8
CONTINGENT EXPECTATIONS

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A Toolbox of Expectation Models

Whenever economic actors are about to make decisions with long-term consequences they must form and factor in expectations about how relevant economic, technological, or social variables might develop in the future. Take, for example, a high school graduate who faces a choice between different university programs: to gauge her future job prospects and earnings potential she would have to estimate the demand for her academic skillset that would exist in the labor market by the time of her graduation. A family looking to purchase a home will try to assess how property prices, mortgage interest rates, and their own earnings are likely to change over the next few decades. A prudent entrepreneur will carefully weigh potential risks and rewards before undertaking a costly investment project. Hence, economists who wish to predict how economic actors will behave in such decision-making situations must therefore make assumptions about how their expectations are formed.

In the first half of the twentieth century, economists usually followed a rather simplistic approach by assuming that economic actors believe that the actual conditions also apply in the future. In the late 1950s, this assumption was replaced by the more sophisticated concept of adaptive expectations, which is premised on the idea that actors form their expectations based on a weighted average of their historical experiences (Nerlove 1958). This backward-looking approach does not imply that actors stubbornly stick to their original expectations in the face of surprising developments. Instead, they are capable of learning. Whenever a variable deviates from the expected value, actors update their expectations. Only a few years later, however, adaptive expectations came under increasing pressure from John Muth's seminal paper (1961) on rational expectations. Muth's concept was a groundbreaking methodological innovation. In contrast to adaptive expectations, the rational expectations theory acknowledges that forward-looking agents are able to respond quickly to exogenous shocks or unexpected policy changes by adequately adjusting their expectations to the new information set (Lucas 1976). Crucially, the speed of adjustment of rational expectations, unlike adaptive expectations, is not slowed down by the baggage of experience. Regardless of their past experience, agents use appropriate models to predict how a surprising change in relevant parameters may affect the future development of certain target

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variables. It was mainly to the influence of Robert E. Lucas (1972, 1973, 1976; see also Sargent and Wallace 1975) that rational expectations subsequently superseded the theory of adaptive expectations in mainstream economics. This triumph was facilitated decisively by the fact that the stagflation of the 1970s could be more accurately explained with the help of rational expectations than with adaptive expectations.

To date, many macroeconomic studies that rely on rational expectations assume that all agents have complete information, which includes knowledge of the (econometric) model needed to estimate the future impact of an unexpected change in certain parameters. In particular, fully informed agents are thought to use the same models as the economists who seek to explain their expectation formation. Thus, the assumption of full-information rational expectations (FIRE) provides economists with the ability to predict actors' expectations "that tend to be distributed, for the same information set, about the prediction of the theory" (Muth 1961, 316). That is why FIRE has long formed the undisputed basis of modern macroeconomics (see Born, Enders, and Müller, Chapter 10 in this volume).

The Great Recession from late 2007 to 2009 has cast doubt on many old certainties. Economists have since increasingly experimented with models of expectation formation that either dispense with the assumption of full information or the assumption of rational expectations. In reality, actors often have diverse incomplete information because they either receive private signals or deliberately choose to ignore or only irregularly update certain public information (Mankiw and Reis 2002; Sims 2003). Diverse information will lead to heterogeneous expectations that are dampened in response to surprising changes compared to FIRE (Angeletos and Lian 2018). The assumption of rational expectations is violated when actors fail to fully consider the influence of their own expectations on the expectations (and the behavior) of the other market participants. The formation of iterative higher beliefs about the expectations of others presupposes that the actors are capable of calculating like game theorists—which is certainly not the rule (Fahri and Werning 2019). On the contrary, behavioral economists have found that people frequently use simple rules of thumb and other practical yardsticks to make decisions, and furthermore, the process of expectation formation has been shown to be distorted in many ways by cognitive biases (Kahneman and Tversky 1974). In light of so much contradictory evidence, Gennaioli and Shleifer (2018, 204f.) have argued that the model of rational expectations is doomed. They have suggested that more evidence-based models of expectation formation should be developed, "so [that] the inaccurate though aesthetically attractive ones can be honorably retired." At the moment, a whole range of alternative expectation models are on offer. These include, for example, epidemiological expectations (Caroll and Wang 2023), diagnostic expectations (Bordalo et al. 2018), fictional expectations (Beckert 2016), biases in expectations due to personal experience (Malmendier and Nagel 2016), or myopia (Gabaix 2020). To date, however, all attempts to bring about a paradigm shift and establish a new dominant theory of expectation formation have failed. The resulting wilderness of competing expectation models is currently causing palpable uncertainty among many social scientists. If it is not possible to reliably predict which expectation model actors will use, it follows that it is also not possible to forecast their expectations and subsequent actions.

In this chapter, we will argue that it is misleading to look for a single optimal model of expectation formation that can be applied in each and every decision-making situation. Instead, we will suggest that economic agents have at their disposal a toolbox of different types of expectation formation from which they usually select the most appropriate

one for a particular decision situation. We refer to this approach as "contingent expectations."[1] By defining the concept as "contingent" we wish to stress that the selection of expectation models depends on context. We need to know the particular circumstances of a given decision-making situation in order to assess which expectation formation model is most likely to be selected by an actor.

Our concept of contingent expectations is supported by research in experimental psychology that suggests that, during human evolution, individuals have developed the cognitive skills to choose between different available methods to achieve a given goal. Gert Gigerenzer (2008), for example, argues that individuals draw on different techniques to optimize their decision-making. With the concept of the "adaptive toolbox," Gigerenzer (2008) introduced a metaphor that describes the "rational ecology" of human decision-making, which is very often based on simple heuristics instead of complex probability calculations or algorithms. This is especially true for "affective-rich" situations when circumstances have strong personal or emotional implications. In such situations, actors often neglect information-seeking and make their decisions spontaneously (see also Spiliopplous and Hertwig 2020). Gigerenzer's approach—even though not directed at historical analysis—provides an interesting reference for our model of contingent expectations, as it points to the trade-off between optimal decisions with comparatively high information cost and "only" satisfactory decisions that often allow for higher marginal returns.

Our argumentation takes place in three main steps. First, we show that the variety of competing methods of expectation formation can be brought to order by a concept that does justice to the complexity of decision-making situations and yet remains simple, clear, and generally applicable. To meet this requirement, we develop the idea of contingent expectations. Second, we elaborate the theoretical structure of contingent expectations, which can be represented in the form of a flowchart. We assume that the method of expectation formation an actor finds suitable for the specifics of a given decision situation depends on the degree of uncertainty, personal experience, the influence of third parties, and the level of information costs. Third, to provide empirical evidence that actors choose between different methods of forming expectations in real-life decision-making situations as if they were following this flowchart of contingent expectations, we discuss a number of historical case studies.

Bringing Order into the Toolbox

In order to develop our model of contingent expectations, we must first understand why mainstream economists have persistently defended the concept of full-information rational expectations (FIRE) and refused to use other, more complex models of expectation formation. For this purpose, it is worth remembering the older debate about the assumption of profit maximization as the sole objective of all entrepreneurial activity. This idea has often been challenged by economists and other social scientists who have usually pointed out that, in reality, many entrepreneurs and managers also pursue other goals. Moreover, it has been argued that maximizing profits is no easy task: entrepreneurs often fail to accomplish their goals because they lack sufficient information to identify the most suitable profit-maximizing strategy in a world of irreducible uncertainty (see, e.g., Alchian 1950). Despite all this criticism, however, the assumption of profit maximization has remained a core element of economic theories to this day. A justification for this persistence was offered by Milton Friedman (1966) in his influential essay "The Methodology of Positive

Economics." Herein, he reminds his readers of the principle known as "Occam's razor": this contends that an essential feature of any good theory is the simplicity, parsimony, and clarity of its basic assumptions. In other words, economic models should not seek to represent the real world in all its complexity—which would render the model just as unmanageable as the reality. Instead, economic models should concentrate only on those aspects of human behavior from which plausible hypotheses can be derived with regards to the questions at hand. Friedman claimed that the assumption of profit maximization has met these requirements and proved itself in the long run: "Yet the continued use and acceptance of the hypothesis over a long period, and the failure of any coherent, self-consistent alternative to be developed and widely accepted, is strong indirect testimony to its worth" (Friedman 1966, 23). To strengthen his point of view, Friedman also refers to arguments from evolutionary economics: only those companies survive competition in the long run that regularly achieve above-average profits, and from this empirical observation it can be concluded that entrepreneurs act *as if* they were pursuing the goal of profit maximization (Friedman 1966, 21f).

In economic models, the assumptions about actors' expectation formation have a similar fundamental importance as the assumptions about their objectives. Therefore, it might make sense to adopt the conclusions from the debate about profit maximization for expectation formation and assume that actors act *as if* they had formed full-information rational expectations. This analogy would help explain why behavioral economists have so far failed to establish a new generally accepted theory of expectation formation. Admittedly, this task poses many challenges. To begin with, the list of cognitive biases that can distort perceptions and lead to erroneous expectations encompasses dozens of different types. Any economic model attempting to account for all these different biases could hardly meet the criteria of simplicity, parsimony, or clarity—it would certainly not lend itself for application as a general workhorse model in the way that FIRE has been used. Therefore, it is understandable if scholars like Thomas Sargent (1999, 9) have argued with conviction that we should hold on to the concept of rational expectations: "I adhere to the rational expectations benchmark and economize on free parameters. I embrace minimalism to discipline my venture into the wilderness of bounded rationality."

In this chapter, we argue that it is not necessary to decide for or against certain concepts of expectation formation. Instead, we try to fit the competing approaches into the overarching framework of contingent expectations. To achieve this goal, it is useful to analyze when specific models of expectation formation emerged, under what circumstances they were found to be viable, and why they sometimes failed or were discarded.

At first glance, such a historical approach seems to lead to a teleological narrative of continued progress in expectation formation theory. There is no denying the advances that were first made in mathematics, especially in probability theory, and later in the social sciences and information technologies, significantly improved human capacities to form precise expectations about the future. At the beginning of this development were, among others, the attempts of Italian insurance entrepreneurs in the late Middle Ages to assess the risks involved in maritime trade by collecting information as current as possible about weather conditions or the activities of pirates (Ceccarelli 2007; see also Huang and Spoerer, Chapter 20 in this volume). Today, we find complex computer-based forecasting models that are routinely used to predict macroeconomic trends or fluctuations in stock market prices. Thus, we can observe a long-term trend of "scientization" and "professionalization" in the formation of expectations, apparently culminating in the theory of full-information

rational expectations that places the highest demands on information-gathering and processing by decision-makers.

However, this success story must be called into question because of recent events and historical evidence. First, the history of financial crises provides many insights (see, for example Kindleberger and Aliber 2005) that should have enabled fully informed rational actors to correctly predict the financial collapse of the Great Recession of late 2007 through 2009. That most investors, bank managers, and forecasters overlooked all the ominous parallels with previous financial crises, has cast doubt on the adequacy and usefulness of FIRE. That is why the experience with the Great Recession gave rise to a new variety of competing models of expectation formation, inspired by behavioral economics and with a renewed focus on experience, which are seen as progress compared to FIRE. Second, a more detailed look at economic history reveals that from as early as the Middle Ages, historical actors have recurred to different forms of expectation formation. There is no neat distinction between a "pre-modern" and a "modern" mode of predicting the future, as Koselleck (1985) has argued. We find that even pre-modern economic agents selected between different approaches to make expectations about future outcomes. Instead of a linear evolution toward an optimal model of expectation formation we find a more complex, contingent, and at times cyclical progression of different guiding concepts.

Discussing the tensions and competition between different methods of expectation formation will help us to elaborate our concept of contingent expectations. The concept is premised on three different but related observations. First, historical processes are open and often accidental by nature, which makes predictions about the future extremely difficult and uncertain. Gathering all relevant information is often impossible for individual households, managers, or investors, and it is usually associated with high information costs. Second, the specific form of making predictions is highly variable as changing historical contexts require different forecasting strategies. Third, predictions and decisions are embedded in complex processes in which agents must regularly revise their information and beliefs. Updating one's knowledge is again costly and requires intellectual effort. That is why economic learning is itself a dynamic—and highly contingent—process (for different learning technologies assumed in economics, see Baley and Veldkamp 2023).

The term "contingent expectations" has been used in the literature only sporadically and in a narrower sense than we do. Roman Frydmann and Michael D. Goldberg (2013) referred to this concept as a model that combines rational forecasting strategies in financial markets with insights from behavioral economics. From a sociological viewpoint, Jens Beckert (2012) argued that the contingent nature of evolution in capitalist societies requires narrative strategies to cope with uncertainty.

In our chapter, we aim to provide a complex concept of contingent expectations that combines economic with historical perspectives. The challenge lies in achieving two difficult objectives at the same time: doing justice to the empirical complexity of history *and* meeting the demand for a clear-cut model that would avoid the wilderness feared by scholars such as Sargent (1999). To meet this challenge, we draw inspiration from the theory of rational inattention (Sims 2003; Wiederholt 2018).

The theory of rational inattention is based on the observation that processing information requires time and attention. These are limited resources that any economic actor does not like to turn away from other activities. The scarcity of time and attention means that, in practice, no actor can handle all available information in any given decision-making situation. Instead, actors will try to make their decisions based on a limited

selection of data. Importantly, this technique is conceptualized as a rational process: actors are well aware that ignoring some available facts can increase the likelihood of making a wrong decision. However, they might be willing to accept this risk if it leaves them with more time and attention that can be devoted to their other activities. The decision-making process thus proceeds in two clearly distinctive steps. In the first step, economic actors decide which information they will use and what can be neglected in a particular situation. In a second step, they acquire and process the selected information to reach a decision.

The basic problem can be illustrated by the example of student admissions. University administrators are required to decide which of the many applicants should be given a place in their program. A plethora of information is available to assess the quality of applicants. Processing some of it is very time-consuming, such as conducting selection interviews or reading long letters of motivation. University faculty may decide to dispense with this information and spend the time saved on research. Rational inattention in this case may mean that only school grades are used as a selection criterion. This procedure may lead to minor errors, e.g., when a less suitable applicant is chosen over a more suitable one. However, major errors are unlikely to occur because poor school grades seldom conceal very good students, and brilliant school records rarely predict academic failure.

Maćkowiak et al. (2021) have systematized the economic implications of the theory of rational inattention. Two insights seem to be of particular importance for our context. First, agents will draw on more information in high-stakes decision-making situations than in situations where they have little to lose. Second, actors will focus their attention on economic variables that display high volatility, because large fluctuations may mean that bad decisions can incur large losses.

The Model of Contingent Expectations

From what has been said so far, it should be clear that expectation formation can be interpreted as an application of the theory of rational inattention. Every economic actor who wishes to form realistic expectations about the future will have to engage in intelligence-gathering. To this end, she can read newspapers, economic textbooks, or academic journals, she can seek personal advice from knowledgeable friends, follow the columns of famous economists, or browse the depths of the Internet to get a better idea of how relevant economic variables might develop in the future. Researching and processing this information absorbs time, money, and attention and thus entails considerable (opportunity) costs. Economic agents will have to weigh the benefits of such information costs. In conventional economic reasoning, the optimum is reached when the marginal cost of obtaining and processing information roughly equals the marginal benefit.

In some decision-making situations, actors may not attribute any value at all to information acquisition because their stakes are low relative to their income or wealth. We observe this behavior, for example, in lottery players who, even if they are not addicted to gambling, ignore the well-known very low probabilities of winning. Another example is offered by many German savers, who held on to their savings accounts even when the real interest rates on this form of investment were negative for many years, as was the case during the stagflation period of the 1970s (Knake 2023; see also Hesse, Knake, and Lehmann-Hasemeyer, Chapter 23 in this volume). Instead of updating their expectations on the basis of easily obtainable information on nominal interest and inflation rates and then searching

for better investment opportunities, many German savers clung stubbornly to routines and traditions such as "in our family, we have always relied on a savings book to accumulate some wealth." The conclusion seems obvious that actors only bother to think about information acquisition and the choice of an appropriate expectation model when they believe that the stakes are high. The problem, however, is determining when the stakes are high. For a low-income household, the loss of a certain amount of assets may mean a dramatic loss, while the same event may not be noticed at all by a wealthy person. For this reason, we avoid the subjective concept of high or low stakes in our model. Instead, we compare the benefits and costs of obtaining information.

The marginal benefit of information acquisition depends on one factor in particular. It hinges on the fundamental epistemological question of to what extent any additional information can improve the accuracy of a given estimate. To explore this issue further, Frank Knight's (1921) clear distinction between calculable risk and incalculable uncertainty is helpful. In the latter case, where the possible future consequences of a present action cannot be predicted, let alone expressed in probabilistic terms, it is impossible to calculate reliable forecasts for any specific variable. Hence, it makes little sense for the decision-maker to invest in the acquisition of further (useless) information—he will have to find other ways of dealing with the irreducible uncertainty.

In order to understand and structure the considerations that may run through an actor's head when choosing his strategy of expectation formation, it is helpful to formalize the decision-making situation in a simple way. We assume that the future outcome of a present decision is affected by the future state of the world. To make the analysis easier, we assume that there is only a good scenario and a bad scenario to be reckoned with. In the good scenario, the future returns will be high ($\overline{X}$); in the bad scenario, the future returns will be low ($\underline{X}$). If the actor is able to assign the probability p to the good scenario, he can calculate the expected value of the returns $E(X)$:

$$E(X) = p\overline{X} + (1-p)\underline{X}$$

The actor will decide to take the economic action today if the expected value of the future return is at least as large as the reservation value X_0 he would realize if he refrained from this action:

$$E(X) \geq X_0$$

To perform these calculations, an actor needs to know the probabilities of the good scenario and the bad scenario (and the returns occurring in both cases). In practice, this necessary precondition is not given in every real-life decision-making situation. In a situation of Knightian uncertainty an actor might not be able to predict both the alternative returns and the probabilities of their occurrence. Hypothetically speaking, this would apply, for example, to an entrepreneur who is trying to develop a basic innovation of which he knows neither the technical properties nor the viability and profitability. Incomplete information in this case is not a conscious decision as described by the theory of rational inattention but an unavoidable fact due to the unpredictability of things that do not yet exist. Under such kind of uncertainty, the simple decision model as described above would not work and we will have to consider how the actor would remain capable of deciding under these circumstances.

However, let us first contemplate expectation formation under risk when the alternative returns are known, and the probabilities of both scenarios can be estimated in advance. It is unlikely that an actor knows the true probabilities of occurrence from the beginning. However, he will have a preliminary idea of their value, which we denote by $\tilde{p}$. This prior belief may result from experiences that the actor has had in similar situations in the past or from assessments that are derived from the actions or narratives of third parties. The actor must now decide whether to rely on his beliefs $\tilde{p}$ or to obtain a better idea of the true value p by gathering and processing additional information. The identification and processing of this information incurs costs C, the amount of which also depends on the actor's personal characteristics, such as education, professional experience, or economic literacy. For example, it may be very difficult for a financial illiterate to interpret readily available data on inflation and interest rates, even if this is easy for a trained economist. Therefore, it will not be worthwhile for the actor to use additional information under all circumstances. Regardless of the true probabilities of the good and the bad scenario, the worst thing that can happen to an actor would be the occurrence of $\underline{X}$ instead of $\overline{X}$. It therefore makes no sense to accept information costs that are greater than the difference of ΔX.

Figure 8.1 shows the options available to an actor when selecting his strategy of expectation formation. If the information costs C are higher than the maximum difference in outcomes ΔX, most actors will rely on past experiences to determine the probabilities of occurrence. If the information costs are lower, it is reasonable to supplement the experiential knowledge with further information from external sources. In this situation, agents gravitate toward the information-based expectations models, which in some extreme cases might also lead to full-information rational expectations. In contrast, an actor who has no experience of his own and is also reluctant to gather information from other sources in light of high information costs will often use simple heuristics or just follow the behavior of other agents. We observe such herd effects, for example, during a speculative bubble. Inexperienced investors enter the market because they follow the lead of their peers or trust the enthusiastic narratives that are publicly disseminated. In summary, these strategies of

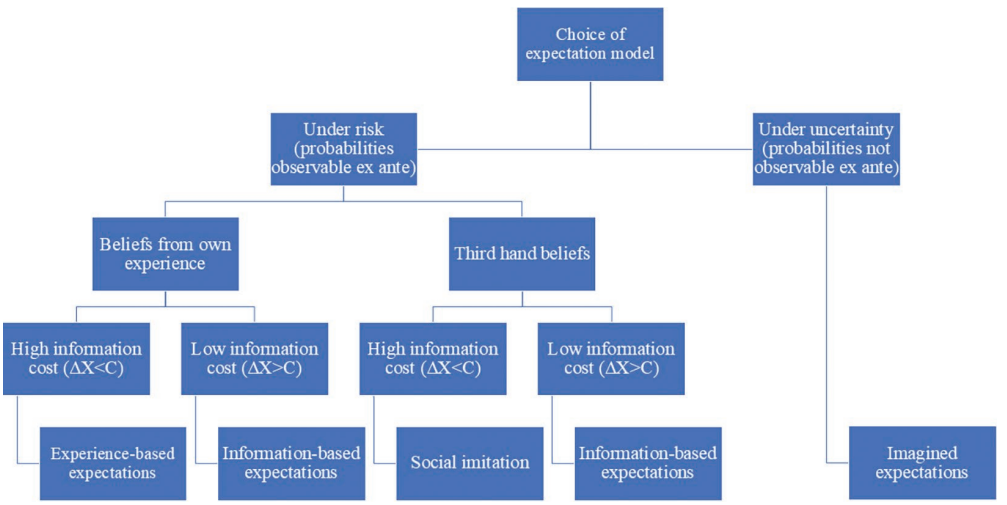

Figure 8.1 The menu of contingent expectations.

Source: Author creation.

expectation formation can be called social imitation. Of course, even those actors without experience of their own may improve their knowledge on future outcomes by processing more information. This may happen if such information is easily accessible, i.e., if the costs of obtaining information are low.

Actors who must make important decisions under uncertainty have no possibility of gathering reliable information and assessing the probabilities of future outcomes. What will actors do in such a situation of fundamental ambiguity? Gilboa and Schmeidler (1989; see also Hansen and Sargent 2001) suppose that actors who cannot determine the probabilities of the good and bad states of the world will instead consider a whole set of different probability distributions. In order to predict which decision actors with such multiple beliefs will reach, Gilboa and Schmeidler (1989) assume uncertainty aversion. Actors with uncertainty aversion are supposed to be primarily concerned that a scenario that is bad for them will occur. That is why uncertainty-averse actors apply the *maximin principle*: they first identify the probability distribution that they believe could lead to the worst outcome and then act in a way that maximizes their own payoff in this worst-case scenario. In practice, uncertainty aversion often leads to excessive caution, to inaction and inertia (Ilut and Schneider 2023). Therefore, this concept is usually not particularly helpful in explaining why actors remain capable of acting despite uncertain expectations.

Imagined expectations, on the other hand, meet this requirement. This concept of expectation formation assumes that uncertain actors tend to form expectations based on fictions and narratives of an imagined future which transcend factual knowledge. Sociologists Jens Beckert's (2016) idea of "fictional expectations" provides an example for this kind of expectation model. The starting point of Beckert's argument is that people in modern capitalist societies share the basic idea that they are empowered to take their destiny into their own hands and create a better future for themselves and others. This optimism would certainly be expressed most strongly in the "American Dream," which gives Americans hope of being able to climb far up the social ladder through hard work (Beckert 2016, 26, 87). This positive attitude, combined with people's inherent creativity, causes economic actors to dream up future achievements and thereby fill the void of an uncertain future. In the absence of reliable quantitative data on outcomes or probability distributions, these fictional expectations usually take the form of a believable story that foretells the longed-for course of future events. These narratives are often sufficient to enable economic actors to take practical action because, according to Beckert (2016, 10), people possess another useful ability. They are able to suppress the awareness that their imagined futures are only fictions rather than definite facts.

Dreaming of a positive outcome in the future may seem like an irrational form of motivation from today's perspective. In fact, such dreams usually lead to failure. Not everyone who dreams of it becomes a successful inventor, company founder, or artist. Many have to realize that their expectations of themselves were too high and settle for mediocre results. Without these dreams of success, however, nobody would even make the attempt. In the rare cases of success, it was precisely thanks to imagined expectations that progress could be made that went beyond the previous state of knowledge.

To avoid an overly complicated model, we assume that actors choose their strategy of expectation formation *as if* they were following the flowchart shown in Figure 8.1. This assumption gives us the ability to predict this choice depending on the particular circumstances of the decision-making situation and to take this prediction into account when designing macroeconomic and microeconomic theories. The precondition for this procedure

is to give up the view that there is an optimal expectation model that fits under all circumstances. Note that contingent expectations do not require actors to have complete information. Contingent expectations are based on the idea that reasonable people try to form expectations in a way that best fits the current decision-making situation. This, of course, does not preclude mistakes that can occur when decisions are based on wrong assumptions and information assessments. Actors might misjudge future returns. They might also miscalculate the information costs needed to estimate more precise probabilities and therefore select an inadequate expectation model. If they recognize these mistakes, this might lead to learning effects in the sense that they may choose a different mode of expectation formation in the event of a similar decision-making scenario in the future. This openness to error and learning processes makes contingent expectations a suitable approach for the study of historical expectation formation. To substantiate this hypothesis, we will discuss some instructive examples in the following section.

Contingent Expectations in Practice

After the triumph of FIRE in the course of the debate about the Phillips curve in the 1970s, experience-based expectation models were discredited for a long time. More recently, however, Ulrike Malmendier and Stefan Nagel (2011, 2016) have contributed much to the renaissance of this class of expectations models by showing that actors' risk aversion and inflation expectations both depend on their personal experiences in the past. This observation holds true even for experts who should know better. Malmendier et al. (2021), for example, demonstrate that personal experiences can trump information even when it comes to the inflation expectations of well-advised central bankers.

An illuminating example of how personal experience affects people's expectations is provided by Gallagher (2014) using an example from the American insurance industry. An American homeowner who was thinking about insuring his home against flooding in the late twentieth century had extensive statistics at his disposal to estimate the likelihood of flooding in that particular geographical region. We can therefore safely assume that it was possible for homeowners to determine the true probability of a flood event at low information costs and to use this knowledge to decide whether or not to take out flood insurance. Current events with no impact on the long-term probability of flooding should not change this decision. Gallagher (2014), however, has pointed to the case of affected American communities where the number of flood insurance policies per capita increased by up to nine percent after a flooding had occurred. Homeowners who endured flooding or saw it happening to their neighbors obviously rated the likelihood of this negative event to occur (again) in the future significantly higher than before the recent disaster. After about a decade, the effects of this personal experience faded, so that the average number of insurance policies per capita between flood-affected and unaffected communities of the same risk class converged again. How can these observations be explained? It is possible that experiencing a flood firsthand changed the probability that homeowners assigned to this kind of disaster. Homeowners with recent flood experience might have adjusted the probability of the bad scenario ($1-\tilde{p}$) upward because they either had underestimated the true probability ($1-p$) of flood events until they were proven wrong by their actual occurrence, or, after witnessing the disaster, they now believed that the probability of the bad scenario was even higher than the statistically correct value. Either case would emphasize the empirical relevance of experience-based expectation models in the insurance business.

To complicate matters further, an alternative interpretation of Gallagher's (2014) observations is conceivable. The personal experience of a flood may have reminded homeowners that they had a great deal to lose in the event of a disaster, namely their house and their possessions, and that it was therefore prudent to take out flood insurance. This interpretation would mean that it was only through the personal experience of the flood that homeowners understood the importance of forming information-based expectations about the likelihood of such an event and then responded accordingly. In this case, personal experience and external information would be neither opposites nor complements, but causally related. The perceived need to gather information in order to better predict the future would have been triggered by a personal experience.

In the economic life cycle of a given household, the purchase of a house represents one of the most important decisions, which can be associated with considerable losses, if, for example, buyers overlook major defects of the house or overestimate their financial abilities to pay the mortgage. The comparatively large difference between owning and losing a good home—implying that potential losses are higher than any reasonable information cost ($\Delta X > C$)—makes home-buying a scenario in which buyers should form their expectations based on the most accurate information possible. Predictions on the development of property prices are, however, extremely difficult. Real estate markets are often characterized by long cycles due to migration effects, local regulations, and a low supply elasticity. Land speculation often increases price fluctuations, with the danger of a bubble. Kuchler and Zafar (2019) suggest, based on US data, that actors simplify the problem by basing their expectations about house price developments on local market experience. In the case of such a lifetime investment, however, expectations about future house prices are not enough. Actors also have to consider the long-term development of general inflation and interest rates, as mortgage loans play an important role in financing home purchases.

To find out which public sources of information households primarily rely on when they form their inflation expectations, Conrad et al. (2022), for example, surveyed more than 2,500 German households in 2019. They were asked whether they obtained information about the European Central Bank's (ECB) monetary policy from traditional media, from social media, directly via ECB communication channels, from other sources, or not at all. Multiple answers regarding the sources of information were possible. It turned out that only ten percent of the respondents said that they were not interested in monetary policy. The vast majority of households (85 percent) indicated that they used traditional media as a source of information on monetary policy. Social media and ECB communication channels played only a minor role, each accounting for about 6 percent of the responses.

The empirical analysis by Conrad et al. (2022) reveals that users of traditional media have lower, less dispersive, and more accurate inflation expectations than users of social media. Moreover, the survey of Conrad et al. confirms the logic of contingent expectations. Households that were planning to finance a house purchase with the help of a mortgage loan and therefore had a particularly strong interest in forming correct inflation expectations were more likely to rely on the ECB's communication channels than other respondents who had less to lose in a bad scenario when real interest rates were high.

People who cannot rely on personal experiences to assess a particular decision-making situation often look to the example of other contemporaries. To explain this form of herd behavior, Shiller (2005, 160) points to the instructive example of choosing between restaurants. Let us imagine that two new restaurants have opened on Main Street, and little is

known about their quality. The first visitor, Ann, has no choice but to select one of the two empty restaurants based on external appearances. The second visitor, Bob, on the other hand, has another piece of information: a glance through the window shows him that one of the two restaurants already has a visitor: Ann. Bob might now assume that Ann knows more than he does and therefore has a good reason to prefer one restaurant over the other. It is therefore likely that Bob follows the example set by Ann. In this case, the third visitor Charles will observe one restaurant with two customers and one without, and he will therefore be even more inclined than Bob to follow his predecessors' lead. The result is an information cascade that can end with a crowded restaurant and an empty one, although there exists no known difference in quality between the two.

If actors have good reason to believe that third parties may have better private information than they do, herd behavior is perfectly rational. This also applies to financial markets, where inexperienced investors will strive to follow the lead of those considered to be better informed (Bikhchandani and Sharma 2001). The problem is that the inexperienced investors often cannot tell whether they are following the lead of experts or other newcomers. In the first case, the resulting information cascade may not cause major damage. In the second case, on the other hand, there is a risk that a speculative bubble will be created by the unidirectional transactions of many clueless people. As early as the mid-nineteenth century, Charles Mackay (1841) interpreted the tulip mania of 1636–1637 as the result of inexperienced speculators following the misleading example of their neighbors and friends and buying tulip bulbs because they hoped for further price increases.[2] Since then, every speculative bubble has probably contained an element of herd behavior. Only after the bursting of a speculative bubble do inexperienced investors realize that it would have been better to inform themselves about the fundamentals of the assets they were feverishly buying. The question remains why this insight usually comes too late. Contingent expectations suggests that inexperienced investors consider the information costs to be too high. This may be true. Many participants in a speculative bubble lack the economic knowledge to estimate the future performance of assets, be it tulip bulbs or stocks, with sufficient accuracy.

Furthermore, it is not only the example of their peers but also the influence of popular narratives that leads many poorly informed investors to buy certain assets. A striking example of this effect is the digital currency Bitcoin, whose technological properties are understood only by a small minority of buyers. What made people buy Bitcoins despite this fact were the numerous newspaper articles that appeared in the 2010s about this mysterious innovation, emphasizing the anarchistic character of this currency and its supposedly outstanding stability in value (Shiller 2019). As with the tulip bulbs centuries earlier, the rising value of this speculative object was partly due to the fact that many people were seduced by these narratives and demanded Bitcoins on a large scale. The narratives functioned as a self-fulfilling prophecy insofar as they triggered the very investor behavior that led to the realization of Bitcoin's imagined future.

In many cases, such narratives are used to challenge consumers' pre-existing experiential knowledge. Many investors are aware that speculative bubbles, like other economic crises, are a regular phenomenon of capitalist economies. To prevent this knowledge from leading to cautious behavior in times when a bull market may tip into a speculative bubble, storytellers with vested interests try to convince market participants that the current situation cannot be compared to the past. To emphasize the uniqueness of the economic development at hand, these storytellers often use the adjective "new." For example, in the run-up to the Great Depression, the American economy was ostensibly in a "new era" of continued

economic growth. Similarly, before the dotcom bubble burst in March 2000, it was claimed that a "new economy" had emerged. The purpose of this rhetorical trick is clear. If a situation is new, it cannot be explained with reference to past experience. Hence the ironic title of Carmen Reinhart and Kenneth Rogoff's book (2009) on the frequent recurrence of crises: *This Time is Different*.

These examples illustrate that it will not always end well if actors heed popular narratives. However, this is a retrospective insight. Without the benefit of hindsight, it will seem sensible to some actors to rely on existing narratives rather than on an information-based model of expectations, considering the high information costs. Making this selection comprehensible is the task of the concept of contingent expectations that we propose in this chapter.

Let us now turn finally to expectation formation under irreducible uncertainty. In business administration, many decision-making models only work if the decision-maker knows what will happen in the future. Popular investment models, for example, suggest that an investment project should only be undertaken if the discounted present value of all future net returns is greater than the initial expenditure. According to this theory, perfectly predicted future events determine the decisions made in the present. In practice, however, company owners and managers are rarely in a position to reliably predict the development of their business over several years, because this would require them to know exactly how competitors, suppliers, and customers will behave in the future, how technological progress will develop, what exogenous crisis will occur, and how politicians will react to all these changes.

An investment activity that takes place under particularly high uncertainty is the founding of a company. Data published by the US Bureau of Labor Statistics show that around 20 percent of new American companies had to be abandoned again just one year after being founded. After five years, only about 50 percent of new businesses still exist, and after ten years, only one third do.[3] Cooper et al. (1988) wanted to find out in the mid-1980s whether company founders were aware of the high probability of their future failure. Therefore, in May 1985, they surveyed nearly 3,000 fresh American business founders who had opened their businesses in 1984 or early 1985. The first question was related to their assessment of their own prospects for success. The entrepreneurs surveyed were asked to rate on a scale of 0 to 10 how likely they thought it was that their business would be successful. One third of the entrepreneurs had no doubts at all and gave the prospects of success the highest possible value of 10. The mean value of expectations was also high at 8.1. The second question asked the entrepreneurs to rate how likely it was that "any business like yours" would be successful. The mean of the responses was 5.9, a clear and significant downward deviation from the mean of the likelihood of success of their own business. In view of the fact that only about half of all start-ups survived the first five years, the American founders surveyed certainly demonstrated some realism when it came to assessing the prospects of success of their competitors. However, they had much more confidence in their own company. Cooper et al. (1988) explain this over-optimism by the assumption that the business founders tried to "rationalize" their decision to establish a company by exaggerated positive expectations in retrospect. In our opinion, it is also conceivable that this over-optimism was already present before the company was founded because it was needed to trigger the foundation process at the first place.

How to explain the fact that everyday "naïve" investment models are fed with inadequate data and used for decision-making? The answer is that this approach enables

decision-makers to act. Setting out into an uncertain future requires courage and confidence, which is provided by the apparently objective numbers from investment models, regardless of whether they are right or wrong. This is particularly true for ambitious innovation projects when neither the future characteristics of a new product or process nor its future profitability can be predicted at the start.

Many innovation projects will turn out to be a failure. This bitter truth is proven, for example, by German patent statistics in the late nineteenth century, a time when German companies worked their way up to global leadership, with numerous innovations in the technologies of the Second Industrial Revolution (chemistry, electrical engineering, mechanical engineering). Acquiring a patent was evidence of an inventor's optimism that he would be able to turn his invention into a commercial success in the foreseeable future. However, the German Patent Act of 1877 stipulated that a patent holder had to pay an annual renewal fee in order to keep his patent in force, and this fee increased over time with an initial fee of 50 marks at the beginning of the second year, increasing in stages up to 700 marks at the beginning of the 15th year, the longest possible patent term. A patent-holder who no longer wanted to pay this annual renewal fee because his patent did not turn out to be as profitable as initially imagined could abandon it prematurely. For this reason, we can infer from the distribution of the life spans of the historical patents how many of the inventors were originally too optimistic about the future profitability of their inventions. The result is unambiguous. Streb et al. (2006) have found that about 70 percent of all German patents granted between 1891 and 1907 were cancelled after just five years. After the fifth year, the speed of patent cancellation slowed down. About ten percent of all patents were still in force after ten years, but only about five percent of all patents reached the maximum age of 15 years. Even contemporaries in the late nineteenth century were probably aware of the fact that only a small proportion of all patents would generate high profits. At the time of the patent grant, however, all patent holders were united by the hope that their invention would belong to this elite group, and only this optimistic imagination drove the inventors, both the successful and the unsuccessful ones, to develop inventions and seek patents. In Chapter 21 of this volume, Magazzini, Nuvolari, and Vasta show that many of the Italian inventors of the late nineteenth century were also overoptimistic.

We refer to expectation models that enable people to act under great uncertainty as imagined expectations (see Figure 8.1). Only individuals who have a high level of confidence in their own abilities or who are enthusiastic about their innovative projects might be able to form imagined expectations as a necessary precondition for venturing into the unknown. An obvious, if extreme, example is an entrepreneur such as Elon Musk, who has been trying against all odds to advance electromobility and even manned space travel. One or two levels below that are all the other Schumpeterian entrepreneurs (Schumpeter 1926) who are willing to venture into the realm of the uncertain and incalculable despite the high danger of failure.

One example of this is the German entrepreneur Berthold Leibinger, who decided in the late 1970s to first develop and then produce at his own company, "Trumpf," the novel laser cutters that he had previously purchased from the USA for installation in his sheet-metal cutting machines (see Streb 2019, Chapter 4). The medium-sized company Trumpf, which had previously been involved in the production of run-of-the-mill machine tools, did not actually have the technological expertise for such a basic innovation. In the run-up to the ambitious project, it must have seemed very likely that it would fail. Leibinger, who was driven by the vision of making his company a world market leader, nevertheless ventured

into this innovation project and, contrary to expectations, was successful. Today, the Trumpf company is one of the largest manufacturers of industrial lasers in the world.

In this context, it is interesting to note that cognitive biases are usually described in economics as an inadequacy of the actors. At least in the case of Schumpeterian entrepreneurs, this assessment is misleading because over-confidence or belief in grandiose visions sometimes enable action in the first place and, to that extent, are prerequisites for innovation and growth.

Imagined expectations are not the only approach that can explain why uncertain actors venture innovation projects. Dorian Beauchêne (2019) believes that some innovation projects are motivated by uncertainty aversion. In Beauchêne's view, the worst-case scenario that an uncertainty-averse entrepreneur has to imagine is that a competitor succeeds in realizing an innovation. In this case, there would be a great danger that the non-innovative entrepreneur would be forced out of the market with his now outdated products. To prevent this worst-case scenario, it might seem sensible to the uncertainty-averse entrepreneur to initiate more innovation projects himself. Interestingly, Beauchêne (2019) concludes that uncertainty fosters innovation.

Conclusion

We argued in this chapter that a universal model of expectation formation that accurately describes the behavior of managers, investors, and households in all (historical) decision situations is inconceivable. We pointed out that, instead, actors usually select between different models of expectation formation to predict future outcomes, according to their experience, the cost of acquiring and processing additional information, the variation in possible outcomes, and the degree of irreducible uncertainty. That is why we suggest that both social scientists and historians should consider this high variability in expectation practices when explaining or predicting individual decisions and their economic effects.

To bring order into the toolbox of the various strategies of expectation formation, we have developed the idea of contingent expectations. The simplicity and the level of abstraction in the historically informed concept of contingent expectation formation is an important desideratum, even though it may not fully reflect all details of individual decisions in a given historical moment. We are more interested in historical *ideal types* than in explaining all nuances of human behavior. We are not interested, for example, in the personal shortcomings that may have caused a particular investor not to foresee the bursting of the speculative bubble on the New York stock market in the run-up to Black Thursday in 1929. Our ambition is to find out what kind of expectations are formed by the *average* or *typical* investor and how this behavior might lead to speculative bubbles.

Moreover, contingent expectations allow us to identify situations in which the basic assumptions of rational expectations or other versions of information-based strategies of expectation formation are plausible. Despite all criticism, the full-information rational expectation hypothesis (FIRE) should not be banned from historical and economic research because it provides a theoretical "best practice" benchmark needed to assess the results of "more realistic" concepts of expectation formation. A final implication of contingent expectations is that, at a given point in time, different people will choose different strategies of expectation formation depending on their individual experiences and the information cost they face. The different strategies almost automatically lead to heterogeneous expectations. Contingent expectations thus offer us the opportunity to do justice to the empirical

diversity of expectation models in (historical) reality without losing sight of the broader picture.

Notes

1 The term *contingent expectations* has been used twice in the literature so far, each time serving as a transitional name for concepts that would soon be called fictional expectations or the Knightian Uncertainty Hypothesis. See Beckert (2012, 2016), Frydman and Goldberg (2013), and Frydman et al. (2019).
2 For a more recent interpretation of the tulip mania see Garber (2000).
3 See https://www.bls.gov/bdm/us_age_naics_00_table7.txt, accessed on August 25, 2023.

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