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Inefficient Debate. The EMH, the "Remarkable Error" and a Question of Point of View

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Abstract: This article develops a critical reflection on the way the efficient market hypothesis (EMH) is debated, and in so doing tries to design an efficient way to criticize it. We first expose the debate is flawed by a confusion between two different forms of efficiency that we call technical and fundamental respectively, a confusion based on the implicit assumption that the first one implies the second one. We then show this inference requires the validity of a hypothesis which is neither tested nor part of the explanatory model of what is tested, and that the tested efficiency is generally the technical one, save in some scarce cases. This very scarcity is finally related to the prevalence of the investor's point of view in financial theory: *technical* efficiency does make sense for investors, but not for regulators, because it does not imply *per se* that market valuation is the best one for financial assets. Assessing the ability of markets to produce informed judgements on the price of these assets would mean to reopen a debate on *fundamental* efficiency.

Keywords: efficient market hypothesis, rational expectations, intrinsic value, research design

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Introduction

Two of the three laureates of the 2013 Nobel Memorial Prize in Economic Sciences, namely Eugene Fama and Robert Shiller, are famous, among other things, for having defended opposite views on the efficient market hypothesis (EMH). Remarkably enough, the "scientific background" report of the Prize Committee[1] was not focused on this question but on asset pricing, the report showing how the three laureates contributed to the understanding of the way financial assets are priced on capital markets. In this report, though, the Committee used and quoted Fama's and Shiller's articles that were clearly integral parts of the debate on the EMH. Now, is this debate really about the *price* of financial assets? Isn't there some confusion about what is at stake when the EMH is discussed?

Markets know best. This 3-word sentence may be the most simple way to express this hypothesis, that states the price of a financial asset reflects all relevant available information, which is a basic tenet of financial theory and financial regulation (Fama, 1965, 1970). But even this little sentence can be understood in two different ways: it can mean either "You can't beat markets" or "Markets tell the truth". Hyme (2004) already showed how the confusion between these two meanings flawed the debate on the EMH. In this article, we will try to make this point again in a different way and to go further. Whereas, for Hyme, the difference between the two efficiencies stems from the difference between the underlying models used to test them, we will argue it derives from the research designs of these tests; we will also try to identify the actors for whom the two kinds of efficiency are relevant, which will allow us to introduce a sociological and political dimension in the debate.

Indeed, the ambiguity of the notion permeates the debate on efficiency theory, and when you disentangle the two different notions people have in mind when debating on it, it may have far-reaching implications. In our view, the most efficient way to criticize the EMH may not be to show its alleged unrealism or inadequacy, but to point out that the kind of efficiency which is effectively formalized and tested, while relevant for investors and especially portfolio managers, is arguably not so for policymakers and regulators.

This critique seems to us efficient insofar as it can be made from within Friedman's epistemological framework (Friedman, 1953), which is the most widely accepted in economics. Thus, it can be shown that, *even in its own*

1 Accessible here: http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/2013/advanced-economicsciences2013.pdf.

epistemological terms, the EMH is not a sound basis for regulation and policymaking.[2] This is what we will try to do in this article: criticizing the EMH in a way which differs from the existing literature based either on psychology or alternative views of risk modeling and/or epistemology, by discussing the way efficiency is debated and defined to reopen the question of the valuation of financial assets in a different way.

This may seem odd or at least outdated, more than seven years after a global financial crisis which seems to have discredited the idea that financial markets were or even could be efficient in any way. Most regulators and policymakers, and even, as we saw, the Nobel Prize Committee members, have kept a low profile since then on this issue. Financial stability is their new motto, as illustrated, notably, by the work of the Financial Stability Board, a newly created global institution devised to fight again systemic risk through macroprudential regulation. We still believe, nevertheless, that the theoretical discussion of the EMH is still relevant and important, especially given what could be called its extraordinary institutional embeddedness. It is not enough to remark the continuing prevalence of the EMH and mainstream financial theory in the way finance is taught all over the world: more to the point is the fact that financial markets professionals, as remarkably shown and illustrated by Ortiz (2013, 2014), see themselves as agents of efficiency by contributing in several ways to make prices reflect the true value of financial assets. The EMH is neither odd nor outdated in CFA[3] programs, the new way to regulate finance by taking in account systemic risk hasn't put an end to the previous one in actual regulation, and it seems all the more important to explain that effectively tested efficiency not only is not about any "true" value of assets, it's not even, in fact, about valuation.

We will start from typical cases of controversy about the EMH that appeared just after the financial crisis, which will make us delineate two different notions of efficiency. We will then recall the confusion between the two notions is nothing new and point out which kind of efficiency is effectively tested most of the time. This will lead us to some remarks on what could explain the persistence of the confusion and how this problem could be addressed.

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2 Interestingly enough, while explicitly rejecting Friedman's epistemology, Herbert Simon also explained in his Nobel lecture (Simon, 1992) that, in the field of theory of the firm, "there are no direct observations that individuals or firms do actually equate marginal costs and revenues. The empirically verified consequences of the classical theory are always weaker than this." (p. 347). This means that, even *within* Friedman's epistemological framework, where what counts is only what is empirically tested, the "classical theory" appears as requiring an *interpretation* of what is tested; thus, this interpretation, being untested, has to be realistic, which is of course not the case for Simon.

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1 A flawed debate

1.1 Robert Lucas vs. "The Economist"

In July 2009, "The Economist" published an article titled "What went wrong with economics" that was trying to assess to what extent the accusations made against economists after the crisis had erupted were founded. Two other articles were detailing the respective cases of macroeconomics and financial economics. Three weeks later, the magazine published a guest article signed by prominent Chicago economist Robert Lucas (Lucas, 2009), who wanted to react to the previous articles in which he apparently saw an unjust attack on his profession.

The efficient market hypothesis was one of the main stakes of the debate. What "The Economist" was saying was that the theory was making people overconfident in capital markets: "Financial economists formalised theories of the efficiency of markets, fueling the notion that markets would regulate themselves and financial innovation was always beneficial." It was also explaining how the efficiency theory had been abundantly criticised for 30 years, but also that this controversy had had little or no impact on market practitioners and regulators. The magazine recalled how behavioural economics had tried to show that individual psychology could explain bubbles and crashes and that arbitrage, that plays a crucial role in the efficiency theory to bring the prices back to intrinsic values when they depart from them, was in fact a limited and risky activity.

So the justification of the critique on efficiency theory in these articles was that financial asset prices should stick to their fundamental or intrinsic value: because efficiency theory was assuming they were, investors and regulators were also assuming it, so they could neither explain bubbles (that is, persistent deviations from the fundamentals) nor even recognize their very existence. The idea was that asset price bubbles and crashes do happen and that it's a problem but that this problem cannot be solved as long as people believe in a theory that says it does not happen.

Now if we look at Robert Lucas'article, titled "In defence of the dismal science", we can see the focus of his defence of efficiency theory was not on fundamental value but on forecastability. "If an economist had a formula that could reliably forecast crises a week in advance, say, then that formula would become part of generally available information and prices would fall a week earlier." Even if bubbles and crashes exist, they can't be forecasted anyway.

It seems Lucas answered a question that was not really asked, and didn't answer the question that stemmed from the previous articles. These articles were

treating bubbles as a problem in itself, and the question that logically arises, then, is "How could we prevent bubbles from happening?". But Lucas answered another question, that is "Could we forecast bubbles?".

1.2 Eugene Fama vs. Justin Fox

This kind of misunderstanding could also be found in Eugene Fama's reaction to Justin Fox's book "The myth of the rational market" (Fox, 2009), that was published the same year. In this text, that appeared on the blog he shares with Kenneth French on Dimensional Advisers' website, Fama (2009) points out the fact that "80 % of mutual fund wealth is actively managed", that is, they rely on the idea that market prices can be, one way or another, forecasted. Consequently, the efficiency theory, that says these prices are unforecastable, cannot be considered guilty. Fama even added that "if banks and investment banks took market efficiency more seriously, they might have avoided lots of their recent problems."

But Fox's book was not at all about passive management being the cause of the crisis; in fact it was not even about the crisis: it was a thorough investigation on the history of financial theory and the related developments of financial industry in the United States since the times of Irving Fisher, that the journalist began to write in 2002, long before the crisis. And even if we concentrate on what he says on efficiency theory, we can see he recalls that what was really new in what Fama called efficiency was a counter-intuitive linkage between the random walk hypothesis and the idea that stock prices were right or, as Fama put it at that time, "best estimates of intrinsic values". What Fox wrote in his book about the crisis, that is the introduction and the epilogue, does not put any blame on the random walk hypothesis, nor does it accuses the more sophisticated versions of this idea that insist on the fact that financial asset prices are unpredictable and that, consequently, you can't consistently make a profit on these markets on the basis of stale information. As in the articles published by "The Economist", he rather accuses the other side of efficiency theory, that is, the idea that these asset prices correctly reflect at any time their intrinsic values.

1.3 A tale of two efficiencies

In both cases, we see on the one hand people who say prices are not right and that's a problem, and on the other hand people who say prices are not predictable and the problem is too many people think they are.

This debate seems flawed, in the sense its participants don't really agree on what it is about. Efficiency just doesn't mean the same thing, apparently, when it is advocated and when it is criticized. What is the difference between the two meanings?

In his own reaction to Fox's book, Richard Thaler (2009), a prominent figure of behavioural finance, gave us a clue. He said two components of efficiency could be distinguished: the "Price Is Right" component and the "No Free Lunch" component. Says Thaler: "The price is right principle says asset prices will, to use Fama's words "fully reflect" available information, and thus "provide accurate signals for resource allocation". The no free lunch principle is that market prices are impossible to predict and so it is hard for any investor to beat the market after taking risk into account."

Going back to the debate, we can say the advocated efficiency was the No Free Lunch component and the criticized one the Price Is Right component. We propose to call the No Free Lunch component technical efficiency, because it's about the technique investors should implement, and the Price Is Right component fundamental efficiency, because it's about asset prices reflecting their fundamental value.[4] Technical efficiency implies an investor should not try to guess the market trend: the best strategy for him is to build a portfolio as representative as possible, in order to replicate this trend as closely as possible. Fundamental efficiency implies any kind of public intervention or regulation trying to influence, to weigh on asset prices can only be harmful, the price produced by the market mechanism being the best one, the more appropriate at any time. Table 1 makes the distinction more visible.

Table 1: Defining two efficiencies.

Kind of efficiency	Technical ("No Free Lunch")	Fundamental ("Price Is Right")
Basic proposition	Asset prices are unforecastable	Asset prices express their intrinsic value
Practical consequence	Passive portfolio management is better than any kind of active portfolio management	Markets can regulate themselves, can be left to their own devices
View on bubbles	Bubbles are unpredictable	Bubbles don't exist

4 The idea Thaler developed in 2009 had been expressed four years earlier, using different words (and in French...), calling "efficience technique" (technical efficiency) what Thaler calls "No Free Lunch component" and "efficience informationnelle" (informational efficiency) what Thaler calls "Price is Right component" (Bourghelle, Brandouy, & Orléan, 2005). Later on, the point has been detailed and refined by Orléan (2014).

When critics of efficiency said fundamental efficiency did not hold, advocates of efficiency answered technical efficiency did hold. The only logical explanation for this is that, for these advocates, technical efficiency necessarily implies fundamental efficiency.

2 A "remarkable error"

This inference was nothing new. As soon as 1984, Robert Shiller had pointed it out and said it was "one of the most remarkable errors in the history of economic thought." (Shiller, 1984, p. 459). We will first focus on what is required for this inference to be valid, i. e. for technical efficiency to necessarily imply fundamental efficiency, and see this validity seems questionable, even within Friedman's epistemological framework. We will then go back to Shiller's reasoning, which will lead us to a paradox: this reasoning didn't mention the question of the research design of efficiency tests, whereas Shiller himself had pioneered a new way to think them. In fact it was a way to investigate directly fundamental efficiency, which some other authors also tried to do.

2.1 An untested inference

According to LeRoy (1989) and Guerrien and Gun (2011, p. 26), what is required for technical efficiency to imply fundamental efficiency is no less than the rational expectations hypothesis, which "means that investors use their information to make those inferences about future events that are justified by objective correlations between the information variables and the future events, and only those inferences. In other words, rational expectations models treat the agents being modelled as knowing the structure of the model and the value of its parameters" (LeRoy, 1989, p. 1595). A definition of market efficiency including this assumption clearly goes beyond the simple question of unforecastability. It leads us to fundamental efficiency, if we admit agents knowing the "true" model of the economy value financial assets at their "true" price.

As LeRoy pointed out, Fama referred to rational expectations in its 1976 definition of efficiency, whereas it was not the case in his famous 1970 article. In the meantime, indeed, the rational expectations assumption had gained traction, notably through several influential articles. In one of these, Robert Lucas tried to demonstrate "long-run neutrality of money, or independence of real and nominal magnitudes" (Lucas, 1972, p. 103) holds even if "the information conveyed to traders by market prices is inadequate to permit them to distinguish

real from monetary disturbances" (ibid., p. 121–122). The demonstration relies on demanding assumptions: "the assumption that traders use the correct conditional distribution in forming expectations, together with the assumption that all exchanges take place at the market clearing price, implies that markets in this economy are efficient, as this term is defined by Roll. It will also be true that price expectations are rational in the sense of Muth" (ibid., p. 110).

As Roll had applied the notion of efficiency to Treasury bill rates, i. e., like Fama, to financial assets, this was already a way to connect the EMH in Fama's terms to the rational expectations assumption, expressed earlier by Muth (1961). Some years later, Lucas, in an article devoted to asset prices, went further by in effect *equalling* the two:

> "Most of our attention will be focused on the derivation and application of a functional equation in the vector of equilibrium asset prices [...]. This equation is a generalization of the Martingale property of stochastic price sequences, which serves in practice as the defining characteristic of market "efficiency," as that term is used by Fama and others. [...] The analysis is conducted under the assumption that, in Fama's terms, prices "fully reflect all available information," an hypothesis which Muth had earlier termed "rationality of expectations." (Lucas, 1978, p. 1429)

We now understand more easily why the same author, in 2009, answered the claim fundamental efficiency did not hold by saying technical efficiency did hold: for him, the idea the second one implied the first one was relying on an assumption he had formulated 37 years earlier, which implied he didn't consider, in effect, the difference between the two.

At this point, we can remark that what is discussed here is the validity of a proposition, which says that technical efficiency necessarily implies fundamental efficiency. Hence it can be useful to recall what is said about such a validity in the most influential epistemological work in economics, namely Milton Friedman's "Methodology of positive economics": "the only relevant test of the validity of a hypothesis is comparison of its predictions with experience" (Friedman, 1953, p. 8–9). In other words, what counts, what can be said valid or not, is a proposition tested against data. Now, looking at the literature on efficiency tests, we didn't find any clear example of the inference we mentioned tested this way. In Friedman's terms, however, what is really significant when assessing the validity of the EMH is, like for any other hypothesis, *what is effectively tested*. We will now see the rational expectations hypothesis is clearly not part of it.

For efficiency advocates, it is quite clear that what is tested in the empirical evidence they generally refer to is technical efficiency. Fama himself explained in 1976 what had to be tested and how. He first recalled a classical definition:

"Market efficiency requires that in setting the price of securities at any time t-1, the market correctly uses all available informations." (Fama, 1976, p. 143). Then he specified: "For simplicity, assume that the prices of securities at t–1 depend only on the characteristics of the joint distribution of prices to be set at t. Market efficiency then requires that in setting prices at t-1, the market correctly uses all available information to assess the joint distribution of prices at t." (ibid., p. 143) To make this proposition testable, Fama explains we need a model of equilibrium. The underlying assumption, here, is that a price that fully reflects information is an equilibrium price and vice versa. Hence the testable definition of efficiency: "in an efficient market the true expected return on any security is equal to its equilibrium expected value." (ibid., p. 144) If it is not, we've got what is generally called an abnormal return. The tests, consequently, are tests for abnormal returns. Fama then presented two kinds of such tests: tests to see if a trading rule gives abnormal returns, and tests choosing a specific piece of information to see if an investor can use it to get abnormal returns. This second kind corresponds to what is called event studies.

Fama also specified "the choice of a model of equilibrium is not restricted by the market efficiency condition." (ibid., p. 144) This problem of the choice of the model has been known since then as the joint hypothesis problem. But it can be stressed the ongoing debate about these models has nothing to do with fundamental efficiency, because, whatever model you choose, what you test is always technical efficiency : the question is always to know if, as an investor, you can beat the market using a trading rule relying on available information. If market prices are not normally distributed, for example, this doesn't contradict fundamental efficiency, but it also doesn't necessarily contradict, in our view, technical efficiency, at least theoretically.[5] The issue, again, is forecastability.

Discussing the various acceptations of the EMH by focusing, like us, on the way it is tested, Hyme (2004) rightly points out that the nature of the debate is flawed by the fact that the kind of efficiency which is advocated differs from the one which is criticized, as illustrated by showing what is effectively tested in Malkiel (2003) clearly differs from what is tested in Shiller (2003). However, our

5 Our initial focus on a critique of efficiency tests explains why we don't refer to Walter's work on efficiency theory (Walter, 1996). Walter's research, partly building on Mandelbrot's work, is mainly focused on the question of risk modeling in financial theory. Departures from a normal distribution in financial assets prices had been documented by Fama himself in his doctoral thesis, also inspired by Mandelbrot (Fama, 1965). In the wake of the financial crisis, the issue has been revived and popularized by Taleb (2007). The point we address here is clearly different, insofar as the way price distribution is modeled can be distinguished from a discussion on fundamental efficiency.

view of the misunderstanding, of the *way* the debate is flawed clearly departs from hers: whereas, for Hyme, the difference between the two kinds of tests lies in the *choice of the price formation model*, opposing "fair game" models to a "fundamental value" model, for us it lies in the *research design* of the tests. This research design, in our view, determines by itself the kind of efficiency which is tested, regardless of the choice of the model.

Remember efficiency, be it technical or fundamental, is about the relationship between information and price. Technical efficiency says that information is instantaneously reflected in prices, hence an investor cannot use information to forecast prices. Fundamental efficiency says the price of a financial asset reflects its intrinsic value through information, hence only information related to this intrinsic value makes these prices move. To test technical efficiency, you have to check how prices react to information. To test fundamental efficiency, you have to check if price changes are explained by fundamental factors. In both cases, you study the information-price relationship but, whereas in the first case you take information as the starting point, in the second case you take price as the starting point. In the first case, you've got information and you want to know how prices react.[6] In the second, you've got prices and you want to know to what extent information on fundamental factors explains them. This distinction is expressed in Table 2.

Table 2: Testing two efficiencies.

Kind of efficiency	Technical ("No Free Lunch")	Fundamental ("Price Is Right")
Rationale of the tests	Does information make prices react instantaneously?	Can price changes be explained by fundamental factors?
Starting point	Information	Price

What is crucial here is neither the kind of assumption made about agents' rationality nor the kind of price formation model considered as "normal" but the starting point chosen when studying the information-price relationship, because it determines what is effectively tested. The famous distinction between strong, semi-strong and weak efficiency is based on the kind of information taken as a starting point, hence it is a distinction between several kinds of technical efficiency.

6 This is obvious in the case of event studies, but this is also the case for tests using a trading rule, for a trading rule has to be based on some kind of available information.

Hence the simple fact that nearly all efficiency tests take information as the starting point tells us that:

- these are technical efficiency tests.
- the rational expectations hypothesis is not, at least in this case, a tested assumption but an *interpretative* one, an assumption you use to interpret, to draw conclusions from your findings.

If we now come back to Friedman's epistemology, we can recall a distinction he made about what is stated in a proposition whose validity has to be assessed: "We can regard the hypothesis as consisting of two parts: first, a conceptual world or abstract model simpler than the "real world" and containing only the forces that the hypothesis asserts to be important; second, a set of rules defining the class of phenomena for which "the model" can be taken to an adequate representation of the "real world" and specifying the correspondence between the variables or entities in the model and observable phenomena." (Friedman, 1953, p. 24). While this second part clearly defines as precisely as possible what is tested and how and "cannot possibly be abstract and complete" (p. 25), the first part expresses the core assumptions, a "model" which doesn't have to be realistic, but has to be unambiguous: "there is no place in the model for, and no function to be served by, vagueness, maybe's, or approximations" (p. 24).

If we now try to apply these principles to the efficient markets hypothesis, we will first remark that, if what is effectively tested is technical efficiency, then the "rules for using the model" will simply recall that prices are unpredictable and, if necessary, how this can be measured; the way the model will explain this can be expressed as follows: *the market mechanism makes the price of a financial asset react instantaneously only to new information, hence this price is unpredictable*.

This proposition captures the Hayekian view of the market as the best information processor, better than any individual actor or organization (Hayek, 1945). The way the proposition is formulated can be compared to the famous example given by Friedman himself: "leaves seek to maximize the sunlight they receive" (p. 24). What is clearly measurable here is "the sunlight they receive": what will be effectively tested is the hypothesis "the sunlight received by leaves is maximized". Of course it is grossly unrealistic to assume leaves are actors that "seek to maximize" something, but this wording is justifiable, in Friedman's terms, because it allows to describe both concisely and precisely a hypothesis, which, then, can be tested. In our formulation of the EMH, what will be effectively tested is the unpredictability of prices; the idea there is a market mechanism that "makes" something is unrealistic but understandable and logical.

Now, fundamental efficiency in itself doesn't appear in this "friedmanian" formulation. Indeed, what can be said about the way it is related to technical efficiency is that:

- it is consistent with it
- it is implied by it only if the rational expectations hypothesis, which is not tested as such, is valid.

The inference we discussed here requires the rational expectations hypothesis to be valid, now this hypothesis is not only untested: it is also not part of the explanatory model, which, based on Hayek's reasoning, doesn't require such a demanding assumption. Consequently, it doesn't seem to be valid in friedmanian terms. It is really nothing more than *an interpretation* and, as we shall see later, one possible interpretation among others, and arguably not the most defensible one. It may well be a "remarkable error", as Shiller said. Now, this is not exactly the argument Shiller used to make this bold statement.

2.2 Shiller's argument

The quotation comes from an article that was published in the Brookings Papers on Economic Activity, based on a conference pronounced at the Brookings Institution.[7] When you read this article, what is remarkable at first sight is that those who were defending the EMH more than 30 years ago were already using the same "unforecastibility" argument when they felt their theory was disputed. The point Shiller wanted to make was that investors' psychology, and more specifically their propensity to follow fads or to herd, strongly influences and even determines financial assets prices. At the beginning of the article, he explains that this idea is not discussed seriously enough: the arguments against it are "confined to an oral tradition, tacitly accepted by all parties, and not discussed in the scholarly literature." (p. 458) And the main argument of this "oral tradition" is that "Returns on speculative assets are nearly unforecastable" and that "because real returns are nearly unforecastable, the real price of stocks is close to the intrinsic value." "This argument for the efficient market hypothesis", Shiller adds, "represents one of the most remarkable errors in the history of economic thought. It is remarkable in the immediacy of its logical error and in the sweep and implications of its conclusion." (p. 459)

Thus, as we said before, this "remarkable error" is the idea that technical efficiency implies fundamental efficiency. Then, how does Shiller challenge this

7 It was later republished in « Market volatility » (Shiller, 1989).

inference? In fact, what he tries to show in the article is that unforecastability, or at least the fact that stock prices are not *very* forecastable, is *consistent with* a model that takes in account investors' departures from rationality.[8] He does not show that prices consistently depart from their intrinsic value but that technical efficiency does not necessarily imply investors' rationality. As, for him, it seems to demonstrate that to infer fundamental efficiency from technical efficiency is a "remarkable error", then the underlying assumption of Shiller's reasoning is that investors' rationality necessarily implies fundamental efficiency. This is also the basic idea of behavioural finance since then: it explains financial assets prices depart from their intrinsic value because investors depart from rationality, and that implies that, were investors rational, then prices would be right.

To make the reasoning visible, we used the sign $\Longrightarrow$ to mean "necessarily implies" and the sign $\not\Longrightarrow$ to mean "does not necessarily imply". Shiller's reasoning can be summed up this way:

Proposition 1 $\Longrightarrow$ Proposition 2

Where

Proposition 1 is: Technical efficiency $\not\Longrightarrow$ Investor's rationality

Proposition 2 is: Technical efficiency $\not\Longrightarrow$ Fundamental efficiency

Hence Shiller's underlying assumption is

Proposition 3: Investor's rationality $\Longrightarrow$ Fundamental efficiency

One can first remark that it is not quite clear that the rationality Shiller evokes means precisely assuming rational expectations in Lucas' sense. If, nevertheless, we admit it is the case, then the main difference between the two approaches is simple to describe: Shiller simply doesn't make this assumption, which implies the discussed inference is a "remarkable error" indeed. In any case, irrationality is clearly at the heart of his argument, whereas he doesn't mention the other question we raised, i. e. the *research design* of the tests.

This is somehow surprising, because his most famous previous article was precisely an attempt to take price as a starting point when studying the information-price relationship (Shiller, 1981). As we said previously, this means it was an attempt to test fundamental efficiency. And when we look more closely at the academic literature in finance, we indeed find some cases where the issue of fundamental efficiency is directly addressed. These are neither weak form efficiency tests nor semi-strong form efficiency tests nor strong form efficiency

8 Summers (1986) later developed this point.

tests: this typology of efficiency as strong, semi-strong or weak is based on the kind of information taken as a starting point, whereas these articles take price as a starting point.

2.3 Attempts to test fundamental efficiency

Fundamental efficiency is the idea that financial asset prices reflect their fundamental value and that, consequently, when they move it's because of some new information related to this fundamental value. Hence testing fundamental efficiency can be made either by comparing directly price changes and intrinsic value changes or by checking if informations that make prices move are the ones that make a difference on intrinsic value, that influence the fundamentals. In the first case, you have to define and measure intrinsic value, in the second you have to define relevant information in order to test its explanatory power on prices.

The first kind of test can be illustrated by Shiller's (1981) article "Do stock prices move too much to be justified by subsequent changes in dividends?". He chose a classical definition of the intrinsic value of a stock, that is the discounted value of future dividends. Hence he compared the movements of the S&P 500 to subsequent changes in dividends paid by S&P 500 companies. Stephen LeRoy and Richard Porter published the same year a similar study, based on earnings rather than dividends (LeRoy & Porter, 1981).

Richard Roll (1988) tried to run regressions on stock price movements on a five-year period on data generated by models of risk supposed to represent fundamental factors. We can consider it a case of the second kind of fundamental efficiency tests, a somewhat clearer example being the article "What moves stock prices" published by David Cutler, James Poterba and Lawrence Summers in 1989. Cutler, Poterba and Summers used regressions on stock returns to measure the explanatory power of seven measures of macroeconomic activity, "chosen to measure both real and financial conditions" (p. 5). They also identified the 50 largest one-day stock market movements in a 42-year period to check if significant news on fundamental factors had appeared in the media on these days or on subsequent days.

More recently, Bouveret & Di Filippo (2009) tried to test *both* technical and fundamental efficiency on forex markets. They defined three kinds of efficiency: "speculative efficiency", "fundamental efficiency" and "macroeconomic efficiency". To put it simply, speculative efficiency corresponds to our technical efficiency, fundamental efficiency means exchange rates are determined by differences between real interest rates and macroeconomic efficiency is a kind of fundamental efficiency which also takes in account other relevant indicators.

Their tests of speculative efficiency are tests of investment strategies based on stale information, hence information is their starting point, whereas their tests of fundamental and macroeconomic efficiency are tests of the explanatory power of models based on fundamental factors. Bouveret & Di Filippo also tried to test the rational expectation hypothesis (REH) on these markets: assuming the REH implies agents don't make systematic forecast errors, they tested the accuracy of the "Consensus Forecast" made by economists on forex markets. Interestingly enough, their empirical results showed these markets were "fundamentally inefficient" on all horizons, "speculatively efficient" at least in the mid-term, and "macroeconomically efficient" in the long term, although they were more cautious about this last point, the choice of the indicators and the model of "macroeconomic efficiency" being difficult and questionable. They also found the REH was not met, which is consistent, as we saw, with a situation where a market is technically *but not* fundamentally efficient.

A remarkable feature of these articles is that they are scarce.[9] The overwhelming majority of the literature on efficiency is only about the technical one, with tests taking information as the starting point. The greatest part of behavioural finance has accepted this methodological approach and made a difference by interpreting abnormal returns in psychological terms, by giving for deviations from technical efficiency an explanation based on assumptions about investors' psychology (Shleifer, 2000). Thus, this literature has come to assume investors' rationality necessarily implies technical efficiency and, when it draws conclusions from its evidence about fundamental efficiency, it means it also assumes technical efficiency necessarily implies fundamental efficiency, which is precisely the "remarkable error" pointed out by Shiller...

In other words, the confusion between the two efficiencies and the "remarkable error" have persisted, this specific problem being rarely raised.

We will now suggest possible explanations of this situation, and try to show what would be at stake if fundamental efficiency was clearly and directly addressed.

3 The investor's point of view, and how it may be challenged

One basic reason for the scarcity of fundamental efficiency tests is practical: there are various measures of intrinsic value, this is a matter of judgment and

9 For another example, see Ryan & Taffler (2004).

the point is controversial; there are also different ways to discriminate between relevant and irrelevant information, and to determine which price changes should be examined. Nevertheless, it doesn't seem much more controversial than the choice of the model of equilibrium that is required to test technical efficiency. We think a more serious reason could be found when we consider financial theory more generally.

When one looks at the story and the social context of the development of financial theory (Bernstein, 1992; Fox, 2009; Mackenzie, 2006), it doesn't seem exaggerated to say that, from the start, academic finance has defined its research questions and research agendas from an investor's point of view.

In the case of efficiency, that is, in the case of the relationship between information and price, the natural question for an investor is "Can I make a profit on information?". That is the question technical efficiency tests give an answer. The question fundamental efficiency tests give an answer is "Do financial asset prices deviate from their intrinsic value?". If we wonder from which point of view this question is relevant, we could say it does matter for actors who are, one way or another, valued or "judged" on the grounds of this market valuation. For listed companies, for states via bond markets, for any organization that relies on financial markets to be funded, it does matter to know it their valuation by financial markets is based on recognizable, rational or stable factors or if it is not. Therefore it matters for their executives and also, indirectly, for their respective personnel, members or citizens. Fundamental efficiency matters, directly or indirectly, for nearly everybody, whereas technical efficiency matters only for investors. Technical efficiency is relevant for investors, that is, for individuals or organizations that are the subjects of financial valuation, whereas fundamental efficiency is relevant for organizations or individuals which are the objects of financial valuation, and that I propose to call investees.[10]

The valuation of financial and other speculative assets is a major issue for the economy as a whole, but research in finance has remained focused on technical efficiency, i. e. not on the way this valuation really occurs, but on the forecastability of this valuation. This appears clearly enough in the Nobel Committee's "scientific background" report we were evoking at the beginning of

10 On this notion of investees, also see Charron, 2015. The development of investor capitalism (Useem, 1996) and the ideology of shareholder value and shareholder primacy (Stout, 2012) clearly have made managers more sensitive to typical investor's concerns. They remain, nevertheless, eager to know on which criteria they are "judged" by the market, these criteria having an impact on the actual decisions they have to make within their organizations, a concern "pure" shareholders don't have to worry about, at least directly.

this article. In its introduction, after having stressed the importance of the "behaviour of asset prices" for all investors, be they professional or not, it is mentioned "Asset prices are also of fundamental importance for the macroeconomy because they provide crucial information for key economic decisions [...]. While prices of financial assets often seem to reflect fundamental values, history provides striking examples to the contrary [...]. Mispricing of assets may contribute to financial crises and, as the recent recession illustrates, such crises can damage the overall economy." (p. 1). But then, when it comes to express the basic problem which was addressed in the research the report is going to summarize, it is said "The question of whether asset prices are predictable is as central as it is old." And the remaining 44 pages of the report explain how this question of predictability has been investigated, to conclude in the end: "We now know that asset prices are very hard to predict over short time horizons, but that they follow movements over longer horizons that, on average, can be forecasted. We also know more about the determinants of the cross-section of returns on different assets. New factors [...] have been demonstrated to add significantly to the prior understanding of returns based on the standard CAPM. Building on these findings, subsequent research has further investigated how asset prices are fundamentally determined by risk and attitudes toward risk, as well as behavioral factors." (p. 45). It appears fundamental efficiency just made a cameo.[11]

Going back to the public controversies that erupted in 2009 can help us to identify what is really at stake. Being exposed to harsh criticisms can urge someone to say clearly and explicitly what is the most important for him.[12] This may have been the case for John Cochrane when one reads the answer he made (Cochrane, 2009) to the famous Paul Krugman's article that appeared in the New York Times under the title "How did Economists get it so wrong?" (Krugman, 2009). Krugman had accused neoclassical Chicago economists of, among other things, not having been able to predict and identify the formation of asset bubbles. "Crying "bubble" is empty unless you have an operational procedure for identifying bubbles", replied Cochrane, adding "It's the central prediction of free-market economics, as crystallized by Hayek, that no academic, bureaucrat or regulator will ever be able to fully explain market price movements. Nobody knows what "fundamental" value is. If anyone could tell what the price of tomatoes should be, let alone the price of Microsoft stock, communism and central planning would have worked. [...] The

11 See also Guerrien & Gun (2014) for a more developed analysis and contextualization of the Nobel Committee's report.

12 Boltanski & Thévenot (1991) gave a lot of examples of the way justifications are made clearer when facing critiques.

case for free markets never was that markets are perfect. The case for free markets is that government control of markets, especially asset markets, has always been much worse." (p. 3)

Indeed, if we follow this reasoning, testing fundamental efficiency is not difficult: it is impossible.[13] Financial assets need to be priced, but the real question is to know if they are better priced on a market or otherwise. It can be argued that, precisely, Hayek's reasoning (Hayek, 1945), while convincing for consumer goods ("tomatoes") may not be so for speculative assets ("the Microsoft stock") (Charron, 2015).[14]

Conclusion

To say that a financial market is efficient can mean two different things, that we called technical efficiency and fundamental efficiency.

The fact that individual actors, organizations, experts... are unable to predict the market price of financial assets, i. e. technical efficiency, doesn't mean this price is *better* than the one their judgment would produce; it just means it is *different*. Fundamental efficiency means the market price of financial assets is the best one, because it reflects their intrinsic value. While this proposition is consistent with technical efficiency, other ones also are. And if we have to choose between these propositions, realism is an acceptable criterion, even within Friedman's epistemological framework, because, as we saw, these are nothing more than interpretations of what is tested and explained by a model, hence they are not subject to the analysis Friedman made on what makes hypotheses valid or not.

Fundamental efficiency requires the rational expectations hypothesis to be valid in order to be consistent with technical efficiency.

Among the other propositions which can be consistent with technical efficiency, the idea that investors depart from rationality in several possible ways, for example through herding, has been developed since more than thirty years

13 Guerrien & Gun (2011), while completely opposed to Cochrane in many respects, agree with him on this.

14 In Hayek's approach of information processing, any information needed is either about the relative scarcity or relative desirability of the good which have to be priced. This information doesn't seem relevant for financial assets, for which scarcity and desirability make little sense, for these goods are not endowed with intrinsic utility and desired for themselves. What has to be judged here is neither scarcity nor desirability but the ability of a certain legal entity to yield some revenue in the future or the liquidity of the assets which "represent" this entity.

by Shiller and the behavioural finance school of thought. Indeed, if investors are irrational, their behaviour, and consequently the market prices which bear the consequences of this behaviour, may be impossible or at least very hard to predict.

Still another proposition is also consistent with technical efficiency: Orléan's self-referential hypothesis (Orléan, 2012, p. 334), initially based on the Keynesian idea of the "beauty contest", which illustrates "the self-referential nature of speculation, where each individual makes up his/her mind according to what he/she anticipates the majority opinion to be" (p. 316–317). Orléan contends that "only subjective estimates can be made" of the value of a financial asset even if investors are supposed to be rational: "because the future cannot be known objectively, there exists a plurality of possible legitimate interpretations" (p. 326) which are equally rational and can all be considered as "rational beliefs" (Kurz, 1994). Using the term "opinion" to qualify these rational beliefs, Orléan describes a financial market as "a public space of opinions and communications, in which ideas and conjectures compete with each other" and where this competition is self-referential in the sense that "each agent tries to predict as accurately as possible what the majority opinion will be" (p. 331). This cognitive process, which can be understood as a pure coordination game (Mehta, Starmer, & Sugden, 1994), produces a "market opinion" expressed by the market price, which "has the nature of a salient opinion that imposes itself on agents" (p. 317). Clearly, the production of successive salient opinions seems impossible or at least very hard to predict: once we admit investors are able to produce different interpretations of the available information, supporting different views of the future which are processed by the market in order to produce a dominant "rational belief", we can also admit these interpretations can be renewed or change over time in a unpredictable way, hence the market price which expresses the prevailing rational belief may be unpredictable.

Now, how can we assess the realism of these three different propositions? If we follow Simon (1976), rational behaviour in the real world means to resort to some kind of procedural rationality, as opposed to the substantive rationality, of which the rational expectations hypothesis is a stringent version. Substantive rationality is used only in marginal cases, which happen to be trivial and uninteresting. "We can expect substantive rationality only in situations that are sufficiently simple as to be transparent to [the human mind]. In all other situations, we must expect that the mind will use such imperfect information as it has, will simplify and represent the situation as it can, and will make such calculations as are within its powers." (Simon, 1976, p. 144) In this perspective, *actors are neither rational in the sense implied by the rational expectations*

hypothesis nor irrational as implied by behavioural finance, hence Orléan's interpretation seems the most accurate, insofar as it relies on a realistic view of the kind of rationality actors can use when investing on financial markets. We can recall here we stayed within Friedman's epistemological framework: we did not oppose the "realism" of Simon's procedural rationality to the "unrealism" of the rational expectations hypothesis, we simply explained that Friedman's reasoning on the realism of hypotheses applies to *tested* hypotheses, that the rational expectations hypothesis was *not effectively tested* and that, consequently, its unrealism could not be justified.

This leaves us with an unsatisfactory situation: if technical efficiency, which has been tested time and again, really doesn't imply, as is seems, fundamental efficiency, whose tests are scarce and questionable, policymakers and regulators, for whom the efficiency that matters is the fundamental one, lack resources and evidence to assess it. When Siegel (2010) contends that, by 2008, "the EMH had been downgraded from a testable hypothesis to an unrealistic but convenient working assumption (known to be false) decades earlier" and that "the EMH resembles the presumption of defendant's innocence in a criminal trial" because "it places the burden of the proof on the analyst who would beat the market", it simply equals efficiency with technical efficiency and ignores the main goal of regulators and policymakers was (and to a great extent still is) to make markets fundamentally efficient and not technically.

What prevents financial theory from studying fundamental efficiency is that it does research from an investor's point of view, which is the main reason for this ignorance. Putting investees back in the picture is probably the first step towards aligning the tests' methods with this point of view (i. e. taking price as a starting point) and, more generally, making asset price research really bother about the price of assets (how it can be assessed, judged, using which criteria…) rather than the predictability of these prices (how their return and their risk can be modelled…).

Judgement and discussion are what risk modeling tries to eliminate. While it is clear that financial assets don't have any "scientific" value, it is also clear that this value doesn't have to be arbitrary. Informed judgment is needed (Bhidé, 2010), but the question remains to see if, in this case, market valuation is the best way to get it. Assessing fundamental efficiency reopens this question, which most economists consider closed. The fact that there is neither objective nor even commonly accepted definition of intrinsic or fundamental value doesn't imply that this discussion should be left aside. Rather, it implies this definition, while not being a scientific object, is a political one, as we

argued in another article (Charron, 2015), and should be discussed accordingly. Here is a sketch of an "accounting vs. finance" debate which differs from the more classical "industry vs. finance" debate: if market prices are not necessarily the "right" ones to value financial assets and firms, then accounting has to be involved in the discussion.[15] We mean here, of course, an approach of accounting which clearly departs from the market view which inspired the fair value revolution (Biondi, 2011), considering the firm as an entity and relying on actual, rather than hypothetical, monetary flows and transactions (Terrill, 2011).

One can argue anyway that an issue which has a deep impact on the economy and the society as a whole, and for which there is no "scientific" or unambiguous answer, has to be publicly and politically debated. Anyone who witnessed the last financial crisis could be convinced asset valuation is such an issue. Stephen LeRoy, in a way, had foreseen this 25 years ago, when he said "The most radical revision in efficient-markets reasoning will involve those implications of market efficiency that depend on asset prices equaling or closely approximating fundamental values." (LeRoy, 1989, p. 1616)

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15 One could also say that making financial valuation an object of contradictory debate could be an instrument of a civic-market compromise, in Boltanski & Thevenot's terms (Boltanski & Thévenot, 1991).

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