

# DISCOVERING MARKETS

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JEL CLASSIFICATION: B53, D84, E71

**ABSTRACT:** This paper extends subjective expectations theory to form a new approach called the discovering markets hypothesis (DMH). Market participants form expectations on the basis of subjective knowledge and communicate with each other through narratives to improve their understanding of factual information before acting in markets. Thus, market prices are shaped by the subjective interpretation of emerging facts and shared narratives. To understand how new narratives replace existing ones, we refer to the theory of scientific revolutions. Winning narratives shape market prices until their victory is confirmed by the facts or they are discredited by facts and replaced by new narratives.

## INTRODUCTION

Prices fluctuate, and especially in financial markets, where they are heavily influenced by expectations of the future. Some economists have explained price fluctuations with the myopia of market participants. For instance, bid and ask prices are based on prices observed in the past, and when supply and demand do not match, prices are adjusted. Other economists have replaced myopia with perfect

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foresight in their models. According to them, all market participants always have all the necessary information to agree on a price equating supply to demand so that prices change only when they receive new information. However, actual price behavior is neither consistent with complete myopia nor perfect foresight among market participants. Sometimes, prices move as if market participants were myopic, sometimes as if they were forward looking. This has prompted another theory, according to which price fluctuations reflect market participants' collective oscillation between rational and irrational behavior.

This paper argues that there is a better way to explain price fluctuations in financial markets. Market participants form their price expectations on the basis of information that they collect and interpret with their individual skills and knowledge of economic relations. They act in the market or communicate with others through narratives to improve their understanding of their factual information before acting. Thus, market prices are shaped by the subjective interpretation of emerging facts and shared narratives. The resulting price movements in return influence narratives and the subjective interpretation of facts.

First, the theories of adaptive and rational expectations and the concept of adaptive markets will be discussed. These theories will then be connected to the theory of subjective expectations and an extension to the latter suggested, the *discovering markets hypothesis* (DMH). Empirical evidence is presented to support this approach, and finally, its utility in making predictions.

## OBJECTIVE THEORIES OF EXPECTATIONS

Economist John Hicks took issue with the idea put forward by Léon Walras that transactions take place at prices where demand is equal to supply. Since traders generally could not know what would be supplied and demanded at certain prices, they could only guess. Hence, Hicks (1939) argued, transactions would generally occur at prices which did not equate supply and demand. Following Hicks, we could describe the market as a mechanism that matches expectations and prices, but not necessarily potential supply and demand.

John Maynard Keynes raised the question of how expectations about the future are formed. Where they could, people would

rationally calculate subjective probabilities for different outcomes and choose the most likely. But they would also often fall back on whim, sentiment, or chance. The latter was especially the case in capital markets, where participants were driven by “animal spirits.” There, it was often necessary to forecast “what average opinion expects average opinion to be” (Keynes 1936). Keynes left the formalization of his macroeconomic expectations theory to his disciples, which often led to a mechanistic reduction of his arguments. An example of this is the theory of adaptive expectations.

In the adaptive expectations model an expected market price depends on the expected price of the previous period and an “error correction” term that is given as a fraction of the difference between the expected and the actual price in the previous period. This model is not only intuitively appealing but benefits also from the advantage that expected prices can be expressed as a weighted average of past prices. Given its user friendliness the adaptive expectations theory has been built into many macroeconomic models and has been used by many econometricians. However, even its most enthusiastic users have had to admit that it describes the formation of expectations in a very mechanical way that falls far short of Keynes’s more sophisticated view (see also Gertchev 2007).

In the early 1960s, the US economist John Muth contradicted the theory of adaptive expectations. He argued that the expectations of economic agents were nothing more than predictions, which could be made with the appropriate economic theory (Muth 1961). In the formation of rational expectations only the future counted, which would be fathomed with the help of economics. If people used all available information efficiently and knew how the economy really worked, then realized prices would differ from expected prices only as a result of random influences. And if the expected value of random influences were zero, market prices would over the longer run equilibrate supply and demand.

Muth’s theory, originally intended to explain price formation in specific markets, was incorporated into an economy-wide, dynamic general equilibrium model by Robert Lucas. According to Lucas, economic agents form their expectations of the future with full knowledge of all economic relations and using all available information. Based on these expectations they maximize their utility over

their lifetime. With his work Lucas not only solved Hicks's problem of imperfect information but also challenged established Keynesian macroeconomics. He argued that robust economic predictions could be made only with models founded in microeconomic theory because macroeconomic relations observed in the past were unstable over time.<sup>1</sup> Economic agents would change their behavior in response to economic policy. For instance, the famous relationship between unemployment and inflation proposed by the Phillips Curve would go up in smoke once people realized that the gains in purchasing power afforded by higher nominal wages were subsequently eroded by higher inflation.

Eugene Fama applied the concept of rational expectations to financial markets and hypothesized that financial prices contained all available information. At a minimum, it should not be possible to use past prices to predict future prices, and at best there would be no difference between market prices and fair prices of financial assets (Fama 1970). Thus, if markets are "weakly efficient," future prices cannot be predicted on the basis of past prices. Already this rather restrained statement contradicts the theory of adaptive expectations, which assumes that past prices contain valuable information for future prices. Markets are "semi-strongly efficient" when prices reflect all publicly available information. In this case, forecasting on the basis of past price movements as well as by considering new publicly available information is impossible. Finally, Fama classifies markets as "strongly efficient" when prices not only reflect all relevant public information but also proprietary insider knowledge. In this case, market prices and fair values of assets would be identical.

Rational expectations theory and the efficient markets hypothesis (EMH) were not only very successful academically—Robert Lucas and Eugene Fama were both awarded Nobel Memorial Prizes for their work—but also highly influential in business and politics. EMH provided the theoretical foundation for "passive investing" through index funds. If no single fund manager could reliably beat the market, why pay fees for active portfolio management? Greater returns could surely be obtained by investing in the entire market at lower costs. And EMH also had a strong influence on government policies. If the market always knew best, why let government

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<sup>1</sup> Lucas's challenge to Keynesian macroeconomics went down in the history of economics as the "Lucas Critique."

bureaucrats regulate it? “Light” regulation was in this case surely better than heavy-handed intervention.

However, Ricardo Campos Dias de Sousa and David Howden (2015), among others, have shown that EMH suffers from logical contradictions. If, as it stipulates, all market participants have all relevant information and interpret it in the same way, all would agree on a price and there would be no incentive to sell or buy. On the other hand, if only a sufficiently critical mass of market participants interpreted relevant information in the same way, transactions could take place, but the price allowing this transaction would be seen as efficient by one and inefficient by the other group. Thus, “efficient prices for one group requires inefficient prices in the eyes of the other” (Campos Dias de Sousa and Howden 2015, 396).

Rational expectations theory and EMH suffered their first practical setback in the early 2000s, when the “technology stock bubble” burst. Apparently market participants were not just cool-headed *homines oeconomici* but could get carried away by emotions. The experience gave a big boost to behavioral economics and finance. Until that point, behavioral economics had largely been an experimental science confined to the laboratories of a few universities—its key protagonists, Daniel Kahnemann and Amos Tversky, were Israeli psychologists. US economist Robert Shiller (2000) applied behavioral economics to finance, publishing a book in which he diagnosed the wild rally of technology stocks towards the end of the 1990s as a bubble just as it was peaking. Not least because of the excellent timing of the release of his book, a serious challenge to the EMH had emerged in science and financial business.

Rational expectations and EMH suffered another setback with the Great Financial Crisis of 2007–08. The systematic mispricing of risk, which became apparent when the credit bubble burst, was inconsistent with the idea that people would base their financial decisions on all available information and with a full knowledge of the true “economic model.” Obviously people in the credit markets had based their actions on inadequate information and a false economic model that indicated risk reduction through asset pooling when risks in fact accumulated as a growing number of people acted on this model.

Despite its obvious failure, EMH has remained the predominant theory of market behavior in academics and large parts of the

business world simply because there has been no other theory in mainstream economics to displace it.<sup>2</sup> In 2017, however, the US financial economist Andrew Lo came up with another challenger to EMH. Conscious of the difficulty of dethroning a theory taught widely at universities and perhaps with the ambition to follow in the footsteps of Nobel Prize winners Fama and Shiller, he named his theory the *adaptive market hypothesis* (AMH) (Lo 2017).

Lo's intention was not to scrap EMH entirely, but to restrict its validity to times of continuous market development. During those times people act rationally, based on a wide knowledge of facts and a good understanding of the valid economic model. But when markets are disrupted for whatever reason, people turn from rational analysis to instinctive behavior. They join others in either rushing into markets for fear of missing out or fleeing them for fear of losing their fortunes. Lo (2017, 188) summarizes his theory in five key principles:

1. We are neither always rational nor irrational, but we are biological entities whose features and behaviors are shaped by the forces of evolution.
2. We display behavioral biases and make apparently suboptimal decisions, but we can learn from past experience and revise our heuristics in response to negative feedback.
3. We have the capacity for abstract thinking, specifically forward-looking what-if analysis; predictions about the future based on past experience; and preparations for changes in our environment. This is evolution at the speed of thought, which is different from but related to biological evolution.
4. Financial market dynamics are driven by our interactions as we behave, learn, and adapt to each other, and to social, cultural, political, economic, and natural environments in which we live.
5. Survival is the ultimate force driving competition, innovation, and adaptation.

Thus, during normal market conditions reward increases with risk. But at times of negative disruption people may shun risks irrespectively of the associated reward. The Capital Asset Pricing Model may

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<sup>2</sup> The confusion in academics about how markets work became evident with the awarding of the 2013 Nobel Memorial Prize to both Eugene Fama and Robert Shiller.

work in normal times but fail in other market environments. Similarly, portfolio optimization according to Markowitz may work in good times but fail in bad times. When there is contagion among different markets, asset diversification may no longer reduce risk (Lo 2017, 282).

Lo's AMH is an intriguing effort to overcome the contradiction between EMH and behavioral finance and connect them by making them state dependent. However, why should "rationally" acting professional investors suddenly turn "irrational" in market downturns, and why should "irrationally" acting retail investors suddenly turn "rational" in normal markets? And why do environments change from "normal" and continuous to "abnormal" and discontinuous? Perhaps we can get a better idea of how markets behave when we study more closely the way that market participants process information.<sup>3</sup>

## A SUBJECTIVE THEORY OF PRICE AND EXPECTATIONS FORMATION

Like Hicks, Austrian economists in the tradition of Carl Menger and Eugen von Böhm-Bawerk acknowledged that people act with imperfect knowledge. However, these economists claimed that although prices realized in transactions may not equilibrate potentially available supply and demand they always cleared the market (in the sense that actual supply matches actual demand). The early Austrian economists introduced real-world outcomes as "points of rest" (Menger) or "momentary equilibria" (Böhm-Bawerk), where market exchanges are carried out without the adjustment of buyers' and sellers' preferences (Klein 2008, 172). Mises coined the term *plain state of rest* (PSR) as opposed to the imaginary construct of the *final state of rest* (FSR) (where all supply equals all demand). He explains: "When the stock market closes, the brokers have carried out all orders which could be executed at the market price. Only those potential sellers and buyers who consider the market prices too low or too high respectively have not sold or bought" (Mises 1949, 245). As an analytical tool, the FSR serves as a hypothetical

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<sup>3</sup> Lo's auxiliary assumption of shifting market environments to retain the EMH could be interpreted, in Lakatos's (1976) words, as a "degenerative problem shift" in a descending research program (see below).

scenario in which basic data of the market are frozen and market participants have perfect information and knowledge. In the FSR all feasible gains from trade are exhausted (Klein 2008, 173). But in reality the FSR never materializes, because market participants have imperfect knowledge that they continuously seek to improve. Thus, during the market process entrepreneurs shuffle and reshuffle resources and capital combinations in response to new knowledge to take advantage of profit opportunities and avoid losses (Salerno 2006). Hence, realized prices generally can be characterized as representing an “equilibrium with error” (Manish 2014). Since the errors of actors with superior knowledge are smaller than those of others, their profits from transactions are larger. As more profitable actors attract more capital at others’ expense, their influence on the exchange process increases. Thus, competition improves the functioning of markets and the economy at large.

Without perfect information and knowledge about the workings of the economy, prices are based on expectations, which are derived from the subjective interpretation of information (Manish 2017). Mises points out: “As action necessarily is directed toward influencing a future state of affairs, even if sometimes only the immediate future of the next instant, it is affected by every incorrectly anticipated change in the data occurring in the period of time between its beginning and the end of the period for which it aimed to provide” (Mises [1949] 1998, 253). From this it follows, according to Mises (1962), that “Every action is a speculation, i.e. guided by a definite opinion concerning the uncertain conditions of the future.” That is—in short—expectations. Thus, expectations “form a crucial component of every act” (Manish 2007, 209). The knowledge used to form expectations is somewhat different in each individual mind, because it reflects the individual’s experience and the specific and unique ability to collect and interpret information. The knowledge is often implicit. Actors may not be able to articulate it, and it certainly cannot be objectively measured. Mises coined the term *thymology* to describe a method that allows historians to “understand” a complex historical event (Mises [1985] 2007). In the same way that historians look into the past, market participants look into the future. This means that just as thymological experience serves as the basis for the historian’s interpretative understanding of past events (so far as they depend on social and not natural causes), it also conditions the actor’s “specific understanding of future events” (Salerno 1995, 309).



After the Austrian revival in the 1970s, debates about expectations and the market process's possible convergence towards equilibrium took on a central role. For Lachmann (1976), expectations are radically subjective and as such radically unpredictable. In consequence, he states: "Expectations must be regarded as autonomous, as autonomous as human preferences are" (Lachmann 1976, 130). This radicality has been criticized as nihilistic (Hülsmann 1997, 25). Of course, experience-based knowledge is fundamentally different from experimentally established facts of the natural sciences, but it is still real knowledge (Salerno 1995, 312). As Mises puts it: "To know the future reactions of other people is the first task of acting man." (Mises [1985] 2007, 311). Kirzner (1973) argued that the alertness of entrepreneurs for profit opportunities leads to a general systematic tendency toward equilibration.

Thus, the market is in a state of continuous disequilibrium but moving toward an equilibrium. Although Mises sees a theoretical final state of equilibrium resulting from the exploitation of profit opportunities from disequilibria by capable entrepreneurs (see above), in reality continuously emerging new facts are changing this equilibrium so that it can never be attained.

## THE DISCOVERING MARKETS HYPOTHESIS

In order to shed more light on the formation of expectations, subjective expectations theory will be extended by including two further observations: (i) The subjective reception of complex contents is communicated in narratives, and (ii) shared narratives shape prices and are shaped by them.

### The Role of Narratives

Before they act, individuals communicate with each other to cross-check their subjective knowledge against the knowledge of others. Complex knowledge is difficult to communicate. When expressed in the form of narratives it is easier to "get across ideas" (Shiller 2017). Robert Shiller has launched a research program (dubbed "narrative economics") to study the influence of popular narratives on seminal events such as the depression of 1920–21 or

the Great Depression of the 1930s (Shiller 2019). Among other things he has found that narratives can spread like epidemics and influence people's behavior, which can feed back into the narratives. While Shiller traces the effects of "big" narratives on historical economic developments, the focus of this text is on the effect of "narrow" narratives on financial market prices. As market participants share narratives and act on them in the market, prices move. In turn, the movement of prices feeds back into the narratives. The legendary stock market trader Jesse Livermore (alias Larry Livingston) explains in the classic book *Reminiscences of a Stock Operator*: "Observation, experience, memory and mathematics—these are what the successful trader must depend on...He must bet always on probabilities—that is, try to anticipate them," (Lefevre 1922, 416).

## Battles of Narratives

Shiller explains the emergence and disappearance of narratives in terms of contagion and recuperation. This can be well applied to "big" narratives evolving and fading with time. The "small" narratives in financial markets, however, do not die of old age but are replaced by other "small" narratives. To understand how new narratives replace existing ones in financial markets, we recur to the theory of scientific revolutions developed by Thomas Kuhn (1970). He argues that scientific knowledge normally increases around a widely accepted paradigm. In normal times, the paradigm itself is not challenged but is fleshed out more by new insights. However, when a critical mass of new facts emerges that is inconsistent with the ruling paradigm a scientific revolution may occur. Previously widely shared and accepted beliefs are questioned and overturned. Uncertainty and confusion may reign until a new paradigm is found that better explains the new facts. After a turbulent period ("extraordinary science"), scientific work returns to its normal state of work ("ordinary science").

Imre Lakatos (1976) speaks of research programs that have a paradigm at their core. According to him, however, the paradigm shift is not abrupt, but a tough struggle between the defenders of the old paradigm in the old research programs and the challengers who question it. When new facts put pressure on a paradigm, defenders find supporting auxiliary hypotheses to save it, but the original core of the paradigm is weakening. Lakatos calls this "degenerative problem

shift.” The challengers, on the other hand, find new explanations for the facts and develop a theory with a higher explanatory value. This leads to a “progressive problem shift.” In contrast to Kuhn, who combines paradigm shifts with radical breaks, Lakatos sees continuous gains in knowledge through the problem shifts in research programs.

The insights of Kuhn and Lakatos into the creation of new scientific knowledge are valuable guides for understanding the effects of the emergence of new knowledge in the market. Participants acting on a new shared narrative influence market prices. For some time, there may be a battle of the ruling and the new narratives. The new narrative may change or bear new narratives during this battle. And eventually the argument will be settled, and a new narrative will rule until the process begins anew. It is possible that the battle of narratives is intense and the victory of the new one absolute, as Kuhn has described the revolutionary paradigm change in science, or that it is drawn out and the new narrative displaces the old one gradually, as Lakatos has argued.

## CONTINUITY AND DISCONTINUITY IN PRICE DISCOVERY

When knowledge improves incrementally narratives change only little and the process of price discovery proceeds gradually. Financial markets are then characterized by relatively small spreads between offer and demand prices (or “bid-ask spreads”) for securities and by moderate price volatility. This notwithstanding, market clearing prices are being found through a process of trial and error and may move around until all participants agree on the price that best reflects their shared narrative. A market “equilibrium with error” (or “plain state of rest” according to Mises [1949] 1998)<sup>4</sup> has then been established, only we don’t see much of these movements.

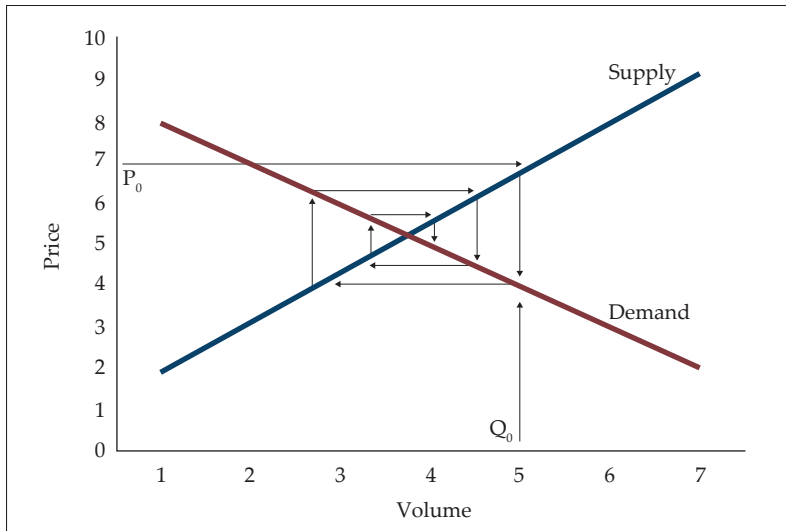
One way to illustrate the search process for a market clearing price is the old-fashioned cobweb model shown in Figure 1. The suppliers want to supply quantity  $Q_0$  at price  $P_0$ . However, the price

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<sup>4</sup> At the “plain state of rest” markets are cleared, but not necessarily in an equilibrium free of all market participant error. This is the “final state of rest,” towards which the market is pushed by competition but which may never be reached in reality.

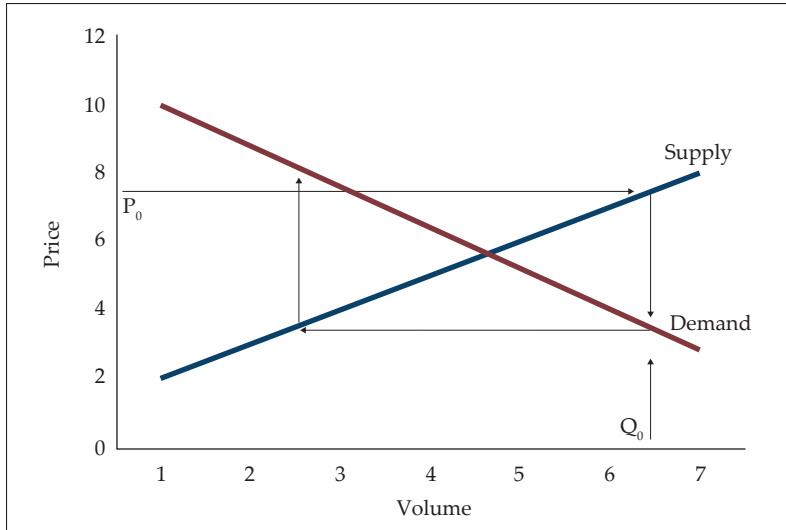
they get when they offer  $Q_0$  is much lower than  $P_0$ . Consequently, many cut their offer so that supply now falls below demand. Excess demand brings suppliers back into the market, but at the new price there is excess supply. They cut back again, only to face excess demand again. The process of trial and error continues until the market clearing price is found.

**Figure 1. Finding the Market Clearing Price in a Cobweb**



In this graph, the market clearing price is found, because the supply curve is more elastic than the demand curve. In consequence, suppliers adjust their prices by large amounts in response to excess supply or demand. But what if suppliers react less and demanders more elastically to excess supply and demand than before? In this case, excess demand and supply grow with each step and a market clearing price cannot be found (Figure 2). This is, incidentally, also true when both sides react with the same elasticity.

**Figure 2. Searching for the Market Clearing Price in Vain in a Cobweb**



Let's now assume that the combination of a fairly inelastic demand with an elastic supply curve characterizes a market where the demanders represent the "wisdom of the crowd" in the eyes of suppliers. This is how people intending to sell securities probably would look at the market. They would adjust their intentions relatively strongly in response to the feedback they get from the market. This is how markets normally behave, when most people share similar knowledge about market circumstances. New knowledge emerges gradually, and prices converge to clear the market.

However, when new and disturbing knowledge drops like a bombshell into the market there will probably be determined (or even forced) sellers in the market and many demanders will be very unsure about what to make of this. In this case, the demanders overreact to sales by the suppliers, and the suppliers in turn underreact to the demand changes by the demanders. No new equilibrium can be found. Bid-ask spreads widen and price volatility increases, because suppliers and demanders are out of synch with each other. Only when the new knowledge has been absorbed and evaluated by everyone can the market return to its "normal" mode of operation.

## Battles of Narratives and Fractal Geometry

Can we identify patterns in the emergence of gradual and revolutionary new narratives in the markets? Fractal geometry, developed by the mathematician Benoit Mandelbrot, may help (Mandelbrot and Hudson 2004). According to Mandelbrot smoothness and roughness alternate in nature and financial markets. There are long periods when little happens and short periods of high turbulence. To borrow from Kuhn, markets are calm when an accepted narrative is not seriously challenged, and they experience heavy turbulence when an accepted narrative is overturned by a radically new one. Or, to borrow from Lakatos, markets shift as new narratives gradually displace old ones. We call the evolution of prices in response to the spread of narratives the *discovering markets hypothesis* (DMH).

## AMH and DMH Compared

Although Lo's adaptive markets hypothesis and the DMH start with the same insight that markets may alternate between continuity and discontinuity, there are important differences. First, AMH takes the change in states as given while DMH explains it as the way in which knowledge emerges and spreads in the form of narratives. Second, AMH assumes schizophrenic minds in market participants and employs psychology to explain alternating behavior while DMH assumes psychologically stable market participants who act continuously and consistently—in a subjectively rational way. By focusing on the process of augmenting subjective knowledge in a battle of narratives, DMH provides a more consistent framework for analyzing and predicting market behavior.

## EMPIRICAL SUPPORT FOR THE DMH

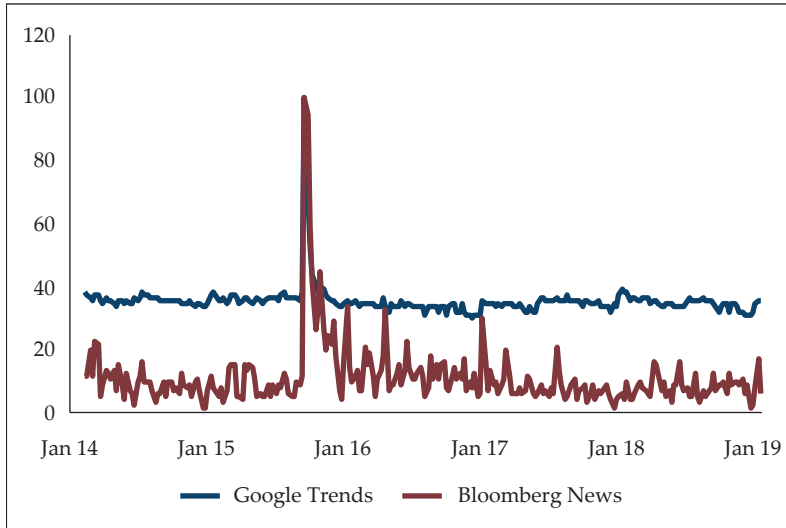
Can we relate market price movements to the emergence of new facts and the spread of new narratives? In this section, DMH is applied to explain a few highly visible market movements, although this does not constitute a test of the theory in the spirit of Karl Popper, in which researchers aim to establish a numerically quantified causal relationship between exogenous and endogenous variables. In view of the complexity of the object of research, F. A.

von Hayek's (1974) "pattern recognition" method is employed. Hayek has argued that numerical predictions based on causal relationships between endogenous and exogenous variables are less reliable the more complex the system to which these variables belong is. The complexity of social systems in particular is such that the establishment of causal relationships between variables and their quantification are next to impossible. But this does not mean that falsifiable hypotheses cannot be created and that predictions are unable to be made (Hayek 1974).

Applying Hayek's theory to the analysis of markets, it is possible to establish whether or not the DMH can explain the pattern of market price movements. What cannot be expected is to find a theory with which market outcomes can be predicted. Below a number of cases in which existing narratives were suddenly overturned by new ones (cases 1–2) is examined. This is followed by a study of two cases in which new narratives emerged after a battle of narratives (cases 3–4). A look at two cases in which the narrative shifted more gradually (cases 5–6) concludes the analysis.

### **Case 1: Diesel Shock**

On September 22, 2015, the German car company Volkswagen AG (VW) published a profit warning acknowledging that Diesel engines had been manipulated so as to disguise the true level of NO<sub>2</sub> exhaust. As Chart 1 shows, this attracted a lot of public attention and news coverage of Volkswagen surged (measured by the number of queries including the term "Volkswagen," Chart 1).

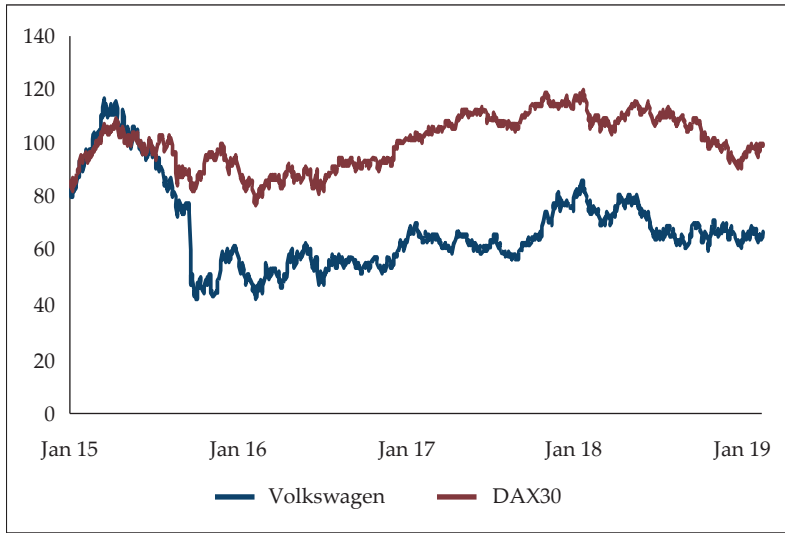
**Chart 1. News Concerning “Volkswagen,” 2014–19**

Source: Bloomberg, Google Trends, Flossbach von Storch Research Institute.

The share price plunged on the news and then moved along with other share prices represented by the DAX30 stock market index (Chart 2). The observed share price movement is consistent with one-off repricing in response to unexpected news as postulated by the efficient markets hypothesis. It is also consistent with a radical shift of the narrative about the profitability of Volkswagen. From the analysis of the share price development, it is not evident which theory gives a better explanation of the observed pattern.



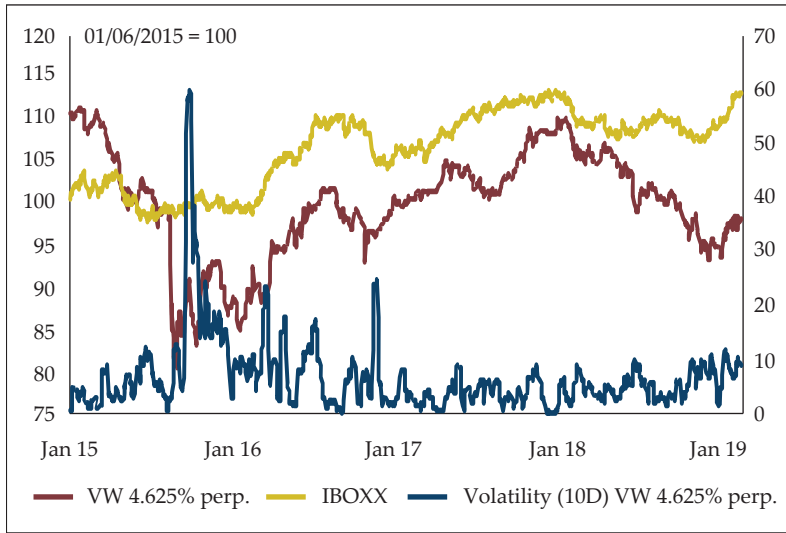
**Chart 2. VW Shares Compared to the DAX30 Equity Price Index, 2015–19 (100 = 01.06.2015)**



Source: Bloomberg, Flossbach von Storch Research Institute.

However, things become clearer by looking at a corporate bond of the company. Until the release of the news the bond fluctuated around the bond price index iBOXX (Chart 3). In response to the release the price plunged in a way similar to the movement of the share price (though somewhat less) and volatility increased. Both markets seemed to follow the same narrative. Thereafter, however, the price of the bond recovered and returned to the level of the bond price index while volatility declined again. The narrative of a company in deep trouble was superseded by the narrative that the company would survive and creditors were fairly safe. If the market was “efficient,” the bond price should have reacted much more calmly than the stock price. But market participants needed to digest the news and differentiate the new narrative in the stock market from that in the bond market before prices in both markets settled.

**Chart 3. Price of VW 4.625 Percent Perpetual Bond and iBOXX, 2015–19**



Source: Bloomberg, Flossbach von Storch Research Institute.

Likewise, the cost of insuring Volkswagen debt against default rose significantly (Chart 4) in September 2015, but it fluctuated at a lower level in the aftermath of the crisis outbreak.

**Chart 4. Price of a Credit Default Swap for Volkswagen (in Basis Points), 2015–18**

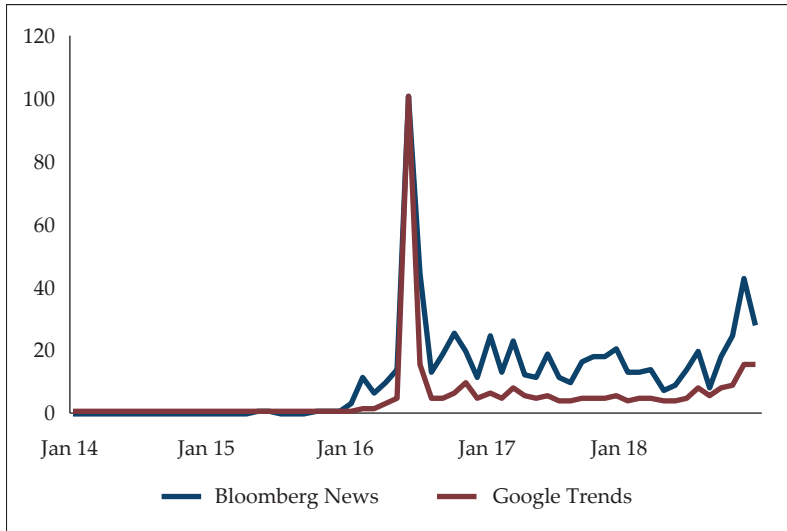


Source: Bloomberg, Flossbach von Storch Research Institute.

## Case 2: Brexit

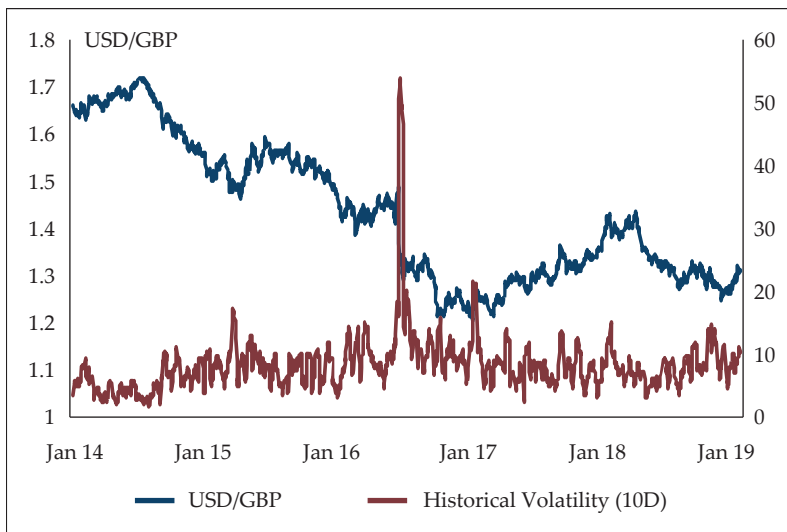
On June 23, 2016, for many people unexpectedly, the British people voted in favor of the country's exit from the European Union. Unsurprisingly, news coverage surged (Chart 5). The exchange rate of sterling against the US dollar took a dive and volatility surged (Chart 6). Following the nosedive, the exchange rate of sterling continued to weaken as it had done before the unexpected news. After some time, however, the initial shock faded and the exchange rate recovered part of the lost ground. Volatility also fell, suggesting that the initially high level of uncertainty gave way to a more stable pattern of views. The observed pattern is consistent with a weakening of the new Brexit narrative over time. As the debate about the terms of Brexit dragged on and the eventual outcome became ever more obscure, the exchange rate flattened. The confusion prevented any narrative from dominating the market.

**Chart 5. News Concerning “Brexit,” 2014–19**



Source: Bloomberg, Google Trends, Flossbach von Storch Research Institute.

**Chart 6. Price Quotation USD/GBP and Volatility, 2014–19**

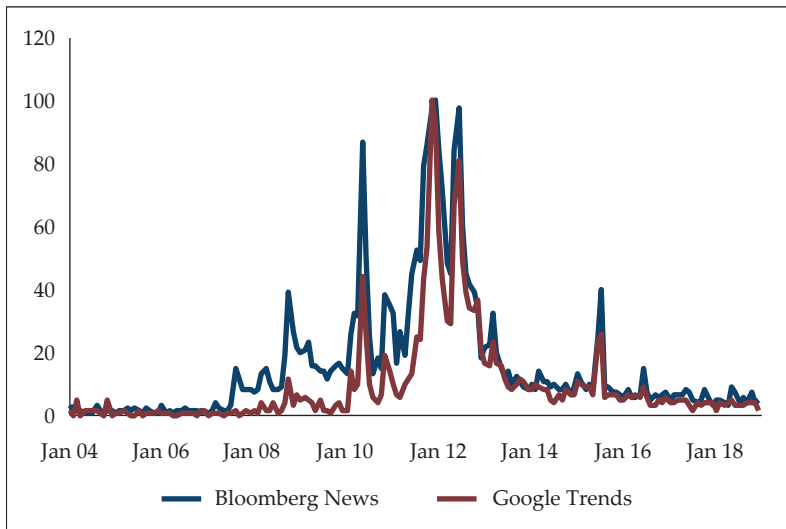


Source: Bloomberg, Flossbach von Storch Research Institute.

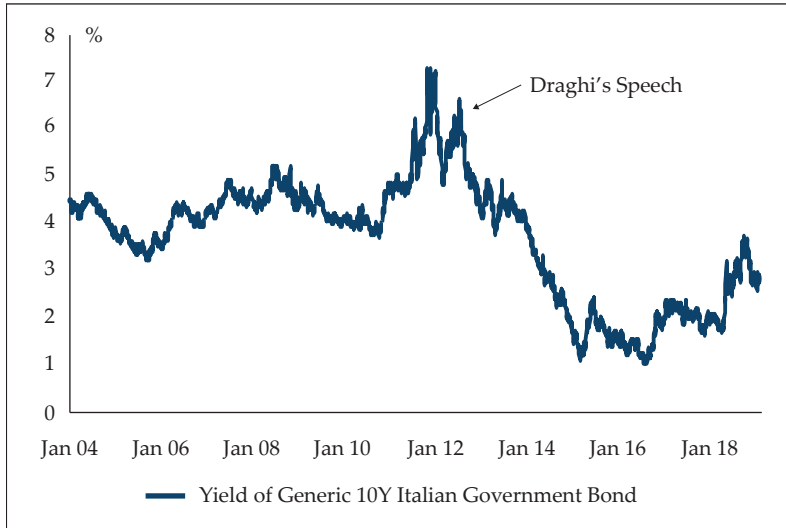
### Case 3: Eurocrisis

Following Greece's debt restructuring in early 2012 markets moved their focus to Italy. While the Greek debt crisis had posed only a limited threat to the survival of the euro an Italian debt crisis could spell its end. Hence, news reports mentioning a "euro crisis" increased (Chart 7). At the same time, Italian bond yields rose (Chart 8). On July 26, 2012, however, European Central Bank President Draghi said that the ECB would do "whatever it takes" to protect the euro. As a result, the Italian bond yields plunged. However, it took the rest of the year for the new narrative of the ECB's survival guarantee to find its way fully into market prices. The pattern observed here is consistent with a new narrative ("whatever it takes") replacing an old one ("euro crisis") in the market.

**Chart 7. News Concerning the "Euro Crisis," 2004–18**



Source: Bloomberg, Google Trends, Flossbach von Storch Research Institute.

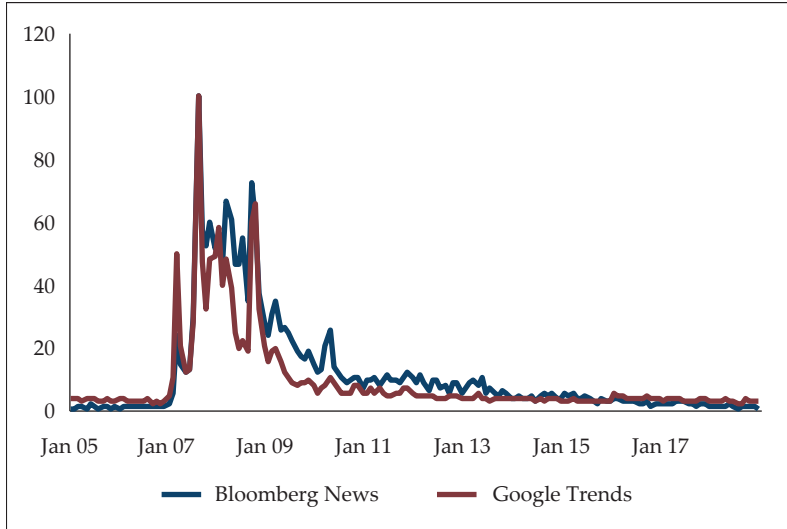
**Chart 8. Ten-Year Italian Government Bond Yields, 2004–13**

Source: Bloomberg, Flossbach von Storch Research Institute.

#### Case 4: Subprime Crisis

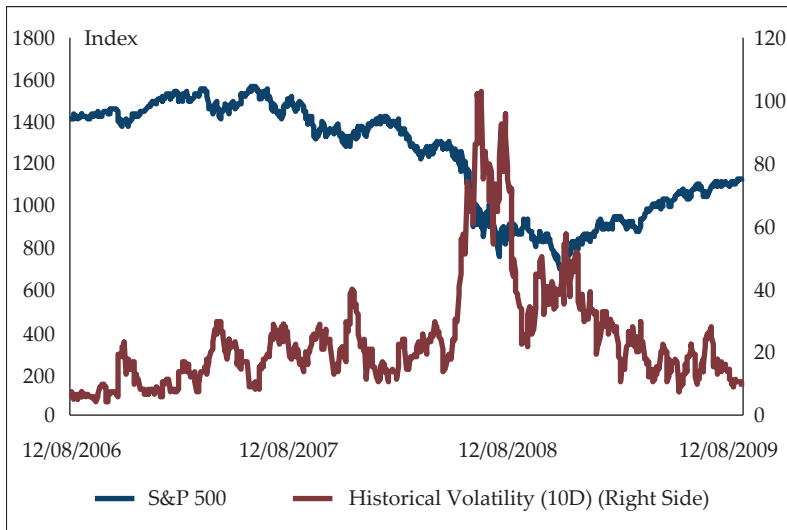
In early 2007 defaults in a segment of the US mortgage market—called “subprime”—received public attention. Initially the events were described as problems caused by the mis-selling of mortgages to financially weak debtors and hence as a limited problem in a relatively small market segment (Chart 9). Money markets in the US and Europe were affected as banks lost trust in each other’s solvency, but the stock market remained calm (Chart 10). The narrative changed with the default of Lehman Brothers, causing news on the subject to surge again (Chart 9). Through the remainder of the year and into 2009 stock prices fell and volatility increased. However, by the end of the first quarter of 2009 the crisis narrative had weakened sufficiently to be superseded by a more positive one, first along the lines of “the worst is over” and then of the recovery beginning. The fear of missing out by sticking to the old narrative was a key motivation in the skeptics becoming optimistic.

**Chart 9. News Concerning “Subprime,” 2005–18**



Source: Bloomberg, Google Trends, Flossbach von Storch Research Institute.

**Chart 10. S&P 500 Price and Historical Volatility, 2006–09**



Source: Bloomberg, Google, Flossbach von Storch Research Institute.

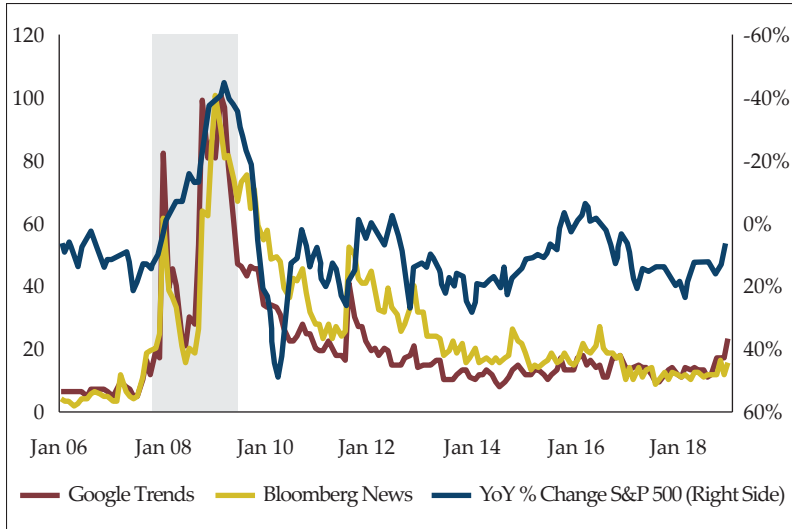
## Case 5: Recession

Although during the Great Recession of 2007/08 money markets were already experiencing severe tensions as of mid-2007, recession fears in the US gained momentum only in August 2007 and peaked in December 2007 (as measured by the number of queries for the word “recession” on Google and Bloomberg, Chart 11). Fears subsided during the first half of 2008 but surged again in August 2008, peaking in October 2008, one month after the bankruptcy of Lehman Brothers. Recession fears eased again during the second quarter of 2009.

The absolute peak of Google recession queries in the observation period occurred just at the beginning of the recession in the US in the first quarter of 2008. The return to a more normal level of recession fears in mid-2009 coincided with the (later proclaimed) official end of recession in the US. At the beginning of 2008 the stock market (as measured by the S&P 500 price index) broke below its 2007 trading range but remained in this range until the end of August. Only after the news of the Lehman bankruptcy on September 15 did stock prices plunge. They reached a nadir in early March 2009, coinciding with the easing of recession fears (measured by the number of Google and Bloomberg queries).



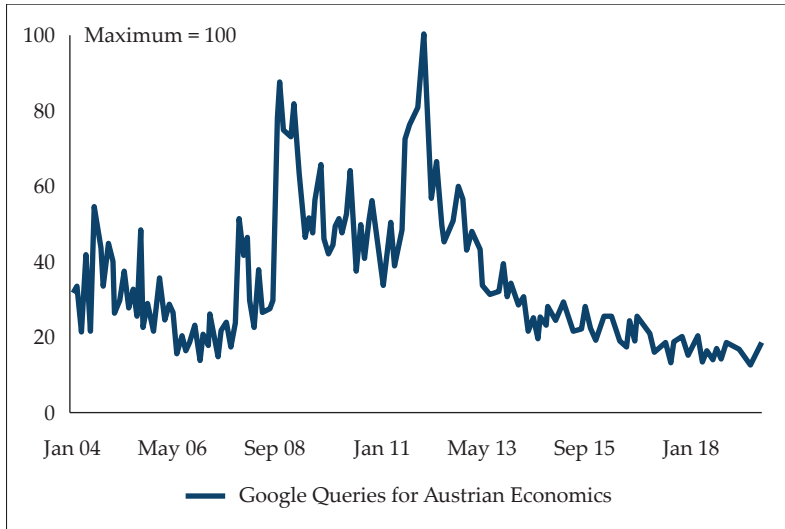
**Chart 11. News Concerning “Recession” and Year-on-Year Percent Change of S&P 500 (Inverted)**



Source: Bloomberg, Google Trends, Flossbach von Storch Research Institute.

## Case 6: Austrian Economics

Conventional New Keynesian economists had not seen the financial crisis and recession coming. This created renewed interest in the explanation of credit and investment cycles in Austrian economics, an explanation which became a narrative of its own. Chart 12 shows queries for “Austrian economics” worldwide. Queries surged in October 2008, the month after Lehman Brothers’s bankruptcy. They jumped to an even higher level in January 2012, when fears rose that Italy would crash out of the European Monetary Union (EMU). As central banks flooded the banking sector with money and Mario Draghi, president of the ECB, effectively guaranteed the existence of the EMU by promising to do “whatever it takes” to preserve the euro, the narrative of “Austrian economics” lost some of its attraction. Past experience suggests that interest will increase again when the financial system comes under renewed pressure in the next economic downturn.

**Chart 12. Queries for “Austrian Economics”**

Source: Google Trends.

## PATTERN PREDICTIONS WITH THE DMH

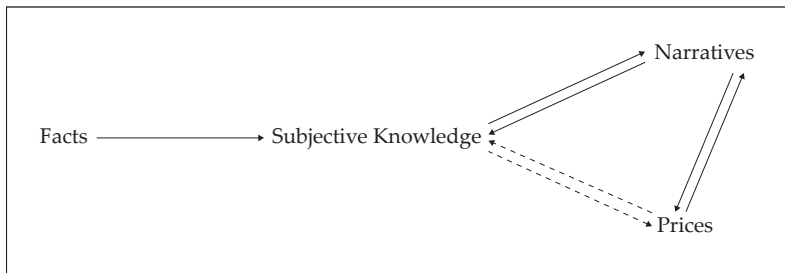
Having found the DMH to explain the pattern of market movements as a competition between different narratives, its use in making “pattern predictions” can now be discussed. Hayek uses the example of a ball game to illustrate what can and cannot be predicted: if we knew precisely the skills and fitness of the opposing teams in addition to the rules of the game, we should in principle be able to predict the outcome with a relatively high degree of certainty. However, the closer the teams come in skills and fitness, the greater will be the role of chance in determining the outcome (Hayek 1974).

The legendary German coach Sepp Herberger once said: “People go to soccer games because they don’t know how the game ends.” In reality, no one has precise information about the skills and fitness of the players at the time of the game, so that not only pure chance but also a lack of information will prevent a reliable anticipation of the outcome. Nevertheless, knowing the rules of the game helps observers focus their attention on what is important to the result.

Moreover, as people observe the game they acquire more information about players' ability and can improve their prediction of the outcome. It is obviously easier to correctly predict the result of a soccer match at halftime than at the beginning, but even then a lot of uncertainty remains.

All this implies that one should not expect to be able to predict market outcomes. But by understanding how markets move we can better focus on what is important to the outcome. Observation of the important drivers of market developments can then help us narrow down the possible range of outcomes. Specifically, the discovering markets hypothesis suggests that we focus on how new facts influence narratives, which shape prices and are themselves reshaped by them. By identifying narratives shared by a large number of people and by finding out whether they are ascending or descending, we may be able to assess the persistence of market price movements. In some cases, narratives that precede price movements may even be identifiable. This is illustrated in Figure 3.

**Figure 3. Formation of Prices**



Facts create subjective knowledge, which may induce financial market participants to act. More likely, however, they will exchange this knowledge with other participants with a view to identifying shared narratives, which have a more powerful influence on prices than individual action does.

## SUMMARY AND CONCLUSION

Expectations of the future shape the movement of prices, which clear markets, although not necessarily at the point where potential

supply is equal to potential demand. This paper followed the argument of Lachmann and Mises that market participants form their expectations on the basis of their ability to collect information and interpret it. In keeping with Shiller, it was observed that market participants tend to communicate their views about the future in the form of narratives and that they learn by listening to the narratives of others. Narratives compete, and winners emerge by knocking out or gradually wrestling down competitors. Winning narratives shape market prices until the facts confirm their victory or until they are discredited by the facts and replaced by new narratives. When we understand how market prices form we can predict the way they adjust to changing economic conditions.

Could artificial intelligence and machine learning replace human actors in financial markets? Those who believe in more mechanical models of expectations—assuming “rational,” “irrational,” or state-dependent “rational/irrational” behavior—may be inclined to say yes. However, if market participants indeed act subjectively rationally and interdependently based on proprietary knowledge accumulated through experience and incomplete information transmitted through narratives—as described in the discovering markets hypothesis—the hurdle to clear for artificial intelligence to beat human intelligence seems fairly high.

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