to vanish. In the most extreme case, bankruptcy forces the entrepreneur to leave the market. In other words, competition allows for a dynamic and advantageous selection of the entrepreneurial elites who are best at managing uncertainty. This specialization in risk taking by the entrepreneurial class is *a*, if not *the*, distinctive feature of capitalism. Knight goes so far as to state that the heart of the profit principle lies in the specialization of risk taking. In contrast, “socialism would prohibit the specialization of risk-taking, which is the essence of the entrepreneur function under private enterprise” (1940, 268).

### *Knight's Case for Capitalism*

This leads us to Knight's tentative case for capitalism, which he bases on the connection between decision making and responsibility for its consequences. In capitalism, entrepreneurial decisions are made by those most able and willing to bear uncertainty. Decision making and the responsibility for the consequences of decisions are intimately related ([1921] 1957, 271). To add to Knight's argument, it is in capitalism that decision makers are held accountable for their actions. In capitalism, control, uncertainty bearing, and responsibility for the results of decisions are not separated in the case of pure entrepreneurs—that is, those entrepreneurs who are simultaneously the owners of the assets with which they make “economic experiments” on how to improve the coordination of economic resources (Foss and Klein 2012). Pure entrepreneurs always put their property at risk in a business. It is ultimately the owners of companies making entrepreneurial judgments who bear the uncertainty.<sup>6</sup> Furthermore, one can remain iteratively in the position of owner and make entrepreneurial decisions or judgments about production only if one makes better judgments than other competing entrepreneurs do (Knight [1921] 1957, 280). Of course, within private companies there can be other layers of decision makers who do not bear the uncertainty for their choices, because they are not the owners of the resources and just receive a fixed contractual income; however, those second layers of decision makers are under the ultimate control of the pure entrepreneurs who have hired them.

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6. Knight (1921, 304) emphasizes that entrepreneurs must own property. See Yunker 1988 for risk taking as a justification for property income and capitalism.

An important part of their entrepreneurial judgment is precisely to articulate strategies to solve the principal-agent problem within their organization (those organizations unable to solve this problem will not efficiently organize factors of production and therefore will be displaced by other competitors who have solved it better).

These considerations make up the essence of capitalism in Knight's view: "It is not too much to say that the very essence of free enterprise is the concentration of responsibility in its two aspects of making decisions and taking the consequences of decisions when put into effect" ([1921] 1957, 349). Knight's argument in favor of capitalism and private property is ultimately a utilitarian argument based on the self-interest of individuals: "If we get more effective management through the system of concentrated private ownership than we would through some democratic machinery [socialism], it is because men plan better when they do not *feel* like government officials doing things for other people, when they feel their work as their own and identify their personalities with it" (360; italics in the original).

Because of the profits that can be expected as a consequence of better judgment, some individuals become entrepreneurs, bear uncertainty, and act carefully and responsibly. Profits are the ultimate incentive for bearing uncertainty efficiently. Note that profits are in principle unlimited. Potentially unlimited profits in capitalism promote better judgment and a better management of resources than otherwise. The more effective management of resources causes an increase in production and knowledge, making society richer (370). Hence, capitalism is preferable to socialism.

## Socialism

By *socialism* we mean an economic system in which the ownership of the means of production is socialized, either among workers' cooperatives or by society as a whole. We call the first type of socialism, which has decentralized productive units and may give a broad coordinating role to the market, *small socialism*, and the second type *big socialism* or *state socialism* (Hodgson 2019, 20–21). Our analysis of the influence of socialism on economic uncertainty is devoted to big socialism because it is the system that has been tried in reality and whose effects are less speculative.

Under big socialism, all the means of production are owned by the citizens as a whole. Private property has been seized. Therefore, decisions regarding how to organize the means of production must be made centrally. This centralization of decision making may be achieved through democratic-assembly procedures or through delegation to a specialized bureaucracy; in practice, the latter is the path that has always been followed, both because of the enormous number of economic decisions that must be taken continuously and because of the need for highly specialized knowledge in each of the different decisions to be made (Nove 1980).

In either case the economic organization of the factors of production must be carried out in a centralized and hierarchical manner: the superior coordinating organization (be it the democratic assembly or a specialized bureaucracy) draws up

a plan for how the factors of production are to be used to maximize the well-being of the workers, and that plan becomes obligatory for the lower-level organizations (Zalenski [1962] 1971, 3–12). Economic relations are vertical: the superiors issue orders (contained in the original central plan and in subsequent developments of it) that are binding on the subordinates, and those orders provide both the information about what must be done and the incentives (rewards or sanctions) to do it (Kornai 1992, 91–92).

The question is how the central planning influences the uncertainty faced by economic agents—more specifically, how it facilitates consolidation of probabilities, dissemination of information, and specialization in improving our belief systems about the different states of the world. As for consolidation, the central plan of a socialist system encompasses all economic activity: all the preferences of consumers and the opportunity costs of all resources fall under the scope of the plan. Therefore, socialism entails the highest possible level of consolidation of economic activity; the law of large numbers can be applied to all of society and not only to smaller groups (Knight [1921] 1957, 241). If, as it has already been remarked, large companies can be considered an advantage of capitalism insofar as they allow for an equally large consolidation of productive risks within those enterprises, consolidation in socialism should allow for an even larger reduction of uncertainty than consolidation under capitalism. However, this apparent advantage of socialism over capitalism is actually one of its main disadvantages. As Knight points out, the consolidation of activities within one unit does not reduce the overall amount of losses, but only distributes them in such a way that they fall on one decision unit ([1921] 1957, 259): it can be helpful to resist idiosyncratic and stochastic risks, but not to avoid systematic risks or idiosyncratic and deterministic risks. Therefore, we must analyze whether this universal consolidation of risks under socialism constitutes in itself a source of new risks.

Under capitalism, the concentration of losses in one entity is limited by the amount of risk uncertainty bearers want to assume: if one company does not possess enough capital to absorb losses and it is not able to raise more capital from investors willing to assume its risks, its operations will cease. Uncertainty bearers are not able to shift risks to the rest of society, and so moral hazard is prevented. Companies that become too large tend to cross-subsidize the inefficient divisions at the expense of the efficient divisions, thereby reducing overall efficiency. For that reason, large conglomerates may split into different companies to avoid internal cross-subsidization (Milgrom and Roberts 1992, 518–19).

Under socialism, something similar to very large firms under capitalism happens: all losses fall on the same entity. But there is no limit to that process, since losses can always be shifted to the rest of society. That means that socialist planners (and potentially also their subordinates) operate under a soft budget constraint: planners can tolerate “persistent loss-making” by subordinates (Kornai 1992, 143), and therefore the subordinates increase their moral hazard and their excess demand for inputs (Kornai 1986). The coercive and unlimited consolidation of losses in the

economy as a whole generates incentives to behave inefficiently from the point of view of allocative and productive efficiency. Therefore, socialism does not reduce uncertainty through consolidation but, on the contrary, increases uncertainty through universal consolidation. In contrast to capitalism—where one can “shirk” uncertainty, becoming a contractually fixed income earner—the collective attempt to “shirk” uncertainty through the externalization of losses in socialism fails because overall uncertainty increases. Because there are no capital and risk markets in socialism in which risk preferences can be assessed and bargained upon, there is no transfer of risks between economic agents that would allow for an efficient distribution of uncertainty bearing.

As for dissemination of information, the central plans of socialism provide all economic agents with common knowledge about the whole set of productive relations; they all possess public information about what should be done and how it should be done. It could be concluded that socialism generates, through the central plans, institutional common knowledge that reduces economic uncertainty about what should be produced and how it should be produced. Within the plan, the productive decisions of other players are completely predictable—there is no margin for deviation, and each player is perfectly capable of foreseeing what moves other players will adopt. This being so, the dissemination of information under socialism is absolute, which turns large-scale economic coordination into a perfect-information game.

This assessment of uncertainty under socialism, however, faces two problems: it does not consider that under socialism, uncertainty can be generated both (1) within the plan and (2) outside it. In other words, there can be uncertainty about the degree of adequate implementation of the plan and about the degree of adequate elaboration of the plan.

On the one hand, for the uncertainty to disappear within the plan, all mandates to all players must be fulfilled as specified by the plan. To the extent that some players are not able or willing to fulfill the objectives entrusted to them by the central plan, the uncertainty will persist for the rest of the economic agents; if the possible strategies of each player and the payoffs of each of the strategies depend on other agents achieving the results specified in the plan, then each individual will continue to face a certain subjective probability that other agents will not be able or willing to fulfill their part of the plan. In particular, we refer to the probability that certain intermediate goods and services will not be available when planned and when, in turn, other actors need them to continue with their part of the central plan. The probability that some economic agents will fail to comply with their part of the central plan is not determined either by the structure of the central plan itself or by any prior knowledge that unifies the central plan; it is a case of pure uncertainty that economic agents continue to face within the central plan drawn up under socialism.

In fact, the intermittent shortage of intermediate goods is pervasive in socialist countries because the productive goals are not always aligned with the resources

allocated to achieve those goals (Rutland 1985, 119), which leads to the overproduction of some goods and the underproduction of others (Kornai 1992, 243–45). The errors were also cumulative because the delay in the manufacture of some intermediate goods causes an additional delay of other intermediate goods that use the former as inputs. Planners are forced to reformulate the plan as it has been implemented, and errors of internal coherence appear. This centralized correction of errors undertaken by the central planners is likely to generate additional errors (Kornai 1992, 270–72).

On the other hand, even if all the economic agents comply perfectly with their part of the central plan, there is no certainty that the plan will succeed in meeting the highest-priority needs of the citizens at the lowest-possible opportunity cost. That is, there is still some probability that the plan will fail in the objectives that inspired it (Boettke and Leeson 2005). The probability of failure of the central plan to achieve its objectives is necessarily a subjective probability that is not predetermined by the structure of the game; that is, it is another case of pure uncertainty under socialism (more specifically, uncertainty outside the plan, or uncertainty about the adequate elaboration of the plan). For example, under socialism, a consumer may suffer a structural shortage of the products he considers to be a priority, but the probability of this happening in each case is necessarily subjective (since not all products experience shortages).

Perhaps this is one of the problems of socialism that has been studied in greatest detail (Mises, 1920; Hayek, 1935; Lavoie, 1985; Kornai, 1992; 2014): the system's inability to amalgamate and transfer huge volumes of dispersed information and therefore its inability to use it in an informationally efficient way (Hurwicz 1973; 1979) to resolve the basic economic problem of producing the most valuable goods at the lowest opportunity cost. Although Knight did not analyze this problem in *Risk, Uncertainty and Profit*, he did subscribe to the view that this was one of the key deficiencies of socialism outside the case of a stationary economy. For Knight, every economic system faced the problem of pure uncertainty when there was a change in the initial economic conditions, because the expectations of different economic agents about how to recalibrate the coordination of resources would not be convergent, nor could that recalibration be simply inferred from the institutional rules of the system (decentralized trial and error entrepreneurship was needed to generate and spread that new information). Therefore, socialism faced the informational problem of dealing with dynamic change (uncertainty) for its inability in creating new information not currently possessed by planners:

Thus the contention of Professor von Mises, and other opponents of socialism, that there would be no objective rationale for the organization of production under socialism, while adequately refuted by Professor Lange (and others) for the routine operations of a stationary economy, is after all essentially correct for the really serious problem of organization. This is the problem of anticipating substantial changes in the given conditions of economic life and in making necessary adaptations and/or of bringing about such changes. (Knight 1940, 285n1)

However, and turning to the third problem, Knight thought that the most serious problem of socialism was its inability to generate enough incentives to promote specialized behavior to counteract uncertainty. In capitalism, when the same person has both residual control of the resources and the residual income generated by those resources, the incentives to generate value in a context characterized by uncertainty are maximized (Milgrom and Roberts 1992, 291–93): those who have the ultimate capacity to decide how to manage the resources are those who internalize the gains or losses from their management. In the words of Knight:

We must remember that the two things, uncertainty-bearing and responsible control, are inseparable; in so far as the reward of any service is contingent upon the success of the undertaking, the owner of that service, in consenting to its employment for a contingent remuneration, exercises judgment and wields power over the enterprise. But the greater part of the uncertainty and power are centered in the ownership of certain property which is placed in the position of guaranteeing the contractual income of the other property and that of the labor used in the business. ([1921] 1957, 350)

But under socialism, the central planners have residual control over resources, while the residual income from the resources flows to the society as a whole (Kornai 1992, 71). From this fact various problems arise when it comes to promoting specialization in uncertainty bearing.

First, central planners are faced with two types of expected payoffs: on the one hand, the private payoffs linked to each strategy, and, on the other, the social payoffs derived from each strategy. When economic agents receive the residual income from their resources, both payoffs are linked—higher social payoffs give rise to higher private payoffs (except in the presence of externalities). On the other hand, in the absence of residual income, such a linkage is necessarily imperfect, especially in the socialist system, in which the social payoff is not easily determined even *ex post* (because we do not have any counterfactual against which to compare the decisions made by the planners). Profits are prices minus costs, but under socialism both prices and costs are determined as administrative prices by the central plan, and therefore profit as residual income may become meaningless (Kornai 1992, 73). In the absence of residual income, the “socialistic state would have no objective or rational basis for fixing the remuneration of managers, the indeterminacy of their value being proportional to the degree in which they exercised initiative” (Knight 1940, 285).

The central planner, therefore, is essentially concerned with her private payoff in drawing up the plan; she is encouraged not only to try to maximize it but also to gather information that will allow her to reduce the uncertainty surrounding it. But, as we have said, the private payoff is not linked to the social payoff, and, consequently, the information needed to reduce the uncertainty about the former does not contribute to reducing the uncertainty about the latter. For instance, even if a given

economic plan does not improve the productive efficiency of resources (social payoff), it may contribute to the job promotion of some of the central planners (private payoff); in turn, the uncertainty surrounding a payoff is of a different nature than the uncertainty surrounding a social payoff.

If the planners' private payoffs depend positively on the central plans being fulfilled as they were initially drawn up, then planners will adopt a very conservative attitude. In the words of Knight ([1921] 1957, 361): "The real trouble with bureaucracies is not that they are rash, but the opposite. When not actually rotten with dishonesty and corruption they universally show a tendency to 'play safe' and become hopelessly conservative. The great danger to be feared from a political control of economic life under ordinary conditions is not a reckless dissipation of the social resources so much as the arrest of progress and the vegetation of life."

If, on the contrary, the planners' private payoffs depend on adopting highly innovative core plans, even with a low subjective probability of compliance, then planners will develop such plans by externalizing the uncertainty they entail onto the population as a whole.

Second, there are problems in establishing an effective incentive system for subordinates, to make them comply with the plan as designed by the central planners. It is true that the central plan itself contains the incentive scheme to induce subordinates to comply with the plan's mandates: complying with the plan implies receiving certain rewards, and failing to comply implies being punished with certain sanctions (Rutland 1985, 118). But this is problematic. Because the plan totally suppresses the incentives of subordinates to act against the plan, subordinates do not disclose their private information by acting in ways they think will increase allocative efficiency or productive efficiency; hence, there is no decentralized procedure for selecting elites based on their proven capacity to maximize efficiency under conditions of uncertainty. As Knight ([1921] 1957, 361) points out, "The essential problem is wisely to select such responsible officials and promote them strictly on a basis of what they accomplish, to give them a 'free hand' to make or mar their own careers."

Actually, the incentive of subordinates is quite the opposite—to generate and transmit false information that minimizes the effort required to give the appearance that the objectives of the plan are being met. Such transmission of false information occurs in two stages: before the plan is developed and after the plan is developed. Before the plan is developed, subordinates transmit manipulated information to their superiors during the consultation phase; they underestimate their productive capacity and exaggerate their needs for complementary productive factors while bargaining with their superiors (Kornai 1992, 122). After the plan is developed, subordinates may focus on achieving the objectives of the plan from a quantitative but not qualitative point of view (Rutland 1985, 135–37). Because the quality of a product can be difficult to evaluate and because plans tend to establish quantitative goals, it is possible for subordinates to maximize quantity at the cost of minimizing quality.

In both cases, therefore, the opportunistic behavior of subordinates generates new uncertainty for the planners that the latter can try to remedy with countermeasures against subordinates such as the ratchet effect (Kornai 1992, 123)—that is, setting the quantitative objectives of each new core plan based on the goals achieved in previous periods. But resorting to the ratchet effect generates, in turn, new sources of uncertainty because subordinates are encouraged to withhold their productive capacity so as not to commit themselves to keeping it high during subsequent periods (Milgrom and Roberts 1992, 233–34).

In short, it is not only that socialism is not able to consolidate losses without disrupting well-behaved incentives or to efficiently disseminate information to unify the probability estimates of economic agents about the different states of the world, but that it also generates incentives opposed to efficient specialization in uncertainty-bearing behavior; economic agents either lack incentives to generate new information that reduces economic uncertainty or, much worse, have incentives to increase economic uncertainty by generating and disseminating new manipulated information throughout the system.

## Conclusion

Institutions reduce uncertainty by providing common knowledge and common priors. Frank Knight, in *Risk, Uncertainty and Profit*, uses the terms *consolidation* or *grouping of information* to refer to the possibility of providing common knowledge and common priors that convert uncertainty into risk. Yet institutions do not only convert uncertainty into risk, but also provide incentives to deal with the remaining pure uncertainty, in a process referred to by Knight as *specialization* in uncertainty bearing.

Capitalism and socialism are differentially equipped to reduce uncertainty, and they entail different types of uncertainty. Knight identifies three main procedures to reduce uncertainty within capitalism. First, he considers the consolidation of probabilities by grouping. When entrepreneurs produce for the market, the preferences of numerous economic agents are consolidated, reducing uncertainty. Second, institutions such as the price system help to disseminate information. Third, specialization in uncertainty bearing arises in the form of an entrepreneurial class formed by the individuals most willing and able to bear uncertainty. Most importantly, these specialized individuals have the appropriate incentives to deal with uncertainty, as potentially unlimited profits link social and private payoffs.

Even though it may be argued that socialism provides common knowledge about productive relations and the planning decisions of all players, thereby converting a game of imperfect information into a game of perfect information, it suffers from a twofold problem. First, not all players are able or willing to fulfill the plan, leading to shortages and cumulative errors of internal coherence. This problem is exacerbated by the possibility of consolidating losses over the whole society. Second, there exists uncertainty about the adequacy of the plan. There is no certainty that the

plan satisfies citizens' needs at the lowest opportunity costs, leading to pure uncertainty. This uncertainty is ultimately related to the inability to efficiently disseminate information and to the lack of market prices.

Moreover, under socialism there is no selection of an entrepreneurial elite that is the most capable of innovating and dealing with uncertainty. Indeed, for Knight, the main problem of socialism is inadequate incentives to specialize in uncertainty bearing. The separation of residual control over resources and residual income from resources implies that private and public payoffs are not linked in socialism. Agents lack incentives to generate new information that reduces uncertainty, and they even increase uncertainty by introducing manipulated information into the system.

Therefore, we can conclude that within the institutional framework of socialism, economic agents have to face an amount of unmitigated pure uncertainty that under capitalism is either completely absent or significantly reduced by profit-seeking entrepreneurs.

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