

Luigi Zingales

*Learning to live with not-so-efficient markets*

For most non-economists, the biggest intellectual casualty of the 2007–2008 financial crisis is the efficient market theory (EMT). Newspapers and talk shows have analyzed the theory's apparent demise; new books with titles like *How Markets Fail*, *The Myth of the Rational Market*, and *A Failure of Capitalism* abound. Yet, in academia, the EMT has been challenged since the 1987 stock market crash, and the theoretical and empirical shortcomings of the theory have been well established. The marginal contribution of the 2007–2008 financial crisis was to weaken the already-losing side of hardcore believers in the EMT.

Thus far, the recent crisis has not provided any crucial new evidence on the deviations of markets from fundamentals, only evidence of the costs of these deviations, especially when coupled with very high leverage. The rise and collapse of the real estate market, with all the consequences these events produce, are much easier to explain as the result of variation in fundamentals than is a 22.6 percent stock market drop in a day with no major news. Hence, those who have remained unchanged in their beliefs since the 1987 stock market crash have been little af-

fectured in their faith by the 2007–2008 financial crisis or by the evidence collected in the intervening twenty years. Yet the increasing proportion of academics who question the EMT have found in the recent crisis a painful example of the costs of ignoring potential market inefficiencies. A major rethinking of the validity of the theory's implications is all but inevitable.

From courtrooms to boardrooms, from policy cabinets to classrooms, the EMT provided the intellectual foundation for an entire generation. The current debate has thrown this foundation into question. Rethinking the theory, however, does not mean abandoning it: the approach still holds many useful insights. Because it has provided a coherent framework with great practical value, rethinking the EMT will be painful; nonetheless, it is necessary. This journey will inevitably be full of mistakes, but the biggest mistake of all would be not to undertake it.

While its intellectual origin can be traced back to the early twentieth century, the EMT hypothesis gained importance in academia in the mid-1960s. In its early formulation, the EMT was simply the idea that if prices adjust rapidly to new information, they should be unpredictable. This hypothesis, validated

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by economist Eugene Fama's dissertation at the University of Chicago in 1965, has three very important implications. First, if prices are unpredictable, then all technical analysis, which uses past price behavior to predict future trends, is useless. Second, if prices are unpredictable, then investors should not pay for investment advice and active money management, but should simply buy mutual funds that passively track the stock market index. Last but not least, if future prices are unpredictable, current prices are the best available estimate of the true value of any asset. If this were not the case, so the theory goes, speculators would intervene to drive prices equal to fundamentals.

Early on, the EMT enjoyed wide empirical support. Subjected to rigorous testing, most technical rules for investing in the stock market, it was found, did not outperform a random strategy. On average, actively managed mutual funds did not outperform a stock market index, and there was no evidence of any persistence among the winners. The only evidence of persistence in mutual funds' performance was in the negative domain: this year's laggards were likely to be next year's, too, because they were charging above-average fees. If one combines a random performance with above-average fees, statistically the consequence is an abnormally low after-fee performance!

The only implication of the EMT that was difficult to test was the last one: that stock prices are the best available estimate of fundamentals. Fama, the main supporter of the EMT, said in 1970:

The primary role of the capital [stock] market is allocation of ownership of the economy's capital stock. In general terms, the ideal is a market in which prices provide accurate signals for resource alloca-

tion: that is, a market in which firms can make production-investment decisions, and investors can choose among the securities that represent ownership of firms' activities under the assumption that securities prices at any time "fully reflect" all available information.<sup>1</sup>

This implication proved difficult to test because one needs a model of fundamental values in order to test whether prices are equal to fundamentals. Yet if one rejects this equality, it is unclear whether that entails rejecting the asset-pricing model that assesses the fundamental value or rejecting the EMT. This joint hypothesis problem has made it difficult to reject the most important implication of the EMT: that current prices are the best estimate of future fundamental values.

Since Friedrich von Hayek's work, economists have recognized the importance of prices in aggregating information and in directing the allocation of resources. Financial markets play a crucial role in this respect: stock prices provide a major indicator of where resources should be allocated. In the late 1990s, seasoned executives abandoned their corporate positions and M.B.A. students their classrooms to join Internet start-ups because of the high valuations these ventures commanded in the marketplace. Thus, market efficiency is not just about how difficult it is to make money in the stock market, but how the stock market provides useful information about how resources should be allocated.

In 1978, empirical support for the EMT was such that Michael Jensen, one of the most prominent researchers in finance, wrote that "there is no other proposition in economics which has more solid empirical evidence supporting it."<sup>2</sup> In science, however, hypotheses cannot be

proved, only rejected. As soon as the EMT became widely accepted, researchers began gathering evidence against it. By 1983, the *Journal of Financial Economics*, the primary journal in finance, dedicated an entire issue to financial “anomalies,” a politically correct term for violations of the EMT.

The first challenge to the EMT arose from the fact that prices are not unpredictable. With longer and more frequent time series, researchers established that there is some predictability in prices in the very short term and even in the very long term. (These latter findings, however, were less statistically robust, due to the lack of long-term time-series data.) As is typical of scientific progress, these initial findings led to modification of the EMT rather than its rejection. In an environment where investors are risk averse, today’s prices do not simply reflect expected future prices; rather, they reflect the expected value for the investors of these future prices. Because investors are risk-averse, this expected value reflects not only the expectation of future prices but also their variability, which impacts investors’ utility. Hence, if spikes in risk aversion (intense moments of panic) are followed by reversals, today’s change in prices can predict tomorrow’s change in prices without violating the EMT. Risk aversion is hard to observe and measure, and this justification has protected the EMT from being clearly rejected.

The second blow to the EMT came from the few cases in which fundamental value can be measured without reference to an underlying asset-pricing model. The primary case is closed-end mutual funds. Unlike the more popular open-ended mutual funds, closed-end mutual funds cannot be redeemed daily for their net asset value; they can only be bought and sold in the stock market. Their price, however, tends to differ from the value

of the underlying assets, which is reported daily, because their assets are traded stock. Even more puzzling is the fact that the difference between price and net asset value oscillates over time, with occasional premiums and more frequent discounts, often reaching 30 percent. This evidence, however, was not considered a clear rejection of the EMT, since the difference between closed-end funds prices and net assets value could reflect some unique ability of the closed-end fund manager (when this difference is positive) or some value appropriated by the manager (when negative).

The EMT was also attacked from a theoretical point of view. If prices indeed reflect all available information – as the EMT claims – there are no incentives for market participants to collect any information. How can the market reflect all available information if no one has any interest in collecting it? In this respect, the EMT was modified to resist the challenge. Prices, it was argued, should reflect information up to the point where the marginal benefits of acting on the information (the expected profits to be made) do not exceed the marginal costs of collecting it.

Finally, the link between the various implications was broken. Unpredictability of stock prices does not equate with prices equal to fundamentals; the difference can be a slow-moving fad that cannot be easily detected with the short time series available.

As economists Andrei Shleifer and Larry Summers, two of the main critics of the EMT, wrote in 1990, “The stock in the efficient markets hypothesis – at least as it has traditionally been formulated – crashed along with the rest of the market on October 19, 1987 and its recovery has been less dramatic than that of the rest of the market.”<sup>3</sup> EMT

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stock crashed because of the lack of any plausible theory of the stock market crash. What fundamental news could have caused aggregate stock prices to drop 22.6 percent in one day? Even after a very aggressive search, the worst the supporters of the EMT could find were a potential announcement of a larger-than-expected trade deficit, the revelation that a key committee of the U.S. Congress would support the elimination of tax benefits for leveraged buyouts, and press speculation that the Federal Reserve would raise its discount rate. How could this news have changed fundamental values by 22.6 percent in a day? This single fact in isolation accounted for more than all the empirical evidence against the EMT collected up to that point.

Not surprisingly, shortly after the 1987 stock market crash the intellectual foundations of the EMT were challenged. Besides empirical evidence, the strongest argument in favor of the EMT was the logical argument originally advanced by Milton Friedman. When prices deviate from their fundamental value, rational investors can profit from these deviations by buying the undervalued asset and selling the overvalued one. The very act of buying undervalued assets and selling overvalued ones pushes prices closer to their fundamental values. No matter how many irrational traders there are in the marketplace, as long as there is a sufficient number of rational investors with access to large pools of money, they will drive prices close to fundamentals. Where but Wall Street can you expect to find smart, rational people with access to plenty of money?

The theoretical counterattack to Friedman's argument took place along two directives. First, even rich and rational agents are risk averse. If "[m]arkets can

remain irrational far longer than you or I can remain solvent," as John Maynard Keynes remarked, then rational but risk-averse individuals may choose not to undertake some arbitrage, even when these arbitrages, carried over a sufficiently long period of time, are risk free. Consider the case of closed-end mutual funds selling at a discount with respect to their net asset value. If carried over until the fund is liquidated, buying the closed-end fund and selling short its assets represent riskless arbitrage, that is, a way to make money without any risk. Yet in any one period, the arbitrageur can incur losses if the deviation widens before it shrinks.

If the risk that the difference between a closed mutual fund price and its net asset value widens is not correlated with the risk that other deviations widen, then this risk can be diversified away by creating large portfolios of these trades. If these events are correlated, though, this diversification will not work, and this risk can prevent rational traders from bringing prices back to their fundamental levels.

The other direction of attack concentrated on potential arbitrageurs' access to funds. Few investors are as rich as George Soros; most need to raise other people's money to trade. In allocating their money to various potential traders, though, the investors look at their performance. This induces a very short horizon even among farsighted rational traders. If a trader risks seeing the money he invests withdrawn every time his performance deteriorates for a few months, his time horizon shrinks to a few months. Furthermore, if his performance is judged vis-à-vis an index, the trader will become very cautious in deviating his investment away from his benchmark index. In other words, if an equity fund's performance is benchmarked against the S&P 500 index, the

manager will be very cautious about taking any arbitrage opportunity that induces him to tilt his portfolio away from S&P 500 stocks. By staying mostly invested in S&P 500 stocks, he faces very little risk. If those stocks go down, so does his benchmark; therefore, it is difficult for him to be fired. If he feels that the S&P 500 stocks are overvalued with respect to similar stocks outside the index, he will be reluctant to try to arbitrage that difference away. Even if he is right, but the deviation increases for a few months before it decreases, he will run the risk of being fired. Benchmarking, while optimal from an investor's point of view, might reduce the willingness of traders to lean against broad movements of stock prices away from fundamentals.

Long before the recent crisis, a majority of academic economists – at least those trained after the 1987 stock market crash – were ready to admit that stock prices could deviate from fundamental value for extended periods of time. The spectacular rise and fall in real estate prices that characterized this recent crisis did very little to change the opinion of academic economists on market efficiency. For one, even the strongest believers in the efficiency of the equity market are ready to concede that there is not a similar presumption for the housing market. Unlike the equity market, the housing market is not populated by smart traders trying to arbitrage away possible differences from fundamentals; most of the buyers and sellers in this market are unsophisticated in their market knowledge. And unlike in the equity market, in the real estate market sophisticated traders face very high cost of arbitrage. If one trader thinks that Microsoft's stock is overvalued with respect to Apple, he will buy Apple and sell short Microsoft. This operation can be completed

in the space of a few seconds with minimal transaction costs. But if a real estate developer thinks that house prices in the suburbs are overvalued, the only opportunity he has to make money is to build more houses in that area. This operation will take years, not seconds, and will involve sizable transaction costs. Thus, Friedman's argument does not apply to the housing market.

Second, most economists were already willing to admit that prices could drift away from fundamentals, and the faith of the remaining economists could not be shaken by the spectacular rise and fall in real estate prices, even if the housing market were similar to the equity market. The reason is that staunch supporters of the EMT are very creative in devising rational explanations for the most extreme events. Even the Internet boom and bust, which most non-economists see as the quintessential bubble, has been justified as the rational expectation of a few of those stocks turning into the new Microsoft. If a 22.6 percent drop in a day with no news does not shake their beliefs, what could?

The dramatic drop in mortgage-backed securities prices during the crisis cannot be considered very strong evidence of market inefficiency either. With the benefit of hindsight, it looks incredible that securities backed by mortgages offered to the riskiest part of the U.S. population could be considered safe, granted the best rating, and priced accordingly. Yet short of a generalized drop in house prices throughout the United States (an event that had not occurred since the Great Depression), those securities appeared to be priced correctly. For markets to be efficient, they do not need to be perfect. Thus, one mistake over the occurrence of a very rare event is hardly evidence against market efficiency.

Paradoxically, the aspect of the crisis that has shocked economists the most has been the diffuse violations of fundamental arbitrage conditions during the peak of the crisis. Take the covered interest rate parity, for example. If I borrow in yen, exchange the proceeds in dollars, invest them in dollars, and then buy yen with delivery when my debt is due to cover my exchange rate risk, I should not be able to make any money. If I can consistently do so, I have found a money machine. For an economist, the violation of this (and other) riskless arbitrages is tantamount to observing numerous \$100 bills on a crowded sidewalk and people passing by without collecting them.

During Fall 2008, many such fundamental relations were violated. The emerging consensus is that these violations were due to a lack of capital in the hands of smart arbitrageurs. Having faced major losses and even larger capital withdrawals by scared investors, smart traders who knew how to exploit these differences were running out of available money. And when there are many opportunities to make money but very little time and money to exploit, smart traders focus on the most profitable one. In other words, if I am running to put out a fire in my house, I might rationally choose to leave \$100 bills on the sidewalk.

While the conditions in Fall 2008 were extreme, they illustrate the importance of access to capital and the limits of the arbitrage process. If limited access to capital can prevent smart traders from exploiting simple, risk-free opportunities, it is not hard to imagine that it might prevent, even in more normal times, the exploitation of complex and risky opportunities. Thus, limited access to capital is a major flaw in Friedman's argument.

What the recent crisis did change is the sense of how costly the violations of

the EMT hypothesis can be, especially when combined with very high leverage. Very few doubted that violations existed. But as long as the documented violations were limited to the fact that stock with positive returns today tend to have a bit of positive momentum in the next six months, or that closed-end funds can trade at a 30 percent discount with respect to their net asset value, this is hardly earth-shattering. For most practical purposes, markets can be considered as if they were efficient.

These minor violations were the easiest ones to document empirically. Unfortunately, the deviations that really matter – like whether the level of stock prices in general is close to fundamental values – are the most difficult to prove because of the joint hypothesis problem: we can always claim that we do not have the adequate model of fundamental values. In other words, this implication of the EMT is not a good theory in the Popperian sense (after philosopher Karl Popper) because it is almost impossible to reject. This is the sense in which the crisis started to change the perspective of people inside and outside academia about the costs associated with ignoring these possible deviations.

In 1996, then-Federal Reserve Chairman Alan Greenspan questioned whether some “irrational exuberance” had taken the stock market to too high a level. The Shiller price-earnings ratio, based on the average of earnings of the previous ten years, was at 25 when Greenspan delivered that speech. It rose 77 percent, to 44.2, at the end of 1999, before it started to drop. During those three years, many commentators ridiculed Greenspan's remarks.

The lesson Greenspan learned was how politically costly it was to lean against the wind. He dutifully applied this lesson when real estate prices rose.

In fact, he elevated the lesson to a principle (the Greenspan Doctrine) that it was not a responsibility of a central banker to try to lean against the formation of potential bubbles. In academia, the staunchest supporter of this approach was a Princeton University macroeconomist little known in the political world at that time: Ben Bernanke! In a 1999 article with fellow economist Mark Gertler, Bernanke analyzed the impact of monetary policy when prices move away from fundamentals. That this contingency was the object of their analysis illustrates how the EMT was losing ground. Their conclusion, however, was that the Fed should not intervene, not only because it is difficult to identify the bubbles but also because “our reading of history is that asset price crashes have done sustained damage to the economy only in cases when monetary policy remained unresponsive or actively reinforced deflationary pressures.” Thus, the case against intervention was not based on the idea that the market always gets it right, but on the premise that the costs of these deviations are relatively minor, with respect to the cost of wrong interventions.

This is what the 2007–2008 financial crisis has changed: the comfortable belief that even if the EMT is not exactly true, it is a sufficiently close approximation to reality that we can safely use it for most practical approximations. This realization is not limited to academia; it is mostly shared by an entire generation of financial economists, accountants, and lawyers who have been trained in the fundamental belief that market prices reflect the best estimates of fundamentals. This belief is the reason why accountants like to use market prices as much as possible in compiling companies’ financial statements. It is the rea-

son why lawyers use stock price movements to assess damages. It is the reason why corporate boards judge and compensate their executives on the basis of changes in stock prices. It is the reason why in most business schools M.B.A.s are taught that any active investment management is a waste of time and resources and that chief financial officers should not try to outguess the market in their financing decisions.

Besides the intellectual appeal of Friedman’s argument and the supporting empirical evidence, the EMT was also very attractive for its practical implications. By providing an objective metric for performance, the shared belief in efficient markets made everyone’s life easier. It was not one expert’s opinion against another’s: the market was the absolute and impartial judge.

Once we lose this objective criterion, we are back in the world of self-interested opinions. All corporate executives will argue that the market undervalues their stock and that any drop in their stock price is due to market irrationality (while any increase is entirely justified by their actions). All politicians will claim that the rise in the yield of their government’s bonds is not the result of their profligacy, but of evil speculation or market irrationality (while ready to take credit for any reduction in the yield). Finally, all charlatans will feel entitled to claim that they have an investment strategy that can beat the market systematically. This is the uncharted territory where the crisis leaves us: a world where confidence in the rationality of the market is shaken but where there is no clear, viable alternative.

Eventually, a grander theory will emerge, one that will enable us to understand when we should expect mar-

ket prices to deviate from fundamentals. At the moment, we can grasp only some elements of this theory. Unfortunately, this quasi-EMT will be less elegant and less clear-cut, making its day-to-day application more difficult. As a synthesis between the original EMT and some of the arguments against it, this emerging theory will displease both sides. It will be considered apostasy by true believers in the EMT, while radical opponents will view it as too conservative. Nevertheless, it is not only the right compromise, it is the only reasonable way forward.

The necessary starting point is always Friedman's argument that deviations of prices from fundamentals create money-making opportunities. Yet this argument should be tempered by the understanding that these opportunities are not as easy to capture as \$100 bills on the sidewalk. Even in the simplest cases, lack of capital can prevent arbitrageurs from doing their job, particularly when it comes to leaning against the entire market.

In normal times we can expect relative prices across similar securities to reflect differences in fundamental values. If the price of Google rises while the price of Yahoo drops, we can be fairly confident that the fundamentals of the two companies have moved accordingly. Nevertheless, in the short run, relative prices can deviate from their relative fundamentals, especially when institutional or technical factors create a significant imbalance between demand and supply. Consider, for instance, the case of acquiring companies. It is well known that on average the stock price of companies engaged in large acquisitions drops. Historically, this drop has been interpreted as a signal that the market values most of these acquisitions negatively. In fact, this drop could be due, at least in part, to the selling pressure of merger arbitrageurs, who buy the target and hedge by selling short

the bidder. Over several days, one expects this deviation to be corrected, but at the announcement of the bid, the imbalance can be very strong and can temporarily alter relative prices. These temporary misalignments have no serious impact on the efficiency with which market prices direct the allocation of resources; still, they must be considered when we make inferences from events studies.

When it comes to the absolute level of prices, however, or the relative price between very different asset classes, we cannot have the same level of confidence in market efficiency. Arbitrages between asset classes or directional arbitrages against the overall level of the markets are extremely risky for any trader. Only a very self-confident trader, one whose job is not at risk because he bets mostly with his own money, can afford to engage in these arbitrages. Warren Buffett is one of the few investors who fit this description. Not surprisingly, he has an amazing record of performance. The paucity of this type of arbitrageur should give us pause in taking the overall level of the market at face value.

That markets may deviate from fundamentals does not necessarily imply that they always do or that it is easy to spot deviations when they occur. The scarcity of investors with long-term success in timing the market (like Warren Buffett) suggests the extreme difficulty of this task. The very reasons that push market prices away from fundamentals – irrational exuberance, lack of capital for arbitrage, or a combination of the two – are likely to affect the market timer as much as the rest of the market. (One has to be very rich, live in Omaha, Nebraska, and not use the Internet to be a good contrarian.) A quasi-EMT, thus, would have practical advice very similar to the EMT when it comes to financial invest-



ment strategy. Yet its implications for real resource allocation would be very different. Without the confidence that the market always provides the best guess, the risk that resources will be misallocated is very real.

Once we recognize these occasional deviations we should not disregard market information, but adjust it or complement it with fundamental analysis. It is safe to start by assuming that market prices reflect fundamentals, but we must be open to changing this assumption when there is overwhelming evidence to the contrary. While a price-earnings ratio of twenty-five might not be irrationally high, it is hard to explain a price-earnings ratio of forty-five – just as it is difficult to justify that the land underneath the imperial palace in Tokyo could cost as much as the entire state of California, as was the case at the peak of the real estate bubble in Japan. While our current knowledge does not provide us with the certainty that these situations are bubbles, it does suggest that completely disregarding these indicators is very risky and leads, on average, to bad decision-making. Faced with these aberrations, central bankers would be foolish not to lean against the wind, especially after seeing the costs a bubble's burst can have on the real economy.

At the same time, in designing executive compensation one should recognize the limitations of stock-based performance. In fact, a significant component of change in a company's stock price is due to variations in the market risk premium, not in the actual fundamentals of the company that can be influenced by its executives. The change in the price of a company relative to the change of an index of its competitors is a much better measure of the actual performance, because we have more confidence in the relative efficiency of the

market rather than in the absolute efficiency. Similarly, before making any inference from an event study, it is necessary to adjust the price changes for temporary order imbalances that might have temporarily moved the price.

As for financial reporting, the faith in marking to market (that is, assessing the accounting value of assets at their market price) should be less absolute. That most of the arguments against marking to market are self-serving ones aimed only at covering bad performance does not imply, however, that marking to market is always the right choice. In this respect, providing two valuations in financial statements, one marked to market and another based on fundamental analysis, with clear description of the underlying hypotheses, can be a useful compromise.

Even when market prices deviate from fundamental values, they still provide useful information about the demand of various assets, information that should not be ignored. When closed-end funds of a particular sector, for example, start selling at a large premium with respect to their net asset value, we should infer that the demand of small investors (the main buyers of closed-end funds) for that sector is booming and is likely to drive the stock prices of the firms in that sector above their fundamental value.

Market prices are a very important source of information. Our only mistake was to consider them the only source of information, in any moment in time, regardless of the conditions under which those prices were obtained. The way forward is not to dismiss market prices, but to consider them in context.

When the definitive history of the EMT is written, the 2007 – 2008 financial crisis will not emerge as a major turning point, only a catalyst of an intellectual

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journey that started at full speed after the 1987 stock market crash. Rather than demonstrating market inefficiency, the 2007–2008 financial crisis stands out as an example of the potential costs that deviations of assets' prices from fundamentals can have on the real economy, especially when these deviations are

amplified by high leverage. This realization is forcing experts both inside and outside academia to rethink the robustness of the implications of the EMT and openly accept the possibility of some inefficiency. While just beginning, this process promises to be very challenging but, eventually, very useful.

#### ENDNOTES

<sup>1</sup> Eugene F. Fama, "Efficient Capital Markets: A Review of Theory and Empirical Work," *The Journal of Finance* (May 1970): 383.

<sup>2</sup> Michael Jensen, "Some Anomalous Evidence Regarding Market Efficiency," *Journal of Financial Economics* 6 (2–3) (1978): 95–101.

<sup>3</sup> Andrei Shleifer and Lawrence H. Summers, "The Noise Trader Approach to Finance," *Journal of Economic Perspectives* 4 (2) (1990): 19.